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Press Ctrl+F to search within the manual

INTRODUCTION

NOTE: Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring any obligation.

IMPORTANT SAFETY NOTICE

Appropriate service methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for performing service with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedure, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts.

NOTES, CAUTIONS AND WARNINGS

As you read through the procedures, you will come across **NOTES**, **CAUTIONS**, and **WARNINGS**. Each one is there for a specific purpose. **NOTES** give you added information that will help you to perform a particular procedure. **CAUTIONS** are given to prevent you from making an error that could damage the vehicle. **WARNINGS** remind you to be especially careful in those areas where carelessness can cause yourself and others personal injury. The following list contains some general **WARNINGS** that you should follow when you work on a vehicle.

- **ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.**
- **KEEP SOLVENTS AWAY FROM IGNITION SOURCES. SOLVENTS MAY BE FLAMMABLE AND COULD IGNITE OR EXPLODE IF NOT HANDLED CORRECTLY.**
- **USE SAFETY STANDS WHENEVER A PROCEDURE REQUIRES YOU TO BE UNDER THE VEHICLE.**
- **MAKE SURE THAT THE IGNITION SWITCH IS ALWAYS IN THE OFF POSITION, UNLESS OTHERWISE REQUIRED BY THE PROCEDURE.**
- **SET THE PARKING BRAKE WHEN WORKING ON THE VEHICLE. IF YOU HAVE AN AUTOMATIC TRANSMISSION, SET IN PARK UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. IF YOU HAVE A MANUAL TRANSMISSION, IT SHOULD BE IN REVERSE (ENGINE OFF) OR NEUTRAL (ENGINE ON) UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. PLACE WOOD BLOCKS (4" X 4" OR LARGER) OR WHEEL CHOCKS AGAINST THE FRONT AND REAR SURFACES OF THE TIRES TO HELP PREVENT THE VEHICLE FROM MOVING.**
- **OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA TO AVOID THE DANGER OF CARBON MONOXIDE POISONING.**
- **KEEP YOURSELF AND YOUR CLOTHING AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE DRIVE BELTS.**
- **TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT METAL PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD, TAIL PIPE, THREE-WAY CATALYTIC CONVERTER AND MUFFLER.**
- **DO NOT SMOKE WHILE WORKING ON A VEHICLE.**
- **TO AVOID INJURY, ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY AND LOOSE CLOTHING BEFORE BEGINNING TO WORK ON A VEHICLE.**
- **WHEN IT IS NECESSARY TO WORK UNDER THE HOOD, KEEP HANDS AND OTHER OBJECTS CLEAR OF THE COOLING FAN BLADES!**

TOOLS

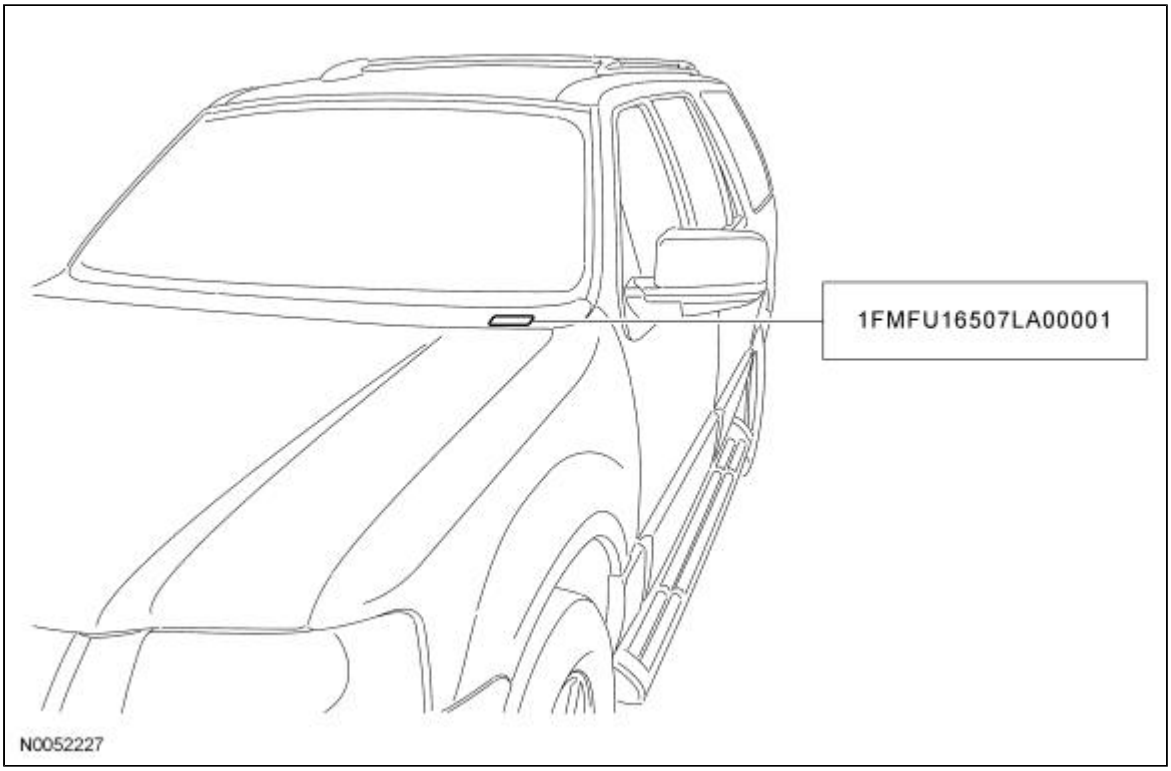
Commercially available hand tools and equipment are used along with Essential Special Service Tools (ESST) and Rotunda equipment. Power tools have become the acceptable industry standard and are used for disassembly only where applicable, unless specified otherwise in the Workshop Manual. The only exception to this policy is installing wheels in conjunction with the use of torque sticks, when possible.

Identification Codes

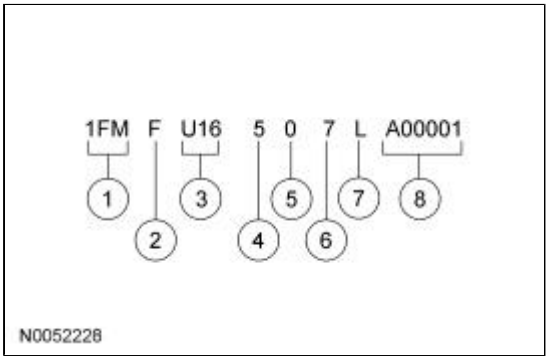
Printable View (623 KB)

Vehicle Identification Number (VIN)

Vehicle Identification Number (VIN) Locator



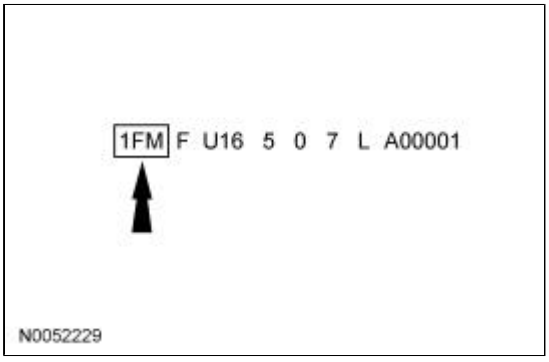
The vehicle identification number (VIN) is a 17-digit combination of letters and numbers. The VIN is stamped on a metal tab riveted to the instrument panel, top upper left of the dash. The VIN number is also found on the vehicle certification (VC) label.



Item	Description
1	World manufacturer identifier (WMI)
2	Brake type and gross vehicle weight rating (GVWR)

3	Vehicle line and series
4	Engine type
5	Computer-generated check digit
6	Model year
7	Assembly plant
8	Production sequence number

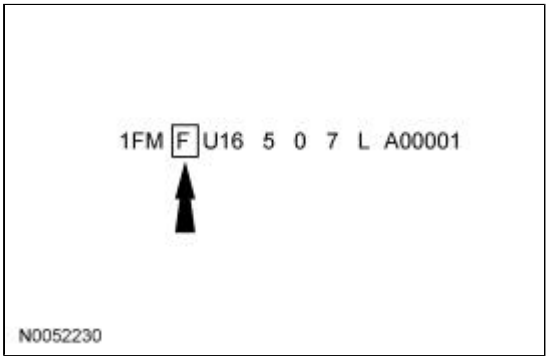
World Manufacturer Identifier (WMI)



The first 3 vehicle identification number (VIN) positions are the world manufacturer identifier.

- 1FM — Ford Motor Company, USA, multi-purpose vehicle
- 5LM — Lincoln, USA, multi-purpose vehicle
- 5L1 — Lincoln, USA, multi-purpose vehicle (limousine)

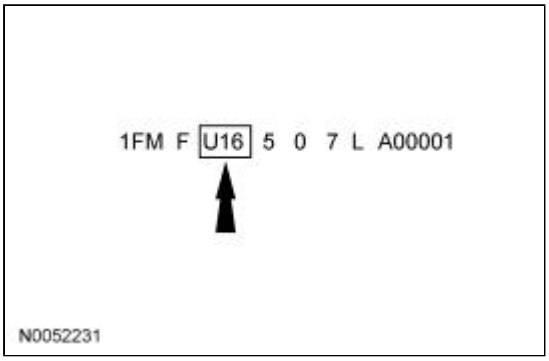
Brake Type and Gross Vehicle Weight Rating (GVWR)



The fourth VIN position is the vehicles brake type and gross vehicle weight rating (GVWR) code. All vehicles use hydraulic brakes.

- F — 7,001-8,000 pounds GVWR with driver and front passenger air bags and driver and front passenger side impact air curtains
- P — 7,001-8,000 pounds GVWR with driver and front passenger air bags

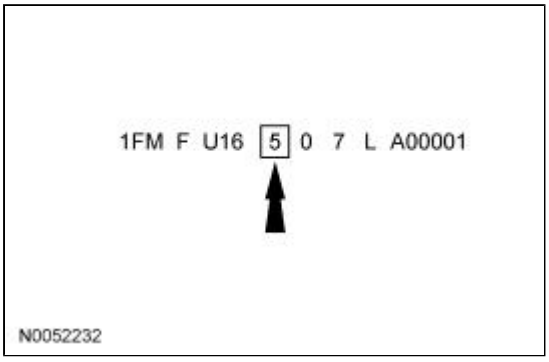
Vehicle Line and Series



Positions 5 through 7 indicate vehicle line and series.

- K15 — Expedition EL, 4x2, XLT
- K16 — Expedition EL, 4x4, XLT
- K17 — Expedition EL, 4x2, Eddie Bauer
- K18 — Expedition EL, 4x4, Eddie Bauer
- K19 — Expedition EL, 4x2, Limited
- K20 — Expedition EL, 4x4, Limited
- U15 — Expedition, 4x2, XLT
- U16 — Expedition, 4x4, XLT
- U17 — Expedition, 4x2, Eddie Bauer
- U18 — Expedition, 4x4, Eddie Bauer
- U19 — Expedition, 4x2, Limited
- U20 — Expedition, 4x4, Limited
- U27 — Navigator, 4x2
- U28 — Navigator, 4x4

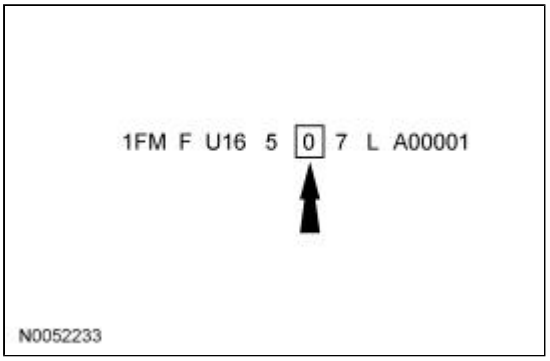
Engine Type



The eighth VIN position is the engine displacement and number of cylinders.

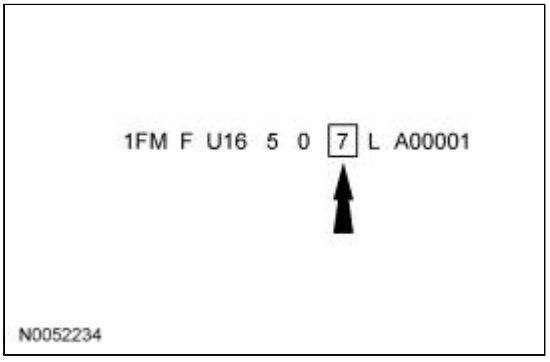
- 5 — 5.4L, SOHC, EFI, 3V, V-8, gas

Computer-Generated Check Digit



The ninth VIN position is a government-assigned, computer-generated check digit.

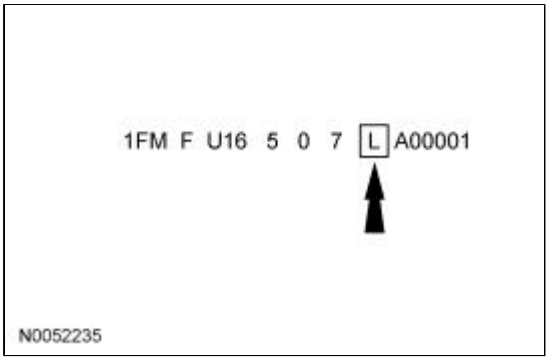
Model Year



The tenth VIN position is the model year code.

- 7 — 2007

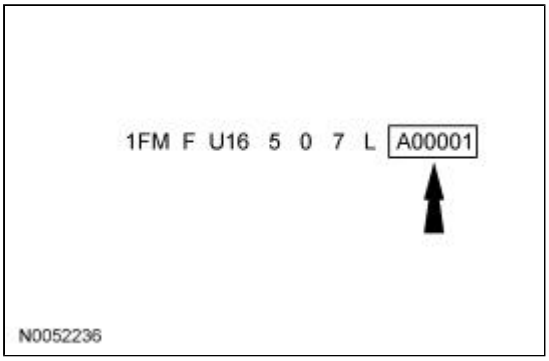
Assembly Plant



The eleventh VIN position is the assembly plant code.

- L — Michigan Truck (Wayne, Michigan)

Vehicle Build Sequence

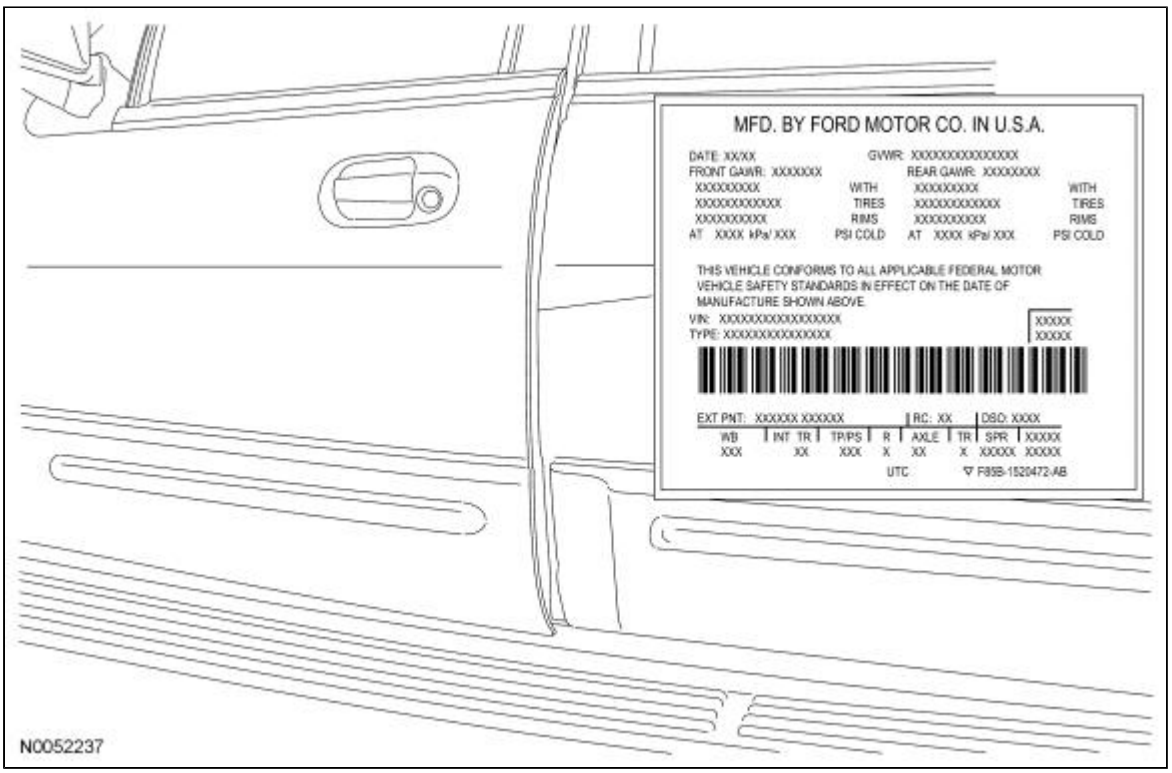


The last 6 VIN positions are an alphanumeric code for the vehicle build sequence. This is also the vehicle serial and warranty number.

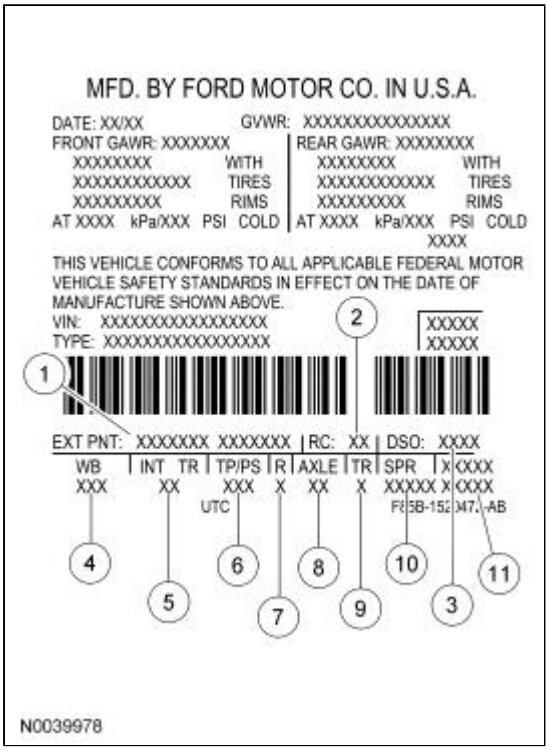
- A00001-F99999 — Ford Division
- J00001-L99999 — Lincoln Division

Vehicle Certification (VC) Label

Vehicle Certification (VC) Label Locator



The vehicle certification (VC) label contains the manufacturer name, the month and year of manufacture, the certification statement and the VIN. It also includes gross vehicle weight ratings (GVWR).



Item	Description
1	Exterior paint code
2	Region code
3	Domestic special order code
4	Wheelbase code
5	Interior trim code
6	Tape/paint pinstripe code
7	Radio code
8	Axle code
9	Transmission code
10	Spring code
11	Powertrain calibration information

Exterior Paint Code

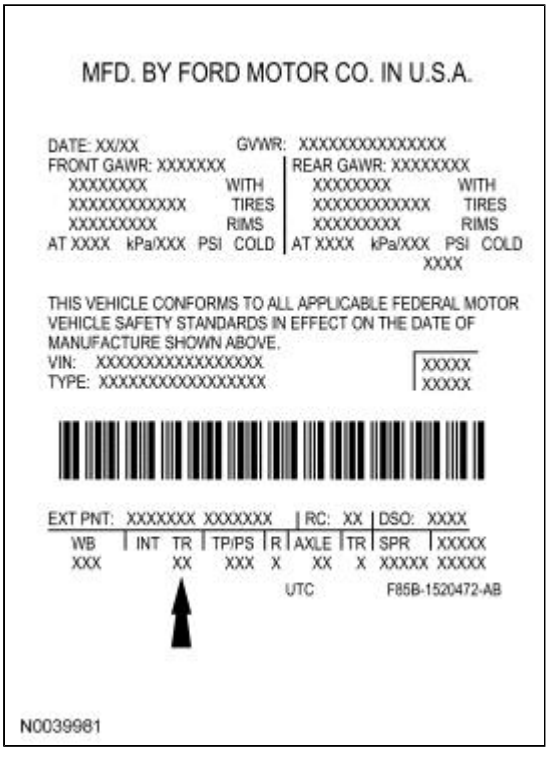
Paint codes may be listed as a 2-part code. The first set of characters listed indicate the vehicle primary body color. The second set of characters listed (if applicable) indicate a 2-tone or accent body color. All colors are base coat/clear coat.

- DX — Dark Blue Pearl
- G2 — Redfire
- G3 — Pueblo Gold
- G5 — Alloy Gray
- JP — Silver Birch Metallic
- PG — Dark Amethyst
- PV — White Chocolate (tri-coat)
- T5 — Dark Copper
- UA — Ebony
- YZ — Oxford White

Wheelbase

- 119 — 119 inch (3,023 mm) wheelbase
- 131 — 131 inch (3,327 mm) wheelbase

Interior Trim



Interior trim codes are listed as a 2-part code. The first character identifies the trim type. The second character identifies the interior trim color.

Trim Type

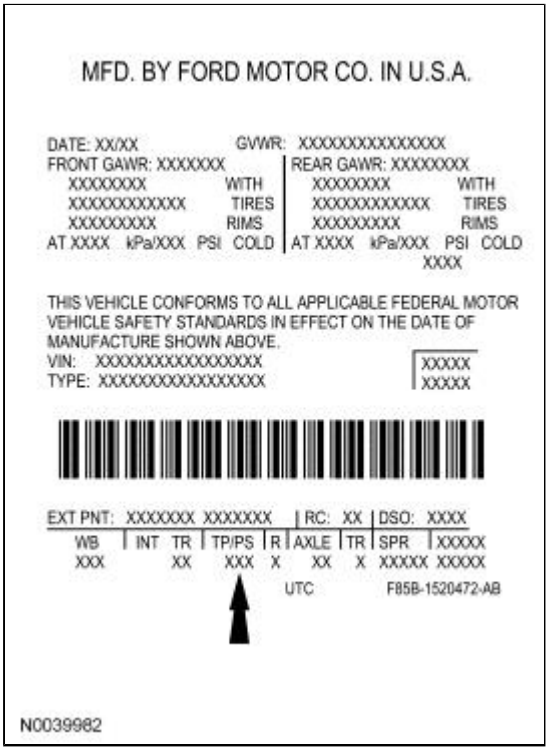
- 1 — Verona leather, 40/40 captain's chairs — Expedition

- 2 — Verona leather, 40/40 captain's chairs — Expedition
- 3 — Verona leather, 40/40 captain's chairs with accent — Expedition
- F — Beck cloth captain's chairs — Expedition
- M — Adobe/Beck cloth, 40/60 split bench seat — Expedition
- T — Premium/Soho leather, 40/40 captain's chairs — Navigator

Interior Trim Color

- C — Camel Tan
- L — Medium Light Stone
- W — Charcoal Black

Tape/Paint Stripe



Tape and paint stripe codes do not apply.

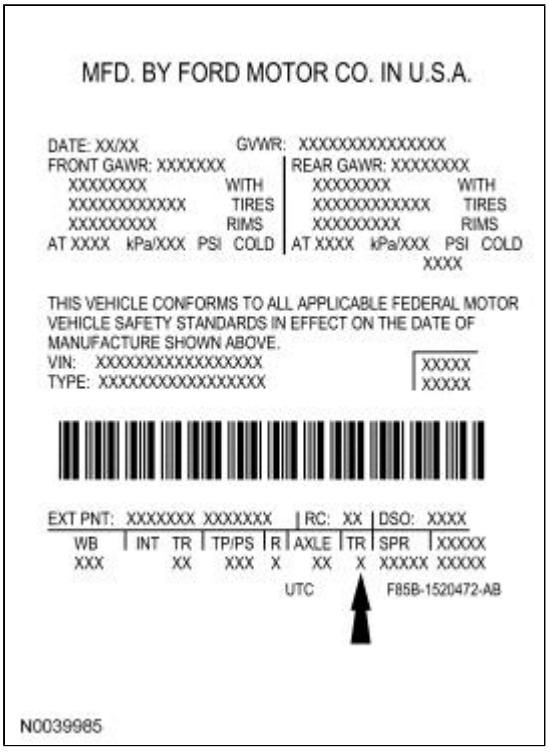
Radio Type

- 1 — Premium AM/FM stereo with in-dash compact 6-disc (CD) changer and clock
- F — AM/FM stereo with CD player, navigation system and clock
- S — Premium electronic AM/FM stereo CD player
- T — Premium AM/FM stereo with in-dash CD changer and clock
- U — Audiophile AM/FM stereo with in-dash, 6-disc CD changer and THX speaker system
- W — Navigation radio
- X — AM/FM stereo with in-dash, CD changer and navigation system

Axle Code

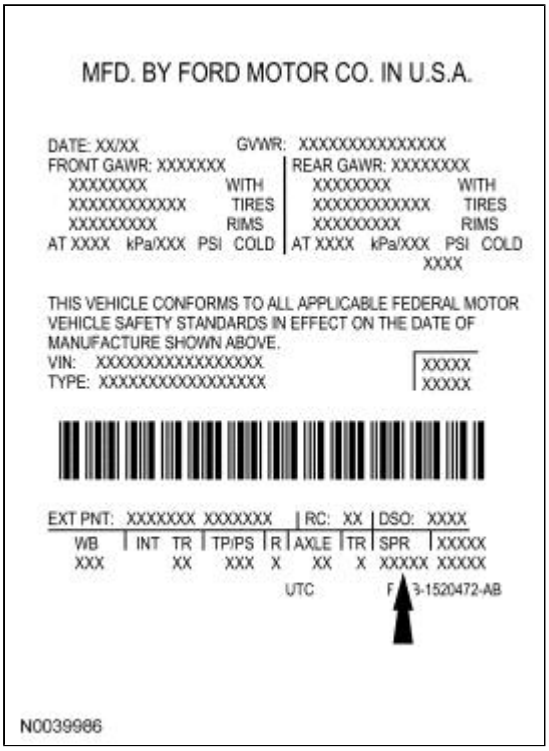
- 15 — 3.31 ratio, non-limited slip
- 16 — 3.73 ratio, non-limited slip
- H5 — 3.31 ratio, limited slip
- H6 — 3.73 ratio, limited slip

Transmission Code



- C — 6-speed automatic (6R75)
- G — 6-speed automatic (ZF 6HP26)

Spring Codes



Spring codes are listed as a 2-part code. The first character listed identifies the front spring code. The second character listed identifies the rear spring code.

Air Suspension

- L — Rear load-leveling air suspension

Front Springs

- AA — 7L14-18B036-AAD
- BB — 7L14-18B036-ABA
- CC — 7L14-18B036-ACD
- DD — 7L14-18B036-AED
- EE — 7L14-18B036-BAE
- FF — 7L14-18B036-AFA
- GG — 7L14-18B036-AGD
- HH — 7L14-18B036-BBA
- JJ — 7L14-18B036-BCE
- KK — 7L14-18B036-BED
- LL — 7L14-18B036-BFA
- MM — 7L14-18B036-BGD

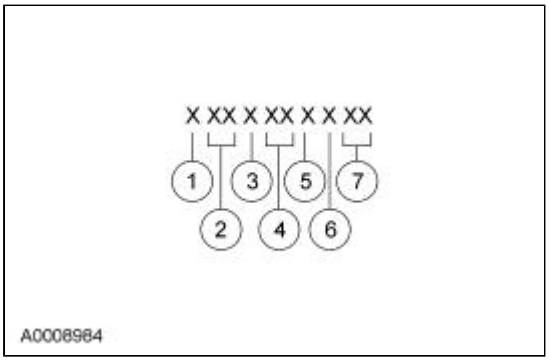
Rear Springs

- AA — 7L14-18W002-BAE
- BB — 7L14-18W004-BBA
- CC — 7L14-5A980/1-BCF
- DD — 7L14-18W002-BEA
- EE — 7L14-18W004-BFA
- FF — 7L14-5A980/1-BGA
- 11 — 7L14-5A980/1-ACF
- 33 — 7L14-5A980/1-AGA
- 55 — 7L14-18W004-ABA
- 77 — 7L14-18W004-AFA
- 88 — 7L14-18W004-AAE

Powertrain Calibration Information

NOTE: Powertrain calibration information is limited to a maximum of 5 characters per line on the Vehicle Certification (VC) label. Because of this, calibration identification consisting of more than 5 characters will wrap to the second line on the VC label.

Powertrain calibration information is printed in the lower right corner of the VC label. Only the base calibration information is printed. Revision levels will not appear, however, they can be found in On Line Automotive Service Information System (OASIS).



Item	Description
1	Model year (model year in which calibration strategy was first introduced)
2	Vehicle code
3	Transmission code
4	Unique calibration (designates different hardware to similar vehicles). Example: tires, drive ratios, etc.
5	Fleet code (describes fleet to which the vehicle belongs). Example: 6 - evaporative emissions
6	Certification region (lead region where multiple regions are included in one calibration). Example: A - U.S. federal

7	Revision level (will advance as revisions occur). Not printed on label

Model Year

- 0 — 2000
- 1 — 2001
- 2 — 2002
- 3 — 2003
- 4 — 2004
- 5 — 2005
- 6 — 2006
- 7 — 2007

Vehicle Line

- TB7 — Expedition
- TB5 — Navigator

Transmission

- 1 — Automatic transmission

Unique Calibration

The Emissions/CAFE/CO2 Compliance Department is responsible for assigning these calibration numbers. Unique calibration identifications are assigned to cover similar vehicles to differentiate between tires, drive configurations, final drive ratios and other calibration-significant factors.

These 2 characters are chosen by the analyst to provide identifiable information unique to each calibration. For example, using the number 2 to denote a 2-valve engine versus using the number 4 to denote a 4-valve engine provides an easily identifiable difference.

Fleet Code

- 1 — HDGE/Dyno
- 2 — Fast AMA, U.S.
- 3 — ADP, U.S.
- 4 — Not assigned
- 5 — Not assigned
- 6 — Evaporative emissions
- 7 — MACAA
- 8 — On-board diagnostics (OBD)
- 9 — Not assigned

Certification Region

- Where multiple regions are included in one calibration, only the lead region will appear.
- 5 — U.S. 50 states
- A — U.S. Federal, including altitude, may include Canada and/or Mexico
- B — U.S. California Standard, includes U.S. green states
- C — Canada
- D — China
- E — European Community (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom)
- F — Extended European Community (E plus Croatia, Czech Republic, Estonia, Hungary, Norway, Poland, Romania, Russian Federation, Slovakia, Slovenia, Switzerland and Yugoslavia)
- G — Gulf Cooperative Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE)
- H — Hong Kong
- J — Japan
- K — Korea

- L — Malaysia
- M — Mexico
- N — New Zealand
- P — Australia
- Q — South America (Brazil)
- S — Singapore
- T — Taiwan
- U — South America (unleaded fuel regions)
- V — Vietnam
- X — ROW (rest of world)
- Y — Military
- Z — Israel

Revision Level (not printed on label)

- 91-99 — Hardware certification levels
- 01-04 — Preliminary levels
- 00 — Job 1 production (initial calibration)
- 05-09 — Pre-job 1 revisions to calibrations
- 10-89 — Post-job 1 revisions to calibrations
- 0B — Durability test level
- BD — On-board diagnostics (OBD) intermediate level (pre-05)

Jacking

Printable View (216 KB)

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting or jacking an air suspension equipped vehicle. Failure to do so may result in unexpected inflation or deflation of the air springs which may result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

WARNING: Do not run the engine when jacking the vehicle. The wheels contacting the ground could cause the vehicle to move.

WARNING: Support the vehicle prior to carrying out any procedure requiring the vehicle to be jacked off the ground.

WARNING: Make sure the jack and jack stands are correctly located to prevent the vehicle from falling.

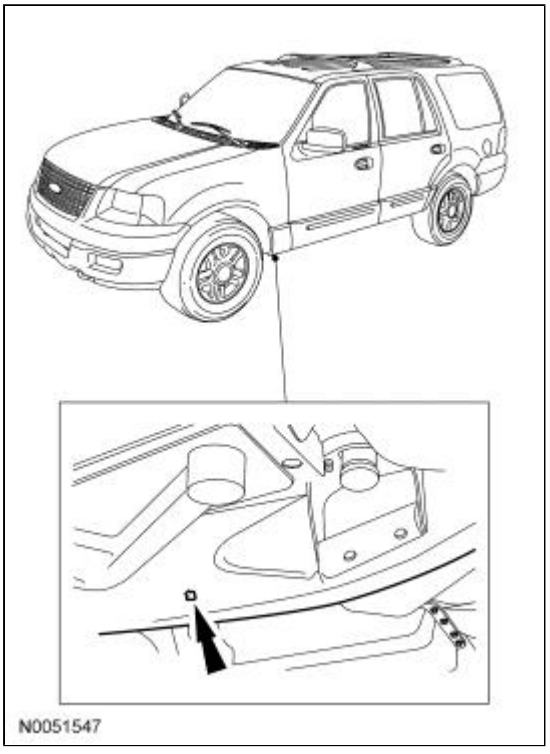
WARNING: Wheel chocks should be used to prevent the vehicle from rolling and falling off the jack.

CAUTION: Never use a halfshaft as a lifting point.

CAUTION: If equipped with retractable running board, disable the system through the instrument cluster controls.

Disable the air suspension system. Refer to Section 204-05 .

Jacking Points — Front

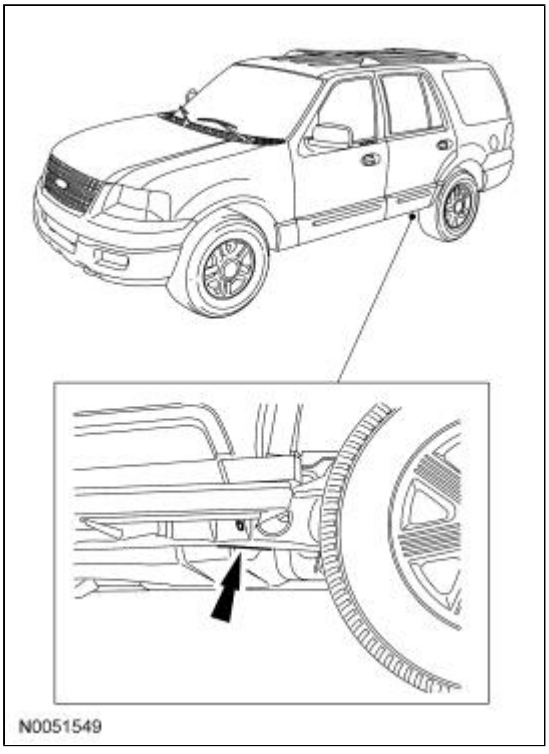


The front jacking point is indicated by an arrow cutout in the frame, located behind the front tire and wheel assembly.

After the vehicle has been lowered, enable the air suspension system. Refer to Section 204-05 .

Jacking Points — Rear

CAUTION: Do not use the differential housing as a lift point. Leaks or damage to the rear axle cover and adjoining differential housing surface can occur if a floor jack or any lifting device is allowed to contact the cover at any point where the cover joins the housing.



CAUTION: Do not use the rear control arms as a lifting point.

The rear jacking point is indicated by an arrow cutout in the frame, located in front of the rear tire and wheel assembly.

After the vehicle has been lowered, enable the air suspension system. Refer to Section 204-05 .

Lifting

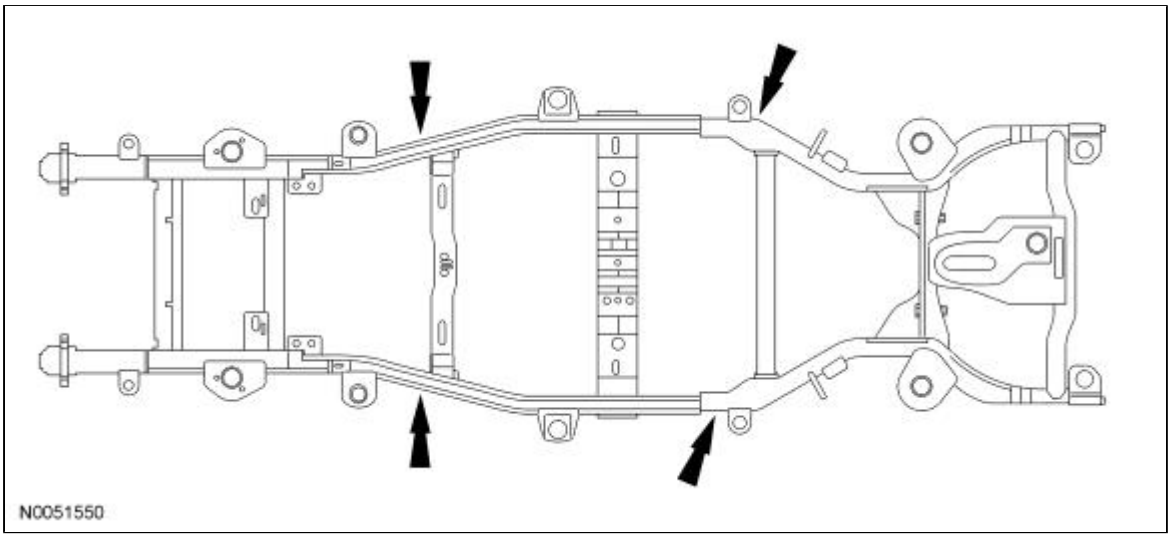
Printable View (149 KB)

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting or jacking an air suspension equipped vehicle. Failure to do so may result in unexpected inflation or deflation of the air springs which may result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

CAUTION: Damage to suspension, exhaust and steering linkage components can occur if care is not exercised when positioning the hoist adapters prior to lifting the vehicle.

Disable the air suspension sytem. Refer to Section 204-05 .

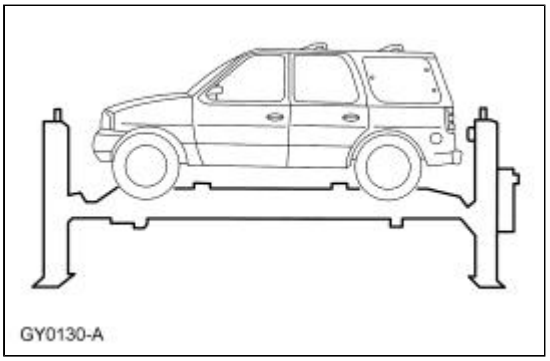
Lifting Points — Twin Post Hoist



Locate the front hoist adapters and rear hoist adapters (top of frame arc) as indicated.

After the vehicle has been lowered, enable the air suspension system. Refer to Section 204-05 .

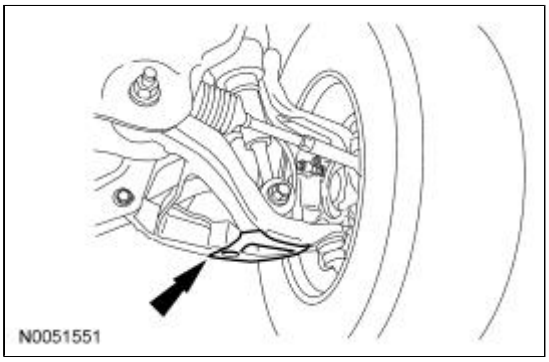
Lifting Points — Drive On Hoist



The vehicle is supported by tires and suspension components.

After the vehicle has been lowered, enable the air suspension system. Refer to Section 204-05 .

Lifting Points — Floor Jack, Front



The front can be lifted using a floor jack under the front control arm directly below the shock.

After the vehicle has been lowered, enable the air suspension system. Refer to Section 204-05 .

Maintenance Schedule — Gasoline Engines

Printable View (108 KB)

The maintenance schedule is designed to protect against major repairs resulting from neglect or inadequate maintenance and to prolong the life of the vehicle.

General Maintenance Information

NOTE: This is a generic maintenance schedule for all Ford, Lincoln and Mercury vehicles. There may be items listed that do not apply to all vehicles.

The Normal Schedule applies to operation of the vehicle under typical, everyday driving conditions. The maintenance frequency in this schedule typifies what the vast majority of vehicles will require. The listed services should be carried out at specified mileage intervals. There are, however, additional services required that only the noted vehicles require.

If the vehicle is operated in one or more of the following special operating conditions, those additional services will be required. The special operating conditions are:

- towing or carrying heavy loads.
- extensive idling and/or driving at low speeds for long distances.
- driving in dusty conditions.
- off-road operation.
- use of E85 fuel 50% of the time or greater (flex fuel vehicles only).

There are also exceptions to the Normal Operating Schedule which will require more frequent maintenance for some components. Those exceptions are:

- standard vehicle axle — maintenance and lubrication.
- police and taxi vehicles — maintenance and lubrication.
- engine oil and Motorcraft Premium Gold coolant — time-based and mileage-based intervals.
- change brake fluid every 2 years (Class A Motorhome).

Special Operating Condition Requirements

When towing a trailer or using a camper or car-top carrier:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months.
- Inspect and rotate tires every 4,800 km (3,000 miles).
- Change automatic transmission fluid (not required on 6R60 transmission), lubricate rear wheel drive (RWD) front wheel bearings, install new grease seals and adjust bearings every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Change transfer case fluid every 96,000 km (60,000 miles).
- Change manual transmission fluid as required.
- Inspect and lubricate U-joints and halfshafts as required.

During extensive idling and/or low speed driving for long distances, as in heavy commercial use such as delivery, taxi, patrol car or livery:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months or 200 hours of engine operation.
- Inspect and rotate tires every 4,800 km (3,000 miles).
- Lube front lower control arm and steering linkage ball joints with zerk fittings (if equipped) every 4,800 km (3,000 miles) or 3 months.
- Inspect brake system and check battery electrolyte level every 8,000 km (5,000 miles).
- Install a new fuel filter every 24,000 km (15,000 miles) (not required for Fusion and Milan).
- Change automatic transmission fluid (not required on 6R60 transmission), lubricate RWD front wheel bearings, install new grease seals and adjust bearings every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Install new spark plugs and change transfer case fluid every 96,000 km (60,000 miles).
- Install a new cabin air filter as required (if equipped).

When operating in dusty conditions such as unpaved or dusty roads:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months.
- Install a new fuel filter every 24,000 km (15,000 miles) (not required for Fusion and Milan).
- Change automatic transmission fluid (not required on 6R60 transmission), check air filter restriction gauge and install a new filter as required (Focus engine only) every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Change rear axle lubricant every 80,000 km (50,000 miles) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 miles).
- Install a new engine air filter as required.
- Install a new cabin air filter as required (if equipped).

When operating in off-road conditions:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months.
- Inspect and rotate tires every 4,800 km (3,000 miles).
- Change automatic transmission fluid every 48,000 km (30,000 miles). If equipped, change the in-line service-installed transmission fluid filter.
- Change rear axle lubricant every 80,000 km (50,000 miles) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 miles).
- Install a new cabin air filter as required (if equipped).
- Inspect and lubricate U-joints and halfshafts.
- Inspect and lubricate steering linkage ball joints with zerk fittings.

Use of E85 fuel 50% of the time or greater (flex fuel vehicles only):

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles), 3 months or 200 hours of engine operation (whichever occurs first).
- Fill the fuel tank with regular gasoline (non E85) once every 3,000 miles.

Checks and Services

Certain basic maintenance checks and inspections should be carried out at specified intervals. Any recognized adverse condition should be corrected as soon as possible.

Multi-Point Inspection

The following inspections are recommended at every service interval:

- Check and top off brake, coolant, manual and automatic transmission (if equipped with a underhood fluid level indicator), power steering and window washer fluids.
- Inspect tires for wear and correct air pressure, including spare tire.
- Check exhaust system for leaks, damage, loose parts and foreign material.
- Check battery performance.
- Check operation of horn, exterior lamps, turn signals and hazard warning lights.
- Check radiator, coolers, heater and air conditioning hoses.
- Inspect windshield wiper spray and wiper operation.
- Check windshield for cracks, chips and pitting.
- Inspect for oil and fluid leaks.
- Inspect air cleaner filter.
- Inspect halfshaft dust boots (if equipped).
- Check shocks, struts and other suspension components for leaks and damage.
- Inspect steering and linkage.
- Inspect accessory drive belt(s).
- Inspect clutch operation (if equipped).

In-Line, Service-Installed Transmission Fluid Filter

Some vehicles may be equipped with an in-line, service-installed transmission fluid filter. This filter is installed in the transmission fluid cooler return line. If equipped, install a new in-line filter during transmission fluid change intervals.

Maximum Oil Change Interval (Normal Schedule)

- 8,000 km (5,000 miles) or 6 months (whichever occurs first).

Maximum Oil Change Interval (Special Operating Conditions)

- 4,800 km (3,000 miles), 3 months or 200 hours of engine operation (whichever occurs first).

Monthly Checks

Check each of the following items every month:

- All interior and exterior lights for correct operation.
- Tires for wear and correct air pressure, including spare tire.
- Engine oil fluid level.
- Windshield washer solvent fluid level.

Six Month Checks

Check each of the following items at least every 6 months:

- Lap/shoulder belts and seat latches for wear and function.
- External mounted spare tire is stowed correctly (tight to body).
- Power steering fluid level.
- Washer spray, wiper operation and clean all wiper blades (install new wiper blades as necessary).
- Parking brake for correct operation.
- Lubricate all hinges, latches, door check straps and outside locks.
- Lubricate upper and lower sliding door tracks (if equipped).
- Clean sliding door contact switches (if equipped).
- Lubricate door rubber weatherstrips.
- Clean body and door drain holes.

- Safety warning lamps (brake, ABS, air bag, safety belt) for correct operation.
- Coolant system fluid level and correct strength.
- Battery connections. Clean if necessary.
- Clutch fluid level, if equipped.

Normal Schedule

NOTE: Rotate tires and inspect for wear at 5,000 miles, 15,000 miles and every 15,000 miles is required thereafter. At other 5,000-mile intervals, rotation is recommended for optimal life.

The following check procedures should be carried out for all cars, minivans, light trucks, sport utilities, vans, four wheel drive (4WD) and natural gas vehicles.

- Retighten the wheel nuts to the specified torque at 800 km (500 miles) after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).
- On vehicles equipped with dual rear wheels, retighten the wheel nuts to the specified torque at 160 km (100 miles) and again at 800 km (500 miles) of new vehicle operation or after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).
- Carry-out multi-point inspection (recommended).

8,000 Km (5,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Carry-out multi-point inspection (recommended).

16,000 Km (10,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

24,000 Km (15,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, ball joints, suspension and if equipped, halfshafts, driveshaft and U-joints.
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate halfshafts, driveshaft and U-joints.
- Rotate tires and inspect for wear.
- Install a new cabin air filter (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

32,000 Km (20,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.

- Carry-out multi-point inspection (recommended).

40,000 Km (25,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

48,000 Km (30,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints and, if equipped, halfshafts, driveshaft and U-joints.
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion and Milan).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift transmission. Install a new remote filter if equipped with a TorqShift transmission. Inspect automatic transmission fluid level using the fluid level on all other vehicles (if equipped with an underhood fluid level indicator). Change the in-line service-installed transmission fluid filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Freestar, Monterey and Expedition).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

56,000 Km (35,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

64,000 Km (40,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

72,000 Km (45,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.

- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

80,000 Km (50,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Change rear axle fluid (Class A Motorhome).
- Carry-out multi-point inspection (recommended).

88,000 Km (55,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

96,000 Km (60,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion and Milan).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift or 4F27E transmissions. Install a new remote filter if equipped with a TorqShift transmission. Inspect automatic transmission fluid level on all other vehicles (if equipped with an underhood fluid level indicator). Change the in-line service-installed transmission fluid filter (if equipped).
- Change automatic transmission fluid on all vehicles equipped with a CVT transmission and install a new high-pressure case filter and O-rings.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Freestar, Monterey and Expedition).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate rear wheel drive (RWD) front wheel bearings, install new grease seals and adjust bearings (if equipped with serviceable bearings).
- Lubricate the four wheel drive (4WD) front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

104,000 Km (65,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

112,000 Km (70,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

120,000 Km (75,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Check air filter restriction gauge, install a new filter as necessary (Focus only).
- Lubricate steering linkage, suspension and ball joints (if equipped zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

128,000 Km (80,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

136,000 Km (85,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

144,000 Km (90,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion and Milan).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with TorqShift transmissions. Install a new remote filter element on vehicles equipped with the TorqShift transmission. Inspect automatic transmission fluid level on all other vehicles (if equipped with an underhood fluid level indicator). If equipped, change the in-line service-installed transmission fluid filter.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Freestar, Monterey and Expedition).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).

- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

152,000 Km (95,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

160,000 Km (100,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect accessory drive belt(s).
- Install new spark plugs.
- Change rear axle fluid (F-450/550, E-450 and Class A Motorhome).
- Change Premium Gold coolant or change at 6 years, whichever comes first.
- Install a new external PCV on all cars and light trucks under 6,000 lb Gross Vehicle Weight (GVW) (except 3V engines).
- Change manual transmission fluid (if equipped) (except Escape).
- Carry-out multi-point inspection (recommended).

168,000 Km (105,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine coolant system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

176,000 Km (110,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

184,000 Km (115,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

192,000 Km (120,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.

- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion and Milan).
- Install a new cabin air filter (if equipped).
- Install a new external PCV valve on all cars and light trucks over 6,000 lb GVW (except 3V engines).
- Change automatic transmission/transaxle fluid on all vehicles equipped with TorqShift or 4F27E transmissions. Install a new remote filter element on the vehicles equipped with the TorqShift transmission. Inspect automatic transmission fluid level on all other vehicles (if equipped with an underhood fluid level indicator). If equipped, change the in-line service-installed transmission fluid filter.
- Change automatic transmission fluid on all vehicles equipped with a CVT transmission and install a new high-pressure case filter and O-rings.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Freestar, Monterey and Expedition).
- Lubricate RWD front wheel bearings, install new grease seals and adjust bearings (if equipped with serviceable bearings).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

200,000 Km (125,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

208,000 Km (130,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

216,000 Km (135,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Carry-out multi-point inspection (recommended).

224,000 Km (140,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

232,000 Km (145,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Carry-out multi-point inspection (recommended).

240,000 Km (150,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Change Motorcraft Premium Gold coolant (see Exceptions To Normal Schedule and Mileage Base).
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new fuel filter (not required for Fusion and Milan).
- Install a new engine air filter (not required on Focus).
- Check air filter restriction gauge, install a new air filter as necessary (Focus only).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid (except CVT transmission).
- Change automatic transaxle filter (except CVT, Five Hundred and Montego equipped with a 6-speed automatic transaxle).
- Change rear axle lubricant on all RWD vehicles.
- Change rear axle fluid (Class A Motorhome).
- Install a new accessory drive belt(s) (if a new belt has not been installed within the last 100,000 miles).
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Freestar, Monterey and Expedition).
- Install a new climate controlled seat back filter (MKZ only).
- Inspect PVC for flow (3V engines).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Install new non-sealed RWD front wheel bearings and seals (if new bearings and seals have not been installed in the last 100,000 miles).
- Lubricate the 4WD front axle shaft U-joints (if equipped) (F-250/350/450/550).
- Change front axle lubricant (4WD only).
- Change transfer case fluid (4WD only).
- Change automatic transmission/transaxle fluid on all vehicles equipped with a 4F50N, 5R44E, 5R55E, 5R555, TorqShift and CD4E transmission/transaxle. Install a new remote filter if equipped with a TorqShift transmission. Inspect automatic transmission fluid level using the fluid level indicator on all other vehicles (if equipped with an underhood fluid level indicator). Change the in-line service-installed transmission fluid filter (if equipped).
- Carry-out multi-point inspection (recommended).

Exceptions To Normal Schedule

Maximum Oil Change Interval

- Normal schedule: 8,000 km (5,000 miles) or 6 months, whichever occurs first.
- Special operating conditions: 4,800 km (3,000 miles), 3 months or 200 hours of operation, whichever occurs first.

Motorcraft Premium Gold Coolant

- Change Motorcraft Premium Gold coolant at 6 years or 160,000 km (100,000 miles) of the vehicle's life, whichever occurs first.
- After the initial change, change coolant every 3 years or 80,000 km (50,000 miles) thereafter.

Normal Vehicle Axle Maintenance

Rear axles and transfer case/power transfer unit (PTU) units containing synthetic lubricant and light duty trucks equipped with Ford-design axles are lubricated for life. These lubricants are not to be checked or changed unless service is required, or if a leak is suspected or the axle assembly has been submerged in water.

The axle and transfer case/PTU fluid should be changed anytime they have been submerged in water. Non-synthetic rear axle lubricants should be replaced every 4,800 km (3,000 miles) or 3 months, whichever occurs first, during extended trailer tow operation above 21°C (70°F) ambient and wide open throttle for extended periods above 45 mph.

The 3,000 mile lube change interval may be waived if the axle was filled with 75W-140 synthetic gear lubricant. Add 4 ounces of additive friction modifier for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

Police and Taxi Vehicle Axle Maintenance

Replace rear axle lubricant every 160,000 km (100,000 miles). Rear axle lubricant change may be waived if the axle was filled with 75W-140 synthetic gear lubricant. Add 4 ounces of additive friction modifier for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

E and F-450 and 550 Series Axle Maintenance

Replace rear axle lubricant every 100,000 miles under normal driving conditions on all E and F-450 and 550 series applications. For E and F-450 and 550 series vehicles operated at or near maximum Gross Vehicle Weights, the rear axle lubricant should be replaced every 50,000 miles.

In addition, the 50,000 mile schedule should be observed when the vehicles are operated under the Special Operating Conditions.

Class A Motorhome

- Every 2 years — change brake fluid.
- Every 48,000 km (30,000 miles) — change the automatic transmission fluid and the transmission remote filter element.
- Change rear axle fluid at 80,000 km (50,000 miles), 160,000 km (100,000 miles) and 240,000 km (150,000 miles).

Noise, Vibration and Harshness (NVH)

Printable View (228 KB)

Noise is any undesirable sound, usually unpleasant in nature. Vibration is any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down. Harshness is a ride quality issue where the vehicle's response to the road transmits sharply to the customer. Harshness normally describes a firmer than usual response from the suspension system. Noise, vibration and harshness (NVH) is a term used to describe these conditions, which result in varying degrees of dissatisfaction. Although, a certain level of NVH caused by road and environmental conditions is normal. This section is designed to aid in the diagnosis, testing and repair of NVH concerns.

Acceptable Noise, Vibration and Harshness

All internal combustion engines and drivelines produce some noise and vibration; operating in a real world environment adds noise that is not subject to control. Vibration isolators, mufflers and dampers reduce these to acceptable levels. A driver who is unfamiliar with a vehicle can think that some sounds are abnormal when actually the sounds are normal for the vehicle type. For example, Traction-Lok® differentials produce a slight noise on slow turns after extended highway driving. This is acceptable and has no detrimental effect on the locking axle function. As a technician, it is very important to be familiar with vehicle features and know how they relate to NVH concerns and their diagnosis. For example, if the vehicle has automatic overdrive, it is important to test drive the vehicle both in and out of overdrive mode.

Diagnostic Theory

The shortest route to an accurate diagnosis results from:

- system knowledge, including comparison with a known good system.
- system history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of possible sources.
- using a systematic diagnostic method that divides the system into related areas.

The diagnosis and correction of noise, vibration and harshness concerns requires:

- a road or system test to determine the exact nature of the concern.
- an analysis of the possible causes.
- testing to verify the cause.
- repairing any concerns found.
- a road test or system test to make sure the concern has been corrected or brought back to within an acceptable range.

Glossary of Terms

Acceleration — Light

An increase in speed at less than 1/2 throttle.

Acceleration — Medium

An increase in speed at 1/2 to nearly full throttle, such as 0-97 km/h (0-60 mph) in approximately 30 seconds.

Acceleration — Heavy

An increase in speed at 1/2 to full throttle, such as 0-97 km/h (0-60 mph) in approximately 20 seconds.

Ambient Temperature

The surrounding or prevailing temperature.

Amplitude

The quantity or amount of energy produced by a vibrating component (G force). An extreme vibration has a high amplitude. A mild vibration has a low amplitude.

Backlash

Gear teeth clearance.

Boom

Low frequency or low pitched noise often accompanied by a vibration. Also refer to drumming.

Bound Up

An overstressed isolation (rubber) mount that transmits vibration/noise instead of absorbing it.

Brakes Applied

When the service brakes are applied with enough force to hold the vehicle against movement with the transmission in gear.

Buffet/Buffeting

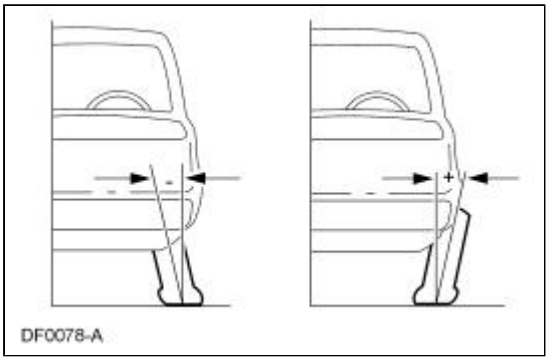
Strong noise fluctuations (less than 1000 Hz) caused by gusting winds. An example would be wind gusts against the side glass.

Buzz

A low-pitched sound (200-5000 Hz) like that from a bee. Often a metallic or hard plastic humming sound. Also describes a high frequency (200-800 Hz) vibration. Vibration feels similar to an electric razor.

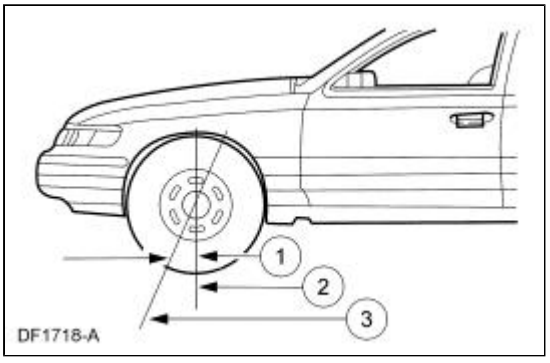
Camber

The angle of the wheel in relation to the true vertical as measured looking from the front of the vehicle. Camber is positive when the wheel angle is offset so that the top of the wheel is positioned away from the vehicle.



Caster

The angle of the steering knuckle in relation to the true vertical as measured looking from the side of the vehicle.



Item	Description
1	Positive caster
2	True vertical
3	Steering axis

Chatter

A pronounced series of rapidly repeating rattling or clicking sounds.

Chirp

A short-duration high-pitched noise associated with a slipping drive belt.

Chuckle

A repetitious low-pitched sound. A loud chuckle is usually described as a knock.

Click

A sharp, brief, non-resonant sound, similar to actuating a ball point pen.

Clonk

A hydraulic knocking sound. Sound occurs with air pockets in a hydraulic system. Also described as hammering.

Clunk/Driveline Clunk

A heavy or dull, short-duration, low-frequency sound. Occurs mostly on a vehicle that is accelerating or decelerating abruptly. Also described as a thunk.

Coast/Deceleration

Releasing the accelerator pedal at cruise, allowing the engine to reduce vehicle speed without applying the brakes.

Coast/Neutral Coast

Placing the transmission range selector in NEUTRAL (N) or depressing the clutch pedal while at cruise.

Constant Velocity (CV) Joint

A joint used to absorb vibrations caused by driving power being transmitted at an angle.

Controlled Rear Suspension Height

The height at which a designated vehicle element must be when driveline angle measurements are made.

Coupling Shaft

The shaft between the transfer case and the front drive axle or, in a 2-piece rear driveshaft, the front section.

CPS

Cycles per second. Same as hertz (Hz).

Cracks

A mid-frequency sound, related to squeak. Sound varies with temperature conditions.

Creak

A metallic squeak.

Cruise

Constant speed on level ground; neither accelerating nor decelerating.

Cycle

The process of a vibrating component going through a complete range of motion and returning to the starting point.

Decibel

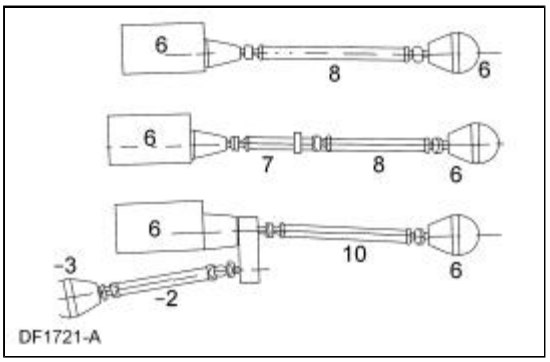
A unit of measurement, referring to sound pressure level, abbreviated dB.

Drive Engine Run-Up (DERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still, the brakes applied and the transmission engaged. This test is used for noise and vibration checks.

Driveline Angles

The differences of alignment between the transmission output shaft, the driveshaft and the rear axle pinion centerline.



Driveshaft

The shaft that transmits power to the rear axle input shaft (pinion shaft). In a 2-piece driveshaft, it is the rearmost shaft.

Drivetrain

All power transmitting components from the engine to the wheels; includes the clutch or torque converter, the transmission, the transfer case, the driveshaft and the front or rear drive axle.

Drivetrain Damper

A weight attached to the engine, the transmission, the transfer case or the axle. It is tuned by weight and placement to absorb vibration.

Drone

A low frequency (100-200 Hz) steady sound, like a freezer compressor. Also described as a moan.

Drumming

A cycling, low-frequency (20-100 Hz), rhythmic noise often accompanied by a sensation of pressure on the ear drums. Also described as a low rumble, boom or rolling thunder.

Dynamic Balance

The equal distribution of weight on each side of the centerline, so that when the wheel and tire assembly spins, there is no tendency for the assembly to move from side-to-side (wobble). Dynamically unbalanced wheel and tire assemblies can cause wheel shimmy.

Engine Imbalance

A condition in which an engine's center mass is not concentric to the rotation center, causing excessive motion.

Engine Misfire

When combustion in one or more cylinders does not occur or occurs at the wrong time.

Engine Shake

An exaggerated engine movement or vibration that directly increases in frequency as the engine speed increases. It is caused by non-equal distribution of mass in the rotating or reciprocating components.

Flexible Coupling

A flexible joint.

Float

A drive mode on the dividing line between cruise and coast where the throttle setting matches the engine speed with the road speed.

Flutter

Mid to high (100-2000 Hz) intermittent sound due to air flow. Similar to a flag flapping in the wind.

Frequency

The rate at which a cycle occurs within a given time.

Gravelly Feel

A grinding or growl in a component, similar to the feel experienced when driving on gravel.

Grind

An abrasive sound, similar to using a grinding wheel, or rubbing sand paper against wood.

Hiss

Steady high frequency (200-800 Hz) noise. Vacuum leak sound.

Hoot

A steady low frequency tone (50-500 Hz), sounds like blowing over a long neck bottle.

Howl

A mid-range frequency (200-800 Hz) noise between drumming and whine. Also described as a hum.

Hum

Mid-frequency (200-800 Hz) steady sound, like a small fan motor. Also described as a howl.

Hz

Hertz; a frequency measured in cycles per second.

Imbalance

Out of balance; heavier on one side than the other. In a rotating component, imbalance often causes vibration.

Inboard

Toward the centerline of the vehicle.

Intensity

The physical quality of sound that relates to the strength of the vibration (measured in decibels). The

higher the sound's amplitude, the higher the intensity and vice versa.

Isolate

To separate the influence of one component to another.

Knock

A heavy, loud, repetitious sound, like a knock on the door.

Moan

A constant, low-frequency (100-200 Hz) tone. Also described as a hum.

Neutral Engine Run-Up (NERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still and the transmission disengaged. This test is used to identify engine related vibrations.

Neutralize/Normalize

To return to an unstressed position. Used to describe mounts. Also refer to bound up.

Outboard

Away from the centerline of the vehicle.

Ping

A short duration, high-frequency sound, which has a slight echo.

Pinion Shaft

The input shaft in a driving axle that is usually a part of the smaller driving or input hypoid gear of a ring and pinion gearset.

Pitch

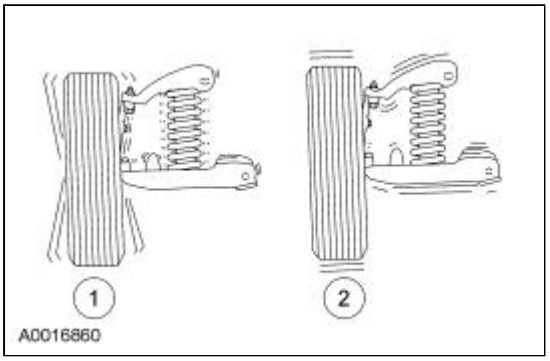
The physical quality of sound that relates to its frequency. Pitch increases as frequency increases and vice versa.

Pumping Feel

A slow, pulsing movement.

Radial/Lateral

Radial is in the plane of rotation; lateral is at 90 degrees to the plane of rotation.



Item	Description
1	Lateral runout
2	Radial runout

Rattle

A random and momentary or short duration noise.

Ring Gear

The large, circular, driven gear in a ring and pinion gearset.

Road Test

The operation of the vehicle under conditions intended to produce the concern under investigation.

Roughness

A medium-frequency vibration. A slightly higher frequency (20 to 50 Hz) than a shake. This type of vibration is usually related to drivetrain components.

Runout

Lateral runout means measuring the movement or "wobble" of a wheel or tire at the sidewall. Radial runout means measuring the out-of-round at the tread surface.

Rustling

Intermittent sound of varying frequency (100-2000 Hz), sounds similar to shuffling through leaves.

Shake

A low-frequency vibration (5-20 Hz), usually with visible component movement. Usually relates to tires, wheels, brake drums or brake discs if it is vehicle speed sensitive, or engine if it is engine speed sensitive. Also referred to as a shimmy or wobble.

Shimmy

An abnormal vibration or wobbling, felt as a side-to-side motion of the steering wheel in the driveshaft rotation. Also described as waddle.

Shudder

A low-frequency vibration that is felt through the steering wheel or seat during light brake application.

Slap

A resonance from flat surfaces, such as safety belt webbing or door trim panels.

Slip Yoke/Slip Spline

The driveshaft coupling that allows length changes to occur while the suspension articulates and while the driveshaft rotates.

Squeak

A high-pitched transient sound, similar to rubbing fingers against a clean window.

Squeal

A long-duration, high-pitched noise.

Static Balance

The equal distribution of weight around the wheel. Statically unbalanced wheel and tire assemblies can cause a bouncing action called wheel tramp. This condition will eventually cause uneven tire wear.

Tap

A light, rhythmic, or intermittent hammering sound, similar to tapping a pencil on a table edge.

Thump

A dull beat caused by 2 items striking together.

Tick

A rhythmic tap, similar to a clock noise.

Tip-In Moan

A light moaning noise heard during light vehicle acceleration, usually between 40-100 km/h (25-65 mph).

TIR

The acronym for total indicated runout is TIR.

Tire Deflection

The change in tire diameter in the area where the tire contacts the ground.

Tire Flat Spots

A condition commonly caused by letting the vehicle stand while the tires cool off. This condition can be corrected by driving the vehicle until the tires are warm. Also, irregular tire wear patterns in the tire tread resulting from wheel-locked skids.

Tire Force Vibration

A tire vibration caused by variations in the construction of the tire that is noticeable when the tire rotates against the pavement. This condition can be present on perfectly round tires because of variations in the inner tire construction. This condition can occur at wheel rotation frequency or twice rotation frequency.

Transient

A noise or vibration that is momentary, a short duration.

Two-Plane Balance

Radial and lateral balance.

Vibration

Any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down.

Whine

A constant, high-pitched noise. Also described as a screech.

Whistle

High-pitched noise (above 500 Hz) with a very narrow frequency band. Examples of whistle noises are a turbocharger or airflow around an antenna.

Wind Noise

Any noise caused by air movement in, out or around the vehicle.

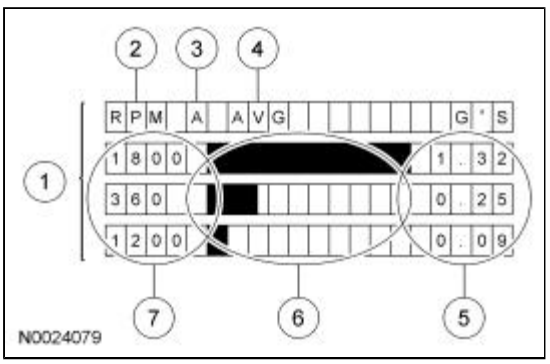
WOT

The acronym for wide open throttle is WOT.

Tools and Techniques

Vibration Analyzer (EVA)

The vibration analyzer (EVA) is a hand-held electronic scan tool which will assist in locating the source of unacceptable vibrations. The vibration sensor can be remotely mounted anywhere in the vehicle for testing purposes. The unit displays the 3 most common vibration frequencies and their corresponding amplitudes simultaneously. A bar graph provides a visual reference of the relative signal strength (amplitude) of each vibration being displayed and its relative G force. The keypad is arranged to make the EVA simple to program and use. Some of the functions include the ability to average readings as well as record, play back and freeze readings. The EVA has a strobe balancing function that can be used to detect imbalance on rotating components such as a driveshaft or engine accessories.



Item	Description
1	EVA screen
2	Frequency mode displayed in rpm or Hz
3	Active sensor input (A or B)
4	Current active mode
5	G force indicators or the strongest frequencies in descending strength of each vibration
6	Strength of each vibration
7	Frequency in rpm/Hz of each vibration

The EVA allows for a systematic collection of information that is necessary to accurately diagnose and repair NVH problems. For the best results, carry out the test as follows:

a. Test drive the vehicle with the vibration sensor inside the vehicle.
b. Place the sensor in the vehicle according to feel.
    - If the condition is felt through the steering wheel, the source is most likely in the front of the vehicle.
    - A vibration that is felt in the seat or floor only will most likely be found in the driveline, drive axle or rear wheels and tires.
c. Record the readings. Also note when the condition begins, when it reaches maximum intensity and if it tends to diminish above/below a certain speed.
    - Frequencies should be read in the "average" mode.
    - Frequencies have a range of plus or minus 2. A reading of 10 Hz can be displayed as an 8 Hz through 12 Hz.
    - Frequencies with a reading of 0.06 Gs or less, are barely perceptible NVH levels. No corrective action is necessary.
d. Place the vibration sensor on or near the suspect area outside the vehicle.
e. Continue the road test, driving the vehicle at the speed the symptom occurs, and take another reading.
f. Compare the readings.
    - A match in frequency indicates the problem component or area.
    - Example: A vibration is felt in the seat. Place the sensor on the console. Record the readings. Place the vibration sensor on the rear axle. Compare the readings. If the frequencies are the same, the axle is the problem component.
    - If the 2 readings are not the same frequency, then diagnose the frequency with the most significant amplitude (Gs) first.

NVH Analyzer (Vetronix)

The MTS 4000 and the MTS 4100 NVH analyzers are tools to aid in the identification and isolation of a noise, vibration or harshness concern in a vehicle. They measures noise and vibration data and compare it with data obtained from the vehicle's powertrain control module (PCM) in order to provide possible sources. The MTS 4000 and the 4100 have the following characteristics:

- Interfaces with the vehicle's computer system
- Support and store vibration data input from 1 or 2 accelerometers
- Support and store noise data input from 2 microphones
- Provide a photo-tachometer for operation of the driveshaft balancing function
- Provide a strobe output capable of driving a standard timing light
- Contain a real time clock circuit that provides time and date information which is used for tagging test data
- Have the capability to print to an external printer and interface with a PC
- Can be powered from a variety of power sources: cigarette lighter, AC power or the internal battery pack

The MTS 4000 and the 4100 NVH analyzers have 4 main operating modes. The first is for vibration

diagnosis. This mode measures data from 1 or 2 accelerometers simultaneously while obtaining data from the vehicle's computer system about the operation of the vehicle. Then it does a frequency analysis on the accelerometer information and compares the vibration frequencies with the frequencies associated with various rotating components within the vehicle. The data can be presented in 4 different display modes: principle component, bar chart, frequency spectrum or waterfall. All display mode formats contain the same common elements, such as amplitude.

The second is for noise diagnosis. This mode measures noise from 1 or 2 microphones simultaneously. All noise measurements are in db's. All frequency bands used for noise measurements are the same as for the vibration measurements, up to 1000 Hz.

The third is driveshaft balancing. Driveshaft balancing is done using 1 or 2 accelerometers and a photo-tachometer. The accelerometers measure the vibrations at both ends of the driveshaft, while the photo-tachometer measures the rotation speed and position reference.

The fourth mode is the strobe. A strobe or standard timing light can be connected to an analyzer, to provide a means for measuring rotational speed. The strobe function is used for isolating the source of a vibration.

Vibrate Software®

Vibrate Software® (Rotunda tool number 215-00003) is a diagnostic aid which will assist in pinpointing the source of unacceptable vibrations. The engine's crankshaft is the point of reference for vibration diagnosis. Every rotating component will have an angular velocity that is faster, slower or the same as the engine's crankshaft. Vibrate Software® calculates the angular velocity of each component and graphically represents these velocities on a computer screen and on a printed vibration worksheet. The following steps outline how Vibrate Software® helps diagnose a vibration concern:

- Enter the vehicle information. Vibrate will do all the calculations and display a graph showing tire, driveshaft and engine vibrations.
- Print a Vibration Worksheet graph. The printed graph is to be used during the road test.
- Road test the vehicle at the speed where the vibration is most noticeable. Record the vibration frequency (rpm) and the engine rpm on the worksheet graph. The point on the graph where the vibration frequency (rpm) reading and the engine rpm reading intersect indicates the specific component group causing the concern.
    - A EVA or equivalent tool capable of measuring vibration frequency and engine rpm will be needed.
- Provide pictures of diagnostic procedures to aid in testing components.

Combination EngineEAR/ChassisEAR

An electronic listening device used to quickly identify noise and the location under the chassis while the vehicle is being road tested. The ChassisEARs can identify the noise and location of damaged/worn wheel bearings, CV joints, brakes, springs, axle bearings or driveshaft carrier bearings.

EngineEAR Basic Unit

An electronic listening device used to detect even the faintest noises, the EngineEARs can detect the noise of damaged/worn bearings in generators, coolant pumps, A/C compressors and power steering pumps. They are also used to identify noisy lifters, exhaust manifold leaks, chipped gear teeth and for detecting wind noise. The EngineEAR has a sensing tip, amplifier and headphones. The directional sensing tip is used to listen to the various components. Point the sensing tip at the suspect component and adjust the volume with the amplifier. Placing the tip in direct contact with a component will reveal structure-borne noise and vibrations, generated by or passing through, the component. Various volume levels can reveal different sounds.

Ultrasonic Leak Detector

The Ultrasonic Leak Detector is used to detect wind noises caused by leaks and gaps in areas where there is weatherstripping or other sealing material. It is also used to identify A/C leaks, vacuum leaks

and evaporative emission noises. The Ultrasonic Leak Detector includes a multi-directional transmitter (operating in the ultrasonic range) and a hand-held detector. The transmitter is placed inside the vehicle. On the outside of the vehicle, the hand-held detector is used to sweep the area of the suspected leak. As the source of the leak is approached, a beeping sound is produced which increases in both speed and frequency.

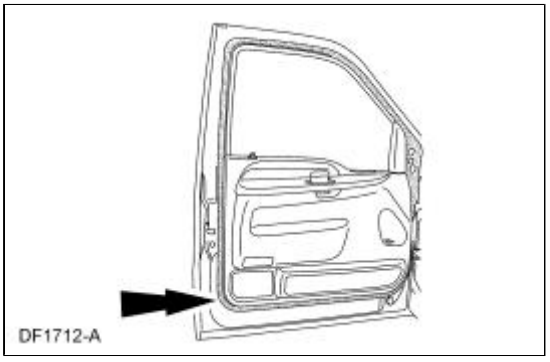
Squeak and Rattle Repair Kit

The Squeak and Rattle Repair Kit (Rotunda tool number 164-R4900) contains lubricants and self-adhesive materials that can be used to eliminate interior and exterior squeaks and rattles. The kit consists of the following materials:

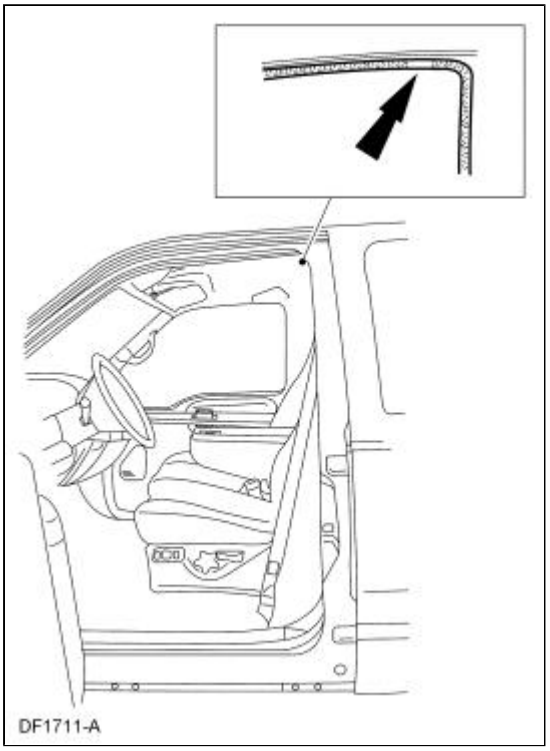
- PVC (soft foam) tape
- Urethane (hard foam) tape
- Flocked (black fuzzy) tape
- UHMW (frosted) tape
- Squeak and rattle oil tube
- Squeak and rattle grease tube

Tracing Powder

Tracing powder is used to check both the uniformity of contact and the tension of a seal against its sealing surface. These tests are usually done when a suspected air leak/noise appears to originate from the seal area or during the alignment and adjustment of a component to a weatherstrip. Tracing powder can be ordered from Crest Industries as ATR Leak Trace. Carry out the tracing powder test as follows:

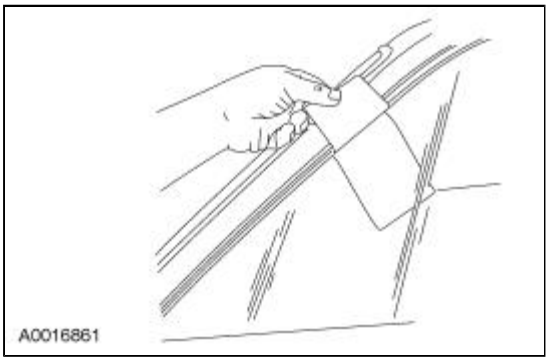


a. Clean the weatherstrip.
b. Spray the tracing powder on the mating surface only.
c. Close the door completely. Do not slam the door.
d. Open the door. An imprint is made where the weatherstrip contacted the mating surface seal. Gaps or a faint imprint will show where there is poor contact with the weatherstrip.



Index Card

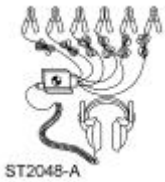
Place an index card or a piece of paper between the weatherstrip and the sealing surface, then close the door. Slowly withdraw the index card or paper after the door is closed and check the amount of pressure on the weatherstrip. There should be a medium amount of resistance as it is withdrawn. Continue around the entire seal area. If there is little or no resistance, this indicates insufficient contact to form a good seal. At these points, the door, the glass or the weatherstrip is out of alignment.



Noise, Vibration and Harshness (NVH)

Printable View (775 KB)

Special Tool(s)

 ST2048-A	ChassisEAR 107-R2102 or equivalent
ST2311-A	Vibration Analyzer 100-F027 (014-00344) or equivalent
ST2312-A	EngineEAR 107-R2100 or equivalent
ST2314-A	Ultrasonic Leak Detector 134-R0135 or equivalent
ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1266-A	Dial Indicator Gauge with Holding Fixture 100-D002 (D78P-4201-B) or equivalent

To assist the service advisor and the technician, a Write-up Job Aid and an NVH Diagnostic Guide are included with this material. The Write-up Job Aid serves as a place to record all important symptom information. The NVH Diagnostic Guide serves as a place to record information reported on the Write-up Job Aid as well as data from the testing to be carried out.

To begin a successful diagnosis, fill out the NVH Diagnostic Guide, record the reported findings, then proceed to each of the numbered process steps to complete the diagnosis.

"WRITE-UP" JOB AID

REPAIR ORDER # _____

CUSTOMER CONCERN # _____

SPECIFIC SENSE IDENTIFICATION AND LOCATION ON VEHICLE OF CUSTOMER SYMPTOM(S)

INSTRUCTIONS: Check below sense affected and location of concern on the generic vehicle illustration (darken the vehicle area). Plus circle appropriate responses to the right.

NOTE: Shaded backgrounds indicate caution areas. Selection of two or more caution areas "flag" difficult repairs. In general, shaded areas are the more difficult to verify and repair, and require all applicable columns to be completed.

SEE YES ☐ | FEEL YES ☐

HEAR YES ☐ | SMELL YES ☐

VEHICLE SYMPTOM AREA	HOW OFTEN?	VEHICLE OPERATING MODE	VEHICLE CONDITIONS	VEHICLE SPEED(mph)	WHEN VEHICLE IS?	AMBIENT CONDITION
Front of Vehicle	Always	Start Up	Accessories On	0	Turning Left	_____ Below Zero
Engine Compartment	Daily A.M. P.M.	Idle	(define below)	1-9	Turning Right	Below Freezing (0 -19)
Dash	Conditional	Gear Selection	Windows Open	10-19	Over Bumps	Below Freezing (20 -32)
Steering Wheel	Weekly	Accel Light	4x4	20-29	Up Hills	33 -49
Accelerator Pedal	Monthly	Accel Moderate	Hauling	30-39	Down Hills	50 -69
Brake Pedal	Intermittent	Accel Heavy	Towing	40-49	Shifting	70 -89
Clutch Pedal	Unknown	Steady Speed	Snow Plowing	50-59	Parked	90 +
Seat		Deceleration	Other	60-69	In Traffic	Sunny
Rear of Vehicle		Neutral	(define below)	70+		Dry
Top of Vehicle		Reverse		ENGINE		Windy
Floor Pan		Stopping/Braking		TEMP		Wet/Humid
Under Vehicle				Cold		Rain
Other (define below)				Normal		Snow
				Hot		Ice

DEALER VERIFICATION

	YES	NO
SERVICE ADVISOR	☐	☐
SHOP FOREMAN	☐	☐
SERVICE MANAGER	☐	☐
QC MANAGER	☐	☐
TECHNICIAN	☐	☐
VERIFIED WITH CUSTOMER	☐	☐

WHAT THE CUSTOMER SAID

OASIS SYMPTOM CODE(S)

VIN NUMBER

N0029787

NVH DIAGNOSTIC GUIDE

Dealer: _____ Date: _____

P.A. Code: _____ Order No. _____ Technician: _____

Owner's Name: _____ Address: _____

Phone No. Home: _____ Work: _____

Vehicle Make: _____ Model: _____ Year: _____

VIN: _____ Mileage: _____ Engine: _____ Trans: _____ Axle: ____

OWNER'S DESCRIPTION OF COMPLAINT:

Did Condition Exist When Vehicle Was New? Yes / No (circle one)

How Did Condition Begin? Gradually ☐ Suddenly ☐

At What Mileage Did It Occur Or Begin Occuring? _____

Which Driving Conditions Affect The Vehicle?

Light Accel ☐ Closed Throttle Decel ☐ Brakes Applied/Released ☐

Medium Accel ☐ Coast (Float) ☐ Driving The Vehicle: Straight ☐

Heavy Accel ☐ Constant Speed ☐ Cornering ☐

Is Vibration Noticed? If So, Where:

Seat ☐ Steering Wheel ☐ Instrument Panel ☐ Floor ☐ Body Panels ☐ Ft/Rr of Vehicle ☐

Is There Sound Or Sensation Of Sound? Yes / No (circle one)

If So, Describe The Sound :

Boom ☐ Hum ☐ Whine ☐ Growl ☐ Other: _____

Drone ☐ Tip-In-Moan ☐ Squeak ☐ Rattle ☐

PREDRIVE CHECKS

Tire Condition/Pressure: _____

Vehicle Body Damage? _____

Other: _____

ROAD TEST:

Vibration/Noise Occurs:

Vehicle Speed _____ Accel _____ Vibration Frequency _____ Hz/RPM

Gear Range _____ Decel/Coast _____ Engine Speed _____ RPM

ENGINE RUN-UP TESTS

Neutral Engine Run-Up (NERU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Drive Engine Run-Up (DERU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Drivetrain Run-Up (DTRU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Indicate Suspected Area of Concern:

Tire/Wheel/Brakes ☐ Engine/Accessory ☐ Rear ☐

Driveline/Axle ☐ Susp/Steering ☐ Right ☐

Body ☐ Front ☐ Left ☐

Other _____

Equipment Used:

Reed Tachometer ☐ Electronic Noise Detector ☐ Tape ☐

Engine Tachometer ☐ Ultrasonic Leak Detector ☐ Other _____

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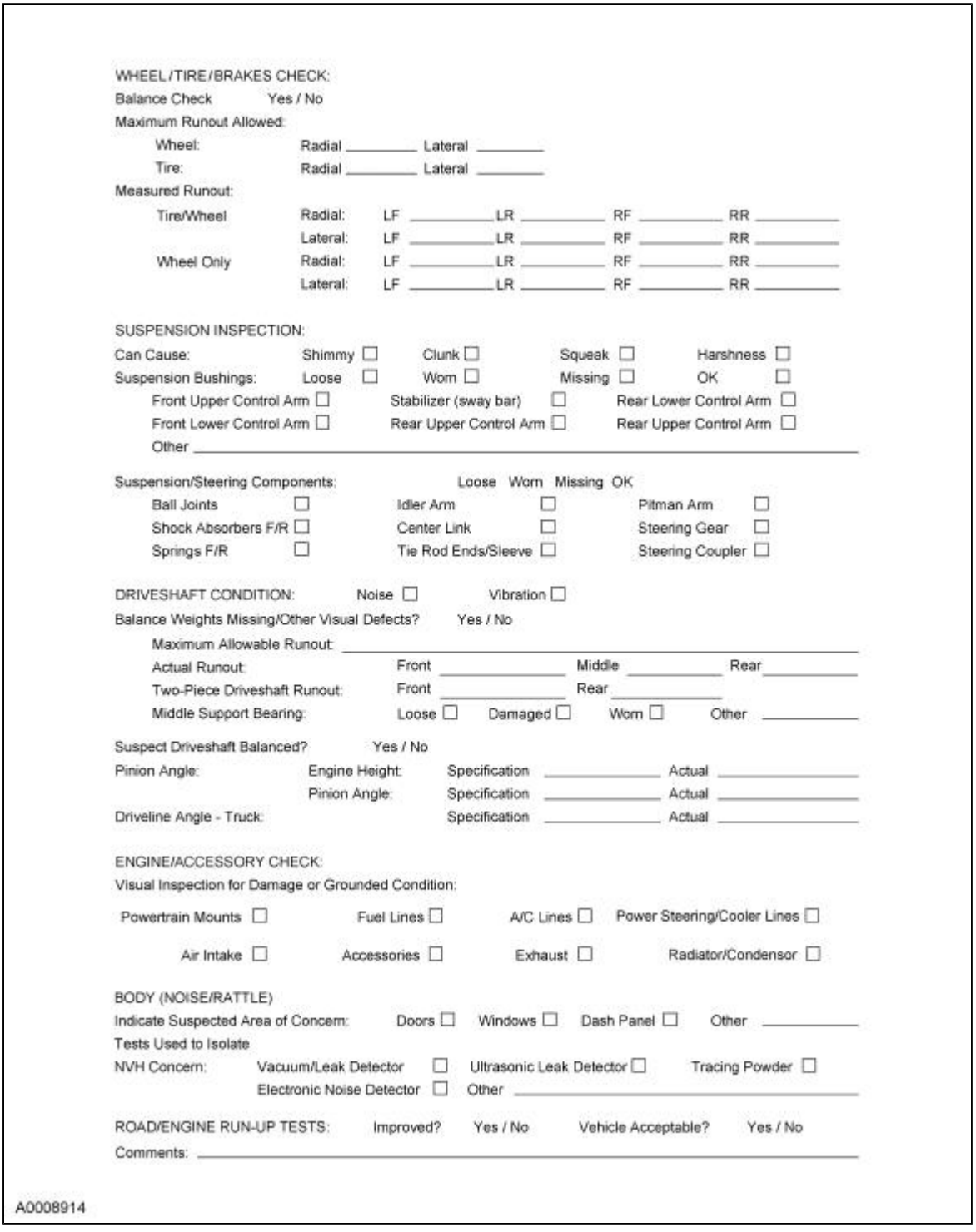

WHEEL/TIRE/BRAKES CHECK:
Balance Check Yes / No
Maximum Runout Allowed:
Wheel: Radial _____ Lateral _____
Tire: Radial _____ Lateral _____
Measured Runout:
Tire/Wheel Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____
Wheel Only Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____

SUSPENSION INSPECTION:
Can Cause: Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐
Suspension Bushings: Loose ☐ Worn ☐ Missing ☐ OK ☐
Front Upper Control Arm ☐ Stabilizer (sway bar) ☐ Rear Lower Control Arm ☐
Front Lower Control Arm ☐ Rear Upper Control Arm ☐ Rear Upper Control Arm ☐
Other _____

Suspension/Steering Components: Loose Worn Missing OK
Ball Joints ☐ Idler Arm ☐ Pitman Arm ☐
Shock Absorbers F/R ☐ Center Link ☐ Steering Gear ☐
Springs F/R ☐ Tie Rod Ends/Sleeve ☐ Steering Coupler ☐

DRIVESHAFT CONDITION: Noise ☐ Vibration ☐
Balance Weights Missing/Other Visual Defects? Yes / No
Maximum Allowable Runout: _____
Actual Runout: Front _____ Middle _____ Rear _____
Two-Piece Driveshaft Runout: Front _____ Rear _____
Middle Support Bearing: Loose ☐ Damaged ☐ Worn ☐ Other _____

Suspect Driveshaft Balanced? Yes / No
Pinion Angle: Engine Height: Specification _____ Actual _____
Pinion Angle: Specification _____ Actual _____
Driveline Angle - Truck: Specification _____ Actual _____

ENGINE/ACCESSORY CHECK:
Visual Inspection for Damage or Grounded Condition:
Powertrain Mounts ☐ Fuel Lines ☐ A/C Lines ☐ Power Steering/Cooler Lines ☐
Air Intake ☐ Accessories ☐ Exhaust ☐ Radiator/Condensor ☐

BODY (NOISE/RATTLE)
Indicate Suspected Area of Concern: Doors ☐ Windows ☐ Dash Panel ☐ Other _____
Tests Used to Isolate
NVH Concern: Vacuum/Leak Detector ☐ Ultrasonic Leak Detector ☐ Tracing Powder ☐
Electronic Noise Detector ☐ Other _____

ROAD/ENGINE RUN-UP TESTS: Improved? Yes / No Vehicle Acceptable? Yes / No
Comments: _____

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1: Customer Interview

The diagnostic process starts with the customer interview. The service advisor must obtain as much information as possible about the problem and take a test drive with the customer. There are many ways a customer will describe NVH concerns and this will help minimize confusion arising from descriptive language differences. It is important that the concern is correctly interpreted and the customer descriptions are recorded. During the interview, ask the following questions:

- When was it first noticed?
- Did it appear suddenly or gradually?
- Did any abnormal occurrence coincide with or proceed its appearance?

Use the information gained from the customer to accurately begin the diagnostic process.

2: Pre-Drive Check

It is important to do a pre-drive check before road testing the vehicle. A pre-drive check verifies that the vehicle is relatively safe to drive and eliminates any obvious faults on the vehicle.

The pre-drive check consists of a brief visual inspection. During this brief inspection, take note of anything that will compromise safety during the road test and make those repairs/adjustments before taking the vehicle on the road.

3: Preparing for the Road Test

Observe the following when preparing for the road test:

- Review the information recorded on the NVH Diagnostic Guide. It is important to know the specific concern the customer has with the vehicle.
- Do not be misled by the reported location of the noise/vibration. The cause can actually be some distance away.
- Remember that the vibrating source component (originator) may only generate a small vibration. This small vibration can in turn cause a larger vibration/noise to emanate from another receiving component (reactor), due to contact with other components (transfer path).
- Conduct the road test on a quiet street where it is safe to duplicate the vibration/noise. The ideal testing route is an open, low-traffic area where it is possible to operate the vehicle at the speed in which the condition occurs.
- If possible, lower the radio antenna in order to minimize turbulence. Identify anything that could potentially make noise or be a source of wind noise. Inspect the vehicle for add-on items that create vibration/noise. Turn off the radio and the heating and cooling system blower.
- The engine speed is an important factor in arriving at a final conclusion. Therefore, connect an accurate tachometer to the engine, even if the vehicle has a tachometer. Use a tachometer that has clearly defined increments of less than 50 rpm. This ensures an exact engine speed reading.

4: Verify the Customer Concern

Verify the customer concern by carrying out a road test, an engine run-up test, or both.

The decision to carry out a road test, an engine run-up test, or both depends on the type of NVH concern. A road test may be necessary if the symptom relates to the suspension system or is sensitive to torque. A drive engine run-up (DERU) or a neutral engine run-up (NERU) test identifies noises and vibrations relating to engine and drivetrain rpm. Remember, a condition will not always be identifiable by carrying out these tests, however, they will eliminate many possibilities if carried out correctly.

5: Road Test

NOTE: It may be necessary to have the customer ride along or drive the vehicle to point out the concern. During the road test, take into consideration the customer's driving habits and the driving conditions. The customer's concern just may be an acceptable operating condition for that vehicle.

The following is a brief overview of each test in the order in which it appears. A review of this information helps to quickly identify the most appropriate process necessary to make a successful diagnosis. After

reviewing this information, select and carry out the appropriate test(s), proceeding to the next step of this process.

- The Slow Acceleration Test is normally the first test to carry out when identifying an NVH concern, especially when a road test with the customer is not possible.
- The Heavy Acceleration Test helps to determine if the concern is torque-related.
- The Neutral Coast Down Speed Test helps to determine if the concern is vehicle speed-related.
- The Downshift Speed Test helps to determine if the concern is engine speed-related.
- The Steering Input Test helps to determine how the wheel bearings and other suspension components contribute to a vehicle speed-related concern.
- The Brake Test helps to identify vibrations or noise that are brake related.
- The Road Test Over Bumps helps isolate a noise that occurs when driving over a rough or bumpy surface.
- The Engine Run-Up Tests consist of the Neutral Run-up Test and the Engine Load Test. These tests help to determine if the concern is engine speed-related.
- The Neutral Run-up Test is used as a follow-up test to the Downshift Speed Test when the concern occurs at idle.
- The Engine Load Test helps to identify vibration/noise sensitive to engine load or torque. It also helps to reproduce engine speed-related concerns that cannot be duplicated when carrying out the Neutral Run-up Test or the Neutral Coast Down Test.
- The Engine Accessory Test helps to locate faulty belts and accessories that cause engine speed-related concerns.
- The Vehicle Cold Soak Procedure helps to identify concerns occurring during initial start-up and when an extended time lapse occurs between vehicle usage.

Slow Acceleration Test

To carry out this test, proceed as follows:

- Slowly accelerate to the speed where the reported concern occurs. Note the vehicle speed, the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify from what part of the vehicle the concern is coming.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Heavy Acceleration Test

To carry out this test, proceed as follows:

- Accelerate hard from 0-64 km/h (0-40 mph).
- Decelerate in a lower gear.
- The concern is torque related if duplicated while carrying out this test.
- Proceed as necessary.

Neutral Coast Down Speed Test

To carry out this test, proceed as follows:

- Drive at a higher rate of speed than where the concern occurred when carrying out the Slow Acceleration Test.

- Place the transmission in NEUTRAL and coast down past the speed where the concern occurs.
- The concern is vehicle speed-related if duplicated while carrying out this test. This eliminates the engine and the torque converter as sources.
- If the concern was not duplicated while carrying out this test, carry out the Downshift Speed Test to verify if the concern is engine speed related.
- Proceed as necessary.

Downshift Speed Test

To carry out this test, proceed as follows:

- Shift into a lower gear than the gear used when carrying out the Slow Acceleration Test.
- Drive at the engine rpm where the concern occurs.
- The concern is engine speed related if duplicated while carrying out this test. This eliminates the tires, wheels, brakes and the suspension components as sources.
- If necessary, repeat this test using other gears and NEUTRAL to verify the results.
- Proceed as necessary.

Steering Input Test

To carry out this test, proceed as follows:

- Drive at the speed where the concern occurs, while making sweeping turns in both directions.
- If the concern goes away or gets worse, the wheel bearings, hubs, U-joints (contained in the axles of four wheel drive [4WD] applications), and tire tread wear are all possible sources.
- Proceed as necessary.

Brake Test

To carry out this test, proceed as follows:

- Warm the brakes by slowing the vehicle a few times from 80–32 km/h (50–20 mph) using light braking applications. At highway speeds of 89–97 km/h (50–60 mph), apply the brake using a light pedal force.
- Accelerate to 89–97 km/h (55–60 mph).
- Lightly apply the brakes and slow the vehicle to 30 km/h (20 mph).
- A brake vibration noise can be felt in the steering wheel, seat or brake pedal. A brake noise can be heard upon brake application and diminish when the brake is released.

Road Test Over Bumps

To carry out this test, proceed as follows:

- Drive the vehicle over a bump or rough surface one wheel at a time to determine if the noise is coming from the front or the back and the left or the right side of the vehicle.
- Proceed as necessary.

Neutral Engine Run-Up (NERU) Test

To carry out this test, proceed as follows:

- Install a tachometer.
- Increase the engine rpm up from an idle to approximately 4000 rpm while in PARK on front wheel drive vehicles with automatic transmissions, or NEUTRAL for all other vehicles. Note the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify what part of the vehicle the concern is coming from.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Drive Engine Run-Up (DERU) Load Test

To carry out this test, proceed as follows:

- **WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**

  CAUTION: Do not carry out the Engine Load Test for more than 5 seconds or damage to the transmission or transaxle can result.

  Block the front and rear wheels.
- Apply the parking brake and the service brake.
- Install a tachometer.
- Shift the transmission into DRIVE, and increase and decrease the engine rpm between an idle to approximately 2000 rpm. Note the engine rpm and, if possible, determine the vibration frequency.
- Repeat the test in REVERSE.
- If the vibration/noise is duplicated when carrying out this test, inspect the engine and transmission or transaxle mounts.
- If the concern is definitely engine speed-related, carry out the Engine Accessory Test to narrow down the source.
- Proceed as necessary.

Engine Accessory Test

To carry out this test, proceed as follows:

- **WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**

  CAUTION: Limit engine running time to one minute or less with belts removed or serious engine damage will result.

  NOTE: A serpentine drive belt decreases the usefulness of this test. In these cases, use a vibration analyzer (VA), to pinpoint accessory vibrations. An electronic listening device, such as an EngineEAR, will also help to identify noises from specific accessories.

  Remove the accessory drive belts.
- Increase the engine rpm to where the concern occurs.

- If the vibration/noise is duplicated when carrying out this test, the belts and accessories are not sources.
- If the vibration/noise was not duplicated when carrying out this test, install each accessory belt, one at a time, to locate the source.

Vehicle Cold Soak Procedure

To carry out this procedure, proceed as follows:

- Test preparations include matching customer conditions (if known). If not known, document the test conditions: gear selection and engine rpm. Monitor the vibration/noise duration with a watch for up to 3 minutes.
- Park the vehicle where testing will occur. The vehicle must remain at or below the concern temperature (if known) for 6-8 hours.
- Before starting the engine, conduct a visual inspection under the hood.
- Turn the key on, but do not start the engine. Listen for the fuel pump, anti-lock brake system (ABS) and air suspension system noises.
- Start the engine.
- **CAUTION: Never probe moving parts.**

  Isolate the vibration/noise by carefully listening. Move around the vehicle while listening to find the general location of the vibration/noise. Then, search for a more precise location by using a stethoscope or EngineEAR.
- Refer to Idle Noise/Vibration in the Symptom Chart to assist with the diagnosis.

6: Check OASIS/TSBs/Repair History

After verifying the customer concern, check for OASIS reports, TSBs and the vehicle repair history for related concerns. If information relating to a diagnosis/repair is found, carry out the procedure(s) specified in that information.

If no information is available from these sources, carry out the vehicle preliminary inspection to eliminate any obvious faults.

7: Diagnostic Procedure

Qualifying the concern by the particular sensation present can help narrow down the concern. Always use the "symptom" to "system" to "component" to "cause" diagnosis technique. This diagnostic method divides the problem into related areas to correct the customer concern.

- Verify the "symptom".
- Determine which "system(s)" can cause the "symptom".
  - If a vibration concern is vehicle speed related, the tire and wheel rpm/frequency or driveshaft frequency should be calculated.
  - If a vibration concern is engine speed related, the engine, engine accessory or engine firing frequencies should be calculated.
- After determining the "system", use the diagnostic tools to identify the worn or damaged "components".
- After identifying the "components", try to find the "cause" of the failure.

Once the concern is narrowed down to a symptom/condition, proceed to NVH Condition and Symptom

Categories.

NVH Condition and Symptom Categories

A good diagnostic process is a logical sequence of steps that lead to the identification of a causal system. Use the condition and symptom categories as follows:

- Identify the operating condition that the vehicle is exhibiting.
- Match the operating condition to the symptom.
- Verify the symptom.
- Identify which category or system could cause the symptom.
- Refer to the diagnostic symptom chart that is referred to.

Operating Condition — Vehicle is Not Moving

1. Static operation
    - Noise occurs during component/system functioning. GO to Symptom Chart - Squeak and Rattle .

2. While cranking
    1. Grinding or whine, differential ring gear or starter motor pinion noise. GO to Symptom Chart - Engine Noise/Vibration .
    2. Rattle. Exhaust hanger, exhaust heat shield or A/C line noise. GO to Symptom Chart - Squeak and Rattle .
    3. Vibration. Acceptable condition.

3. At idle
    - Idle noise. GO to Symptom Chart - Idle Noise/Vibration .
    - Idle vibration or shake. GO to Symptom Chart - Idle Noise/Vibration .

4. During Gear Selection
    1. Vehicle parked on a steep incline. Acceptable noise.
    2. Vehicle parked on a flat surface. GO to Symptom Chart - Driveline Noise/Vibration .
    3. Vehicle with a manual transmission. GO to Symptom Chart - Transmission (Manual) and Transfer Case Noise/Vibration .

Operating Condition — Vehicle is Moving

1. Depends more on how the vehicle is operated
    1. Speed related
        - Related to vehicle speed
            - Pitch increases with vehicle speed. GO to Symptom Chart - Tire Noise/Vibration .
            - Noise occurs at specific vehicle speed. A high-pitched noise (whine). GO to Symptom Chart - Driveline Noise/Vibration .
            - Loudness proportional to vehicle speed. Low-frequency noise at high speeds, noise and loudness increase with speed. GO to Symptom Chart - Driveline Noise/Vibration .
            - A low-pitched noise (drumming). GO to Symptom Chart - Engine Noise/Vibration .
            - Vibration occurs at a particular speed (mph) regardless of acceleration or deceleration. GO to Symptom Chart - Tire Noise/Vibration .
            - Noise varies with wind/vehicle speed and direction. GO to Symptom Chart - Air Leak and Wind Noise .
        - Related to engine speed.
            - Noise varies with engine rpm. GO to Symptom Chart - Engine

Noise/Vibration .
        - Vibration occurs at a particular speed (mph) regardless of engine speed (rpm).
    2. Acceleration
        - Wide open throttle (WOT)
            - Engine induced contact between components. Inspect and repair as necessary.
            - Noise is continuous throughout WOT. Exhaust system or engine ground out. GO to Symptom Chart - Engine Noise/Vibration .
        - Light/moderate acceleration
            - Tip-in moan. Engine/exhaust noise. GO to Symptom Chart - Engine Noise/Vibration .
            - Knock-type noise. GO to Symptom Chart - Engine Noise/Vibration .
            - Driveline shudder. GO to Symptom Chart - Driveline Noise/Vibration .
            - Engine vibration. GO to Symptom Chart - Engine Noise/Vibration .
    3. Turning noise. GO to Symptom Chart - Steering Noise/Vibration .
    4. Braking
        - Clicking sound is signaling ABS is active. Acceptable ABS sound.
        - A continuous grinding/squeal. GO to Symptom Chart - Brake Noise/Vibration .
        - Brake vibration/shudder. GO to Symptom Chart - Brake Noise/Vibration .
    5. Clutching
        - A noise occurring during clutch operation. GO to Symptom Chart - Transmission (Manual) and Transfer Case Noise/Vibration .
        - Vibration. GO to Symptom Chart - Transmission (Manual) and Transfer Case Noise/Vibration .
    6. Shifting
        - Noise or vibration condition related to the transmission (automatic). GO to Symptom Chart - Transmission (Automatic) Noise/Vibration .
        - Noise or vibration related to the transmission (manual). GO to Symptom Chart - Transmission (Manual) and Transfer Case Noise/Vibration .
    7. Engaged in 4WD. GO to Symptom Chart - Transmission (Manual) and Transfer Case Noise/Vibration .
    8. Cruising speeds
        - Accelerator pedal vibration. GO to Symptom Chart - Engine Noise/Vibration .
        - Driveline vibration. GO to Symptom Chart - Driveline Noise/Vibration .
        - A shimmy or shake. GO to Symptom Chart - Tire Noise/Vibration .
    9. Driving at low/medium speeds
        - A wobble or shudder. GO to Symptom Chart - Tire Noise/Vibration .

2. Depends more on where the vehicle is operated
    1. Bump/pothole, rough road or smooth road. GO to Symptom Chart - Suspension Noise/Vibration .
        - Noise is random or intermittent occurring from road irregularities. GO to Symptom Chart - Squeak and Rattle .
        - Noise or vibration changes from one road surface to another. Normal sound changes.
        - Noise or vibration associated with a hard/firm ride. GO to Symptom Chart - Suspension Noise/Vibration .

Symptom Charts

Symptom Chart — Air Leak and Wind Noise

Condition	Possible Sources	Action
• Air leak around	• Loose fit seal	• PINCH the seal carrier to

door perimeter		improve retention on the seal flange.
	• Seal installed incorrectly	• REINSTALL the seal.
	• Door misaligned	• REALIGN the door. CHECK door gaps and fit in the door opening and ADJUST as necessary.
	• Scuff plate installed incorrectly	• REINSTALL the scuff plate.
	• Seal or seal pushpins damaged	• INSTALL a new seal.
• Air leak around glass run	• Door glass misaligned	• ADJUST the door glass.
	• Glass run installed incorrectly	• ADJUST the glass run. INSERT foam in the glass run carrier.
	• Leak path behind glass run	• INSTALL foam rope behind the glass run.
	• Glass run channel spread wide	• PINCH the glass run channel to reduce the size of the opening.
	• Blow-out clip bent or contacting door glass	• ADJUST the blow-out clip or INSTALL a new glass run/blow-out clip molding assembly.
	• Glass run damaged	• INSTALL a new glass run.
• Air leak at inner belt line	• Belt line seal installed incorrectly on flange	• ADJUST the seal. (Do not bend the flange.)
	• Belt line seal integrated with door trim installed incorrectly (no glass contact)	• REINSTALL the door trim.
	• No contact with side glass	• ADJUST the door glass.
	• No contact with glass runs at both ends of belt line seal	• ADJUST the belt line seal or ADD foam at the seal ends.
	• Belt line seal damaged	• INSTALL a new seal.
• Air leak at outer belt line	• Belt line seal installed incorrectly on flange (no glass contact)	• ADJUST the seal.
	• Belt line seal does not contact the glass	• ADJUST the door glass.
	• No contact with glass runs at both ends of belt line seal	• ADJUST the belt line seal/ADD foam at the seal ends.
	• Belt line seal damaged	• INSTALL a new seal.
• Draft at inner door handle/speaker opening	• Hole in watershield	• SEAL the hole with a suitable tape.
	• Watershield misaligned	• REALIGN the watershield.

		INSTALL a new watershield if the pressure sensitive adhesive fails.
	• Exterior door handle seal misaligned/damaged	• REALIGN or INSTALL a new seal as necessary.
• Wind noise from side view mirror	• Outside mirror housing misaligned	• REALIGN with the edges shingled correctly and no gaps.
	• Mirror sail gasket folded/misaligned	• REINSTALL with the gasket unfolded and aligned correctly.
	• Mirror housing trim cap installed incorrectly	• REINSTALL with the edges shingled to the air flow.
	• Air leak through mirror housing hinge	• Fully ENGAGE the mirror into its operating position/USE foam to block the air path through the hinge.
	• Inner sail trim installed incorrectly	• REINSTALL the sail trim/ADJUST the door trim.
	• Inner sail gasket/barrier installed incorrectly	• REINSTALL the trim cover with the gasket/barrier aligned correctly.
	• Air path through wiring bundle/fastener access holes	• BLOCK the air path(s) with foam/tape.
	• Exposed fastener access hole on mirror housing/sail	• INSTALL a new cap if it is missing.
• Air leak around perimeter of fixed glass	• Gaps in the sealant bead	• APPLY approved sealant.
	• Air traveling up windshield molding along A-pillar	• INSTALL foam rope the full length of the A-pillar.
	• Windshield/backlite misaligned or not installed correctly	• REINSTALL the windshield/backlite.
	• Rear hood seal at base of windshield misaligned/damaged	• REALIGN or INSTALL a new seal as necessary.
• Air leak at cowl	• Cowl gasket misaligned/damaged	• REALIGN or INSTALL a new seal as necessary.
• Air leak around liftgate perimeter	• Loose fit seal	• PINCH the seal carrier to improve retention on the seal flange or INSERT foam in the carrier.
	• Seal misaligned	• REINSTALL the seal.
	• Liftgate misaligned	• REALIGN the liftgate. CHECK the liftgate fit in the body opening and ADJUST as necessary.
	• Scuff plate misaligned	• REINSTALL the scuff plate.
	• Seal or seal pushpins	• INSTALL a new seal.

	damaged	
• Air leak around the liftgate flip window perimeter	• Loose fit seal	• PINCH the seal carrier to improve the retention to the seal flange.
	• Seal misaligned	• REINSTALL the seal.
	• Glass misaligned	• REALIGN the glass.
	• Seal damaged	• INSTALL a new seal.
• Wind noise from antenna	• Shape of antenna	• INSTALL an antenna boot or a spiral antenna.
	• Air leak around antenna cable access hole	• INSPECT the antenna access hole grommet. REPAIR as necessary.
• Air leak from closed roof opening panel	• Seal installed incorrectly	• REINSTALL the seal.
	• Roof opening panel glass/door misaligned	• REALIGN the roof opening panel glass/door.
	• Roof opening panel damaged	• INSTALL a new roof opening panel.
• Buffeting from an open roof opening panel	• Wind deflector inoperative/damaged	• REPAIR or INSTALL a new wind deflector as necessary.
	• Wind deflector height incorrect	• ADJUST the wind deflector higher.
• Wind noise created by airflow over or behind body panels	• Fender splash shield misaligned	• REALIGN the fender splash shield.
	• Body panel misaligned (exposed edge)	• REALIGN the appropriate body panel.
	• Hood misaligned (front margin)	• CHECK hood gaps and fit. ADJUST the hood as necessary.
	• Front grille edge noise	• APPLY foam in the hollow areas behind the louvers.
• Wind noise created by grille opening panel	• Grille relationship to leading edge on hood	• ADJUST the grille opening panel forward to eliminate wind noise.
	• Sharp edges due to material imperfections	• REMOVE the sharp edges (no damage to visible surface).
• Wind noise from air extractor	• Air extractor housing seated incorrectly	• REINSTALL the air extractor housing.
	• Air extractor housing or flaps damaged	• INSTALL a new air extractor.
• Air leak at top of A-pillar — vehicles with a convertible top	• Seal at windshield header installed incorrectly	• REINSTALL the seal.
	• Seal pinched	• FILL the seal with foam to reshape it.
	• Gap between side rail and header seal at A-pillar	• ADJUST the J-hook/vinyl top.

• Air leak at rear quarter glass (division bar) — vehicles with a convertible top	• No contact between front side glass and quarter glass division bar	• ADJUST the front side glass regulator and the rear quarter glass regulator.
• Air leak or wind noise from top of side glass — vehicles with a convertible top	• Gap between side rail and vinyl top	• ADD additional foam tape to seal between the side rail and the vinyl top.
	• Seal at windshield header installed incorrectly	• REINSTALL the seal.
	• Seal damaged between side rail and vinyl top	• INSTALL a new seal.
	• Vinyl top damaged	• INSPECT the vinyl top. INSTALL a new vinyl top as necessary.
• Air leak or wind noise at windshield header — vehicles with a convertible top	• Vinyl top not flush with header	• ADJUST the J-hook to lower the top to achieve a flush condition.
	• Seal at windshield header installed incorrectly	• REINSTALL the seal.
	• Header seal not flush with header	• REINSTALL the seal.
• Convertible top flapping with the top up	• Vinyl top contacting interior headliner	• Working from front to back, INSTALL a 6.35 mm (0.25 in) foam sheet between the headliner and the vinyl top at the suspected area. Allow a clearance of 50 mm (2 in) - 75 mm (3 in) away from the roof bows and the side rails.
• Noise from roof rack	• Roof rack rails or crossbars loose	• TIGHTEN the fasteners.
	• Roof rack fasteners missing	• INSTALL the approved fasteners.
	• Roof rack crossbars installed backward	• REINSTALL the crossbars.
	• Roof rack rub strips partially lifting from roof	• REAPPLY adhesive or fasteners or INSTALL new rub strips as necessary.
	• Roof rack gaskets loose or misaligned	• REINSTALL the gasket.
• Wind noise from bug shield/exterior windshield sun visor	• Turbulence created by location and shape	• REMOVE per customer direction if it is a dealer installed option.

Symptom Chart — Brake Noise/Vibration

Condition	Possible Sources	Action
• Rattling noise	• Caliper mounting bolts loose	• CHECK the caliper bolts. TIGHTEN to specifications. REFER to Section 206-03 for the front disc brakes or Section 206-04 for the rear disc brakes.
	• Damaged or worn caliper pins or retainers	• CHECK the caliper pins and retainers for lubrication and correct fit. LUBRICATE or INSTALL new components as necessary. REFER to Section 206-03 for the front disc brakes or Section 206-04 for the rear disc brakes.
	• Missing or damaged anti-rattle clips or springs	• CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to Section 206-03 for the front disc brakes or Section 206-04 for the rear disc brakes.
	• Loose brake disc shield	• TIGHTEN the brake disc shield bolts to specification. REFER to Section 206-03 .
• Clicking noise — with brakes applied with ABS brakes	• ABS hydraulic control unit	• Acceptable condition.
• Squealing noise — occurs on first (morning) brake application	• Disc brake pads	• Acceptable condition. Caused by humidity and low disc brake pad temperature.
• Squealing noise — a continuous squeal	• Disc brake pads or linings worn below minimum thickness	• INSTALL new disc brake pads. REFER to Section 206-03 for the front disc brakes or Section 206-04 for the rear disc brakes.
• Squealing noise — an intermittent squeal brought on by cold, heat, water, mud or snow	• Disc brake pad	• Acceptable condition.
• Groaning noise — occurs at low speeds with brake lightly applied (creeping)	• Disc brake pads	• Acceptable condition.
• Grinding noise — continuous	• Disc brake pads or linings worn below minimum thickness	• INSPECT the disc brake pads, brake discs/drums and attaching hardware for damage. REPAIR or INSTALL new components as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
• Moaning noise	• Brake linings contaminated	• INSPECT the brake pads and shoes for contamination.

	with grease or oil	REPAIR or INSTALL new components as necessary.
• Brake vibration/shudder — occurs when brakes are applied	• Uneven disc or drum wear • Uneven disc brake pad or lining transfer • Suspension components	• Go To Pinpoint Test A .
• Brake vibration/shudder — occurs when the brake pedal is released	• Brake drag	• INSPECT the disc brake pads or linings for premature wear. REPAIR or INSTALL a new caliper or wheel cylinder as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

Symptom Chart — Driveline Noise/Vibration

Condition	Possible Sources	Action
• Axle howling or whine — front or rear axle	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification.
	• Axle housing damage	• INSPECT the axle housing for damage. REPAIR or INSTALL a new axle as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Damaged or worn wheel bearings or axle bearings	• CHECK for abnormal wheel bearing play or roughness. REFER to Wheel Bearing Check in this section. ADJUST or INSTALL new wheel bearings as necessary.
	• Damaged or worn differential ring and pinion	• INSPECT the ring and pinion ring for abnormal wear patterns or broken teeth. INSTALL a new ring and pinion as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Damaged or worn differential side or pinion bearings	• CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Damaged or worn differential side gears and pinion gears	• DISASSEMBLE the differential carrier. INSPECT the side and pinion gears for abnormal wear patterns or broken teeth. INSTALL new gears as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.

• Driveline clunk — loud clunk when shifting from reverse to drive	• Incorrect axle lubricant level	• CHECK the lubricant level. FILL the axle to specification.
	• Excessive backlash in the axle or transmission	• CARRY OUT a total backlash check. REFER to Section 205-00 .
	• Damaged or worn pinion bearings	• CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary
	• Damaged or worn universal joints (U-joints)	• INSPECT the U-joints for wear or damage. INSTALL new U-joints as necessary. REFER to Section 205-01 .
	• Loose suspension components	• INSPECT the suspension for damage or wear. REPAIR or INSTALL new components as necessary.
	• Broken powertrain mounts	• INSPECT the powertrain mounts. REFER to Section 303-01 . INSTALL new mounts as necessary.
	• Idle speed too high	• CHECK for the correct idle speed.
• Driveline clunk — occurs as the vehicle starts to move forward following a stop	• Worn or galled driveshaft slip-yoke splines	• CLEAN and INSPECT the splines of the yoke for a worn or galled condition. INSTALL a new yoke as necessary. REFER to Section 205-01 .
	• Worn or galled driveshaft and coupling shaft splines	• CLEAN and INSPECT the splines of the driveshaft and coupling shaft for a worn or galled condition. INSTALL a new driveshaft assembly as necessary. REFER to Section 205-01 .
	• Loose rear leaf spring U-bolts	• CHECK the U-bolts for loose nuts. TIGHTEN to specification. REFER to Section 204-02 .
• Driveline clunk four wheel drive (4WD) vehicles — occurs during shift-on-the-fly engagement	• Clutch relay • Shift motor • Transfer case • GEM	• CHECK the 4WD engagement system. REPAIR or INSTALL new components as necessary. REFER to Section 308-07A and Section 308-07B .
• Clicking, popping or grinding — occurs while vehicle is turning	• Inadequate or contaminated lubrication in the (CV) joints	• CHECK the CV boots and joints for wear or damage. REPAIR or INSTALL new components as necessary. REFER to Section 205-04 .
	• Another component contacting the halfshaft	• CHECK the halfshafts and the area around the halfshafts. REPAIR as necessary.
	• Brake components	• INSPECT the front brakes for wear or damage. REPAIR as necessary. REFER to

		Section 206-03 .
	• Steering components	• INSPECT the drag link, inner and outer tie-rods or idler arm for wear or damage. REPAIR as necessary.
	• Suspension components	• INSPECT the upper and lower ball joints for wear or damage. REPAIR as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
	• Damaged or worn wheel bearings	• CHECK for abnormal wheel bearing play or roughness. REFER to Wheel Bearing Check in this section. ADJUST or INSTALL new wheel bearings as necessary.
• Clicking or snapping — occurs when accelerating around a corner	• Damaged or worn outboard CV joint	• INSPECT the outboard CV joint and boot. REPAIR or INSTALL a new CV joint as necessary. REFER to Section 205-04 .
• High pitched chattering — noise from the rear axle when the vehicle is turning	• Incorrect or contaminated lubricant	• CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). FLUSH and REFILL with the specified rear axle lubricant and friction modifier as necessary.
	• Damaged or worn differential (differential side gears and pinion gears)	• DISASSEMBLE the differential assembly. INSPECT the differential case, pin and gears for wear or damage. REPAIR or INSTALL a new differential as necessary. REFER to Section 205-02 for the rear axle.
• Buzz — buzzing noise is the same at cruise or coast/deceleration	• Damaged or worn tires	• CHECK for abnormal tire wear or damage. INSTALL new tire(s) as necessary. REFER to Section 204-04 .
	• Incorrect driveline angles	• CHECK for correct driveline angles. REPAIR as necessary.
• Rumble or boom — noise occurs at coast/deceleration, usually driveshaft speed related and noticeable over a wide range of speeds	• Driveshaft is out-of-balance	• CHECK the driveshaft for damage, missing balance weights or undercoating. REPAIR or INSTALL a new driveshaft as necessary.
	• U-joints binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints as necessary. REFER to Section 205-01 .

	• Excessive pinion flange runout	• CARRY OUT a runout check. REPAIR as necessary. REFER to Section 205-00 .
• Grunting — normally associated with a shudder experienced during acceleration from a dead stop	• Driveshaft slip yoke binding	• CLEAN and LUBRICATE the male and female splines.
	• Loose rear spring U-bolts	• INSPECT the rear suspension. TIGHTEN the U-bolt nuts to specification. REFER to Section 204-02 .
• Howl — can occur at various speeds and driving conditions. Affected by acceleration and deceleration	• Incorrect ring and pinion contact, incorrect bearing preload or gear damage	• CHECK the ring and pinion and bearings for damage. INSPECT the ring and pinion wear pattern. REFER to Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. ADJUST or INSTALL new components as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
• Chuckle — heard at coast/deceleration. Also described as a knock	• Incorrect ring and pinion contact or by damaged teeth on the coast side of the ring and pinion	• CHECK the ring and pinion for damage. INSPECT the ring and pinion wear pattern. REFER to Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. ADJUST or INSTALL new components as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
• Knock — noise occurs at various speeds. Not affected by acceleration or deceleration	• Gear tooth damage to the drive side of the ring and pinion	• CHECK the differential case and ring and pinion for damage. INSTALL new components as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Excessive axle shaft end play (vehicles with integral axles)	• CHECK the axle end play using a dial indicator. INSTALL a new axle shaft or side gears as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
• Scraping noise — a continuous low pitched noise starting at low speeds	• Worn or damaged pinion bearings	• CHECK the pinion bearings. INSTALL new pinion bearings as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
• Driveline shudder — occurs during	• Rear drive axle assembly	• CHECK the axle mounts and the rear suspension for

acceleration from a slow speed or stop	mispositioned	damage or wear. REPAIR as necessary.
	• Loose rear spring U-bolts	• INSPECT the U-bolts. TIGHTEN the U-bolt nuts to specification. REFER to Section 204-02 .
	• Incorrect or high CV joint operating angle	• CHECK vehicle ride height is within limits. REPAIR as necessary.
	• Damaged or worn front suspension components	• CHECK for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. INSPECT the steering linkage for wear or damage. REPAIR or INSTALL new components as necessary. REFER to the appropriate section for the service procedure.
	• Driveline angles out of specification	• CHECK for correct driveline angles. REPAIR as necessary. REFER to Driveline Angles in this section.
	• U-joints binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints as necessary. REFER to Section 205-01 .
	• Binding, damaged or galled splines on the driveshaft slip-yoke	• CLEAN and INSPECT the splines of the slip-yoke, driveshaft and coupling shaft for a worn, damaged or galled condition. INSTALL a new slip-yoke or driveshaft assembly as necessary. REPAIR as necessary. REFER to Section 205-01 .
• Driveline vibration — occurs at cruising speeds	• U-joints are worn	• CHECK for wear or incorrect seating. INSTALL new U-joints as necessary. REFER to Section 205-01 .
	• Worn or damaged driveshaft center bearing support	• CHECK the insulator for damage or wear. ROTATE the driveshaft and CHECK for rough operation. INSTALL a new center bearing support as necessary. REFER to Section 205-01 .
	• Loose axle pinion flange bolts	• INSPECT the axle pinion flange. TIGHTEN the pinion flange bolts to specification. REFER to Section 205-01 .
	• Excessive axle pinion flange runout	• CARRY OUT a Runout Check. REPAIR as necessary.
	• Driveshaft is out-of-balance	• CHECK the driveshaft for damage, missing balance weights or undercoating.

		REPAIR as necessary.
	• Binding or damaged splines on the driveshaft slip-yoke	• CLEAN and INSPECT the splines of the slip-yoke, driveshaft and coupling shaft for wear or damage. INSTALL a new slip-yoke or driveshaft assembly as necessary. REFER to Section 205-01 . REPAIR as necessary.
	• Driveshaft runout	• REPAIR as necessary.
	• Incorrect lateral and radial tire/wheel runout	• INSPECT the tire and wheels. MEASURE tire runouts. REPAIR or INSTALL new components as necessary. REFER to Section 204-04 .
	• Driveline angles out of specification	• CHECK for correct driveline angles. REPAIR as necessary.
	• Incorrectly seated CV joint in the front wheel hub	• CHECK the outer CV joint for correct seating into the hub. REPAIR as necessary. REFER to Section 205-04 .

Symptom Chart — Engine Noise/Vibration

Condition	Possible Sources	Action
• Grinding noise — occurs during engine cranking	• Incorrect starter motor mounting	• INSPECT the starter motor for correct mounting. REPAIR as necessary. REFER to Section 303-06 .
	• Starter motor	• CHECK the starter motor. REPAIR or INSTALL a new starter motor as necessary. REFER to Section 303-06 .
	• Incorrect starter motor drive engagement	• INSPECT the starter motor drive and flexplate/flywheel for wear or damage. INSTALL a new starter motor drive or flexplate/flywheel as necessary. REFER to Section 303-06 .
• Engine ticking noise	• Fuel injector • Fuel line • Oil pump • Valve lifter • Belt tensioner • Water pump • Obstruction of cooling fan	• Go To Pinpoint Test B .
• Engine drumming noise — normally accompanied by vibration	• Powertrain mount	• CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section.
	• Damaged or misaligned exhaust	• INSPECT the exhaust system for loose or broken

	system	clamps and brackets. CARRY OUT Exhaust System Neutralizing in this section.
• Whistling noise — normally accompanied with poor idle condition	• Air intake system	• CHECK the air intake ducts, air cleaner, throttle body and vacuum hoses for leaks and correct fit. REPAIR or ADJUST as necessary. REFER to Section 303-12 .
• Clunking noise	• Water pump has excessive end play or imbalance	• CHECK the water pump for excessive end play. INSPECT the water pump with the drive belt off for imbalance. INSTALL a new water pump as necessary. REFER to Section 303-03 .
	• Generator has excessive end play	• CHECK the generator for excessive end play. REPAIR or INSTALL a new generator. REFER to Section 414-02 .
• Pinging noise	• Exhaust system leak	• INSPECT the exhaust system for leaks. REPAIR as necessary.
	• Gasoline octane too low	• VERIFY with customer the type of gasoline used. CORRECT as necessary.
	• Knock sensor operation	• CHECK the knock sensor. INSTALL a new knock sensor as necessary. REFER to Section 303-14 .
	• Incorrect spark timing	• CHECK the spark timing. REPAIR as necessary.
	• High operating temperature	• INSPECT cooling system for leaks. CHECK the coolant level. REFILL as necessary. CHECK the coolant for the correct mix ratio. DRAIN and REFILL as needed. CHECK engine operating temperature is within specifications. REPAIR as necessary.
	• Foul-out spark plug	• CHECK the spark plugs. REPAIR or INSTALL new spark plugs as necessary.
	• Catalytic converter	• Acceptable noise.
• Knocking noise — light knocking noise, also described as piston slap. Noise is most noticeable when engine is cold with light to medium acceleration. Noise disappears	• Excessive clearance between the piston and the cylinder wall	• Engine cold and at high idle. Using an EngineEAR, pull a spark plug or fuel injector connector until the noise goes away. CARRY OUT a cylinder bore clearance to piston check. INSTALL a new piston. REFER to Section 303-01 .

as engine warms		
• Knocking noise — light double knock or sharp rap sound. Occurs mostly with warm engine at idle or low speeds in DRIVE. Increases in relation to engine load. Associated with poor lubrication history	• Excessive clearance between the piston and the piston pin	• INSTALL a new piston or piston pin. REFER to Section 303-01 .
• Knocking noise — light knocking noise is most noticeable when engine is warm. Noise tends to decrease when vehicle is coasting or in neutral	• Excessive clearance between the connecting rod bearings and the crankshaft	• Engine warm and at idle. Using an EngineEAR, PULL a spark plug or fuel injector connector until the noise goes away. INSTALL new bearings. REFER to Section 303-01 .
• Knocking — deep knocking noise. Noise is most noticeable when engine is warm, at lower rpm and under a light load and then at float	• Worn or damaged crankshaft main bearings	• CARRY OUT Drive Engine Run-Up (DERU) Test. CHECK for noise with vehicle at operating temperature, during medium to heavy acceleration. CHECK at idle with injector disconnected, noise does not change. INSTALL new main bearings. REFER to Section 303-01 .
• Knocking noise — occurs mostly with warm engine at light/medium acceleration	• Spark plugs • Carbon accumulation in combustion chamber	• CHECK the spark plug for damage or wear. INSTALL new spark plugs as necessary. • REMOVE carbon from combustion chamber.
• Whine or moaning noise	• Air intake system • Generator electrical field or bearings	• CHECK the air cleaner and ducts for correct fit. INSPECT the air intake system for leaks or damage. REPAIR as necessary. • CARRY OUT generator load test. REPAIR or INSTALL a new generator as necessary. REFER to Section 414-02 .
• Drone type noise	• Exhaust system • A/C compressor	• CARRY OUT Exhaust System Neutralizing in this section. REPAIR as necessary. • CHECK for noise with vehicle at constant speeds. CYCLE the compressor on

		and off and listen for a change in pitch. REPAIR as necessary. REFER to Section 412-01 .
	• Powertrain mounts	• CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section.
• Sputter type noise — noise worse when cold, lessens or disappears when vehicle is at operating temperature	• Damaged or worn exhaust system components	• INSPECT the exhaust system for leaks or damage. REPAIR as necessary. REFER to Section 309-00 .
• Rattling noise — noise from the upper engine (valve train). Worse when engine is cold	• Low oil level	• CHECK oil level. FILL as necessary.
	• Thin or diluted oil	• INSPECT the oil for contamination. If oil is contaminated, CHECK for the source. REPAIR as necessary. CHANGE the oil and filter.
	• Low oil pressure	• CARRY OUT an oil pressure test. If not within specifications, REPAIR as necessary. REFER to Section 303-00 .
	• Worn rocker arms/fulcrums or followers	• CARRY OUT a valve train analysis. INSTALL new valve train components as necessary. REFER to Section 303-01 .
	• Worn valve guides	• CARRY OUT a valve train analysis. INSTALL new valve guides as necessary. REFER to Section 303-01 .
	• Excessive runout of valve seats on the valve face	• CARRY OUT a valve seat runout test. INSPECT the valve face and seat. INSTALL new valves as necessary. REFER to Section 303-01 .
• Rattling noise — from the bottom of the vehicle	• Loose muffler shields or catalytic converter shields	• CHECK the exhaust system for loose exhaust shields. REPAIR as necessary.
• Thumping noise — from the bottom of the vehicle, worse at acceleration	• Exhaust pipe/muffler grounded to chassis	• CHECK the exhaust system to chassis clearance. CHECK the exhaust system hangers for damage. REPAIR as necessary. REFER to Section 309-00 .
• Whoosh — occurs during light	• Throttling late, creating turbulence	• CHECK for leaks or missing seal in the dash panel.

vehicle acceleration. Heard inside the vehicle	transmitted through the plastic manifold	
• Engine vibration — increases intensity as engine rpm is increased	• Engine out-of-balance	• CARRY OUT Neutral Engine Run-Up (NERU) Test. ROTATE the torque converter, 120 degrees for 3 bolt and 180 degrees for 4 bolt. INSPECT the torque converter pilot outer diameter to crankshaft pilot inner diameter. REPAIR as necessary. REFER to Section 307-01A or Section 307-01B .
• Engine vibration — is felt with increases and decreases in engine rpm	• Strain on exhaust mounts	• CARRY OUT Exhaust System Neutralizing in this section. REPAIR as necessary.
	• Damaged or worn powertrain/drivetrain mounts	• CHECK the powertrain/drivetrain mounts for damage. CARRY OUT the Powertrain/Drivetrain Mount Neutralizing in this section. REPAIR as necessary.
	• Engine or transmission grounded to chassis	• INSPECT the powertrain/drivetrain for correct clearances. REPAIR as necessary.
• Engine vibration — vibration felt at all times	• Excessive engine pulley runout	• CARRY OUT Engine Accessory Test. INSTALL a new engine pulley as necessary. REFER to Section 303-01 .
	• Damaged or worn accessory component	• CARRY OUT Engine Accessory Test. REPAIR or INSTALL a new component as necessary.
• Accelerator pedal vibration — felt through the pedal as a buzz	• Throttle cable loose or misrouted	• INSPECT the throttle cable. REPAIR as necessary. REFER to Section 310-02 .
• Engine vibration — mostly at coast/neutral coast. Condition improves with vehicle accelerating	• Combustion instability	• CHECK the ignition system. INSTALL new components as necessary.
• Engine vibration or shudder — occurs with light to medium acceleration above 56 km/h (35 mph)	• Worn or damaged spark plugs	• INSPECT the spark plugs for cracks, high resistance or broken insulator. INSTALL a new spark plug (s) as necessary.

	• Plugged fuel injector • Damaged spark plug wire • Contaminated fuel • Worn or damaged torque converter	• REPAIR or INSTALL a new injector as necessary. • INSPECT the spark plug wires for damage. INSTALL a new spark plug wire(s) as necessary. • INSPECT the fuel for contamination. DRAIN the fuel system and refill. • CHECK the torque converter. INSTALL a new torque converter as necessary. REFER to Section 307-01A or Section 307-01B .

Symptom Chart — Idle Noise/Vibration

Condition	Possible Sources	Action
• Idle air control (IAC) valve moan — occurs on throttle tip-out	• IAC valve is contaminated with oil	• GO to Component Tests in this section.
• Accessory drive belt chirp — occurs at idle or high idle, cold or hot. Most common occurrence is during humid weather	• Accessory drive belt worn, or pulley is misaligned or loose	• INSPECT for loose or misaligned pulleys. CHECK the drive belt for wear or damage. INSTALL new pulley(s)/accessory drive component or drive belt, as necessary. REFER to Section 303-05 .
• Accessory drive bearing hoot — occurs at idle or high idle in cold temperatures of approximately +4°C (+40°F) or colder at first start of the day	• Accessory drive idler or tensioner pulley bearing is experiencing stick/slip between ball bearings and bearing race	• Go To Pinpoint Test C .
• Power steering moan — occurs at high idle and possibly at idle during the first cold start of the day in temperatures of approximately -18°C (0°F) or colder. Noise can even be a severe screech for less than one minute in very cold temperatures of approximately -29°C (-20°F) or colder	• High fluid viscosity, or plugged reservoir screen in power steering reservoir starves pump causing cavitation	• Go To Pinpoint Test D .
• Generator whine — during high electrical loads at idle or high idle, a high pitch whine or moan is emitted from the generator	• Generator electrical field noise	• Using an EngineEAR, PROBE near the generator housing. LISTEN for changes in the noise level while changing electrical loads (such as rear defrost,

		headlamps, etc.). CARRY OUT a generator load test. If the system passes the load test, the noise is from the generator bearings, INSTALL new bearings. If the system fails the load test, INSTALL a new generator. REFER to Section 414-02 .
• Engine-driven cooling fan moan — occurs during the first start of the day. It is most objectionable near idle speeds up to 2000 rpm. The noise increases with rpm	• The viscous cooling fan clutch engages until the fluid in the clutch reaches normal operating temperature, causing the fan to fully engage	• Go To Pinpoint Test E .
• Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	• Exhaust system vibration excites the body resonances inducing interior noise • Engine vibration excites the body resonances inducing interior noise	• Go To Pinpoint Test F .
• Hissing noise — occurs during idle or high idle that is apparent with the hood open	• Vacuum leak or idle air control (IAC) valve flow noise	• Use the Ultrasonic Leak Detector/EngineEAR to locate the source. Scan the air intake system from the inlet to each cylinder intake port. DISCARD the leaking parts, and INSTALL a new component.
	• Vehicles with a plastic intake manifold	• Acceptable condition. Some plastic manifolds exhibit this noise, which is the effect of the plastic manifold.
• Automatic transmission buzz or hiss	• Incorrect driveline angles	• CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00 .
	• Worn or damaged main control solenoids or valves	• Using a transmission tester, activate the solenoids to duplicate sound. INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
• Manual Transmission Clutch throw-out bearing whine. A change in noise pitch or loudness while depressing the clutch pedal	• Worn throw-out bearing	• INSTALL a new throw-out bearing.

• Heating, vacuum and air conditioning (HVAC) system chirp — most audible inside the vehicle. Listen for a change in noise pitch or loudness while changing the HVAC system blower speed	• Damaged or worn HVAC blower bearing	• INSTALL a new blower motor. REFER to Section 412-02 .
• Air conditioning (A/C) clutch ticking — occurs when the compressor clutch engages	• Acceptable noise • Incorrect air gap	• LISTEN to the clutch to determine if the noise occurs with clutch engagement. A small amount of noise is acceptable. If the noise is excessive, CHECK the A/C clutch air gap. INSPECT the A/C clutch for wear or damage. INSTALL a new clutch as necessary. REFER to Section 412-01 .
• Intermittent rattle, or scraping/rubbing noise	• Loose exhaust heat shield(s) • Wiring, hose or other part interfering with accessory drive belt or pulley	• INSPECT the exhaust system for loose parts using a glove or clamps to verify cause. REPAIR as necessary. REFER to Section 309-00 . • INSPECT accessory drive system closely verifying there is adequate clearance to all rotating components. REPAIR as necessary.
• Engine ticking or knocking noise — occurs during idle or high idle during the first cold start of the day	• Piston noise or valvetrain noise (bled down lifter/lash adjuster)	• Go To Pinpoint Test G .
• A continuous, speed-dependent rattle from the engine — occurs during idle or high idle during the first cold start of the day and disappears as the engine warms up	• Piston noise or valvetrain noise (bled down lifter/lash adjuster)	• Go To Pinpoint Test G .
• Idle vibration — a low-frequency vibration (5-20 Hz) or mild shake that is felt through the seat/floorpan	• Cylinder misfire • Engine or torque converter out of balance	• Using a diagnostic tool, CHECK the ignition system. CARRY OUT a cylinder power test. REFER to Section 303-00 . • VERIFY the torque converter to crankshaft pilot clearance is correct, REPAIR as necessary. RE-INDEX the torque converter on the flex plate by 120 degrees on a 3 bolt converter or 180 degrees for a 4 bolt converter. REFER to Section 307-01A or Section 307-01B . RETEST

		the vehicle.
• Idle vibration — a high-frequency vibration (20–80 Hz) or buzz, that is felt through the steering wheel or seat	• Exhaust system mounts bound up	• VERIFY concern occurs at engine firing frequency. CHECK that the exhaust system vibrates at the same frequency as the engine. ADD 9–14 Kg (20–30 lb) to the tail pipe to test, CARRY OUT Exhaust System Neutralizing in this section.
	• Body mounts loose	• INSPECT the body mounts. CARRY OUT a Neutral Engine Run-Up (NERU) Test. REPAIR as necessary
	• Power steering lines grounded out	• INSPECT that the power steering lines are not contacting the chassis or each other. REPAIR as necessary.

Symptom Chart — Squeak and Rattle

Condition	Possible Sources	Action
• Squeak — heard inside the vehicle when closing/opening the door	• Insufficient lubrication on the door hinge or check strap	• LUBRICATE the hinge or check strap.
	• Internal door components loose, rubbing or misaligned	• CHECK the inside of the door. TIGHTEN or ALIGN as necessary. USE the Rotunda Squeak and Rattle Kit to isolate any rubbing components.
• Squeak — heard inside the vehicle when closing/opening the window	• Worn or damaged glass run/channel	• REPAIR or INSTALL a new glass run/channel. REFER to Section 501-11 .
• Squeak — heard outside of vehicle when closing/opening the door	• Exhaust shield rubbing against the chassis or exhaust pipe	• CHECK the exhaust system. REPAIR as necessary. Section 309-00 .
• Squeak — occurs with initial brake pedal application	• Disc brake pads	• Under certain conditions, asbestos free pads can generate a squeak noise. This noise is normal and does not indicate a concern.
• Squeak — a constant noise that occurs with brake pedal applications	• Damaged or worn disc brake pads	• INSPECT the pads for oil, grease or brake fluid contamination. CHECK for glazed linings. A brake disc with hard spots will also cause a squeak type noise. REPAIR or INSTALL new pads as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
• Squeak — noise	• Worn control	• INSPECT the control arm

occurs over bumps or when turning	arm bushings	bushings. Spray with lubricant and CARRY OUT a "bounce test" to determine which bushing. REPAIR as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
	• Worn or damaged shock absorber/strut	• INSPECT the shock absorber for damage. CARRY OUT a "bounce test" to isolate the noise. INSTALL a new shock absorber/strut as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles and Section 204-01B for four wheel drive (4WD) vehicles for the front shock absorber/strut or Section 204-02 for the rear shock absorber/strut.
• Rattle — heard when closing/opening the door or window	• Loose internal door mechanism, bracket or attachment	• REPEAT the motion or CARRY OUT a "tap test" to duplicate the noise. INSPECT the door for loose components. TIGHTEN loose components or USE the Rotunda Squeak and Rattle Kit to isolate any rattling components.
• Squeak or rattle — heard inside the vehicle over rough roads/bumps	• Misaligned glove compartment door/hinge	• ALIGN the glove compartment door.
	• Instrument panel trim loose or misaligned	• INSPECT the instrument panel trim for missing or loose clips or screws. REPAIR as necessary.
	• Loose interior component or trim	• CARRY OUT a "touch test". ELIMINATE the noise by pressing or pulling on interior trim and components. USE the Rotunda Squeak and Rattle Kit to isolate any rattling/squeaking components.
• Squeak or rattle — noise with a vibration concern	• Damaged or worn body mounts	• INSPECT the upper and lower absorbers and washers for damage or wear. CHECK the body mount brackets for damage. CHECK the nuts and bolts are tightened to specifications. TIGHTEN as necessary.
	• Damaged or worn sub-frame mounts	• INSPECT the upper and lower absorbers for damage or wear. CHECK the sub-frame for damage. CHECK the nuts and bolts are tightened to specifications. TIGHTEN as necessary.

Symptom Chart — Steering Noise/Vibration

Condition	Possible Sources	Action
• Steering grunt or	• Steering gear or power	• GO to Steering Gear

shudder — occurs when turning into or out of a turn at low speeds (temperature sensitive)	steering hoses	Grunt/Shudder Test component test in this section.
• Steering System clonk — hydraulic knocking sound	• Air in the steering hydraulic system	• CHECK for leaks in the system. PURGE the air from the system. REFER to Section 211-00 .
• Power steering pump moan — loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with rpm	• Power steering hose grounded out to chassis	• INSPECT the power steering hoses. REPAIR as necessary.
	• Aerated fluid	• PURGE the air from the system. REFER to Section 211-00 . CHECK for leaks in the system.
	• Steering gear isolators	• INSPECT the isolators for wear or damage. REPAIR as necessary.
	• Low fluid	• CHECK the fluid level. REFILL as necessary.
	• Power steering pump brackets loose or misaligned	• CHECK bolts, brackets and bracket alignment. TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to Section 211-02 .
• Steering gear clunk — occurs only while cornering over a bump (can be temperature sensitive)	• Steering gear	• INSPECT the steering gear for loose mounting bolts. TIGHTEN as necessary. REFER to Section 211-02 .
• Feedback (rattle, chuckle or knocking noise in the steering gear) — a condition where roughness is felt in the steering wheel when the vehicle is driven over rough surfaces	• Column intermediate/flexible shaft joints damaged or worn	• INSTALL a new intermediate/flexible shaft. REFER to Section 211-04 .
	• Loose, damaged or worn tie-rod ends	• TIGHTEN the nuts to specification or INSTALL new tie-rod ends as necessary.

	• Steering gear insulators or mounting bolts loose or damaged • Steering column intermediate shaft bolts are loose • Steering column damaged or worn • Loose suspension bushings, bolts or ball joints	• TIGHTEN the bolts or INSTALL new bolts as necessary. REFER to Section 211-02 . • TIGHTEN the bolts to specification. REFER to Section 211-04 . • REPAIR or INSTALL a new steering column as necessary. REFER to Section 211-04 . • INSPECT the suspension system. TIGHTEN or INSTALL new components as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
• Feedback (nibble at the steering wheel) — a condition where slight rotational movement is felt in the steering wheel when the vehicle is driven over rough or grooved surfaces	• Lateral runout in the tire or wheel • Yoke spring in the steering gear	• Go To Pinpoint Test H . • CHECK TSBs for revised yoke spring for applicable vehicles.
• Accessory drive belt squeal/chirp — when rotating the steering wheel from stop to stop	• Loose or worn accessory drive belt	• ADJUST or INSTALL a new accessory drive belt as necessary. REFER to Section 303-05 .
• Power steering gear hiss	• Steering column intermediate/flexible shaft-to-steering gear is binding or misaligned • Grounded or loose steering column boot at the dash panel • Damaged or worn steering gear input shaft and valve	• REPAIR or INSTALL a new intermediate/flexible shaft as necessary. REFER to Section 211-04 . • REPAIR as necessary. • REPAIR or INSTALL a new steering gear as necessary. REFER to Section 211-02 .
• Steering column rattle	• Loose bolts or attaching brackets • Loose, worn or insufficiently lubricated column bearings	• TIGHTEN the bolts to specifications. • LUBRICATE or INSTALL new steering column bearings as necessary. REFER to Section 211-04 .

	• Steering shaft insulators damaged or worn • Intermediate/flexible shaft compressed or extended	• INSTALL new insulators. REFER to Section 211-04 . • INSPECT the rubber spider coupling for damage. INSTALL a new intermediate/flexible shaft. REFER to Section 211-04 .
• Steering column squeak or cracks	• Insufficient lubricated steering shaft bushings • Loose or misaligned steering column shrouds • Steering wheel rubbing against steering column shrouds • Insufficient lubricated speed control slip ring • Upper or lower bearing sleeve out of position	• LUBRICATE the steering shaft and shaft tube seals. • TIGHTEN or ALIGN the steering column shrouds. • REPOSITION the steering column shrouds. • LUBRICATE the speed control slip ring. • REPOSITION the bearing sleeves.
• Power steering pump noisy	• Incorrect assembly of components • Imperfections on the outside diameter or end surface of the power steering pump rotor • Damaged or worn power steering pump rotor splines • A crack on the inner surface of the power steering pump cam • Interference between the power steering pump rotor and cam • Damaged or worn power steering pump rotor and pressure plates	• REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02 .
• Power steering pump swish noise	• Power steering fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54° C (130°F)	• Acceptable condition.
• Power steering pump whine noise	• Aerated fluid • Damaged power steering pump cam • Damaged valve cover O-ring seal	• CHECK for a leak in the system. PURGE the air from the system. REFER to Section 211-00 . • REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02 . • REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02 .

• Power steering pump clicking (mechanical) noise	• Power steering pump rotor slippers too long, excessive rotor slipper-to-slot clearance or damaged or worn rotor assembly	• REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02 .
• Power steering pump clatter noise	• Damaged corners on the outside diameter or the power steering rotor or distorted rotor slipper ring	• REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02 .

Symptom Chart — Suspension Noise/Vibration

Condition	Possible Sources	Action
• Squeak or grunt — noise from the front suspension, occurs more in cold ambient temperatures. More noticeable over rough roads or when turning	• Front stabilizer bar insulators	• Under these conditions, the noise is acceptable. CHECK TSBs for applicable vehicle.
• Clunk — noise from the front suspension, occurs in and out of turns	• Loose front struts or shocks	• INSPECT for loose nuts or bolts. TIGHTEN to specifications. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
• Clunk — noise from the rear suspension, occurs when shifting from reverse to drive	• Loose rear suspension components	• INSPECT for loose or damaged rear suspension components. REPAIR or INSTALL new components as necessary. REFER to Section 204-02 .
• Click or pop — noise from the front suspension. More noticeable over rough roads or over bumps	• Worn or damaged ball joints	• CARRY OUT a ball joint inspection. INSTALL new ball joints or control arms as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
• Click or pop (FWD vehicles) — noise occurs when vehicle is turning	• Worn or damaged ball joints	• CARRY OUT a ball joint inspection. INSTALL new ball joints or control arms as necessary.
• Click or snap — occurs when accelerating around a corner	• Damaged or worn outboard CV joint	• INSPECT the outboard CV joint and boot. REPAIR or INSTALL a new CV joint as necessary. REFER to Section 205-04 .
• Front suspension noise — a squeak, creak or rattle noise. Occurs mostly over	• Steering components • Loose or bent	• Go To Pinpoint Test H .

bumps or rough roads	front struts or shock absorbers • Damaged spring or spring mounts • Damaged or worn control/radius arm bushings • Worn or damaged stabilizer bar bushings or links	
• Rear suspension noise — a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Loose or bent rear shock absorbers • Damaged spring or spring mounts • Damaged or worn control arm bushings • Worn or damaged stabilizer bar bushings or links	• Go To Pinpoint Test I .
• Shudder — occurs during acceleration from a slow speed or stop	• Rear drive axle assembly mispositioned • Incorrect or high CV joint operating angle • Damaged or worn front suspension components	• CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. • CHECK vehicle ride height is within limits. REPAIR as necessary. • CHECK for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. INSPECT the steering linkage for wear or damage. REPAIR or INSTALL new components as necessary.
• Shimmy — most noticeable on coast/deceleration. Also hard steering condition	• Excessive positive caster	• CHECK the caster alignment angle. CORRECT as necessary. REFER to Section 204-00 .

Symptom Chart — Tire Noise/Vibration

Condition	Possible Sources	Action
• Tire noise — hum/moan at constant speeds	• Abnormal wear patterns	• SPIN the tire and CHECK for tire wear. INSTALL a new tire as necessary. INSPECT for damaged/worn suspension components. CARRY OUT

		wheel alignment.
• Tire noise — noise tone lowers as the vehicle speed is lowered	• Out-of-balance tire	• BALANCE the tire and road test. INSTALL a new tire as necessary. REFER to Section 204-04 .
• Tire noise — ticking noise, changes with speed	• Nail puncture or stone in tire tread	• INSPECT the tire. REPAIR as necessary.
• Wheel and tire — vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	• Damaged or worn tire	• Go To Pinpoint Test J .
• Tire wobble or shudder — occurs at lower speeds	• Damaged wheel bearings	• SPIN the tire and CHECK for abnormal wheel bearing play or roughness. ADJUST or INSTALL new wheel bearings as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.
	• Damaged wheel	• INSPECT the wheel for damage. INSTALL a new wheel as necessary. REFER to Section 204-04 .
	• Damaged or worn suspension components	• INSPECT the suspension components for wear or damage. REPAIR as necessary.
	• Loose wheel nuts	• CHECK the wheel nuts. TIGHTEN to specification. REFER to Section 204-04 .
	• Damaged or uneven tire wear	• SPIN the tire and CHECK for abnormal tire wear or damage. INSTALL a new tire as necessary. REFER to Section 204-04 .
• Tire shimmy or shake — occurs at lower speeds	• Wheel/tire out of balance	• BALANCE the wheel/tire assembly.
	• Uneven tire wear	• CHECK for abnormal tire wear. INSTALL a new tire as necessary. REFER to Section 204-04 .
	• Excessive radial runout of wheel or tire	• CARRY OUT a radial runout test of the wheel and tire. INSTALL a new tire as necessary. REFER to Section 204-04 .
	• Worn or damaged wheel studs or elongated stud	• INSPECT the wheel studs and wheels. INSTALL new components as necessary. REFER to Section 204-01A for

	holes	rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles for the front wheels or Section 204-02 for the rear wheels.
	• Excessive lateral runout of the wheel or tire	• CARRY OUT a lateral runout test of the wheel and tire. REFER to Section 204-04. CHECK the wheel, tire and hub. REPAIR or INSTALL new components as necessary.
	• Foreign material between the brake disc and hub or in the brake disc fins	• CLEAN the mounting surfaces of the brake disc and hub. CHECK the brake disc fins for material.
• High speed shake or shimmy — occurs at high speeds	• Excessive wheel hub runout • Damaged or worn tires • Damaged or worn wheel bearings • Worn or damaged suspension or steering linkage components • Brake disc or drum imbalance	• Go To Pinpoint Test K.

Symptom Chart — Manual Transmission and Transfer Case Noise/Vibration

Condition	Possible Sources	Action
• Clutch rattling noise — occurs with clutch engaged, noise changes/disappears with clutch pedal depressed	• Flywheel bolts, clutch housing bolts or clutch pressure plate bolts loose	• TIGHTEN the bolts to specifications. CHECK the bolts for damage.
• Clutch squeaking noise — noise is heard when the clutch is operated. Vehicle moves slowly or creeps when the clutch is disengaged. Can also be difficult to shift into 1st and REVERSE gear	• Pilot bearing seized or damaged	• INSTALL a new pilot bearing.
• Clutch squeaking noise — occurs with clutch pedal depressed/released	• Worn clutch pedal shaft or bushings	• INSPECT the clutch pedal for wear or damage. REPAIR as necessary.
• Clutch whirring/rattle noise — occurs when clutch pedal is depressed	• Worn, damaged or misaligned clutch release bearing	• INSTALL a new clutch release bearing.

• Clutch grating/grinding noise — occurs when clutch pedal is depressed	• Clutch pressure plate fingers bent or worn	• INSPECT the clutch pressure plate release fingers. INSTALL a new pressure plate as necessary.
	• Contact surface of clutch release bearing worn or damaged	• INSTALL a new clutch release bearing.
• Clutch chatter — a small amount of noise when clutch pedal is released at initial take-off	• Clutch engagement	• Acceptable operating condition.
• Clutch chatter/grabs — in some cases a shudder is felt. Occurs with clutch pedal depressed/released	• Damaged or worn powertrain/driveline mounts	• INSPECT the powertrain/drivetrain mounts. CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section. INSTALL new mounts as necessary.
	• Binding or dragging plunger of the clutch master cylinder or slave cylinder	• CHECK the master and slave cylinder operation. INSPECT the components for damage or wear. INSTALL a new master or slave cylinder as necessary.
	• Grease or oil on the clutch disc facing	• CHECK the input shaft seal and rear main oil seal. REPAIR as necessary. INSTALL a new clutch disc.
	• Clutch disc surface glazed or damaged	• INSPECT the clutch disc surface for a glazed, hardened or damaged condition. CARRY OUT a disc check. INSTALL a new clutch disc as necessary.
	• Damaged or worn clutch pressure plate	• INSPECT the clutch pressure plate for wear or damage. INSTALL a new clutch pressure plate as necessary.
	• Flywheel surface damaged or glazed	• INSPECT the flywheel for damage or wear. CARRY OUT a flywheel runout check. INSTALL a new flywheel as necessary.
• Clutch chatter noise — noise when clutch pedal is released at initial take-off. Clutch is hard to engage and disengage	• Pilot bearing worn, damaged or not correctly aligned in bore	• INSPECT the clutch pressure plate release fingers for uneven wear, clutch components burnt or a seized pilot bearing. INSTALL a new pilot

		bearing as necessary.
• Clutch vibration	• Loose flywheel bolts • Damaged or loose clutch pressure plate • Excessive flywheel runout	• Go To Pinpoint Test L .
• Transmission rattling/clattering noise — noise at idle or on light acceleration from a stop. Gear selection difficult	• Gearshift lever joint worn or damaged	• INSTALL a new gearshift lever.
	• Gearshift lever loose	• TIGHTEN the bolts to specification.
	• Gearshift linkage rods worn or damaged	• CHECK the linkage bushings for wear. INSTALL new linkage rods as necessary.
• Transmission rattling/clattering noise — occurs in neutral or in gear, at idle	• Incorrect fluid level or fluid quality	• CHECK that the transmission is filled to the correct level and with the specified fluid.
• Transmission rattling/clattering noise — noise at idle in neutral	• Worn or rough reverse idler gear	• CHECK the reverse idler gear. REPAIR as necessary.
	• Rough running engine, cylinder misfire	• CHECK the ignition system. CARRY OUT a cylinder power test.
	• Excessive backlash in gears	• CHECK the gear backlash. ADJUST as necessary.
	• Worn countershaft gears	• REPAIR as necessary.
• Transmission whine — a mild whine at extreme speeds or high rpm	• Rotating gears/geartrain	• Acceptable noise.
• Transmission whine — a high pitched whine, also described as a squeal	• Transmission gears are worn (high mileage vehicle)	• Result of normal gear wear. REPAIR as necessary.
	• Mismatched gear sets	• INSPECT the gear sets for an uneven wear pattern on the face of the gear teeth. REPAIR as necessary.
	• Damaged or worn transmission bearing	• INSPECT the transmission bearings. INSTALL new bearings as necessary.
• Transmission growling/humming — noise occurs in the forward gears. The noise is more prominent when the	• Gear is cracked, chipped or rough	• INSPECT the transmission gears for damage or wear. INSTALL new gears as necessary.

gear is loaded. The problem gear can be located as the noise occurs in a specific gear position		
• Transmission hissing — noise in neutral or in forward gears. As bearings wear or break up, the noise changes to a thumping noise	• Damaged or worn bearings	• INSPECT the transmission bearings. INSTALL new bearings as necessary.
• Transmission knocking/thudding — noise at low speeds in forward gears	• Bearings with damaged balls or rollers or with pitted and spalled races	• INSPECT the transmission bearings. INSTALL new bearings as necessary.
• Transmission rumble/growl — noise at higher speeds in forward gears, more pronounced in a coast/deceleration condition	• Incorrect driveline angle	• CHECK the driveline angle. REPAIR as necessary.
	• Driveshaft out of balance or damaged	• CHECK the driveshaft for damage, missing balance weights or undercoating. Using a vibration analyzer (VA), CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REPAIR as necessary.
• Transmission rumble/growl — noise at all speeds in forward gears, more pronounced in a heavy acceleration condition	• Damaged or worn transmission bearing or gears (high mileage vehicles)	• CHECK transmission fluid for excessive metal particles. REPAIR as necessary.
• Transfer case whine — noise at all ranges	• Incorrect fluid level or fluid quality	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to Section 308-07B .
	• Worn oil pump	• DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
	• Under-inflated or oversized tires	• CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble — noise at all ranges (A small amount of planetary noise can be heard	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as

when the transfer case is operated in low range.)		necessary. REFER to Section 308-07B .
• Transfer case scraping/grating — noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case howl/hum — noise at all ranges or high range only	• Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case howl/hum — noise at low range only	• Worn or damaged intermediate gear and sliding gears (clutch pack)	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case vibration — vibration felt with vehicle in 4WD	• Transfer case mounting • Driveshaft out of balance • Excessive pinion flange runout	• Go To Pinpoint Test M .

Symptom Chart — Automatic Transmission Noise/Vibration

Condition	Possible Sources	Action
• Rattle — occurs at idle or at light acceleration from a stop	• Damaged engine or transmission mounts	• CHECK the powertrain/drivetrain mounts for damage. REFER to Section 303-01 .
	• A loose front exhaust pipe heat shield	• REPAIR or INSTALL a new heat shield as necessary.
	• Loose inspection plate or dust cover plate	• CHECK for loose bolts. TIGHTEN to specifications. REFER to Section 307-01A or Section 307-01B .
	• Loose flexplate to converter nuts	• CHECK for loose nuts. TIGHTEN to specifications. REFER to Section 307-01A or Section 307-01B .
• Whine — pitch increases with vehicle speed. Starts in 1st and 2nd gear, decreases or goes away at higher gears	• Damaged or worn low one-way clutch • Damaged or worn intermediate one-way clutch • Friction elements • Damaged or worn planetary or sun gear	• INSPECT the transmission for wear or damage. REPAIR or INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
• Whine — the pitch changes with engine speed	• A worn or damaged accessory drive component	• CARRY OUT the Engine Accessory Test. REPAIR or INSTALL new components as necessary.

	• Incorrect fluid level	• CHECK that the transmission is filled to the correct level. ADD fluid as necessary. REFER to Section 307-01A or Section 307-01B .
	• Partially blocked filter	• INSPECT the filter. CLEAN or INSTALL a new filter as necessary. REFER to Section 307-01A or Section 307-01B .
	• Worn or damaged torque converter	• CARRY OUT the torque converter service and replacement check. REFER to Section 307-01A or Section 307-01B .
	• Worn or damaged front pump	• INSPECT the front pump. INSTALL a new front pump as necessary. REFER to Section 307-01A or Section 307-01B .
• Whine — pitch changes with vehicle speed	• Speedometer cable or gears	• REPAIR or INSTALL new cables or gears as necessary.
• Whine/moan type noise — pitch increases or changes with vehicle speed	• Damaged engine or transmission mount	• CHECK the powertrain/drivetrain mounts for damage. REFER to Section 303-01 .
	• U-joints worn or damaged	• INSPECT the U-joints for wear or damage. INSTALL new U-joints as necessary. REFER to Section 205-01 .
	• Damaged or worn differential ring and pinion	• INSPECT the differential ring and pinion for damage. CARRY OUT the Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. REPAIR or INSTALL a new differential ring and pinion as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Planetary gears nicked or chipped	• CHECK the planetary gears for damage. INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
• Whistle — noise is high pitched, constant. Changes in pitch with throttle position	• Hydraulic pressure in the main control	• INSPECT the main control. REPAIR or INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
	• Incorrect band/clutch apply pressure	• CARRY OUT the line pressure tests. REPAIR or INSTALL components as necessary. REFER to Section 307-01A or Section 307-01B .

	• Worn or damaged torque converter	• CARRY OUT the torque converter service and replacement check. REFER to Section 307-01A or Section 307-01B .
• Clunk — occurs when shifting from PARK to a drive or reverse position	• Damaged powertrain mounts	• INSPECT the powertrain mounts for damage. INSTALL new mounts as necessary. REFER to Section 307-01A or Section 307-01B .
	• Damaged or worn pinion bearings	• CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary. REFER to Section 205-02 for the rear axle or Section 205-03 for the front axle.
	• Worn or galled driveshaft slip yoke splines	• CLEAN and INSPECT the splines of the yoke. INSTALL a new slip yoke as necessary. REFER to Section 205-01 .
	• Worn friction elements or excessive clutch pack end plate play	• INSPECT the transmission for wear. CHECK that all end play and clearances are within specification. REPAIR or INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
• Bump — occurs when shifting from PARK to a drive or reverse position. Similar to Clunk but with no sound	• Initial gear engagement	• Acceptable condition.
• Buzz or hiss	• Incorrect driveline angles	• CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00 .
	• Worn or damaged main control solenoids or valves	• Using a transmission tester, ACTIVATE the solenoids to duplicate sound. INSTALL new components as necessary. REFER to Section 307-01A or Section 307-01B .
• Vibration — a high frequency (20–80 Hz) that is felt through the seat or gear shifter. Changes with engine speed	• Transmission cooler lines grounded out	• CHECK the transmission cooler lines. REPAIR as necessary.
	• Flexplate to torque converter nuts loose	• CHECK the flexplate nuts. TIGHTEN to specification. REFER to Section 307-01A or Section 307-01B .
	• Fluid filler tube grounded out	• CHECK the fluid filler tube. REPAIR as necessary.

	• Shift cable incorrectly routed, grounded out or loose	• CHECK the shift cable. REPAIR as necessary. REFER to Section 307-05 .
• Shutter or chatter — occurs with light to medium acceleration from low speeds or a stop	• Electrical inputs/outputs • Vehicle wiring harness • Incorrect inputs/outputs from the powertrain control module (PCM), digital transmission range (TR) sensor, brake pedal position (BPP) sensor, throttle position (TP) sensor, transmission speed sensor (TSS), output speed shaft (OSS) sensor or the torque converter clutch (TCC)	• CARRY OUT a Torque Converter Clutch Operation Test. RUN on-board diagnostics or self-test. REFER to Section 307-01A or Section 307-01B . CLEAR the DTC's, road test and rerun on-board diagnostics or self–test.

Pinpoint Tests

The pinpoint tests are a step-by-step diagnostic process designed to determine the cause of a condition. It may not always be necessary to follow a pinpoint test to its conclusion. Carry out only the steps necessary to correct the condition. Then, test the system for normal operation. Sometimes, it is necessary to remove various vehicle components to gain access to the component requiring testing. REFER to the appropriate Workshop Manual section for removal and installation procedures. Reinstall all components after verifying system operation is normal.

PINPOINT TEST A: BRAKE VIBRATION/SHUDDER

Test Step	Result / Action to Take
A1 ROAD TEST THE VEHICLE — LIGHT BRAKING	
• Check that the wheel and tires are correct for the vehicle. Inspect the tires for abnormal wear patterns. • Road test the vehicle. Warm the brakes by slowing the vehicle a few times from 80–32 km/h (50 to 20 mph) using light braking applications. At highway speeds of 89–97 km/h (55-60 mph), apply the brake using a light pedal force. • **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**	**Yes** GO to A4 . **No** GO to A2 .
A2 ROAD TEST THE VEHICLE — MODERATE TO HEAVY BRAKING	
• Road test the vehicle. At highway speeds of 89–97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force. • **Is there a vibration/shudder?**	**Yes** For vehicles with ABS, GO to A3 . For vehicles with standard brakes, GO to A4 . **No** Vehicle is OK. VERIFY condition with customer. TEST the vehicle for normal operation.

A3 NORMAL ACTUATION OF THE ABS SYSTEM DIAGNOSIS	
• During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS system. Pedal pulsation or steering wheel nibble (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component. • **Is the vibration/shudder vehicle speed sensitive?**	**Yes** GO to A5 . **No** The brake system is operating correctly.
A4 APPLICATION OF THE PARKING BRAKE	
• **NOTE:** Begin at the front of the vehicle unless the vibration or shudder has been isolated to the rear. • This test is not applicable to vehicles with drum-in-hat type parking brakes. For vehicles with drum-in-hat parking brakes, proceed to the next test. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89–97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test. • **Is there a vibration/shudder?**	**Yes** GO to A8 . **No** GO to A5 .
A5 CHECK THE FRONT WHEEL BEARINGS	
• Check the front wheel bearings. Refer to Wheel Bearing Check in this section. • **Are the wheel bearings OK?**	**Yes** GO to A6 . **No** INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.
A6 CHECK THE FRONT SUSPENSION	
• Check the front suspension for: ▪ broken or loose bolts. ▪ damaged springs. ▪ worn or damaged upper and lower control arm bushings. ▪ loose or rough front bearings. ▪ uneven tire wear. • **Are all the suspension components in satisfactory condition?**	**Yes** GO to A7 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
A7 RESURFACE THE FRONT BRAKE DISCS	
• **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the front brake discs. Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** GO to A8 . **No** Vehicle is OK.
A8 CHECK THE REAR SUSPENSION	
• Check the rear suspension for: ▪ broken or loose bolts. ▪ damaged or worn springs or spring bushings. ▪ worn or damaged upper and lower control arm bushings. ▪ worn or damaged trailing arms. ▪ loose or rough rear bearings. ▪ uneven tire wear.	**Yes** GO to A9 . **No** REPAIR or INSTALL new components as necessary. TEST the

• **Are all the suspension components in satisfactory condition?**	system for normal operation.
A9 RESURFACE THE REAR BRAKE DISC OR DRUM	
• **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturers instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the rear brake discs or drums. Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** CHECK the front suspension for wear or damage, RESURFACE the front brake discs. TEST the system for normal operation. **No** Vehicle is OK.

PINPOINT TEST B: ENGINE TICKING NOISE

Test Step	Result / Action to Take
B1 CHECK FOR TICKING NOISE AT THE FUEL RAIL	
• Disconnect the first fuel line clip. • **Is the ticking noise gone?**	**Yes** CHECK for TSB for applicable vehicle. REPAIR as necessary. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK FOR TICKING NOISE AT THE FUEL INJECTOR	
• Using an EngineEAR, listen at the fuel injectors by placing a probe on each injector. To isolate the faulty injector, disconnect the injector electrical connector and listen for the noise. • **Is the fuel injector the source of the ticking noise?**	**Yes** INSTALL a new fuel injector. REFER to Section 303-04 . TEST the system for normal operation. **No** GO to B3 .
B3 CHECK THE BELT TENSIONER FOR TICKING NOISE	
• Inspect the accessory drive. Check for the belt tensioner bottoming at end of travel or not at end of stroke. • Using an EngineEAR, listen at the belt tensioner. • **Is the belt tensioner the source of the noise?**	**Yes** INSTALL a new belt tensioner. TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE WATER PUMP FOR TICKING NOISE	
• Using an EngineEAR, listen at the water pump for ticking noise. • **Is the water pump the source of the noise?**	**Yes** INSTALL a new water pump. REFER to Section 303-03 . TEST the system for normal operation. **No** GO to B5 .
B5 CHECK FOR AN OBSTRUCTION OF THE COOLING FAN	
• Inspect the cooling fan for obstructions.	**Yes**

• Check the cooling fan and shroud for wear or damage. • **Was there an obstruction or does the cooling fan show signs of damage?**	REPAIR or INSTALL a new cooling fan. TEST the system for normal operation. REFER to Section 303-03 . **No** GO to B6 .
B6 CHECK THE OIL PUMP FOR TICKING NOISE	
• Check the oil pump using EngineEARs and probe at the oil filter adapter to verify the oil pump as a source. • **Is the oil pump the source of the noise?**	**Yes** INSTALL a new oil pump. REFER to Section 303-01 . TEST the system for normal operation. **No** GO to B7 .
B7 CHECK VALVE LIFTERS OR LASH ADJUSTERS FOR CORRECT OPERATION	
• Check valve lifter/lash adjuster for correct operation, using EngineEARs. • **Are the valve lifters/lash adjusters operating correctly?**	**Yes** VERIFY customer concern. CONDUCT a diagnosis of other suspect components. **No** INSTALL a new valve lifter/lash adjuster(s). REFER to Section 303-01 . TEST the system for normal operation.

PINPOINT TEST C: ACCESSORY DRIVE BEARING HOOT

Test Step	Result / Action to Take
C1 CHECK THE ACCESSORY DRIVE IDLER AND TENSIONER PULLEY BEARINGS	
• Carry out the Vehicle Cold Soak Procedure in this section. • Key in START position. • Place an EngineEAR probe directly on the pulley center post or bolt to verify which bearing is making the noise. • Key in OFF position. • **Is either bearing making the noise?**	**Yes** INSTALL a new pulley/idler. CARRY OUT the Vehicle Cold Soak Procedure and TEST the system for normal operation. **No** CONDUCT a diagnosis on other suspect accessory drive components.

PINPOINT TEST D: POWER STEERING MOAN

Test Step	Result / Action to Take
D1 CHECK THE POWER STEERING SYSTEM	
• Carry out the Vehicle Cold Soak Procedure in this section. • Key in START position. • Turn the steering wheel while the noise is occurring and listen for changes in sound pitch or loudness. • Key in OFF position. • **Does the sound pitch or loudness**	**Yes** GO to D2 . **No** CONDUCT a diagnosis on other suspect accessory drive components.

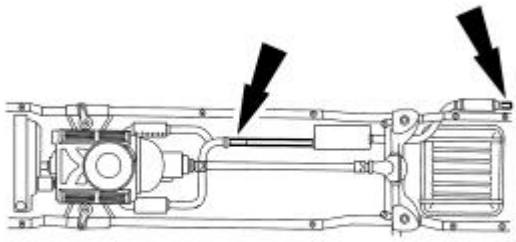
change while turning the steering wheel?	
D2 VERIFY THE SOURCE • Key in START position. • Place an EngineEAR probe near the power steering pump/reservoir while the noise is occurring. While an assistant turns the steering wheel, listen for changes in sound pitch or loudness. • Key in OFF position. • **Does the sound pitch or loudness change while turning the steering wheel?**	**Yes** VERIFY that the supply tube to the pump is unobstructed. CHECK the fluid condition and level. DRAIN the fluid and REFILL. REFER to Section 211-02 . CARRY OUT the Vehicle Cold Soak Procedure and TEST the system for normal operation. **No** Normal system operation.

PINPOINT TEST E: ENGINE DRIVEN COOLING FAN MOAN

Test Step	Result / Action to Take
E1 CHECK THE ENGINE DRIVEN COOLING FAN AFTER A COLD SOAK • Carry out the Vehicle Cold Soak Procedure in this section. • Key in START position. • Assess the airflow. • Raise the engine speed to 1500 rpm while listening for the moan to increase in proportion to the airflow. • Key in OFF position. • **Does the moan increase in proportion to the airflow?**	**Yes** TEST the fan for normal operation. If the fan tests normal, GO to E2 . Otherwise, REPAIR as necessary. **No** Normal system operation.
E2 CHECK THE ENGINE DRIVEN COOLING FAN AT NORMAL OPERATING TEMPERATURE • Key in START position. • Run the engine to normal operating temperature while listening for the moan to stop. • Key in OFF position. • **Does the moan stop?**	**Yes** Normal clutch operation. **No** INSTALL a new fan clutch. TEST the system for normal operation.

PINPOINT TEST F: DRUMMING NOISE

Test Step	Result / Action to Take
F1 CHECK THE EXHAUST SYSTEM • Key in START position. • Increase the engine rpm until the noise is the loudest. Note the engine rpm. • Key in OFF position. • Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then at the front pipe.	**Yes** CARRY OUT Exhaust System Neutralizing in this section. TEST the system for normal operation. **No** GO to F2 .

 DF1768-A • Key in START position. • Increase the engine rpm and listen for the drumming noise. Note the engine rpm if the noise occurs. • Key in OFF position. • Using a vibration analyzer (VA), determine the amount of vibration that occurs with the drumming noise. • **Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different rpm?**	
F2 POWERTRAIN/DRIVETRAIN MOUNT NEUTRALIZING	
• Carry out Powertrain/Drivetrain Mount Neutralizing in this section. Test the system for normal operation. • **Is the noise reduced or eliminated?**	**Yes** Vehicle OK. TEST the system for normal operation. **No** CONDUCT diagnosis of other suspect components.

PINPOINT TEST G: ENGINE TICKING, KNOCKING OR CONTINUOUS RATTLE

Test Step	Result / Action to Take
G1 CHECK FOR NOISE AT THE VALVE COVERS AND THE FRONT COVERS (OHC ENGINES)	
• Carry out the Vehicle Cold Soak Procedure in this section. • Key in START position. • **NOTE:** For a short-duration ticking noise, multiple engine starts may be necessary. • Using an EngineEAR, listen closely at the valve covers and the front covers (OHC engines) by placing the probe near the surface of the valve cover and then on the surface front cover. • Key in OFF position. • **Is the noise source apparent?**	**Yes** REMOVE the appropriate cover and INSPECT for loose, worn/broken components. REPAIR as necessary. TEST the system for normal operation. **No** GO to G2 .
G2 CHECK FOR NOISE AT THE CYLINDER BLOCK	
• Key in START position. • Using an EngineEAR, listen closely at the cylinder block by placing a probe on or near each freeze plug. • Key in OFF position. • **Is the noise source apparent?**	**Yes** REPAIR or INSTALL new components as necessary. **No** GO to G3 .
G3 CHECK FOR NOISE WHILE DISCONNECTING EACH FUEL INJECTOR ELECTRICAL CONNECTOR, ONE AT A TIME	
• Key in START position.	**Yes**

• Disconnect each fuel injector electrical connector, one at a time, to decrease piston force and listen for the noise. • Key in OFF position. • **Is the noise reduced or eliminated?**	INSTALL a new fuel injector. TEST the system for normal operation. **No** INSPECT accessory drive or the transmission as a possible source.

PINPOINT TEST H: FRONT SUSPENSION NOISE

Test Step	Result / Action to Take
H1 ROAD TEST THE VEHICLE	
• Test drive the vehicle. • **NOTE:** An assistant will be needed for this road test. • During the road test, drive the vehicle over a rough road. Using ChassisEARs, determine from which area/component the noise is originating. • **Is there a squeak, creak or rattle noise?**	**Yes** GO to H2 . **No** The suspension system is OK. CONDUCT a diagnosis on other suspect systems.
H2 INSPECT THE STEERING SYSTEM	
• **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.** • Raise and support the vehicle. • Check the steering system for wear or damage. Carry out a steering linkage test. Refer Section 211-00 . • Inspect the tire wear pattern. Refer to Tire Wear Patterns chart in this section. • **Are the steering components worn or damaged?**	**Yes** REPAIR the steering system. INSTALL new components as necessary. TEST the system for normal operation. **No** GO to H3 .
H3 FRONT SHOCK ABSORBER/STRUT CHECK	
• Check the front shock absorber/strut mounts for loose bolts or nuts. • Check the front shock absorbers/struts for wear or damage. Carry out a "bounce test". • **Are the front shock absorbers/struts loose or damaged?**	**Yes** TIGHTEN to specifications if loose. INSTALL new front shock absorbers/struts if damaged. TEST the system for normal operation. **No** GO to H4 .
H4 CHECK THE FRONT SPRINGS	
• Check the front spring and front spring mounts/brackets for wear or damage. • **Are the front springs or spring mounts/brackets worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to H5 .
H5 CHECK THE CONTROL ARMS/RADIUS ARMS	
• Inspect the control arm bushings for wear or damage. • Inspect for twisted or bent control arm/radius arm. • **Are the control arms/radius arms damaged or worn?**	**Yes** REPAIR or INSTALL new components as necessary.

	TEST the system for normal operation. **No** GO to H6 .
H6 CHECK THE STABILIZER BAR/TRACK BAR	
• Check the stabilizer bar/track bar bushings and links for damage or wear. • Check the stabilizer bar/track bar for damage. • Check for loose or damaged stabilizer bar isolators or brackets. • **Are the stabilizer bar/track bar components loose, worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** Suspension system OK. CONDUCT diagnosis on other suspect systems.

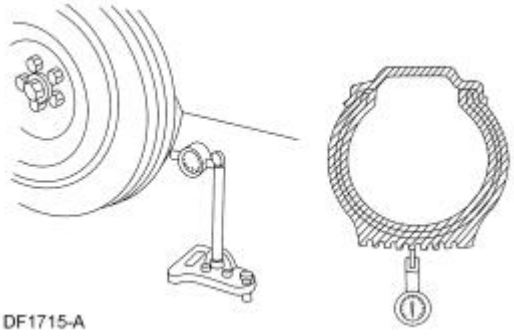
PINPOINT TEST I: REAR SUSPENSION NOISE

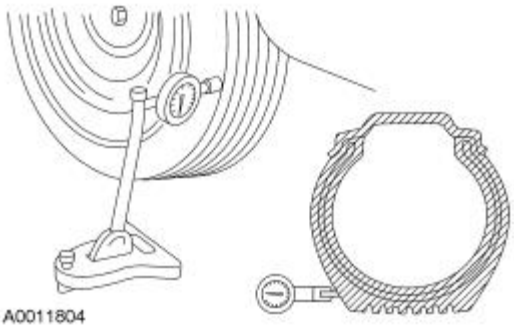
Test Step	Result / Action to Take
I1 ROAD TEST THE VEHICLE	
• Test drive the vehicle. • **NOTE:** An assistant will be needed for this road test. • During the road test, drive the vehicle over a rough road. Using ChassisEARs, determine from which area/component the noise is originating. • **Is there a squeak, creak or rattle noise?**	**Yes** GO to I2 . **No** The suspension system is OK. CONDUCT a diagnosis on other suspect systems.
I2 REAR SHOCK ABSORBER/STRUT CHECK	
• **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.** • Raise and support the vehicle. • Check the rear shock absorber/strut mounts for loose bolts or nuts. • Check the rear shock absorbers/struts for damage. Carry out a shock absorber check. • **Are the rear shock absorbers/struts loose or damaged?**	**Yes** TIGHTEN to specifications if loose. INSTALL new rear shock absorbers/struts if damaged. TEST the system for normal operation. **No** GO to I3 .
I3 CHECK THE REAR SPRINGS	
• Check the rear springs and rear spring mounts/brackets for wear or damage. • **Are the rear springs or spring mounts/brackets worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to I4 .
I4 CHECK THE CONTROL ARMS/TRAILING ARMS	
• Inspect the control arm/trailing arm bushings for wear or damage. Check for loose control arm/trailing arm bolts. • Inspect for twisted or bent control arms/trailing arms.	**Yes** REPAIR or INSTALL new components as necessary.

• **Are the control arms/trailing arms loose, damaged or worn?**	TEST the system for normal operation. **No** GO to I5 .
I5 CHECK THE STABILIZER BAR/TRACK BAR	
• Check the stabilizer bar/track bar bushings and links for damage or wear. • Check the stabilizer bar/track bar for damage. • Check for loose or damaged stabilizer bar isolators or brackets. • **Are the stabilizer bar/track bar components loose, worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. Test the system for normal operation. **No** Suspension system OK. CONDUCT diagnosis on other suspect systems.

PINPOINT TEST J: WHEEL AND TIRE

Test Step	Result / Action to Take
J1 ROAD TEST THE VEHICLE	
• **NOTE:** Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle. • Test drive the vehicle at different speed ranges. • During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires. • **Is there a vibration and noise?**	**Yes** GO to J2 . **No** The wheel and tires are OK. CONDUCT a diagnosis on other suspect systems.
J2 CHECK THE FRONT WHEEL BEARINGS	
• Check the front wheel bearings. Refer to Wheel Bearing Check in this section. • **Are the wheel bearings OK?**	**Yes** GO to J3 . **No** INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.
J3 INSPECT THE TIRES	
• Check the tires for missing weights. • Check the wheels for damage. • Inspect the tire wear pattern. Refer to the Tire Wear Patterns chart in this section. • **Do the tires have an abnormal wear pattern?**	**Yes** CORRECT the condition that caused the abnormal wear. INSTALL new tire(s). TEST the system for normal operation. **No** GO to J4 .
J4 TIRE ROTATION DIAGNOSIS	
• Spin the tires slowly and watch for signs of lateral runout.	**Yes** GO to J5 . **No**

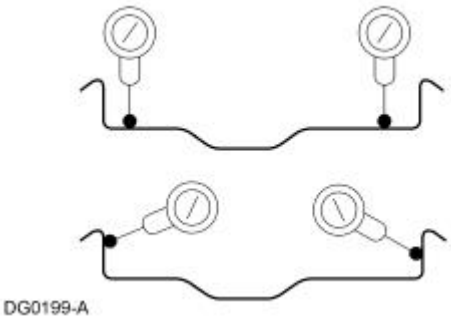
 DF1713-A • Spin the tires slowly and watch for signs of radial runout. DF1714-A • **Are there signs of visual runout?**	CHECK the wheel and tire balance. CORRECT as necessary. TEST the system for normal operation.
J5 RADIAL RUNOUT CHECK ON THE TIRE • Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.14 mm (0.045 in).  DF1715-A • **Is the radial runout within specifications?**	**Yes** GO to J8 . **No** GO to J6 .
J6 RADIAL RUNOUT CHECK ON THE WHEEL • Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14 mm (0.045 in). • **Is the radial runout within specifications?**	**Yes** INSTALL a new tire. TEST the system for normal operation. **No** GO to J7 .
J7 CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT • Measure the pilot or bolt circle runout. A typical specification for radial runout is: ▪ pilot runout — less than 0.15 mm (0.006 in). ▪ bolt circle runout — less than 0.38 mm (0.015 in). • **Is the radial runout within specifications?**	**Yes** INSTALL a new wheel. TEST the system for normal operation. **No** REPAIR or INSTALL new components as necessary.

	REFER to Section 204-01A for rear wheel drive (RWD) vehicles and Section 204-01B for four wheel drive (4WD) vehicles for the front wheels or Section 204-02 for the rear wheels.
J8 LATERAL RUNOUT CHECK ON THE TIRE • Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 1.14 mm (0.045 in).  A0011804 • **Is the lateral runout within specifications?**	**Yes** Wheel and tires OK. CONDUCT diagnosis on other suspect systems. **No** GO to J9.
J9 LATERAL RUNOUT CHECK ON THE WHEEL • Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.14 mm (0.045 in). • **Is the lateral runout within specifications?**	**Yes** INSTALL a new tire. TEST the system for normal operation. **No** GO to J10.
J10 CHECK THE FLANGE FACE LATERAL RUNOUT • Measure the flange face lateral runout. A typical specification for lateral runout is: ▪ hub/brake disc — less than 0.13 mm (0.005 in). ▪ axle shaft — less than 0.25 mm (0.010 in). • **Is the lateral runout within specifications?**	**Yes** INSTALL a new wheel. TEST the system for normal operation. **No** REPAIR or INSTALL new components as necessary. REFER to Section 204-01A for rear wheel drive (RWD) vehicles and Section 204-01B for four wheel drive (4WD) vehicles for the front wheels or Section 204-02 for the rear wheels.

PINPOINT TEST K: HIGH SPEED SHAKE OR SHIMMY

Test Step	Result / Action to Take
K1 CHECK FOR FRONT WHEEL BEARING ROUGHNESS • Chock the rear wheels. • Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. • Spin the front tires by hand. Refer to Wheel Bearing Check in	**Yes** INSPECT the wheel bearings. REPAIR as necessary. TEST the

this section. • **Do the wheel bearings feel rough?**	system for normal operation. **No** GO to K2 .
K2 CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS • Check the end play of the front wheel bearings. Refer to Section 204-00 . • **Is the end play OK?**	**Yes** GO to K3 . **No** ADJUST or REPAIR as necessary. TEST the system for normal operation.
K3 MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE • Measure the lateral runout and the radial runout of the front wheels on the vehicle. Refer to Pinpoint Test J. • **Are the measurements within specifications?**	**Yes** GO to K4 . **No** INSTALL new wheels as necessary and BALANCE the assembly. TEST the system for normal operation.
K4 MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE • Measure the lateral runout of the front tires on the vehicle. Refer to Pinpoint Test J. • **Is the runout within specifications?**	**Yes** GO to K5 . **No** INSTALL new tires as necessary and BALANCE the assembly. TEST the system for normal operation.
K5 MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE • Measure the radial runout of the front tires on the vehicle. Refer to Pinpoint Test J. • **Is the runout within specifications?**	**Yes** BALANCE the front wheel and tire assemblies. If any tire cannot be balanced, INSTALL a new tire. TEST the system for normal operation. **No** GO to K6 .
K6 MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY • Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. • **Is the runout within specifications?**	**Yes** BALANCE the assembly. TEST the system for normal operation. **No** If the high spot is not within 101.6 mm (4 inches) of the first high spot on the

	tire, GO to K7 .
K7 MEASURE THE WHEEL FLANGE RUNOUT	
• Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Refer to Section 204-04 .  DG0199-A • **Is the runout within specifications?**	**Yes** LOCATE and MARK the low spot on the wheel. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If the condition persists, GO to K8 . **No** INSTALL a new wheel. CHECK the runout on the new wheel. If the new wheel is within limits, LOCATE and MARK the low spot. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If the condition persists, GO to K8 .
K8 CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. • **Is the vibration present?**	**Yes** SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation. **No** GO to K9 .
K9 CHECK FOR VIBRATION FROM THE REAR OF THE VEHICLE	
WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Chock the front wheels. • Raise and support the rear end of the vehicle so that the rear wheel and tire assemblies can spin. • Engage the drivetrain and carefully accelerate the drive wheels while checking for vibration. • **Is the vibration present?**	**Yes** GO to K10 . **No** TEST the system for normal operation.
K10 CHECK THE DRIVETRAIN	

WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Remove the rear wheel and tire assemblies. Refer to Section 204-04 . • Secure the brake drums (if so equipped), by installing wheel hub bolt nuts, reversed. • Carefully accelerate the drivetrain while checking for vibration. • **Is the vibration present?**	**Yes** CHECK/TEST the drivetrain and driveline components. TEST the system for normal operation. **No** SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation.

PINPOINT TEST L: CLUTCH VIBRATION

Test Step	Result / Action to Take
L1 CHECK ENGINE COMPONENTS FOR GROUNDING	
• **NOTE:** Make sure the clutch is the cause of the vibration concern. The vibration should occur during clutch operation. The clutch can also be difficult to engage or disengage. Eliminate all related systems before checking the clutch components. • **NOTE:** Check the driveline angles and driveshaft runout before disassembling the clutch system. Refer to Section 205-00 . • Check the powertrain/drivetrain mounts, exhaust manifolds or other engine components for grounding on the chassis. • **Are any mounts or engine components grounded?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** GO to L2 .
L2 CHECK THE ACCESSORY DRIVE BELT	
• Remove the accessory drive belt. • **Does the vibration stop with the accessory drive belt removed?**	**Yes** DIAGNOSE the accessory drive components. **No** GO to L3 .
L3 CHECK FOR LOOSE CLUTCH PRESSURE PLATE BOLTS	
• Check for loose clutch pressure plate bolts. Inspect the clutch pressure plate for damage or for material between the pressure plate and flywheel. • **Are there any loose bolts or damage?**	**Yes** TIGHTEN the bolts to specifications or if damaged, INSTALL a new clutch pressure plate. **No** GO to L4 .
L4 CHECK THE CLUTCH DISC SPRINGS	
• Check for worn, broken or loose clutch disc springs. • **Are the clutch springs worn, broken or loose?**	**Yes** INSTALL a new clutch disc. TEST the system for normal operation. **No** GO to L5 .
L5 CHECK THE CLUTCH DISC SPLINES	

• Inspect the clutch disc splines for damage or wear. • **Is there damage or wear?**	**Yes** INSTALL a new clutch disc. TEST the system for normal operation. **No** GO to L6 .
L6 CHECK THE FLYWHEEL BOLTS	
• Check for loose flywheel bolts. • **Are the bolts loose?**	**Yes** TIGHTEN the bolts to specifications. TEST the system for normal operation. **No** GO to L7 .
L7 CHECK THE FLYWHEEL SURFACE	
• Inspect the flywheel surface for wear or damage. Check the flywheel runout. • **Is there any damage or excessive wear?**	**Yes** INSTALL a new flywheel. TEST the system for normal operation. **No** Clutch system normal. CONDUCT a diagnosis on other suspect systems.

PINPOINT TEST M: TRANSFER CASE VIBRATION

Test Step	Result / Action to Take
M1 INSPECT THE TRANSFER CASE	
• **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.** • Inspect the transfer case for loose or missing mounting bolts. Check for fluid seepage between the transfer case and the transmission. • **Are the mounting bolts missing or loose?**	**Yes** TIGHTEN to specifications or INSTALL new bolts as necessary. TEST the system for normal operation. **No** GO to M2 .
M2 INSPECT THE REAR DRIVESHAFT	
• **NOTE:** Verify that the driveshaft and pinion flange index marks are aligned. • Inspect the driveshaft for missing weights, damage or undercoating. • Inspect the U-joints for freedom of movement. • Check driveshaft runout and, if necessary, check the pinion flange runout. • **Is the driveshaft or U-joints worn or damaged or misaligned?**	**Yes** REPAIR or INSTALL a new driveshaft as necessary. TEST the system for normal operation. **No** GO to M3 .
M3 CHECK THE DRIVELINE ANGLES	
• Measure the rear driveshaft and pinion angles. Refer to Section 205-00 .	**Yes** REPAIR as necessary.

• Measure the front driveshaft and pinion angles. Refer to the appropriate workshop manual for the service procedures. • **Are the driveline angles incorrect?**	TEST the system for normal operation. **No** GO to M4 .
M4 INSPECT THE FRONT DRIVESHAFT	
• **NOTE:** Verify that the driveshaft and pinion flange index marks are aligned. • Inspect the front driveshaft for missing weights, damage or undercoating. • Inspect the U-joints and slip yoke for freedom of movement. • Check driveshaft runout and, if necessary, check the pinion flange runout. Refer to Section 206-00 . • **Is the driveshaft or U-joints worn or damaged?**	**Yes** REPAIR or INSTALL a new driveshaft as necessary. TEST the system for normal operation. **No** GO to M5 .
M5 ROAD TEST WITH THE FRONT DRIVESHAFT ONLY	
• **NOTE:** Index mark the driveshaft to the pinion flange and to the output shaft before removal. • Remove the rear driveshaft. • Plug the transfer case with an output shaft seal plug. • **NOTE:** Shift the transfer case into 4WD high so the vehicle is driven by the front driveshaft only. • Test drive the vehicle. • **Is the vibration gone?**	**Yes** INSTALL and BALANCE the rear driveshaft. TEST the system for normal operation. **No** GO to M6 .
M6 ROAD TEST WITH THE REAR DRIVESHAFT ONLY	
• **NOTE:** Index mark the front driveshaft to the pinion flange. • Remove the front driveshaft. • Test drive the vehicle. • **Is the vibration gone?**	**Yes** INSTALL and BALANCE the front driveshaft. TEST the system for normal operation. **No** GO to M7 .
M7 TRANSFER CASE TAIL SHAFT INSPECTION	
• Inspect the splines of the output shaft for wear or damage. • Inspect the splines of the driveshaft slip yoke for wear or damage. • **Are the splines worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** The transfer case is OK. CONDUCT a diagnosis on other suspect systems.

Component Tests

Idle Air Control (IAC) Valve

1. Open the hood.

2. **NOTE:** Key symptom is elevated idle speed while noise is occurring.

   NOTE: "Snapping" the throttle can induce the noise.

Verify the condition by operating the vehicle for a short time.

3. Inspect the IAC valve. If physical evidence of contamination exists, install a new IAC valve.

4. While the noise is occurring, either place an EngineEAR probe near the IAC valve and the inlet tube, or create a 6.35 - 12.7 mm (0.25 - 0.50 in) air gap between the inlet tube and the clean air tube. If the IAC valve is making the noise, install a new IAC valve.

5. Test the vehicle for normal operation.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.

2. Set engine idle speed to 1200 rpm.

3. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump will occur.**

   Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Turn the steering wheel slowly in a 15 degree to 30 degree arc.

4. Turn the steering wheel another 90 degrees. Turn the steering wheel slowly in a 15 degree to 30 degree arc.

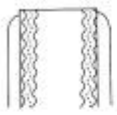
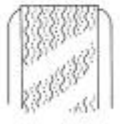
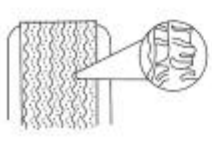
5. Repeat the test with power steering fluid at different temperatures.

6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.

7. If a loud grunt is heard or a strong shudder is felt, fill and purge the power steering system.

Tire Wear Patterns and frequency calculations

Tire Wear Chart

TIRE WEAR	CONDITION	POSSIBLE CAUSES
	•Rapid wear at both shoulders.	•Tires underinflated. •Worn suspension components. •Excessive cornering speeds. •Lack of rotation.
	•Rapid wear at the center.	•Tires overinflated. •Lack of rotation. •Excessive toe on drive wheels. •Heavy acceleration on drive wheels.
	•Wear at one shoulder.	•Toe adjustment out of specification. •Camber out of specification. •Damaged strut. •Damaged lower control arm.
	•Feather edges.	•Toe adjustment out of specification. •Damaged or worn tie rods. •Damaged spindle or knuckle.
	•Bald spots or cupping.	•Unbalanced wheel. •Excessive radial runout. •Worn strut or shock absorber.
	•Tire scalloped.	•Toe adjustment out of specification. •Camber out of specification. •Worn or damaged suspension components.
	•Wear pattern - FWD vehicles.	•Excessive toe on non-drive wheels. •Lack of rotation.
	•Wear pattern - FWD vehicles. Edge of thread blocks worn.	•Excessive toe on non-drive wheels. •Lack of rotation.

DF1717-A

Wheel and tire NVH concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in NEUTRAL is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions.

For a vibration concern, use the vehicle speed to determine tire/wheel frequency and rpm. Calculate tire

and wheel rpm and frequency by carrying out and following:

- Measure the diameter of the tire.
- Record the speed at which the vibration occurs.
- Obtain the corresponding tire and wheel rpm and frequency from the Tire Speed and Frequency Chart.
    - If the vehicle speed is not listed, divide the vehicle speed at which the vibration occurs by 16 km/h (10 mph). Multiply that number by 16 km/h (10 mph) tire rpm listed for that tire diameter in the chart. Then divide that number by 60. For example: a 40 mph vibration with 835 mm (33 in) tires. 40 ÷10 = 4. Multiply 4 by 105 = 420 rpm. Divide 420 rpm by 60 seconds = 7 Hz at 40 mph.

Tire Speed and Frequency Chart

Tire Diameter	**Tire RPM/Hz**	**Tire RPM/Hz**	**Tire RPM/Hz**	**Tire RPM/Hz**
mm (inch)	@ 16 km/h (10 mph)	@ 80 km/h (50 mph)	@ 97 km/h (60 mph)	@ 113 km/h (70 mph)
483 (19)	182	910/15	1092/18	1274/21
508 (20)	173	865/14	1038/17	1211/20
533 (21)	165	825/14	990/16	1155/19
560 (22)	158	790/13	948/16	1106/18
585 (23)	151	755/13	906/15	1057/18
610 (24)	145	725/12	870/14	1015/17
635 (25)	139	695/12	834/14	973/16
660 (26)	134	670/11	804/13	938/16
685 (27)	129	645/11	774/13	903/15
710 (28)	124	620/10	744/12	868/14
735 (29)	119	595/10	714/12	833/14
760 (30)	115	575/10	690/11	805/13
785 (31)	111	555/9	666/11	777/13
810 (32)	108	540/9	648/11	756/13
835 (33)	105	525/9	630/10	735/12
864 (34)	102	510/8	612/10	714/12

Powertrain/Drivetrain Mount Neutralizing

Printable View (80 KB)

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.
4. **CAUTION: Do not twist or strain the powertrain/drivetrain mounts.**

   Move the vehicle in forward and reverse 0.6-1.2 meters (2-4 ft).
5. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
6. Tighten the powertrain/drivetrain mount fasteners.
7. Lower the vehicle.
8. Test the system for normal operation.

Exhaust System Neutralizing

Printable View (80 KB)

WARNING: Exhaust gases contain carbon monoxide, which is harmful to health and potentially lethal. Repair exhaust system leaks immediately. Never operate the engine in an enclosed area.

WARNING: Exhaust system components are hot.

NOTE: Neutralize the exhaust system to relieve strain on mounts which can be sufficiently bound up to transmit vibration as if grounded.

1. **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.**

   CAUTION: Make sure the system is warmed up to normal operating temperature, as thermal expansion can be the cause of a strain problem.

   Raise and support the vehicle.

2. Loosen all exhaust hanger attachments and reposition the hangers until they hang free and straight.

3. Loosen all exhaust flange joints.

4. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.

5. Verify there is adequate clearance to prevent grounding at any point in the system. Make sure that the catalytic converter and heat shield do not contact the frame rails.

6. Begin at the front of the vehicle. Tighten all the fasteners in the following order.
   - Tighten the RH lower catalytic converter-to-exhaust manifold nut.
   - Tighten the LH upper catalytic converter-to-exhaust manifold nut.
   - Tighten the transmission mount hanger bolt.
   - Tighten the exhaust clamp nut.
   - Tighten the LH outer catalytic converter-to-exhaust manifold nut.
   - Tighten the LH inner catalytic converter-to-exhaust manifold nut.
   - Tighten the catalytic converter-to-muffler bolts.
   - Tighten the exhaust hanger-to-frame bolts.

7. After neutralization, the rubber in the exhaust hangers should show some flexibility when movement is applied to the exhaust system. With the exhaust system installed securely and cooled, the rear hanger should be angled forward.

8. Lower the vehicle.

9. Test the exhaust system for normal operation.

Wheel Bearing Check

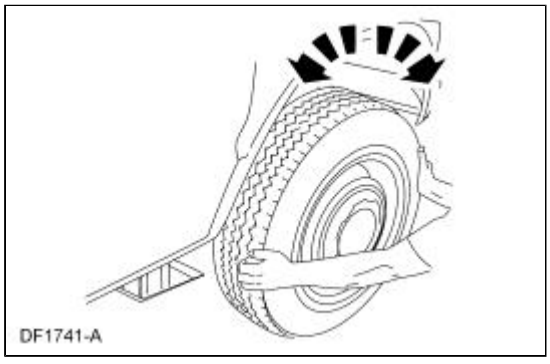
Printable View (153 KB)

1. **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.**

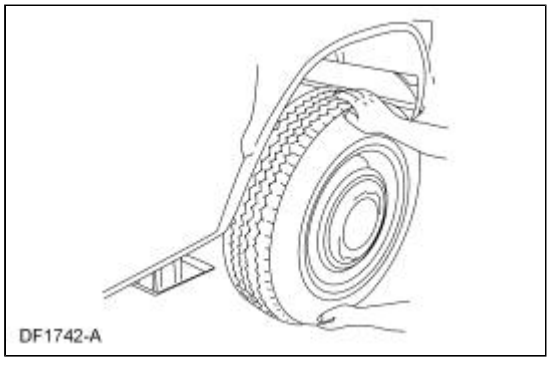
   Raise the vehicle until the front tires are off the floor.
   - Make sure the wheels are in a straight forward position.

2. **NOTE:** Make sure the wheel rotates freely and that the brake pads are retraced sufficiently to allow free movement of the tire and wheel assembly.

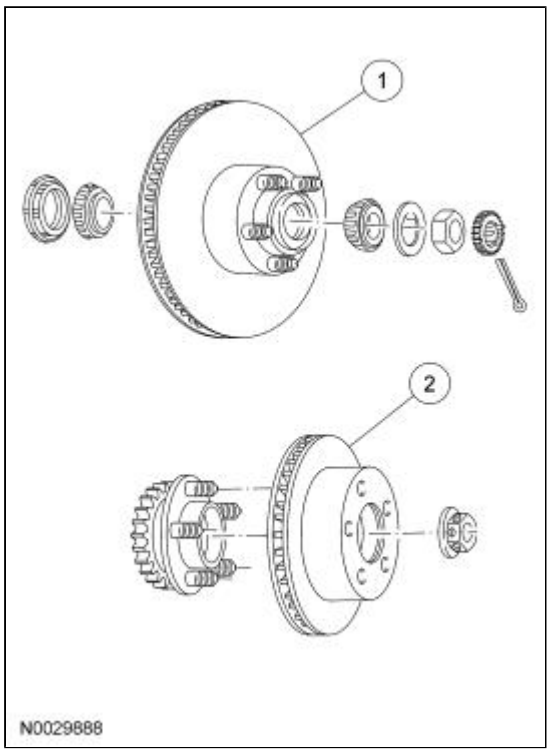
   Spin the tire by hand to check the wheel bearings for roughness.



3. Grip each front tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the front wheel bearing.



4. If the tire and wheel (hub) is loose on the spindle, does not rotate freely, or has a rough feeling when spun, carry out one of the following:
   1. On vehicles with inner and outer bearings, inspect the bearings and cups for wear or damage. Adjust or install new bearings and cups as necessary.
   2. On vehicles with one sealed bearing, install a new wheel hub.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Alignment Specifications Vehicles With Rear Coil Spring Suspension

Item	LH	RH	Total/ Split
Expedition			
Caster (Front)	4.0° ± 1.0°	4.3° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ curb ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
Navigator			
Caster (Front)	4.0° ± 1.0°	4.3° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
Expedition EL			
Caster (Front)	4.1° ± 1.0°	4.4° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ curb ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
Navigator L			
Caster (Front)	4.1° ± 1.0°	4.4° ± 0.75°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ curb ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°

Alignment Specifications Vehicles With Rear Air Suspension

Item	LH	RH	Total/ Split
Rear wheel drive (RWD) Expedition			
Caster (Front)	4.0° ± 1.0°	4.3° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
RWD Navigator			

Caster (Front)	4.0° ± 1.0°	4.3° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
RWD Expedition EL/Navigator L			
Caster (Front)	4.1° ± 1.0°	4.4° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
Four wheel drive (4WD) Expedition/Navigator			
Caster (Front)	4.0° ± 1.0°	4.3° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°
4WD Expedition EL/Navigator L			
Caster (Front)	4.1° ± 1.0°	4.4° ± 1.0°	-0.3° ± 0.75°
Camber (Front)	-0.3° ± 0.75°	-0.3° ± 0.75°	0° ± 0.75°
Total toe (Front) @ trim ride height	—	—	0.14° ± 0.20°
Camber (Rear)	-0.5° ± 0.75°	-0.5° ± 0.75°	—
Total toe (Rear) @ trim ride height	0.10° ± 0.20°	0.10° ± 0.20°	0.20° ± 0.20°

General Specifications

Item	Specification
Front Ride Height (Full Fluids, Including Fuel)	
Rear wheel drive (RWD) Expedition with rear coil spring suspension without roll stability control (RSC)	105 mm (4.13 in) ± 12 mm (0.31 in)
RWD Expedition with rear coil spring suspension with RSC	107 mm (4.21 in) ± 12 mm (0.31 in)
Four wheel drive (4WD) Expedition with rear coil spring suspension with RSC	108 mm (4.25 in) ± 12 mm (0.31 in)
4WD Expedition with rear coil spring suspension without RSC	106 mm (4.17 in) ± 12 mm (0.31 in)
RWD Expedition EL with rear coil spring suspension without RSC	109 mm (4.29 in) ± 8 mm (0.31 in)
4WD Expedition EL with rear coil spring suspension	110 mm (4.33 in) ± 12 mm (0.3 in) (w/o RSC)
RWD Expedition ELwith rear coil spring suspension with RSC	108 mm (4.25 in) ± 12 mm (0.31 in)
RWD Navigator with rear coil spring suspension	98 mm (3.85 in) ± 12 mm (0.3 in) (w/o RSC)

4WD Navigator with rear coil spring suspension	101 mm (3.97 in) ± 12 mm (0.3 in) (w/o RSC)
RWD Navigator L with rear coil spring suspension	107 mm (4.21 in) ± 12 mm (0.3 in) (w/o RSC)
4WD Navigator L with rear coil spring suspension	109 mm (4.29 in) ± 12 mm (0.3 in) (w/o RSC)
Expedition with rear air suspension	108 mm (4.25 in) ± 12 mm (0.31 in)
Expedition EL with rear air suspension	110 mm (4.33 in) ± 12 mm (0.31 in)
RWD Navigator L with rear air suspension	98 mm (4.21 in) ± 12 mm (0.31 in)
4WD Navigator L with rear air suspension	101 mm (4.29 in) ± 12 mm (0.31 in)
Rear Ride Height (Full Fluids, Including Fuel)	
RWD Expedition with rear coil spring suspension	101 mm (3.97 in) ± 8 mm (0.31 in)
4WD Expedition with rear coil spring suspension	100 mm (3.93 in) ± 8 mm (0.31 in)
RWD Expedition EL with rear coil spring suspension	103 mm (3.97 in) ± 8 mm (0.31 in)
4WD Expedition EL with rear coil spring suspension	101 mm (3.97 in) ± 8 mm (0.31 in)
4WD Navigator with rear coil spring suspension	98 mm (3.85 in) ± 8 mm (0.31 in)
RWD Navigator with rear coil spring suspension	99 mm (3.89 in) ± 8 mm (0.31 in)
4WD Navigator L with rear coil spring suspension	100 mm (3.93 in) ± 8 mm (0.31 in)
RWD Navigator L with rear coil spring suspension	101 mm (3.97 in) ± 8 mm (0.31 in)
Expedition with rear air suspension	99 mm (3.89 in) ± 8 mm (0.31 in)
Expedition EL with rear air suspension	99 mm (3.89 in) ± 8 mm (0.31 in)
Navigator with rear air suspension	99 mm (3.89 in) ± 8 mm (0.31 in)
Navigator L with rear air suspension	99 mm (3.89 in) ± 8 mm (0.31 in)
Vehicle Lean (Side-to-Side Differences)	
Front ride height — maximum (with coil spring suspension)	12 mm (0.28 in)
Vehicle Lean (Side-to-Side Differences)	
Rear ride height — maximum	7 mm (0.28 in)
Wheel Track	
Wheel track	0.6 mm (0.02 in)
Ball Joint Deflection	
Lower	0-0.8 mm (0-0.032 in)
Upper	0-0.2 mm (0-0.008 in)

Torque Specifications

Description	Nm	lb-ft

Tie-rod end jam nuts (front)	115	85
Toe link cam bolt nuts (rear)	275	203
Lower arm forward and rearward nuts (front)	350	258
Upper arm-to-frame bolts (rear)	300	221

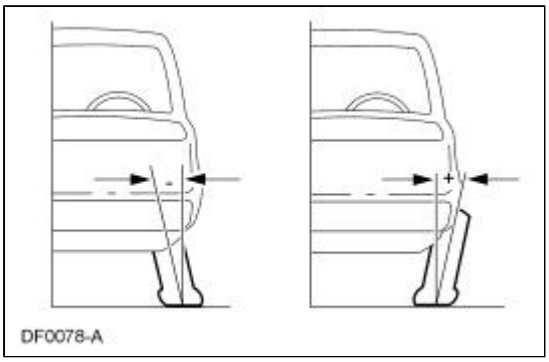
Wheel Alignment Angles

Printable View (188 KB)

The front caster and camber are adjusted by removing the lower arm front and rear bolts and installing adjuster kits to allow the arm to be adjusted in the frame slots. Front toe is adjusted by the use of the front wheel knuckle tie rods. The rear camber is adjusted by removing the upper arm camber set shim or shim pins to allow the arm to be adjusted in the frame slot. The rear toe is adjusted by the use of the rear toe link cam bolt and nut.

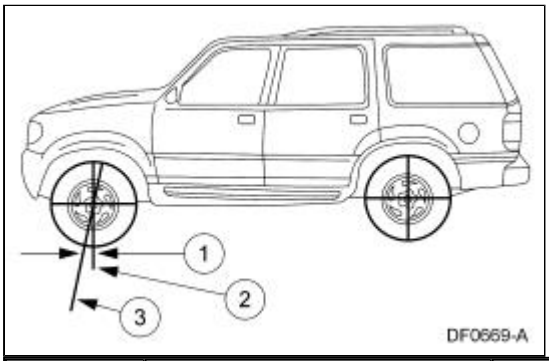
Camber

Negative and Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct affect on tire wear.

Caster



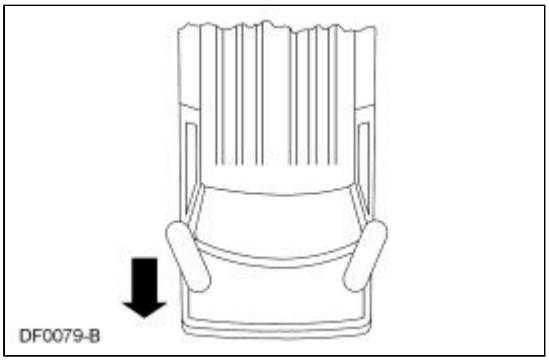
Item	Part Number	Description
1	—	Positive caster
2	—	True vertical
3	—	Steering axis

Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability

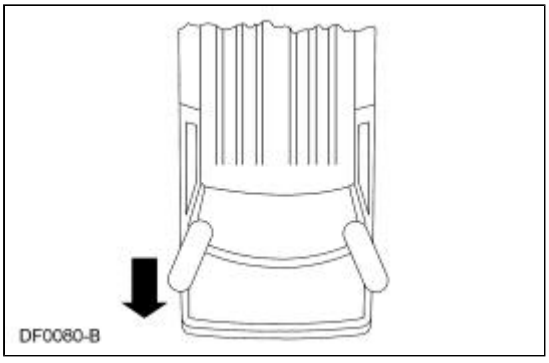
characteristics when loaded and driven. The caster setting does not affect tire wear.

Toe

Positive Toe (Toe In)



Negative Toe (Toe Out)



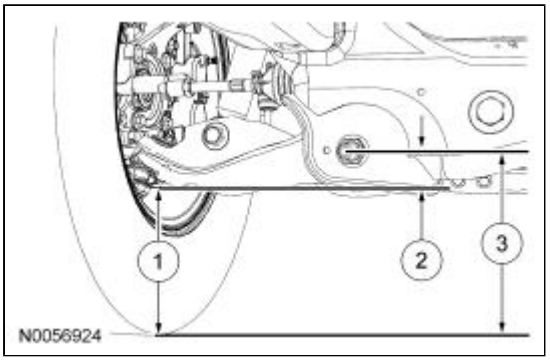
The vehicle toe setting:

- affects tire wear and directional stability.
- must be checked after adding aftermarket equipment, such as a snowplow.

Ride Height

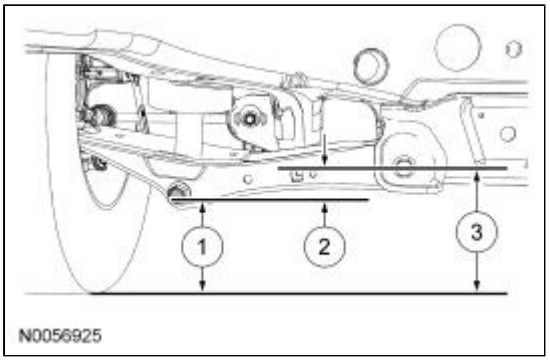
NOTE: Air suspension vehicles must be at trim height prior to measuring the vehicle ride height. Refer to Section 204-05 .

Front Ride Height Measurement



Item	Description
1	Distance between the ground and the lower surface of the wheel knuckle near the ball joint.
2	Ride height = 3-1
3	Distance between the ground and the center of the lower arm rear bolt

Rear Ride Height Measurement



Item	Description
1	Distance between the ground and the lower edge of the arm below the shock absorber lower bolt
2	Ride height = 3-1
3	Distance between the ground and the center of the lower arm front bolt

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces or tire imbalance. This condition is observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or when the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (such as wind or road camber).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center."

- Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.
- In the diagnosis of a steering or alignment concern, it is important to understand the difference between wander and poor groove feel.

Suspension System

Printable View (290 KB)

Inspection and Verification

1. Road test.
   - Verify the customer's concern by performing a road test on a smooth road. If any vibrations are apparent, refer to Section 100-04 .

2. Inspect the tires.
   - Check the tire pressure with all normal loads in the vehicle and the tires cold. Refer to the vehicle certification (VC) label.
   - Verify that all tires are sized to specification. Refer to the VC label.
   - Inspect the tires for incorrect wear and damage. Refer to Section 204-04 .

3. Inspect chassis and underbody.

4. Inspect for aftermarket equipment.
   - Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition or heavy duty). The specifications shown in this manual **do not** apply to vehicles equipped with aftermarket equipment.

Visual Inspection Chart

Mechanical
• Front wheel bearing(s) • Loose or damaged front or rear suspension components • Loose, damaged or missing suspension fastener(s) • Incorrect spring usage • Damaged or sagging spring(s) • Damaged or leaking shock absorber(s) • Worn or damaged suspension bushing(s) • Loose, worn or damaged steering system components • Damaged axle components • Ball joint boot seals

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.

6. If the fault is not visually evident, determine the symptom and proceed to the following symptom chart.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

• Incorrect thrust angle (dogtracking)	• Excessive rear thrust angle	• ADJUST rear toe as necessary.
• Drift/pull	• Unequal tire pressure	• ADJUST tire pressure.
	• Caster total split is not within specification	• CHECK the wheel alignment. ADJUST as necessary.
	• Camber total split is not within specification	• CHECK the wheel alignment. ADJUST as necessary.
	• Tire forces	• CROSS ROTATE tires front to rear.
	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Steering components	• REFER to Section 211-00 .
	• Brake drag	• REFER to Section 206-00 .
• Front bottoming or riding low	• Spring(s)	• INSTALL new spring(s) as necessary. REFER to Section 204-01A , Section 204-01B or Section 204-05 .
	• Front shock absorber(s)	• INSTALL new shock absorber(s) as necessary. REFER to Section 204-01A , Section 204-01B or Section 204-05 .
• Incorrect tire wear	• Incorrect tire pressure (rapid center rib or inner and outer edge wear)	• ADJUST tire pressure.
	• Excessive front or rear toe (rapid inner or outer edge wear)	• CHECK the wheel alignment. ADJUST as necessary.
	• Excessive negative or positive camber (rapid inner or outer edge wear)	• CHECK the wheel alignment. ADJUST as necessary.
	• Front or rear suspension components	• INSPECT the front and rear suspension system. REPAIR or INSTALL new suspension components as necessary. REFER to Section 204-01A , Section 204-01B , Section 204-02 or Section 204-05 .
	• Tires out of balance (tires cupped or dished)	• BALANCE tires.
• Rough ride	• High tire pressure	• ADJUST tire pressure.
	• Shock absorber(s)	• INSTALL new shock absorbers as necessary. REFER to Section 204-01A , Section 204-02 or Section 204-05 .

	• Spring(s)	• INSTALL new spring(s) as necessary. REFER to Section 204-01A , Section 204-02 or Section 204-05 .
• Shimmy or wheel tramp	• Loose wheel nut (s)	• TIGHTEN to specification. REFER to Section 204-04 .
	• Loose front suspension fasteners	• TIGHTEN to specification. REFER to Section 204-01A , Section 204-01B or Section 204-05 .
	• Front wheel bearing	• REFER to Section 100-04 .
	• Wheel or tire concerns	• REFER to Section 204-04 .
	• Shock absorber(s)	• INSTALL new shock absorber(s) as necessary. REFER to Section 204-01A , Section 204-02 or Section 204-05 .
	• Loose, worn or damaged ball joint (s)	• GO to the Ball Joint Inspection component test in this section.
	• Loose, worn or damaged steering components	• REFER to Section 211-00 .
	• Front wheel alignment	• CHECK the wheel alignment. ADJUST as necessary.
• Sticky steering, poor returnability	• Ball joints	• GO to the Ball Joint Inspection component test in this section.
	• Steering components	• REFER to Section 211-00 .
	• Caster out of specification	• CHECK the wheel alignment. ADJUST as necessary.
• Steering wheel off-center	• Unequal front or rear toe settings (side-to-side)	• CHECK the wheel alignment. ADJUST as necessary
	• Steering components	• REFER to Section 211-00 .
• Sway or roll	• Overloaded, unevenly or incorrectly loaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Loose wheel nut (s)	• TIGHTEN to specification. REFER to Section 204-04 .
	• Shock absorber(s)	• INSTALL new shock absorbers as necessary. REFER to Section 204-01A , Section 204-02 or Section 204-05 .
	• Loose stabilizer assembly	• TIGHTEN to specification. REFER to Section 204-01A , Section 204-01B or Section 204-02 .
	• Worn stabilizer assembly bushing (s) or link(s)	• INSTALL new stabilizer assembly bushings as necessary. REFER to Section 204-01A , Section 204-01B or Section 204-02 .

	• Worn spring(s)	• INSTALL new as necessary. REFER to Section 204-01A or Section 204-02 .
• Vehicle leans to one side	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Front or rear suspension component	• INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary. REFER to Section 204-01A , Section 204-01B , Section 204-02 or Section 204-05 .
	• Spring(s)	• INSTALL new spring(s) as necessary. REFER to Section 204-01A , Section 204-02 or Section 204-05 .
• Vibration/noise	• Tire and wheel concerns • Wheel bearings • Wheel hubs • Brake components • Suspension components • Steering components	• REFER to Section 100-04 .
• Wander	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Ball joint(s)	• GO to the Ball Joint Inspection component test in this section.
	• Loose, worn or damaged front wheel bearing(s)	• REFER to Section 100-04 .
	• Loose, worn or damaged suspension component(s)	• INSTALL new suspension components as necessary. REFER to Section 204-01A , Section 204-01B , Section 204-02 or Section 204-05 .
	• Loose suspension fasteners	• TIGHTEN to specification. REFER to Section 204-01A , Section 204-01B , Section 204-02 or Section 204-05 .
	• Steering components	• REFER to Section 211-00 .
	• Wheel alignment (excessive total front toe out)	• ADJUST as necessary.

Component Tests

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. Refer to Section 100-04 .

2. **WARNING: If equipped with vehicle dynamic suspension, the system must be disabled prior to lifting the vehicle. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury. Disabling the vehicle dynamic suspension is covered in Section 204-05 .**

   NOTE: In order to obtain accurate measurements, the suspension must be in full rebound with the weight of the vehicle supported by the frame.

   Raise and support the vehicle by the frame to allow the wheels to hang in the rebound position.

3. Inspect the ball joint and ball joint boot for damage.
   - If the ball joint or ball joint boot is damaged, install a new ball joint as necessary. Refer to Section 204-01A for rear wheel drive (RWD) vehicles and Section 204-01B for four wheel drive (4WD) vehicles.

NOTE: Carry out Steps 4-6 to inspect the lower ball joint. Carry out Steps 7-9 to inspect the upper ball joint.

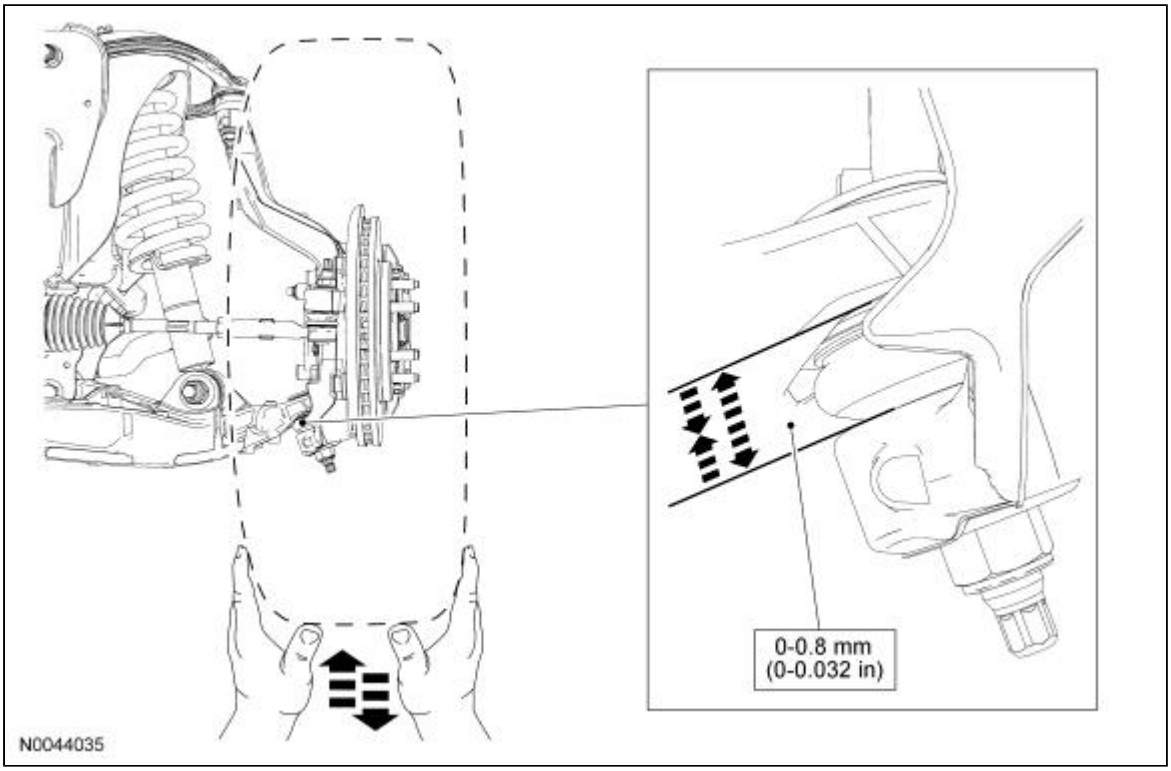
4. **CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage can occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.**

   NOTE: The weight of the wheel and tire assembly must be overcome to obtain an accurate measurement on the dial indicator.

   Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the wheel and tire assembly by hand. Note any relative vertical movement between the wheel knuckle and lower arm at the lower ball joint.
   - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
   - If relative movement is found, continue with Step 5.

5. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis (center line) of the ball joint.

   To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the lower control arm and the wheel knuckle or ball joint stud.



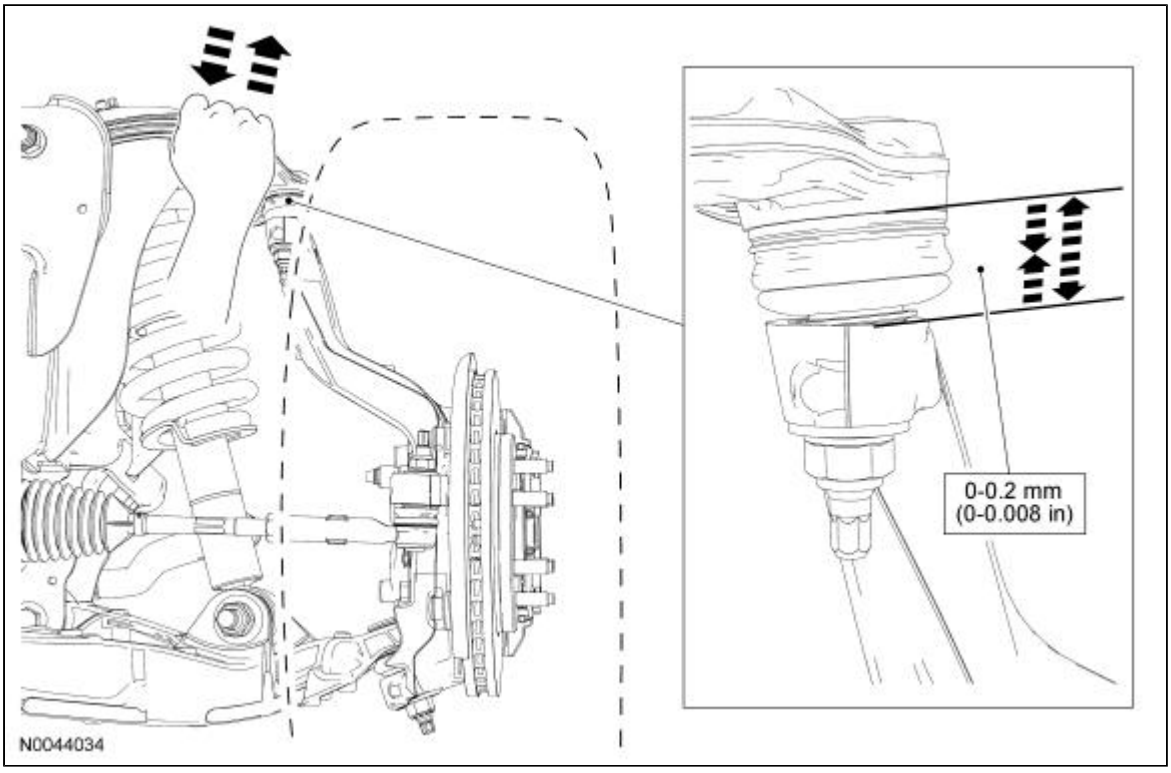
6. Measure the ball joint deflection while an assistant pushes up and pulls down on the wheel and tire assembly by hand.
    - If the deflection exceeds the specification, a new ball joint must be installed. Refer to Section 204-01A for RWD vehicles and Section 204-01B for 4WD vehicles.
    - If the deflection meets the specification, continue with the procedure.

7. **CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage can occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.**

    Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the upper control arm by hand. Note any relative vertical movement between the wheel knuckle and upper arm at the upper ball joint.
    - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
    - If relative movement is found, continue with Step 8.

8. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis of the ball joint.

    To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the upper control arm and the wheel knuckle or ball joint stud.



9. Measure the ball joint deflection while an assistant pushes up and then pulls down on the upper control arm by hand.
    - If the deflection exceeds the specification, a new ball joint must be installed. For additional information, refer to Section 204-01A for RWD vehicles and Section 204-01B for 4WD vehicles.
    - If the deflection meets the specification, no further action is required.

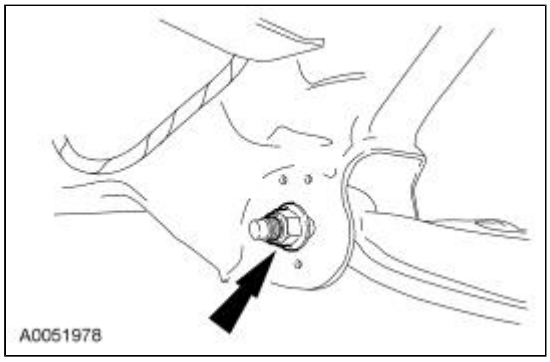
Camber and Caster Adjustment — Front

Printable View (96 KB)

NOTE: Air suspension vehicles must be at trim ride height prior to measuring or adjusting the caster, camber or toe. For additional information, refer to Section 204-05 .

1. Using alignment equipment and the manufacturers instructions, measure the front caster and camber.
   - Refer to Alignment Specifications in the Specifications portion of this section for optimal alignment settings.
   - If the caster and camber values are not within specification, go to the next step.

2. Remove and discard the lower arm front and rear nuts and bolts.



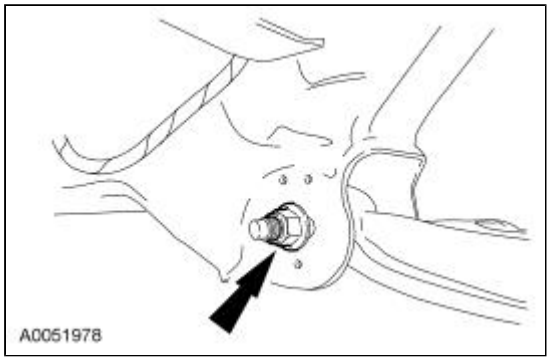
3. **NOTE:** New lower arm front and rear bolts must be installed with cam bolt kit (3B236 for the front and rear bushing), to allow for adjustment of the arm in the frame slot. The vehicle should be supported by the frame to ease movement of the lower arm in the slot.

   Install the cam bolt kit and loosely install the nut.

4. To adjust the caster and camber, refer to the following chart.
   - Adjustments that require moving the front and the rear of the lower arm should be made equally.

Adjustment	Front of Lower Arm	Rear of Lower Arm
Increase caster	In	Out
Decrease caster	Out	In
Increase camber	In	In
Decrease camber	Out	Out
Increase caster and camber simultaneously	In	—
Decrease caster and camber simultaneously	Out	—

5. While holding the cam bolt, tighten the nut to 350 Nm (258 lb-ft).



6. Check and, if necessary, adjust the front toe. For additional information, refer to Toe Adjustment — Front in this section.

Toe Adjustment — Front

Printable View (187 KB)

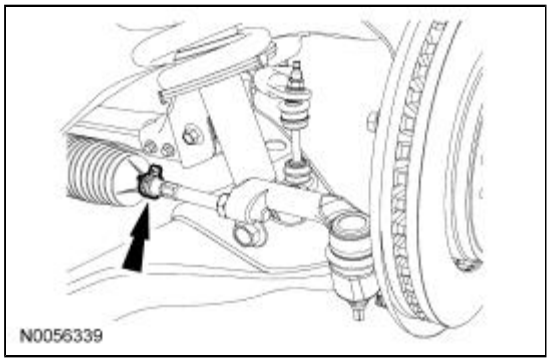
NOTE: Air suspension vehicles must be at trim ride height prior to measuring or adjusting the caster, camber or toe. For additional information, refer to Section 204-05 .

1. Using alignment equipment and the manufacturer's instructions, measure the front toe.
   - Refer to Alignment Specifications in the Specifications portion of this section for optimal alignment settings.
   - If the front toe values are not within specification, go to the next step.

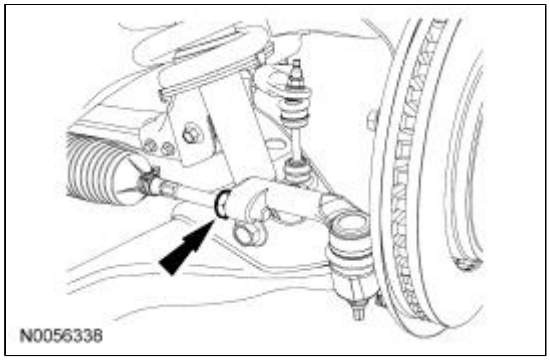
2. Start the engine and center the steering wheel.

3. Turn the engine off and, using a suitable steering wheel holding device, lock the steering wheel in the straight-ahead position.

4. Remove the steering gear bellows clamp(s).

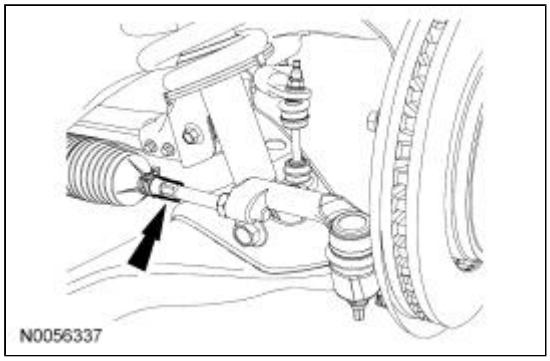


5. Loosen the tie-rod end jam nut(s).



6. **NOTE:** Do not allow the steering gear bellows to twist while rotating the tie rod.

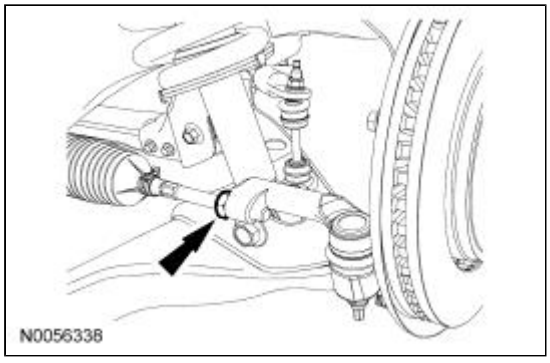
   Rotate the tie rod(s) to achieve the desired toe setting.



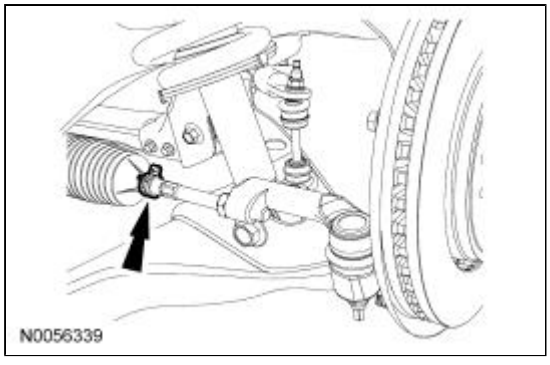
7. **CAUTION: Make sure to hold the tie-rod end stationary while tightening the jam nut or damage to the boot can occur.**

   NOTE: Make sure that the toe settings are not disturbed while tightening the jam nuts.

   Tighten the tie-rod end jam nut(s) to 115 Nm (85 lb-ft).



8. Install the steering gear bellows clamp(s).



Camber Adjustment — Rear

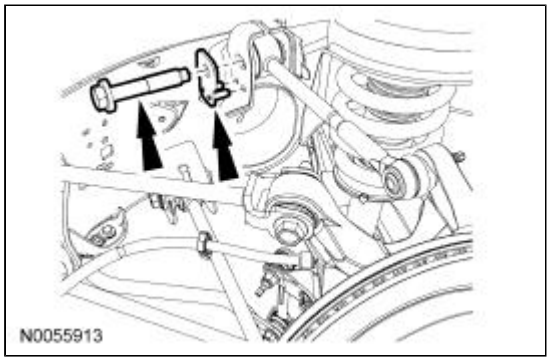
Printable View (121 KB)

NOTE: Air suspension vehicles must be at trim ride height prior to measuring or adjusting the rear camber or toe. For additional information, refer to Section 204-05 .

NOTE: Before carrying out a camber adjustment, check the tires for the correct pressure. Inspect the tires for incorrect wear or damage. Inspect the suspension for wear or damage.

1. Using alignment equipment and the manufacturer's instructions, measure the rear camber.
   - Refer to Alignment Specifications in the Specifications portion of this section for optimal alignment settings.
   - If the rear camber value is not within specification, go to the next step.

2. Remove the upper arm-to-frame bolt and the camber set shim.
   - Discard the camber set shim.
   - Install and snug the upper arm-to frame bolt.



3. Position the upper arm-to-frame bolt in the upper arm-to-frame slot until the camber setting is within specification.

4. **NOTE:** Do not allow the upper arm to move and change the camber adjustment setting when tightening the bolt.

   Tighten the upper arm-to-frame bolt to 300 Nm (221 lb-ft).

5. Recheck the camber setting, adjust as necessary.

6. Check and, if necessary, adjust the rear toe. For additional information, refer to Toe Adjustment — Rear in this section.

Toe Adjustment — Rear

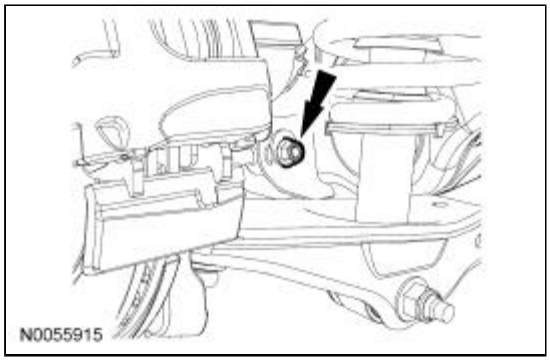
Printable View (158 KB)

NOTE: Air suspension vehicles must be at trim ride height prior to measuring or adjusting the rear toe. For additional information, refer to Section 204-05 .

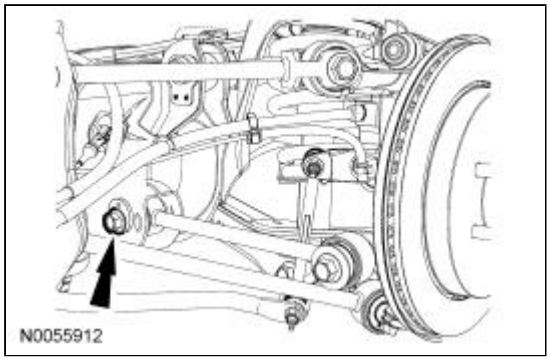
NOTE: Before carrying out a toe adjustment, check the tires for the correct pressure. Inspect the tires for incorrect wear or damage. Inspect the suspension for wear or damage.

1. Using alignment equipment and the manufacturer's instructions, measure the rear toe.
   - Refer to Alignment Specifications in the Specifications portion of this section for optimal alignment settings.
   - If the rear toe values are not within specification, go to the next step.

2. Loosen the toe link cam bolt nut(s).



3. Rotate the toe link cam bolt(s) until the toe setting is within specification.



4. **NOTE:** Make sure the toe settings are not disturbed while tightening the cam nut(s).

   Tighten the toe link cam bolt nut(s) to 275 Nm (203 lb-ft).

5. Recheck the rear toe setting, adjust as necessary.

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolts	200	148
Brake disc shield bolts	17	13
Lower arm forward and rearward nuts	350	258
Lower ball joint nut	150	111
Shock absorber and spring assembly upper nuts	40	30
Shock absorber and spring assembly lower nut	475	350
Shock rod nut	56	41
Stabilizer bar bracket nuts	55	41
Stabilizer bar link upper and lower nuts	80	59
Tie-rod end nut	115	85
Upper arm-to-frame nuts	150	111
Upper ball joint nut	115	85
Wheel bearing and wheel hub bolts	150	111
Wheel speed sensor harness bracket bolt	12	9
Wheel speed sensor bolt	18	13

Front Suspension

Printable View (80 KB)

WARNING: The vehicle can be equipped with either a vehicle dynamic suspension (using air springs in the rear of the vehicle) or a standard suspension (using coil springs at all 4 corners of the vehicle). If equipped with vehicle dynamic suspension, the system must be disabled prior to jacking or lifting the vehicle. Disabling the vehicle dynamic suspension is covered in Section 204-05 .

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

The vehicle can be equipped with either a vehicle dynamic suspension (using air springs in the rear of the vehicle) or a standard suspension (using coil springs at all 4 corners of the vehicle). Both are an independent-type front suspension which utilize a stabilizer bar to aid in vehicle stability. Vehicle dynamic suspension is covered in Section 204-05 . The wheel hub and wheel bearing assemblies are sealed units and are serviced as such. The lower ball joints are serviceable. The rear wheel drive (RWD) front suspension consists of the following parts:

- Upper control arms
- Lower control arms
- Shock absorber and coil spring assemblies
- Wheel knuckles
- Wheel bearing and wheel hub assemblies
- Stabilizer bar
- Stabilizer bar links

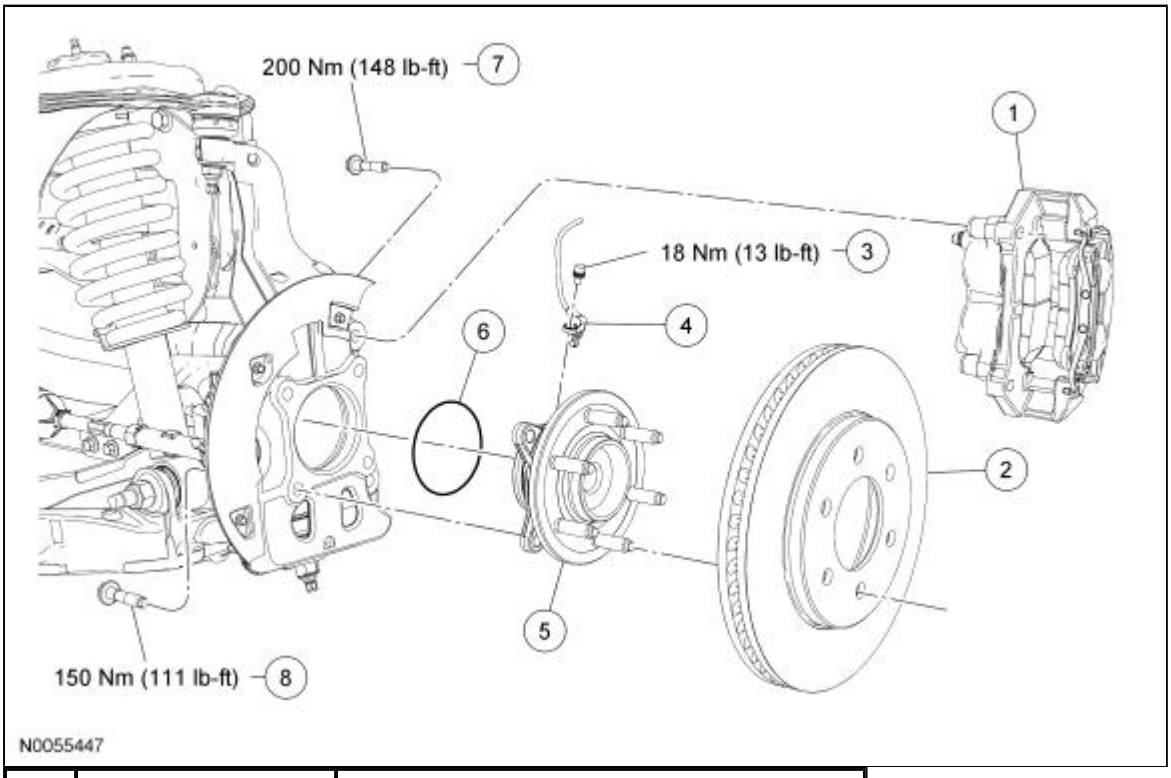
Front Suspension

Printable View (62 KB)

Refer to Section 204-00 .

Wheel Hub

Printable View (237 KB)

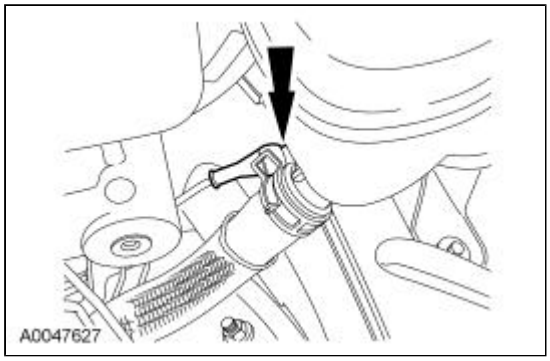


Item	Part Number	Description
1	2B121 LH/ 2B120 RH	Brake caliper and anchor plate assembly
2	1125	Brake disc
3	—	Wheel speed sensor bolt
4	—	Wheel speed sensor
5	2B663	Wheel bearing and wheel hub
6	—	O-ring seal
7	W707292	Brake caliper anchor plate bolt (2 required)
8	W707353	Wheel bearing and wheel hub bolt (4 required)

Removal and Installation

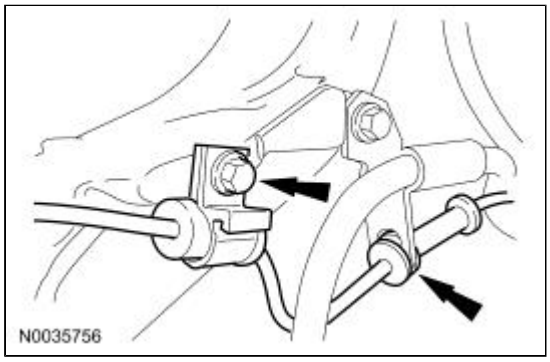
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Disconnect the wheel speed sensor electrical connector.



2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the wheel speed sensor harness bracket bolt and detach the harness from the retainers.
   - To install, tighten to 12 Nm (9 lb-ft).



4. **CAUTION: Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can result.**

   Remove the bolts and position the caliper and anchor plate aside.
   - Support the caliper using mechanic's wire.
   - To install, tighten to 200 Nm (148 lb-ft).

5. Remove the brake disc.

6. Remove the 4 wheel bearing and wheel hub assembly bolts and the wheel bearing and wheel hub.
   - To install, tighten to 150 Nm (111 lb-ft).

7. If installing a new wheel bearing and wheel hub, remove the wheel speed sensor bolt and the wheel speed sensor.
   - To install, tighten to 18 Nm (13 lb-ft).

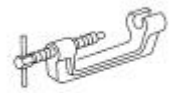
8. **CAUTION: If the original wheel bearing and wheel hub is being installed, install a new wheel bearing and wheel hub assembly O-ring seal.**

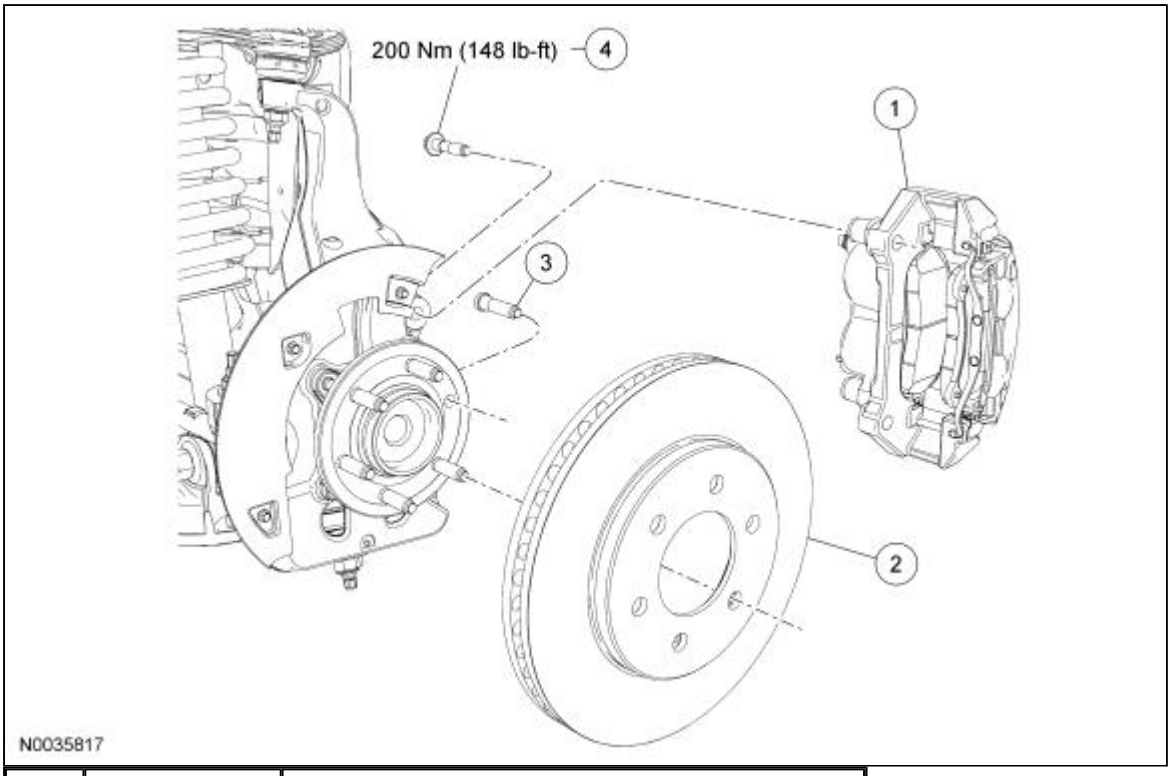
   To install, reverse the removal procedure.

Wheel Studs

Printable View (228 KB)

Special Tool(s)

 ST1494-A	C-Frame and Screw Assembly 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	—	Brake caliper and anchor plate assembly
2	1125	Brake disc
3	W707287	Wheel stud
4	W707353	Brake caliper anchor plate bolt (2 required)

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

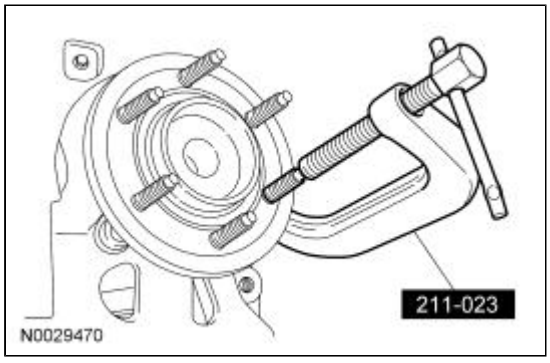
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can result.**

   Remove the bolts and position the brake caliper and anchor plate assembly aside.
   - Support the brake caliper and anchor plate assembly using mechanic's wire.

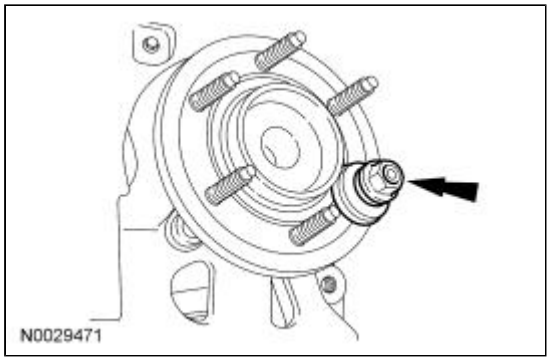
3. Remove the brake disc.

4. Using the special tool, remove the wheel stud.



Installation

1. Position the new wheel stud in the wheel hub, aligning the serrations in the wheel hub flange made by the original wheel stud.
   - Place 4 washers over the outside end of the wheel stud and thread a standard wheel nut onto the wheel stud with the flat side against the washers.
   - Tighten the wheel nut until the wheel stud head seats against the back side of the wheel hub flange.



2. Remove the wheel nut and washers.

3. Install the brake disc.

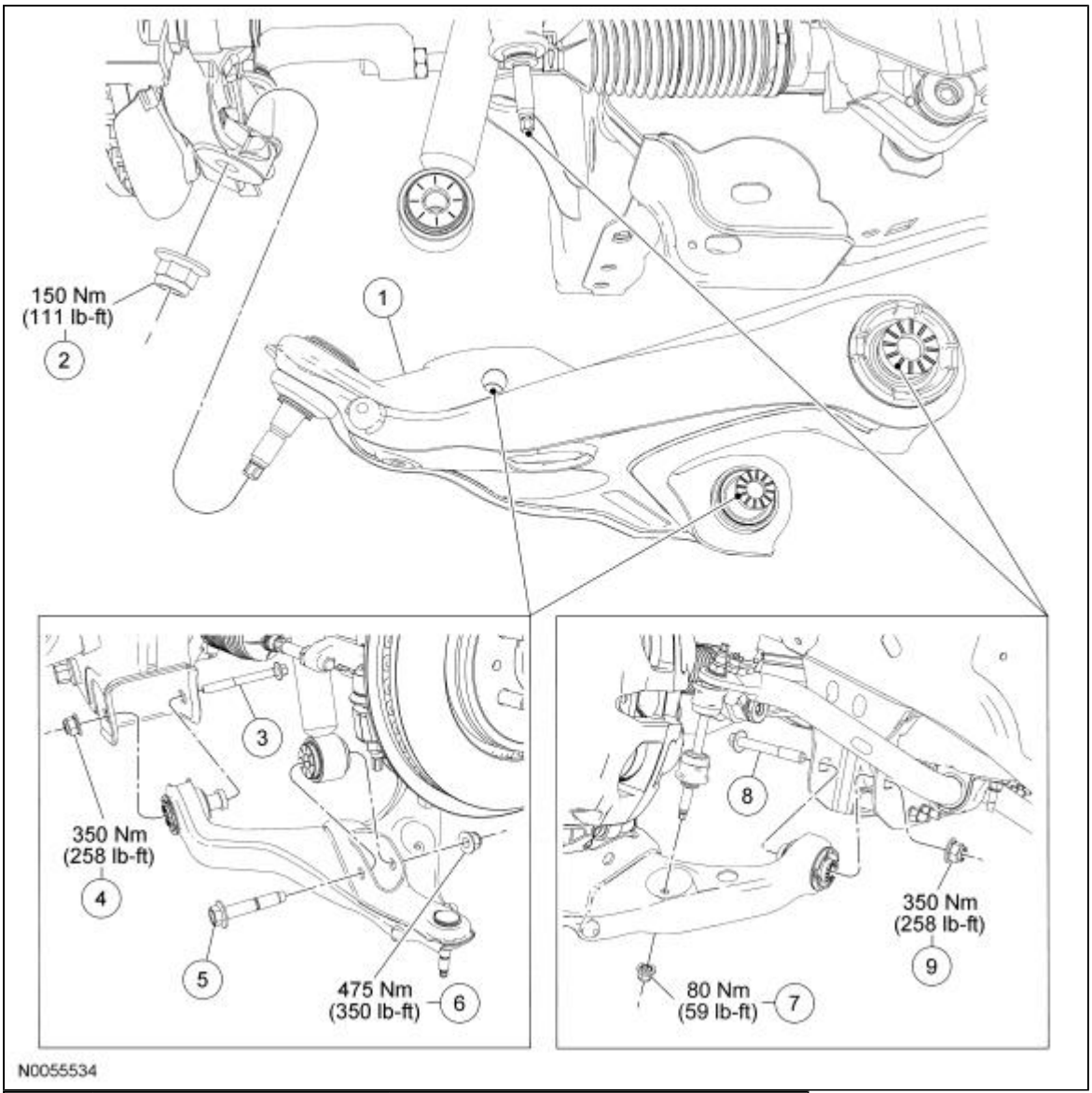
4. Position the brake caliper and anchor plate assembly and install the bolts.
   - Tighten the bolts to 200 Nm (148 lb-ft).

Lower Arm

Printable View (284 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	3051 LH/ 3042 RH	Lower arm
2	W707254	Lower ball joint nut

3	W711399	Lower arm forward bolt
4	W711310	Lower arm forward nut
5	W712682	Shock absorber lower bolt
6	W520217	Shock absorber lower nut
7	N807144	Stabilizer bar link lower nut
8	W709877	Lower arm rearward bolt
9	W711310	Lower arm rearward nut

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the lower shock nut, lower arm forward nut or lower arm rearward nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

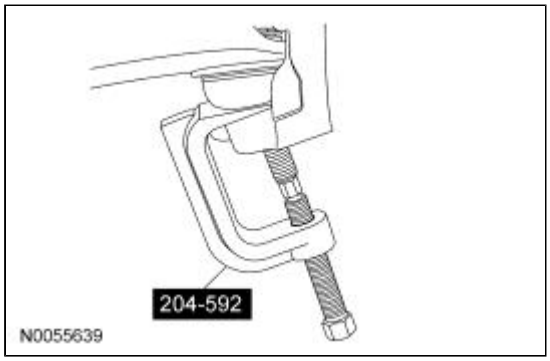
2. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

   Remove and discard the stabilizer bar link lower nut.
   - To install, tighten to 80 Nm (59 lb-ft).

3. Remove and discard the lower ball joint nut.
   - To install, tighten to 150 Nm (111 lb-ft).

4. **CAUTION: Make sure to use the special tool when separating the lower ball joint from the knuckle to prevent damage to the ball joint boot.**

   Using the special tool, separate the ball joint from the knuckle.



5. **NOTE:** Use a crowsfoot wrench to install the lower arm rearward nut.

   Remove the lower arm rearward nut and bolt.
   - Discard the nut.
   - To install, tighten to 350 Nm (258 lb-ft).

6. Remove the lower arm forward nut and bolt.
    - Discard the nut.
    - To install, tighten to 350 Nm (285 lb-ft).

7. Remove the shock absorber lower nut, bolt and the lower arm.
    - Discard the shock absorber lower nut.
    - To install, tighten to 475 Nm (350 lb-ft).

8. To install, reverse the removal procedure.

9. **CAUTION: Do not tighten the lower shock nut, lower arm forward nut or lower arm rearward nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Upper Arm

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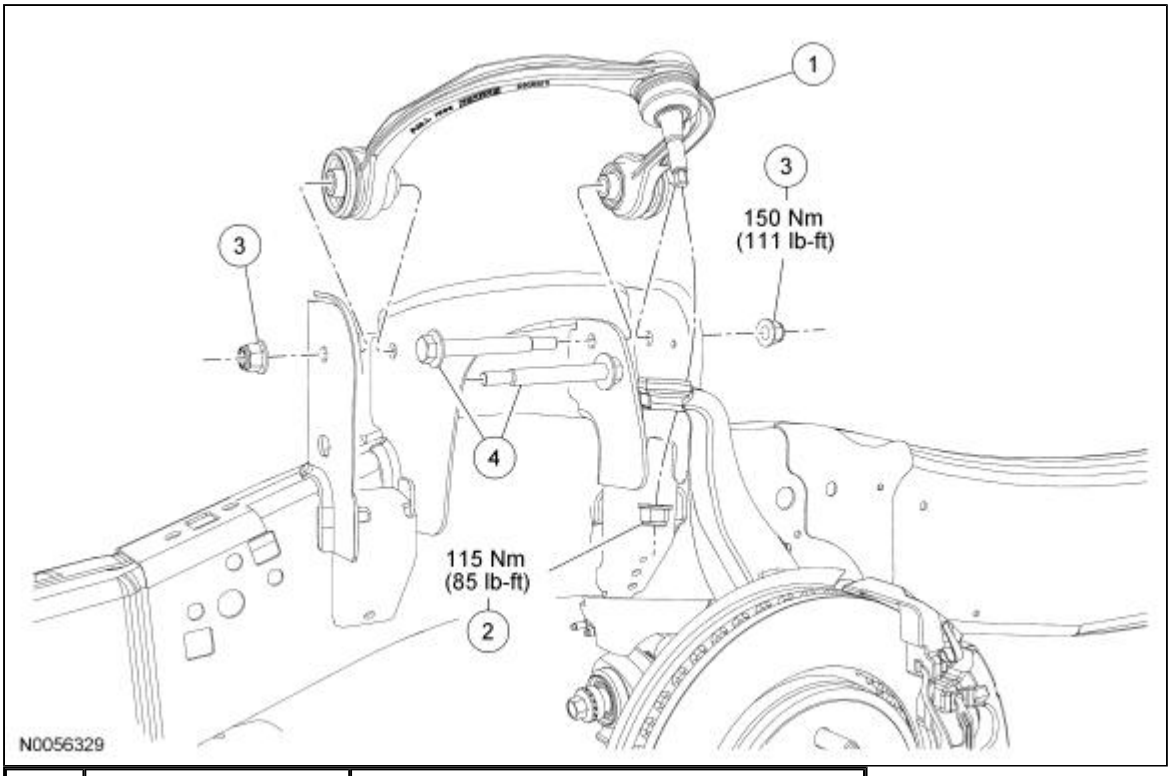
Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



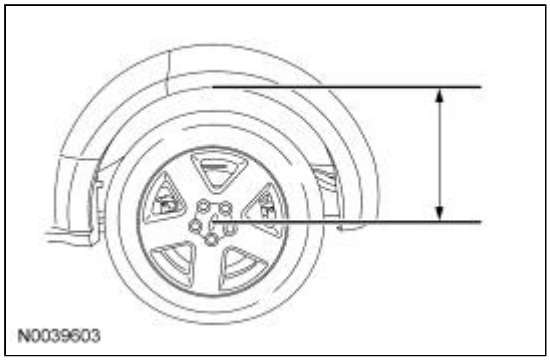
Item	Part Number	Description
1	3091 LH/ 3084 RH	Upper arm
2	W520215	Upper ball joint nut
3	W520215	Upper arm-to-frame nuts (2 required)
4	W707841	Upper arm-to-frame bolts (2 required)

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height).

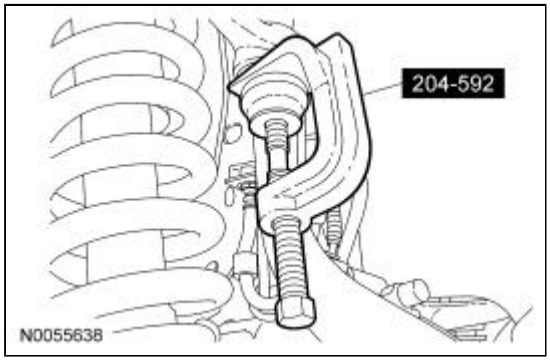
1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the shock absorber and spring assembly. For additional information, refer to Shock Absorber and Spring Assembly in this section.

3. Remove and discard the upper ball joint nut.
   - To install, tighten to 115 Nm (85 lb-ft).

4. Using the special tool, separate the upper ball joint from the wheel knuckle.



5. Remove the upper arm-to-frame nuts and bolts and the upper bolts.
   - Discard the bolts.
   - To install, tighten to 150 Nm (111 lb-ft).

6. **CAUTION: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height).**

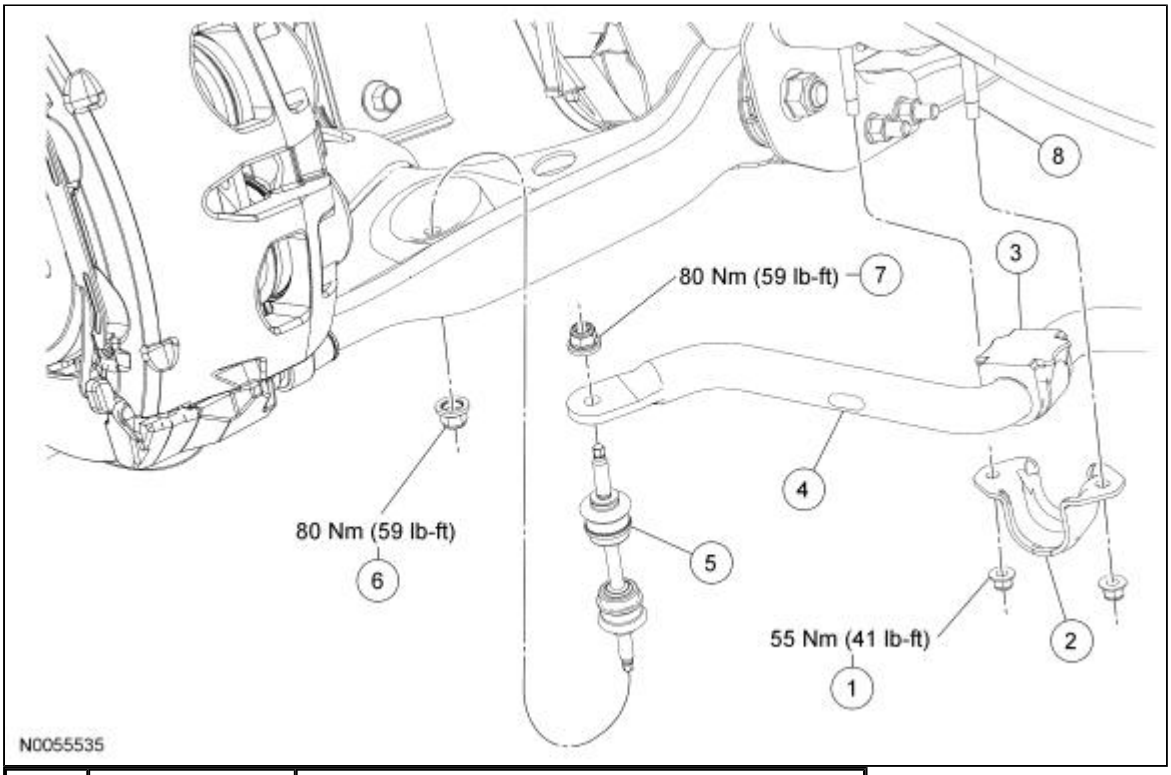
   To install, reverse the removal procedure.

7. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Stabilizer Bar and Link

Printable View (180 KB)

NOTE: LH side shown, RH side similar.



Item	Part Number	Description
1	W520213	Stabilizer bar bracket nut (4 required)
2	3B353	Stabilizer bar bracket (2 required)
3	5484	Stabilizer bar bushing (2 required)
4	5494	Stabilizer bar
5	5K483	Stabilizer bar link (2 required)
6	N807144	Stabilizer bar link lower nut (2 required)
7	N807144	Stabilizer bar link upper nut (2 required)
8	W711583	Stabilizer bracket bolt plate

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** The hex holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the 2 stabilizer bar link upper nuts.
   - To install, tighten to 80 Nm (59 lb-ft).

3. **CAUTION: Do not hold the stabilizer link boot with any tool, as damage to the boot will occur.**

   NOTE: Use the hex holding feature to prevent the stud from turning while removing the nut.

   Remove and discard the 2 stabilizer bar link lower nuts and remove the 2 stabilizer bar links.
   - To install, tighten to 80 Nm (59 lb-ft).

4. Remove the 4 stabilizer bar bracket nuts, brackets and the stabilizer bar.
   - Discard the nuts.
   - To install, tighten to 55 Nm (41 lb-ft).

5. Remove and discard the stabilizer bracket bolt plates.

6. **NOTE:** Make sure the stabilizer bar bushing upset is installed into the bracket groove.

   Inspect and, if necessary, install new stabilizer bar bushings.

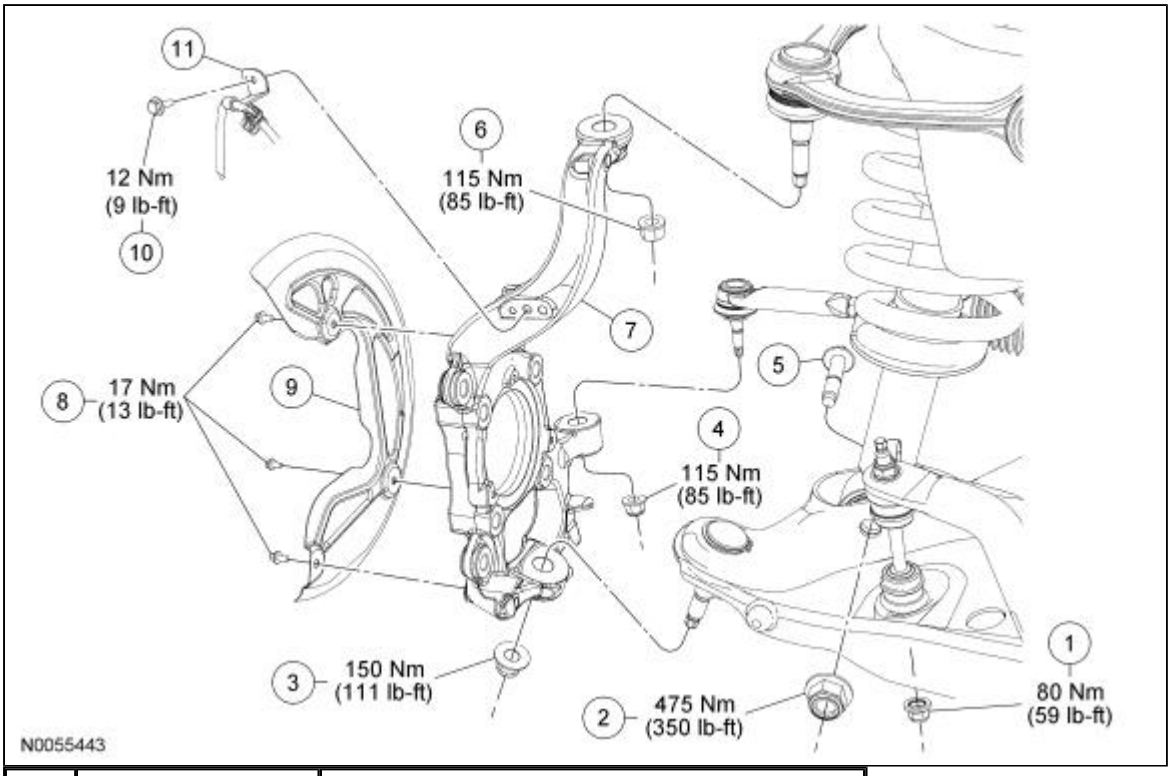
7. To install, reverse the removal procedure.

Wheel Knuckle

Printable View (253 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	N807144	Stabilizer bar link lower nut
2	W520217	Shock absorber lower nut
3	W707254	Lower ball joint nut
4	W520215	Tie-rod end nut
5	W712682	Shock absorber lower bolt
6	W520215	Upper ball joint nut
7	3K186 LH/ 3K185 RH	Wheel knuckle
8	W505211	Brake disc shield bolts (3 required)
9	2K005 LH/ 2K004 RH	Brake disc shield

10	—	Wheel speed sensor harness bracket bolt
11	—	Wheel speed sensor harness bracket (part of 2C204)

Removal and Installation

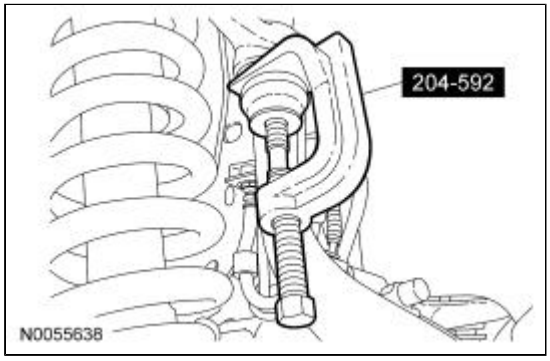
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

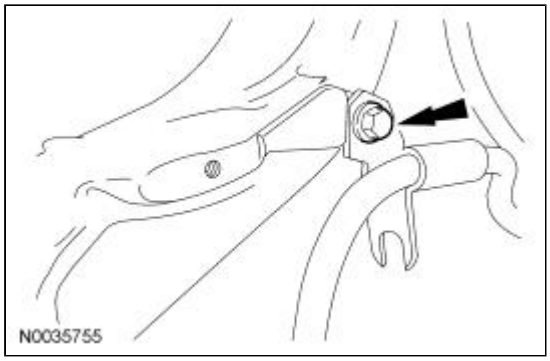
1. Remove the wheel bearing and wheel hub. For additional information, refer to Wheel Hub .

2. Remove and discard the tie-rod end nut.
   - To install, tighten to 115 Nm (85 lb-ft).

3. Using the special tool, separate the upper ball joint from the wheel knuckle.



4. Remove the wheel speed sensor harness bracket bolt and position the harness aside.
   - To install, tighten to 12 Nm (9 lb-ft).



5. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

   Remove and discard the stabilizer bar link lower nut.
   - To install, tighten to 80 Nm (59 lb-ft).

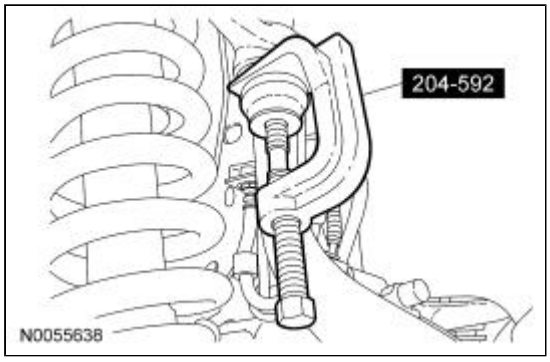
6. Remove and discard the shock absorber lower nut and bolt.

- To install, tighten to 475 Nm (350 lb-ft).

7. Remove and discard the upper ball joint nut.
   - To install, tighten to 115 Nm (85 lb-ft).

8. **NOTE:** Be sure not to damage the ball joint boot when installing the special tool.

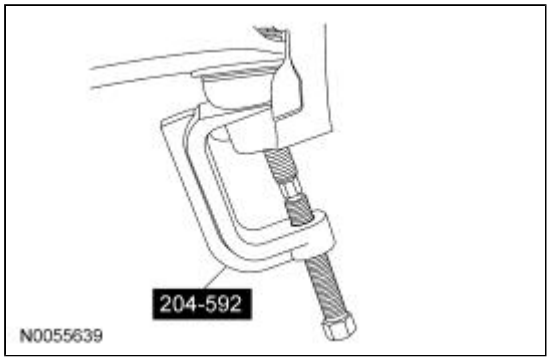
   Using the special tool, separate the upper ball joint from the wheel knuckle.



9. Remove and discard the lower ball joint nut.
   - To install, tighten to 150 Nm (111 lb-ft).

10. **CAUTION: Make sure to use the special tool when separating the lower ball joint from the knuckle to prevent damage to the ball joint boot.**

    Using the special tool, separate the ball joint from the knuckle.



11. If necessary, remove the 3 brake disc shield bolts and remove the brake disc shield.
    - To install, tighten to 17 Nm (13 lb-ft).

12. To install, reverse the removal procedure.

13. **CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

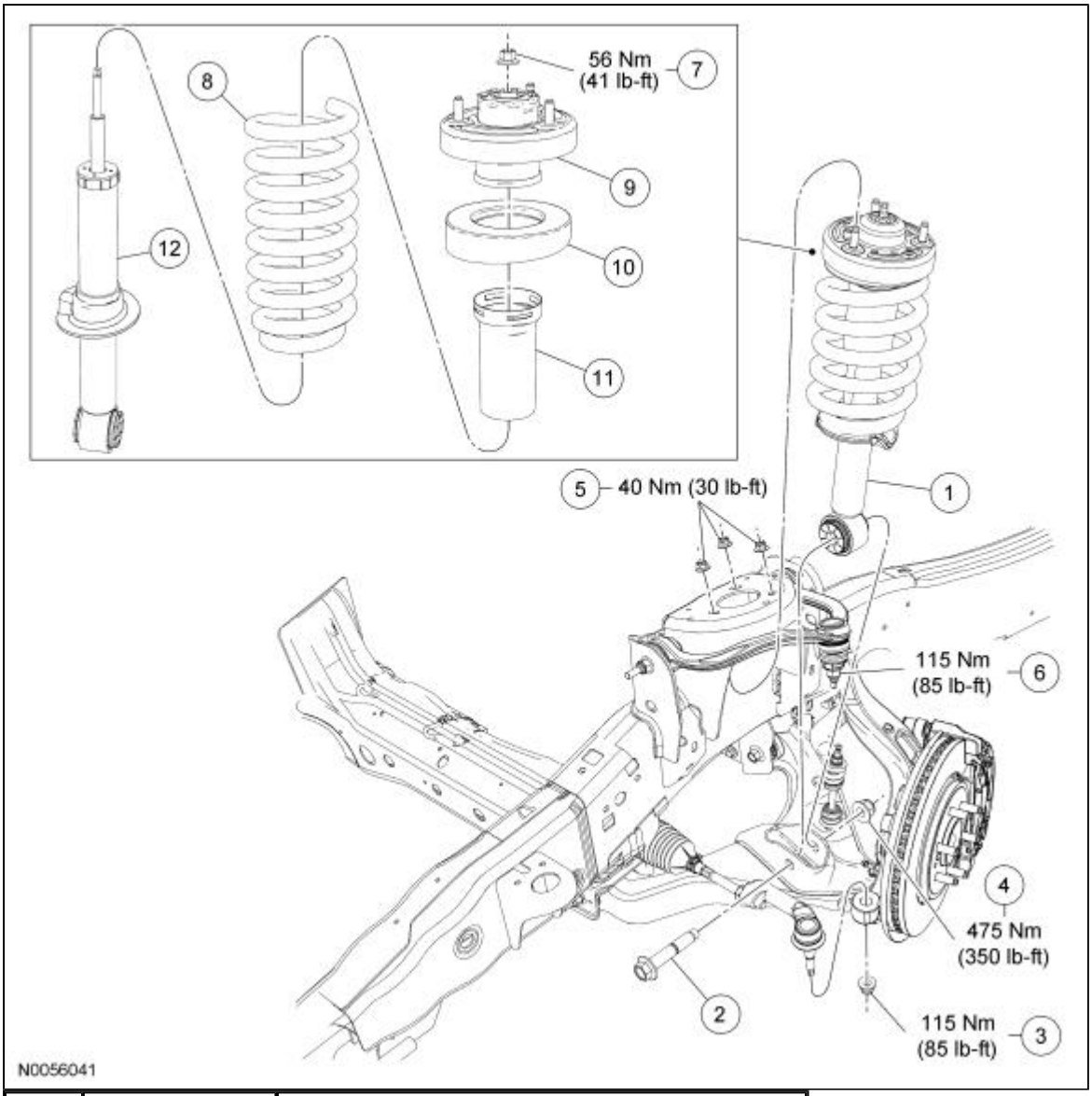
    Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Shock Absorber and Spring Assembly

Printable View (333 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	18B036	Shock absorber and spring assembly
2	W712682	Shock absorber lower bolt

3	W707251	Tie-rod end nut
4	W520217	Shock absorber lower nut
5	W712334	Shock absorber upper nuts (3 required)
6	W520215	Upper ball joint nut
7	W712134	Shock rod nut
8	5310	Spring
9	18A099	Upper mount
10	18A154	Insulator
11	18A047	Dust boot
12	18045	Shock absorber

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

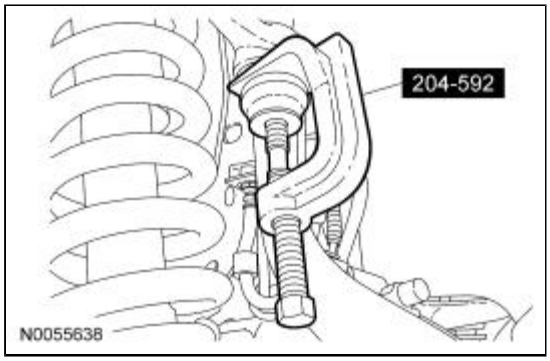
CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove and discard the shock absorber and spring assembly upper nuts.
   - To install, tighten to 40 Nm (30 lb-ft).

3. Remove and discard the tie-rod end nut.
   - To install, tighten to 150 Nm (111 lb-ft).

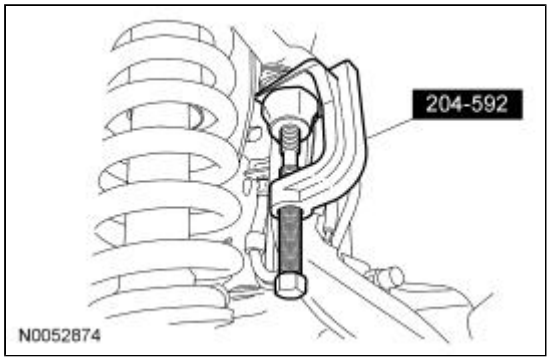
4. Using the special tool, separate the upper ball joint from the wheel knuckle.



5. Remove and discard the upper ball joint nut.
   - To install, tighten to 115 Nm (85 lb-ft).

6. Remove and discard the shock absorber and spring assembly lower nut and bolt.
   - To install, tighten to 475 Nm (295 lb-ft).

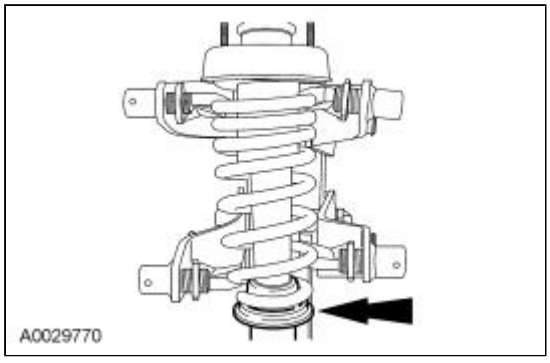
7. Using the special tool, disconnect the upper arm from the wheel knuckle and remove the shock absorber and spring assembly.



8. **NOTE:** If the individual spring and/or shock components are not being serviced, continue with Step 11.

   NOTE: For reference during assembly, index the upper mount, spring and shock absorber.

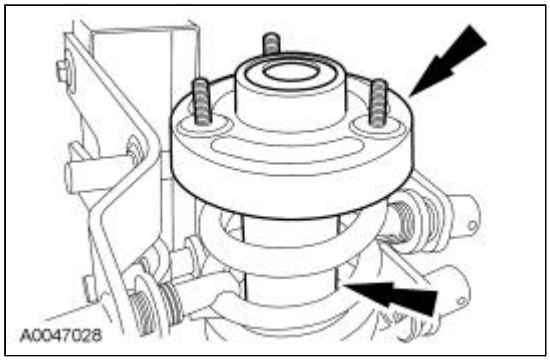
   Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.



9. **NOTE:** Use the hex holding feature to prevent the shock rod from turning while removing the nut.

   While holding the shock rod, remove the nut and the shock absorber.
   - Discard the nut.
   - To install, tighten to 56 Nm (41 lb-ft).

10. Remove the upper mount, dust boot and insulator.



11. **CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

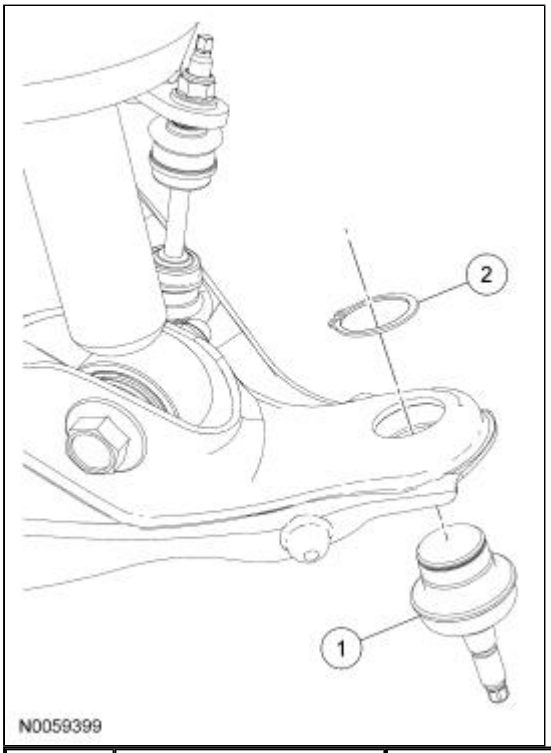
    To install, reverse the removal procedure.

Ball Joint — Lower

Printable View (167 KB)

Special Tool(s)

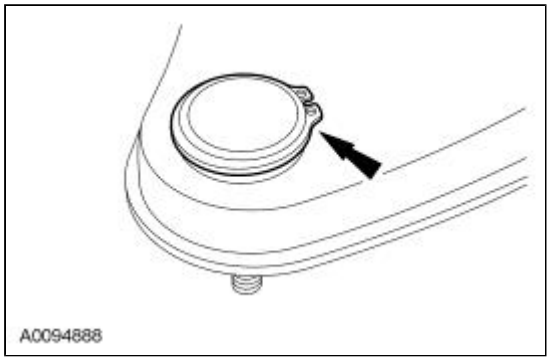
ST1172-A	Installer/Remover, C-Frame and Screw 205-086
ST2929-A	Installer/Remover, Ball Joint 204-358



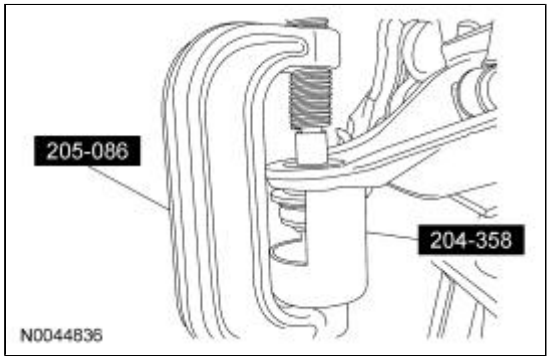
Item	Part Number	Description
1	3050	Lower ball joint
2	—	Lower ball joint snap ring

Removal and Installation

1. Remove the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.
2. Remove and discard the lower ball joint snap ring.



3. Using the special tools, remove the lower ball joint.



4. **CAUTION: Do not damage the lower ball joint boot when installing the special tool.**

   NOTE: Clean and inspect the lower arm ball joint bore for damage before installing a new ball joint.

   NOTE: Make sure the new lower ball joint snap ring is fully seated.

   NOTE: Always install new nuts and cotter pins.

   To install, reverse the removal procedure.

Printable View (65 KB)

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolts	200	148
Brake disc shield bolts	17	13
Halfshaft nut	27	20
Integrated wheel end disconnect bolt	15	11
Lower arm forward and rearward nuts	350	258
Lower ball joint nut	150	111
Shock absorber and spring assembly upper nuts	40	30
Shock absorber and spring assembly lower nut	475	350
Shock rod nut	56	41
Stabilizer bar bracket nuts	55	41
Stabilizer bar link upper and lower nuts	80	59
Tie-rod end nut	115	85
Upper arm-to-frame nuts	150	111
Upper ball joint nut	115	85
Wheel bearing and wheel hub assembly bolts	185	136
Wheel speed sensor bolt	18	13
Wheel speed sensor harness bracket bolt	12	9

Front Suspension

Printable View (80 KB)

WARNING: The vehicle can be equipped with either a vehicle dynamic suspension (using air springs in the rear of the vehicle) or a standard suspension (using coil springs at all 4 corners of the vehicle). If equipped with vehicle dynamic suspension, the system must be disabled prior to jacking or lifting the vehicle. Disabling the vehicle dynamic suspension is covered in Section 204-05 .

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

The vehicle can be equipped with either a vehicle dynamic suspension (using air springs in the rear of the vehicle) or a standard suspension (using coil springs at all 4 corners of the vehicle). Both are an independent-type front suspension which utilize a stabilizer bar to aid in vehicle stability. Vehicle dynamic suspension is covered in Section 204-05 . The wheel hub and wheel bearing assemblies are sealed units and are serviced as such. The lower ball joints are serviceable. The four wheel drive (4WD) front suspension consists of the following parts:

- Upper control arms
- Lower control arms
- Shock absorber and coil spring assemblies
- Wheel knuckles
- Wheel bearing and wheel hub assemblies
- Stabilizer bar
- Stabilizer bar links

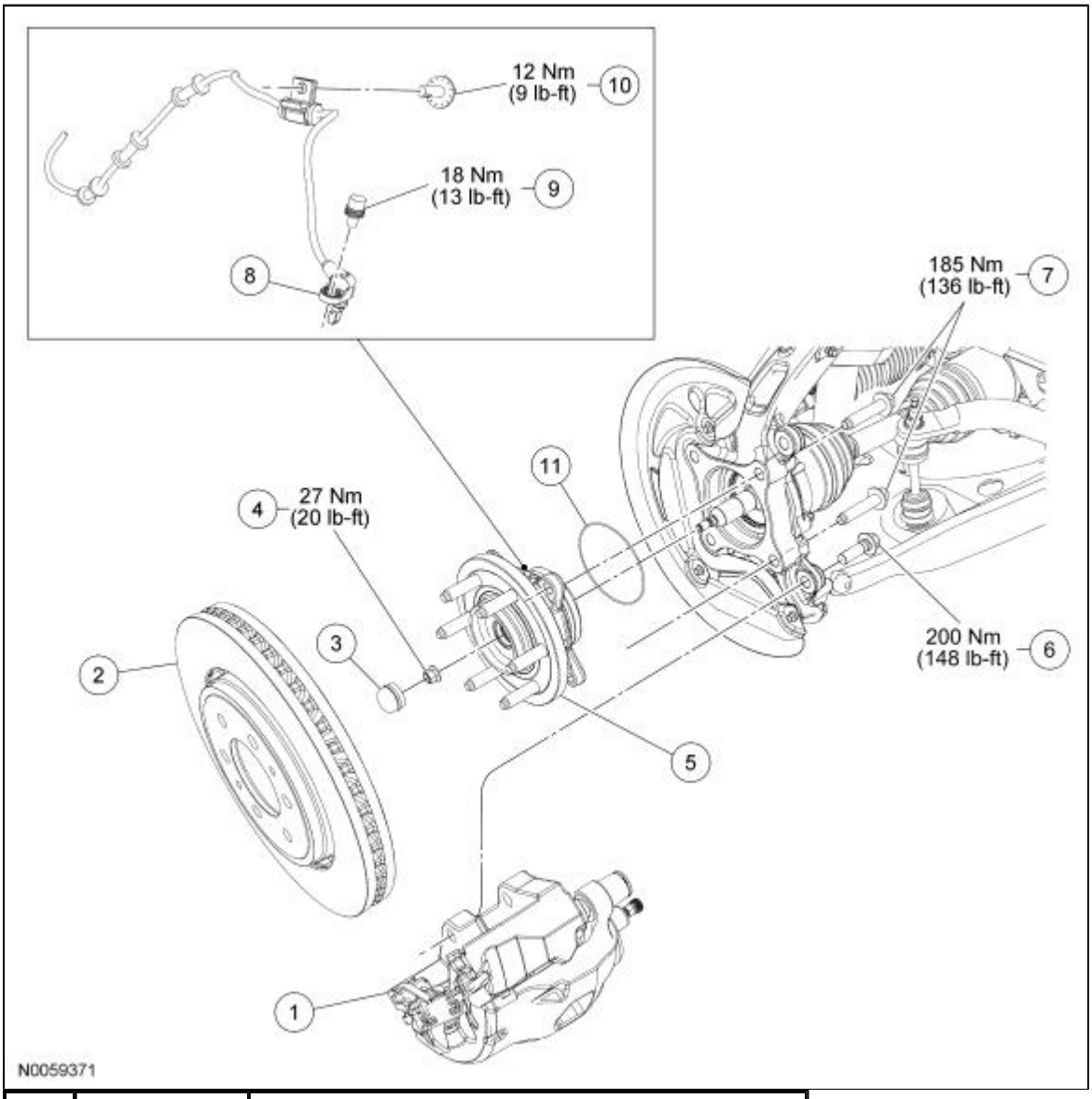
Front Suspension

Printable View (62 KB)

Refer to Section 204-00 .

Wheel Hub

Printable View (261 KB)



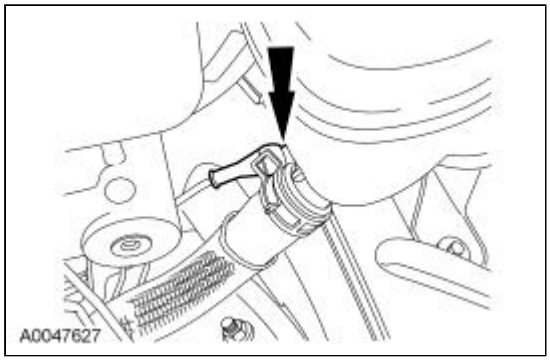
Item	Part Number	Description
1	—	Brake caliper and anchor plate assembly
2	1125	Brake disc
3	1131	Dust cap
4	N808405	Halfshaft nut
5	2B663	Wheel bearing and wheel hub
6	W707292	Brake caliper anchor plate bolt (2 required)
7	W707353	Wheel bearing and wheel hub bolt (4 required)
8	2C204	Wheel speed sensor
9	—	Wheel speed sensor bolt

10	—	Wheel speed sensor harness bracket bolt
11	1177	O-ring seal

Removal and Installation

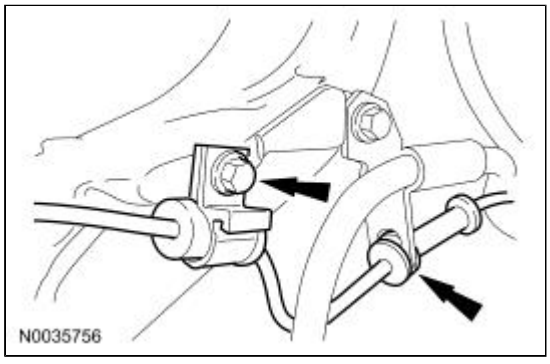
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Disconnect the wheel speed sensor electrical connector.



2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the wheel speed sensor harness bolt and detach the harness from the retainers.
   - To install, tighten to 12 Nm (9 lb-ft).



4. **CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can result.**

   Remove the bolts and position the brake caliper and anchor plate assembly aside.
   - Support the brake caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten to 200 Nm (148 lb-ft).

5. Remove the brake disc.

6. Remove the halfshaft nut dust cap.

7. Remove and discard the halfshaft nut.

- To install, tighten to 27 Nm (20 lb-ft).

8. Remove the 4 wheel bearing and wheel hub bolts and the wheel hub.
    - To install, tighten to 185 Nm (136 lb-ft).

9. If installing a new wheel bearing and wheel hub, remove the wheel speed sensor bolt and the wheel speed sensor.
    - To install, tighten to 18 Nm (13 lb-ft).

10. **CAUTION: If the original wheel bearing and wheel hub is being installed, install a new wheel hub O-ring seal.**

    To install, reverse the removal procedure.

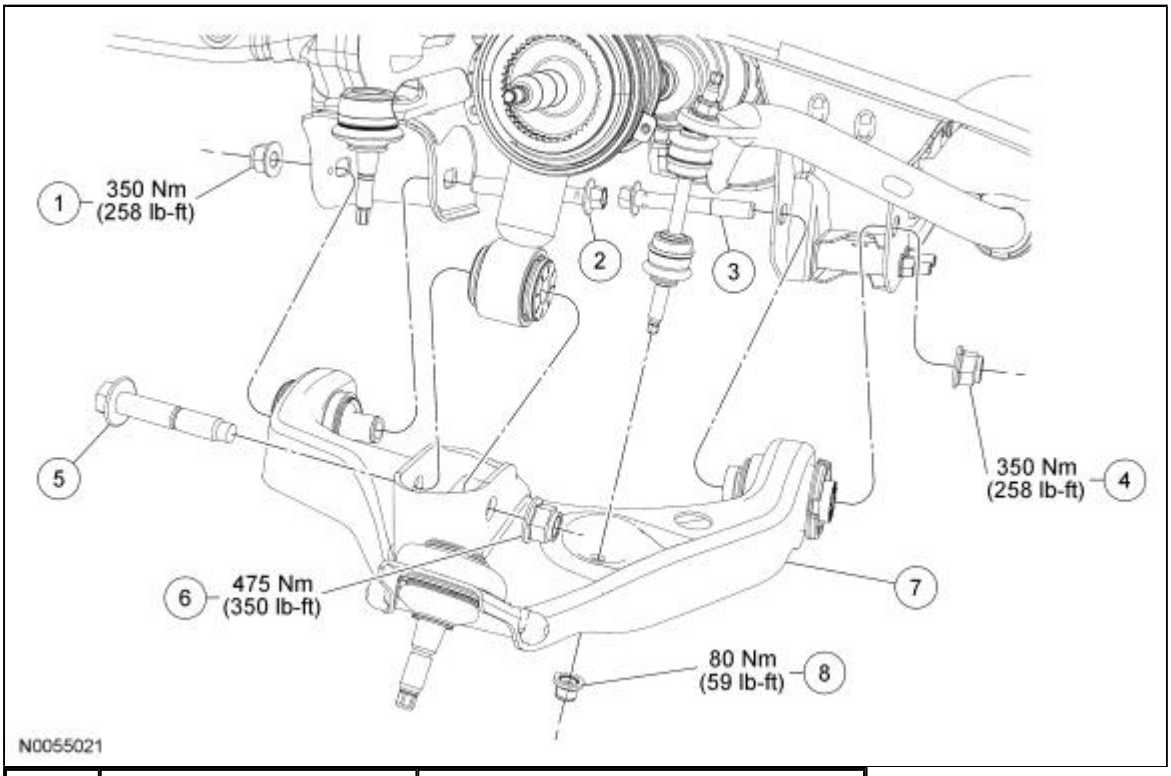
Wheel Studs

Printable View (62 KB)

For additional information, refer to Section 204-01A .

Lower Arm

Printable View (183 KB)



Item	Part Number	Description
1	W707254	Lower arm forward nut
2	W707843	Lower arm forward bolt
3	W707202	Lower arm rearward bolt
4	W707254	Lower arm rearward nut
5	W712682	Shock absorber lower bolt
6	W520217	Shock absorber lower nut
7	3051 LH/ 3042 RH	Lower arm
8	N807144	Stabilizer bar link lower nut

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the lower shock nut, lower arm forward nut or lower arm rearward nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. Remove the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.

2. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

   Remove and discard the stabilizer bar link lower nut.
   - To install, tighten to 80 Nm (59 lb-ft).

3. Remove the lower arm rearward nut and bolt.
   - Discard the nut.
   - To install, tighten to 350 Nm (258 lb-ft).

4. Remove the lower arm forward nut and bolt.
   - Discard the nut.
   - To install, tighten to 350 Nm (258 lb-ft).

5. Remove the shock absorber lower nut, bolt and the lower arm.
   - Discard the shock absorber lower nut.
   - To install, tighten to 475 Nm (350 lb-ft).

6. **CAUTION: Do not tighten the lower shock nut, lower arm forward nut or lower arm rearward nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

   To install, reverse the removal procedure.

7. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Upper Arm

Printable View (62 KB)

For additional information, refer to Section 204-01A .

Stabilizer Bar and Link

Printable View (62 KB)

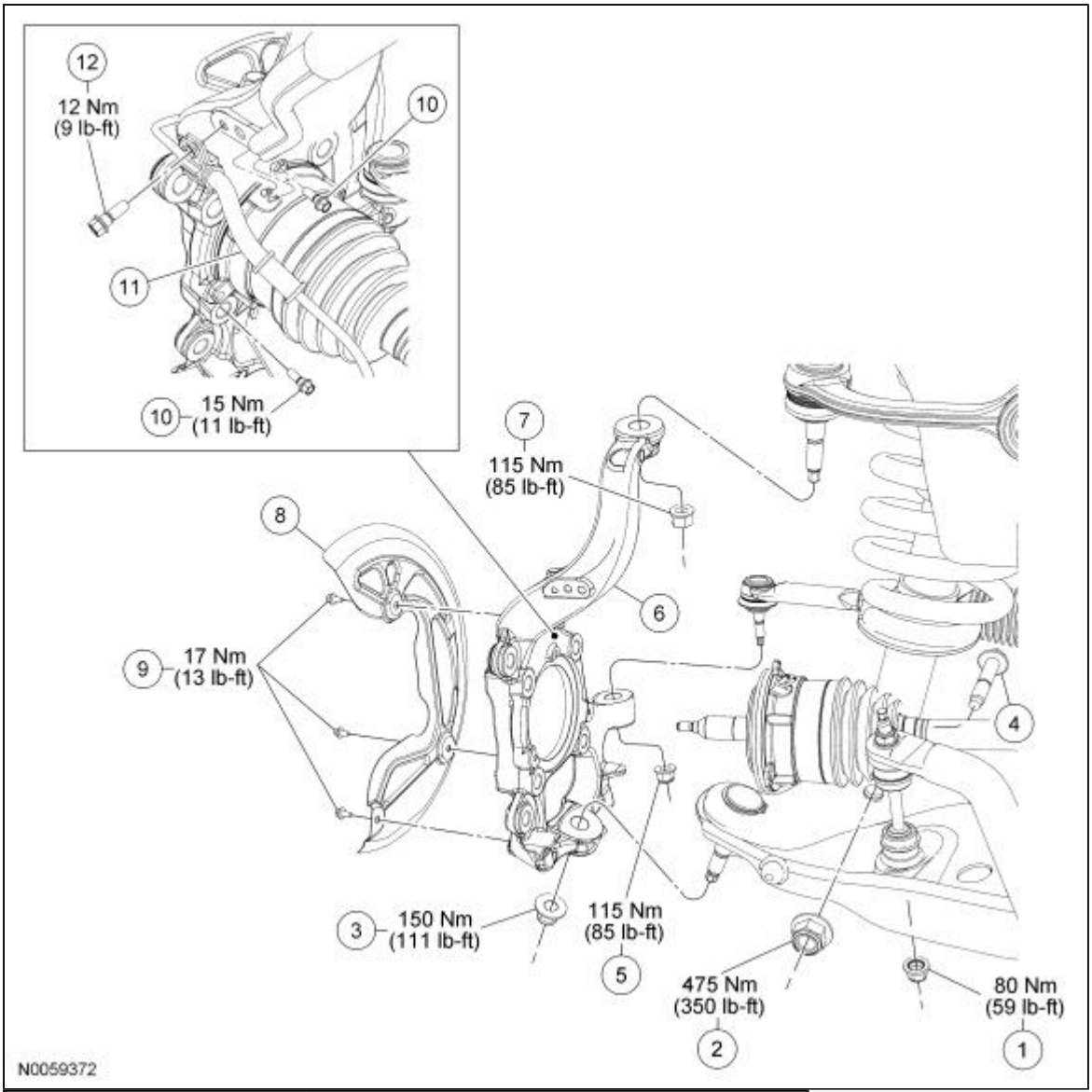
For additional information, refer to Section 204-01A .

Wheel Knuckle

Printable View (337 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	N807114	Stabilizer bar link lower nut
2	W520217	Shock absorber lower nut

3	W707254	Lower ball joint nut
4	W712682	Shock absorber lower bolt
5	W520215	Tie-rod end nut
6	3K186 LH/ 3K185 RH	Wheel knuckle
7	W520215	Upper ball joint nut
8	2K005 LH/ 2K004 RH	Brake disc shield
9	W505211	Brake disc shield bolt (3 required)
10	—	Integrated wheel end disconnect bolt (3 required)
11	—	Wheel speed sensor harness bracket
12	—	Wheel speed sensor harness bracket bolt

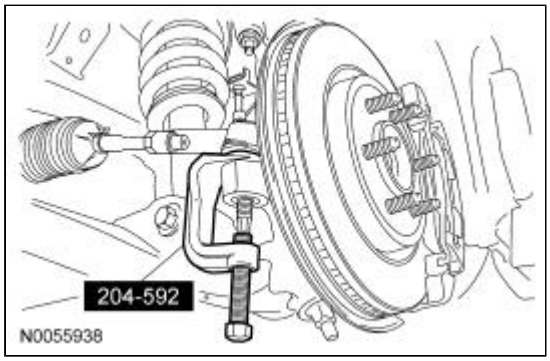
Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

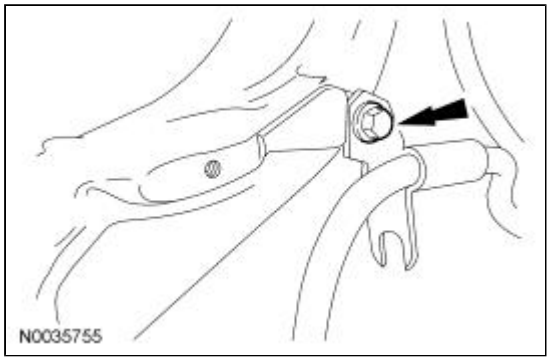
CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

CAUTION: When servicing the lower shock nut, take care not to damage the stabilizer link.

1. Remove the wheel bearing and wheel hub. For additional information, refer to Wheel Hub .
2. Remove and discard the tie-rod end nut.
   - To install, tighten to 115 Nm (85 lb-ft).
3. Using the special tool, separate the tie-rod end from the wheel knuckle.



4. Remove the wheel speed sensor harness bracket bolt and position the harness aside.
   - To install, tighten to 12 Nm (9 lb-ft).



5. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

   Remove and discard the stabilizer bar link lower nut.
   - To install, tighten to 80 Nm (59 lb-ft).

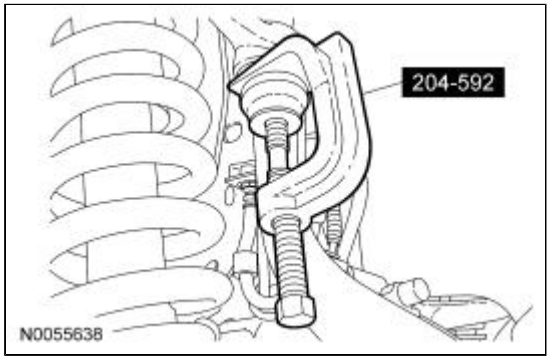
6. Remove and discard the shock absorber lower nut and bolt.
   - To install, tighten to 475 Nm (350 lb-ft).

7. Remove the 3 integrated wheel end bolts.
   - To install, tighten to 15 Nm (11 lb-ft).

8. Remove and discard the upper ball joint nut.
   - To install, tighten to 115 Nm (85 lb-ft).

9. **NOTE:** Be sure not to damage the ball joint boot when installing the special tool.

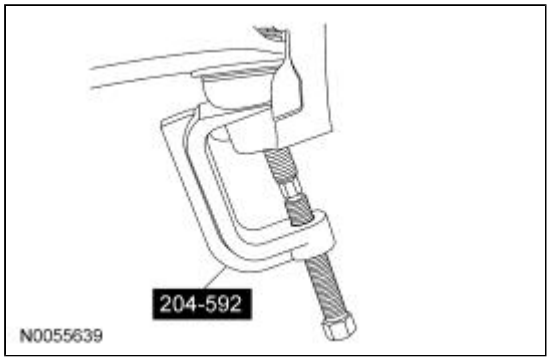
   Using the special tool, separate the upper ball joint from the wheel knuckle.



10. Remove and discard the lower ball joint nut.
    - To install, tighten to 150 Nm (111 lb-ft).

11. **CAUTION: Make sure to use the special tool when separating the lower ball joint from the knuckle to prevent damage to the ball joint boot.**

    Using the special tool, separate the lower ball joint from the wheel knuckle and remove the wheel knuckle.



12. If necessary, remove the 3 brake disc shield bolts and remove the brake disc shield.
    - To install, tighten to 17 Nm (13 lb-ft).

13. **CAUTION: Do not tighten the lower shock nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    To install, reverse the removal procedure.

14. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Shock Absorber and Spring Assembly

Printable View (62 KB)

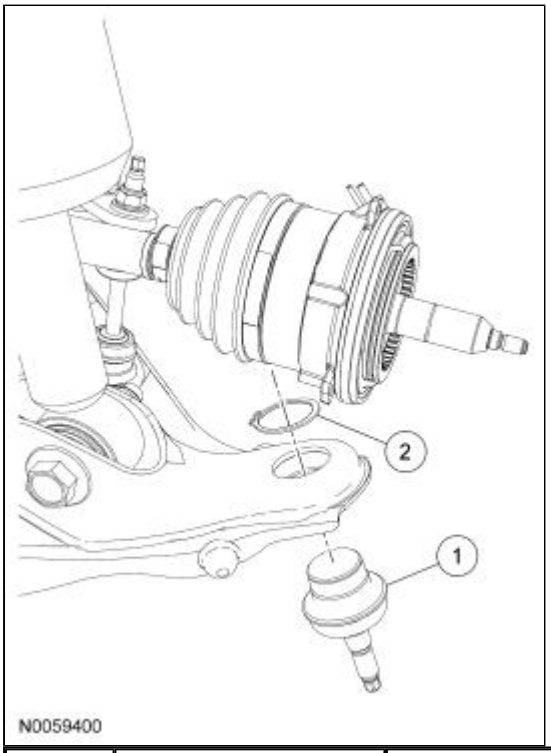
For additional information, refer to Section 204-01A .

Ball Joint — Lower

Printable View (176 KB)

Special Tool(s)

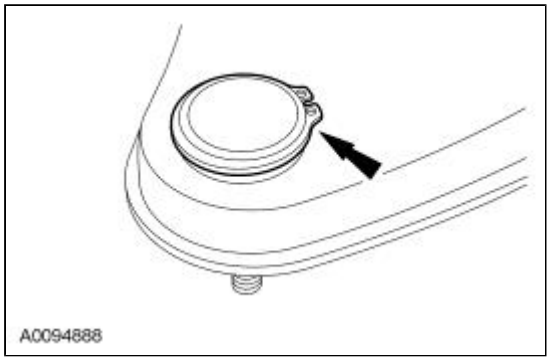
ST1172-A	Installer/Remover, C-Frame and Screw 205-086
ST2929-A	Installer/Remover, Ball Joint 204-358



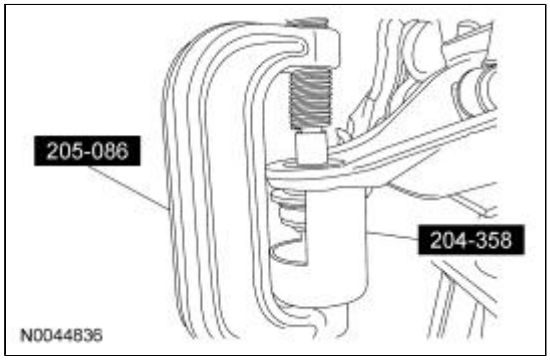
Item	Part Number	Description
1	3050	Lower ball joint
2	—	Lower ball joint snap ring

Removal and Installation

1. Remove the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.
2. Remove and discard the lower ball joint snap ring.



3. Using the special tools, remove the lower ball joint.



4. **CAUTION: Do not damage the lower ball joint boot when installing the special tool.**

   NOTE: Clean and inspect the lower arm lower ball joint bore for damage before installing a new ball joint.

   NOTE: Make sure the lower ball joint is fully seated in the lower control arm.

   NOTE: Make sure the new lower ball joint snap ring is fully seated.

   NOTE: Always install new nuts and cotter pins.

   To install, reverse the removal procedure.

Printable View (65 KB)

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolts	190	140
Halfshaft nut	300	221
Lower arm-to-frame bolt	350	258
Lower ball joint nut	150	111
Lower shock absorber bolt	475	350
Lower trailing arm-to-frame bolt	275	203
Lower trailing arm-to-wheel knuckle bolt	103	76
Shock absorber upper mount nut	40	30
Shock rod nut	56	41
Stabilizer bar link nut	63	46
Stabilizer bar bracket nut	48	35
Toe link-to-frame nut	275	203
Toe link-to-wheel knuckle bolt	225	165
Upper arm-to-frame bolt	300	221
Upper arm-to-wheel knuckle nut	103	76
Upper trailing arm-to-wheel knuckle bolt	250	184
Upper trailing arm-to-frame bolt	275	203
Wheel bearing and wheel hub bolt	185	136
Wheel speed sensor bolt	18	13

Rear Suspension

Printable View (80 KB)

WARNING: All vehicles are equipped with gas-pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

The vehicle can be equipped with either a vehicle dynamic suspension (using air springs in the rear of the vehicle) or a standard suspension (using coil springs in the rear of the vehicle). Vehicle dynamic suspension is covered in Section 204-05 . Both are an independent-type rear suspension which utilize a stabilizer bar to aid in vehicle stability. The wheel hub and wheel bearing assemblies are sealed units and are serviced as such. The rear suspension has serviceable lower ball joints and wheel knuckle bushings. The rear suspension also incorporates toe links to adjust the rear toe and camber adjustment can be made using camber shims located at the upper arm-to-frame mounts. The rear suspension consists of the following parts:

- Upper arms
- Lower arms
- Shock absorber and spring assemblies
- Wheel knuckles
- Wheel bearing and wheel hub assemblies
- Stabilizer bar
- Stabilizer bar links
- Upper trailing arms
- Lower trailing arms
- Toe links

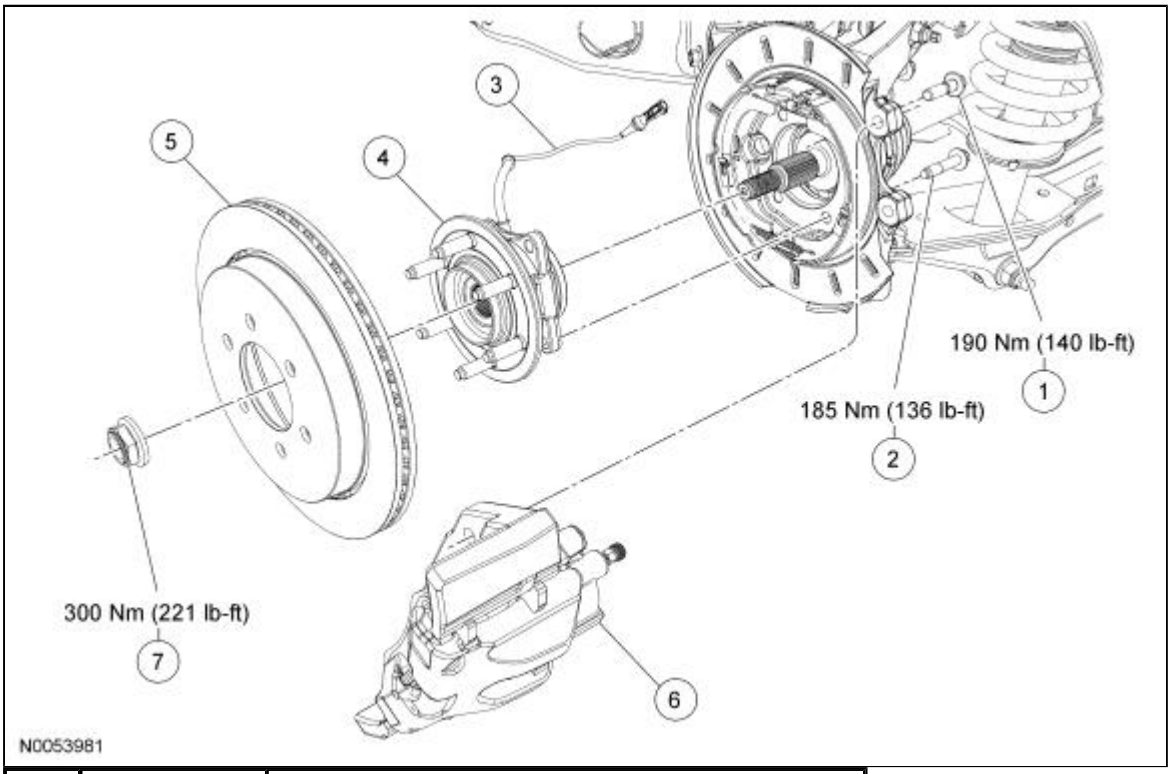
Rear Suspension

Printable View (62 KB)

Refer to Section 204-00 .

Wheel Bearing and Wheel Hub

Printable View (279 KB)



Item	Part Number	Description
1	W707292	Brake caliper anchor plate bolt (2 required)
2	W707353	Wheel bearing and wheel hub bolt (4 required)
3	2C204	Rear wheel speed sensor bolt
4	2B664	Wheel bearing and wheel hub
5	1126	Brake disc
6	—	Brake caliper and anchor plate assembly
7	W710084	Halfshaft nut

Removal and Installation

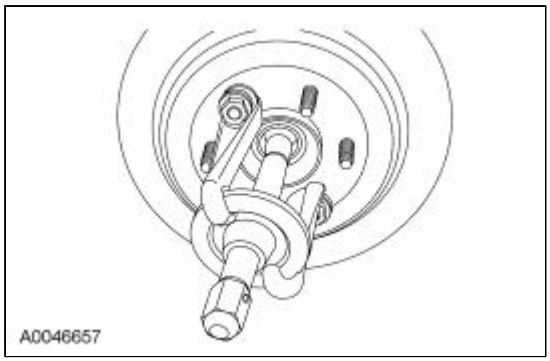
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** Have an assistant press the brake pedal to keep the axle from rotating.

   Remove and discard the halfshaft nut.
   - To install, tighten to 300 Nm (221 lb-ft).

3. Using a suitable hub puller, separate the outboard CV joint from the wheel hub.

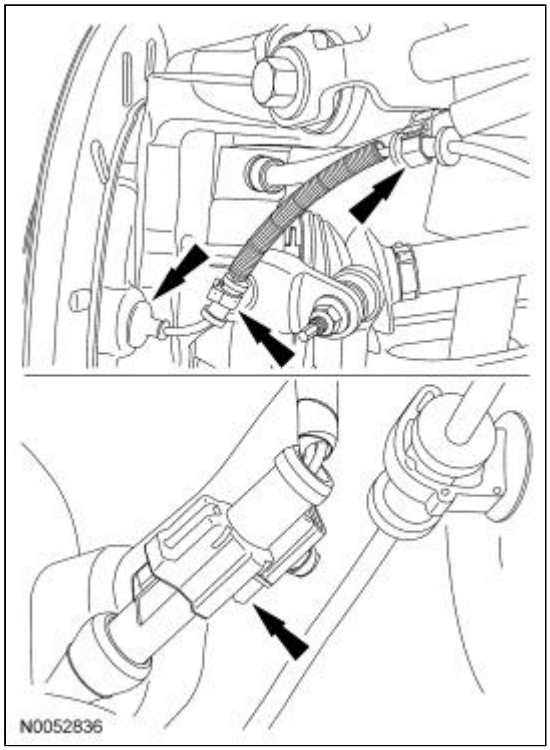


4. **CAUTION: Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can result.**

   Remove the bolts and position the caliper and anchor plate assembly aside.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten to 190 Nm (140 lb-ft).

5. Remove the brake disc.

6. Detach the wheel speed sensor harness from the retainers and disconnect the wheel speed sensor electrical connector. Push the wheel speed sensor harness grommet through the brake disc shield.



7. Remove the 4 wheel bearing and wheel hub bolts, the wheel bearing assembly and the wheel speed sensor as an assembly.
   - Route the sensor wiring through the access hole in the brake disc shield.
   - Discard the bolts.
   - To install, tighten to 185 Nm (136 lb-ft).

8. If necessary, remove the wheel speed sensor bolt and the wheel speed sensor from the wheel bearing and wheel hub.
    - To install, tighten to 18 Nm (13 lb-ft).

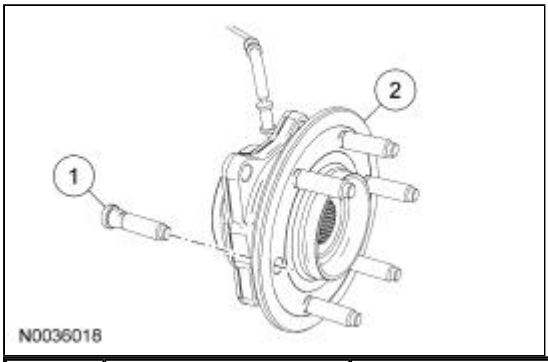
9. To install, reverse the removal procedure.

Wheel Studs

Printable View (146 KB)

Special Tool(s)

ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	W707287	Wheel stud
2	2B664	Wheel bearing and wheel hub

Removal

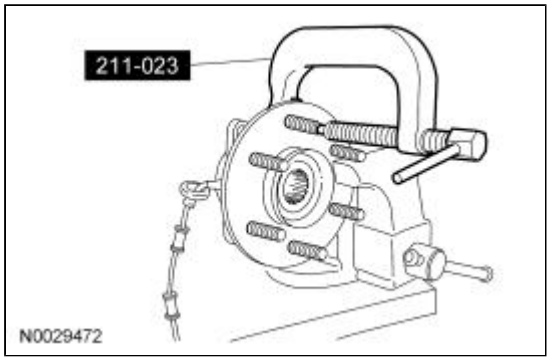
WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the LH rear quarter trim panel. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel bearing and wheel hub. For additional information, refer to Wheel Bearing and Wheel Hub in this section.

2. **CAUTION: Never use a hammer to remove a wheel stud. Damage to the wheel hub can result.**

   Place the wheel hub in a soft-jawed vice and, using the special tool, remove the wheel stud.



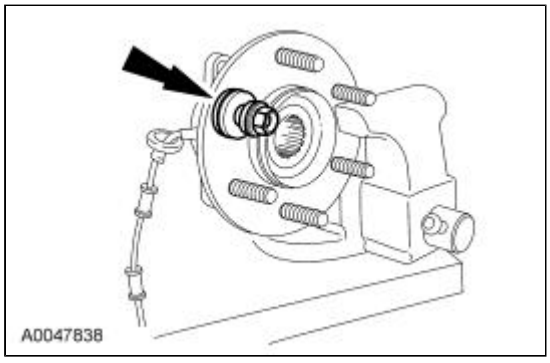
Installation

1. Position the new wheel stud in the wheel bearing and hub assembly, aligning the serrations in the wheel hub flange made by the original wheel stud.

2. **CAUTION: Do not use power tools to install the wheel stud. The serrations on the flange can be stripped.**

   NOTE: Do not use the wheel nut that came with the vehicle.

   Install 4 washers and a wheel nut on the wheel stud and tighten the wheel nut until the stud seats against the flange.

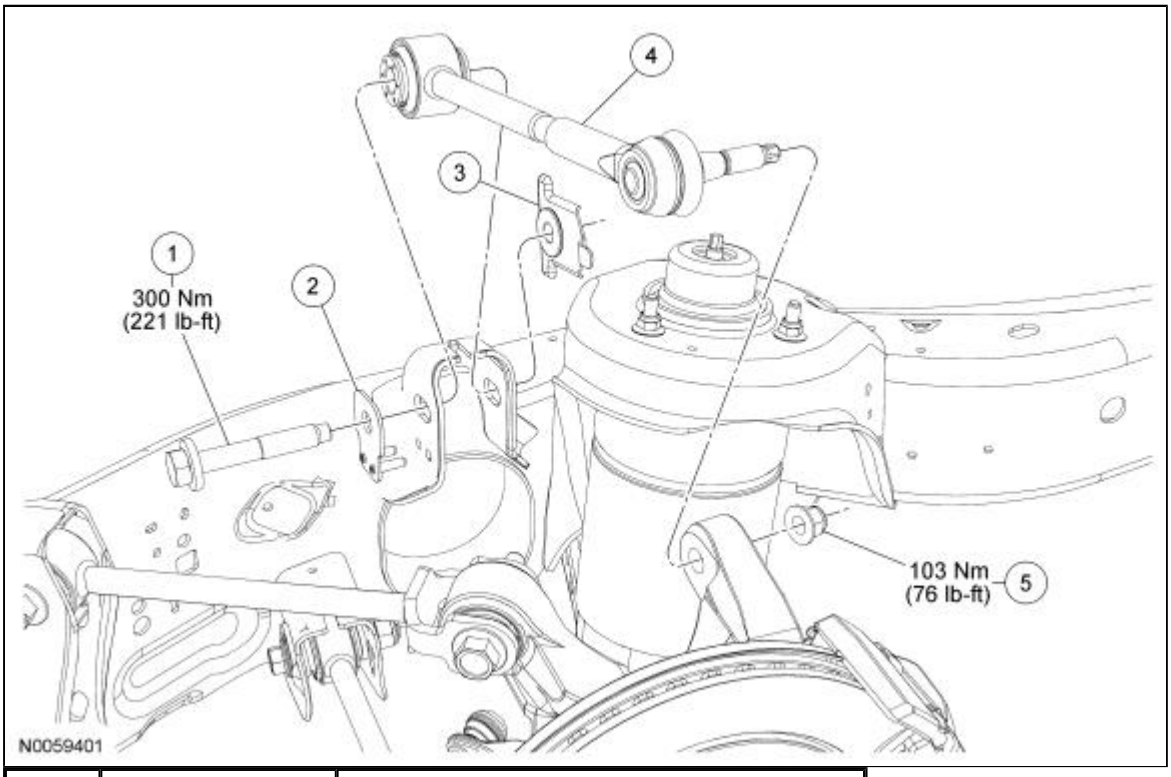


3. Remove the wheel nut and washers.
   - Discard the wheel nut.

4. Install the wheel bearing and wheel hub. For additional information, refer to Wheel Bearing and Wheel Hub in this section.

Upper Arm

Printable View (190 KB)



Item	Part Number	Description
1	W712774	Upper arm-to-frame bolt
2	5A983	Camber set shim
3	W711495	Flagnut
4	5A814	Upper arm
5	W520215	Upper arm-to-wheel knuckle nut

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the upper arm-to-frame bushing until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove and discard the upper arm-to-wheel knuckle nut.
   - To install, tighten to 103 Nm (76 lb-ft).

3. Remove and discard the upper arm-to-frame bolt, washer, camber set shim and flagnut.
    - To install, tighten to 300 Nm (221 lb-ft).

4. Remove the upper arm.

5. **CAUTION: Do not tighten the upper arm-to-frame bushing until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

   To install, reverse the removal procedure.

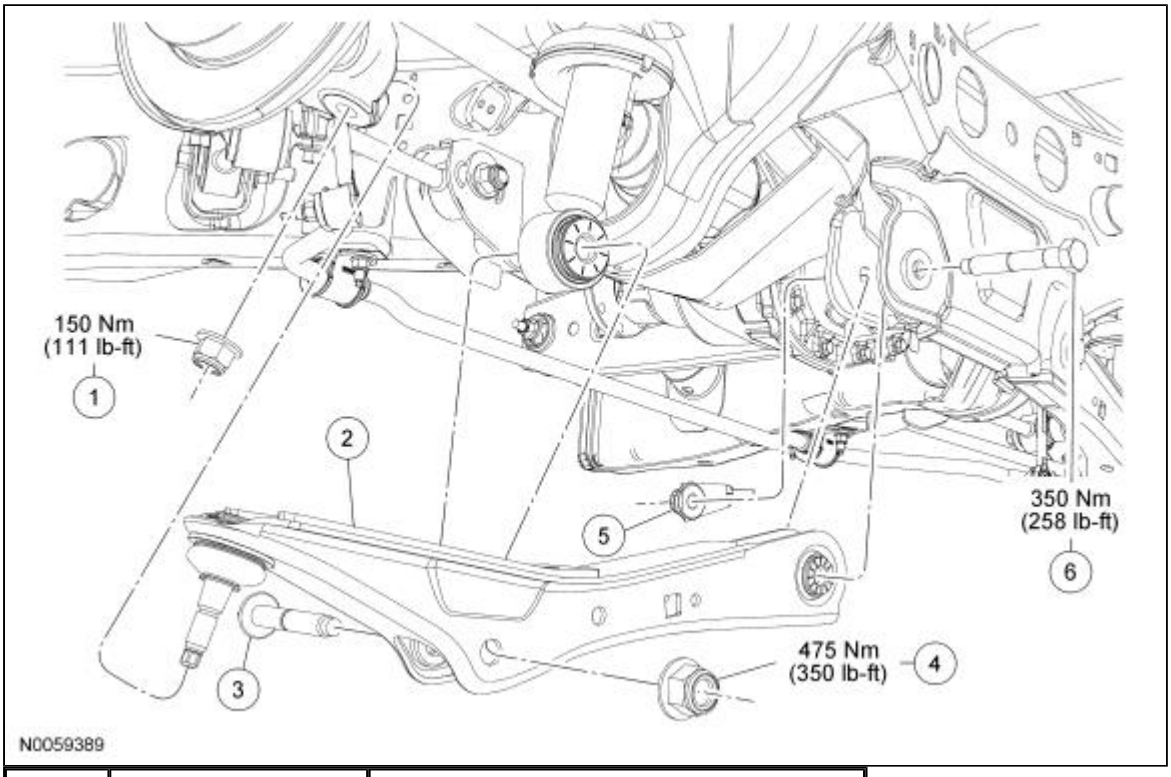
6. Check and, if necessary, adjust the rear alignment. For additional information, refer to Section 204-00 .

Lower Arm

Printable View (251 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	W520216	Lower ball joint nut
2	5B530	Lower arm
3	W712104	Lower shock absorber bolt
4	W520217	Lower shock absorber nut
5	W712774	Lower arm-to-frame flagnut
6	W711481	Lower arm-to-frame bolt

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during

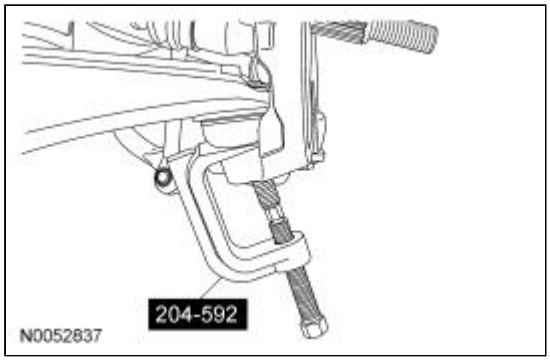
reassembly to make sure of correct retention of these parts.

CAUTION: Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed.

CAUTION: Do not tighten the lower arm-to-frame bolt or shock absorber lower nut until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If equipped, disconnect the air suspension height sensor connecting link from the lower arm.
3. Remove and discard the shock absorber lower bolt and flagnut.
4. Remove and discard the lower arm-to-frame bolt and flagnut.
5. Remove and discard the lower ball joint nut.
6. **CAUTION: Do not damage the ball joint boot while installing the special tool.**

   Using the special tool, separate the lower ball joint from the wheel knuckle.



7. Swing the lower arm to the rear of the vehicle and remove the lower arm.

Installation

1. Position the lower arm ball joint onto the wheel knuckle and install the lower ball joint nut.
   - Tighten to 150 Nm (111 lb-ft).
2. **CAUTION: Do not tighten the lower arm-to-frame bolt at this time.**

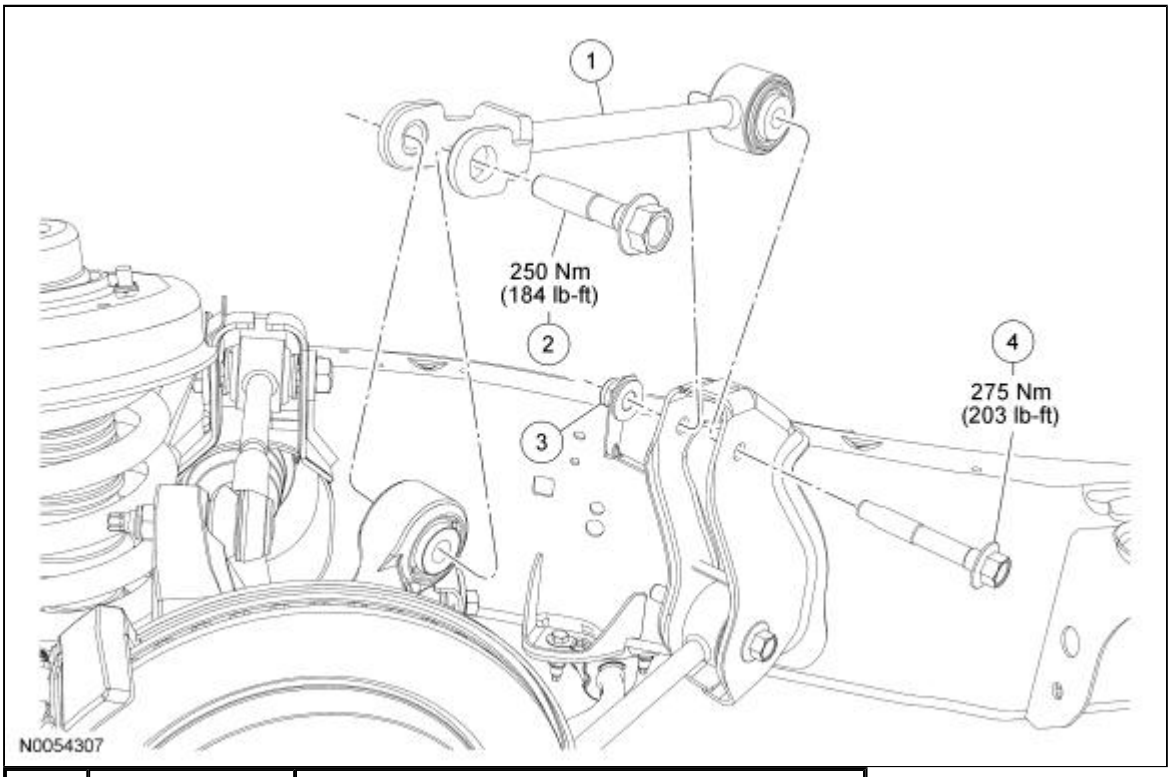
   Install the lower arm-to-frame bolt and flagnut.
3. **CAUTION: Do not tighten the shock absorber lower nut at this time.**

   Position the lower arm and install a new shock absorber lower bolt and nut.
4. Lower the vehicle so that the weight of the vehicle is on the wheel and tire assemblies.

5. Tighten the lower arm-to-frame bolt to 350 Nm (258 lb-ft).
6. Tighten the shock absorber lower bolt to 475 Nm (350 lb-ft).
7. Lower the suspension and remove the jack.
8. If equipped, connect the air suspension height sensor connecting link to the lower arm.

Trailing Arm — Upper

Printable View (188 KB)



Item	Part Number	Description
1	5B672	Upper trailing arm
2	W711865	Upper trailing arm-to-wheel knuckle bolt
3	W711480	Upper trailing arm-to-frame flagnut
4	W711478	Upper trailing arm-to-frame bolt

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the upper arm-to-frame bolt or upper arm-to-knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove and discard the upper trailing arm-to-wheel knuckle bolt.
   - To install, tighten to 250 Nm (184 lb-ft).

3. Remove and discard the upper trailing arm-to-frame bolt and flagnut.
    - To install, tighten to 275 Nm (203 lb-ft).

4. **NOTE:** After removal of the upper trailing arm, inspect the knuckle bushing for excessive wear or damage and replace if necessary. For additional information, refer to Wheel Knuckle Bushing in this section.

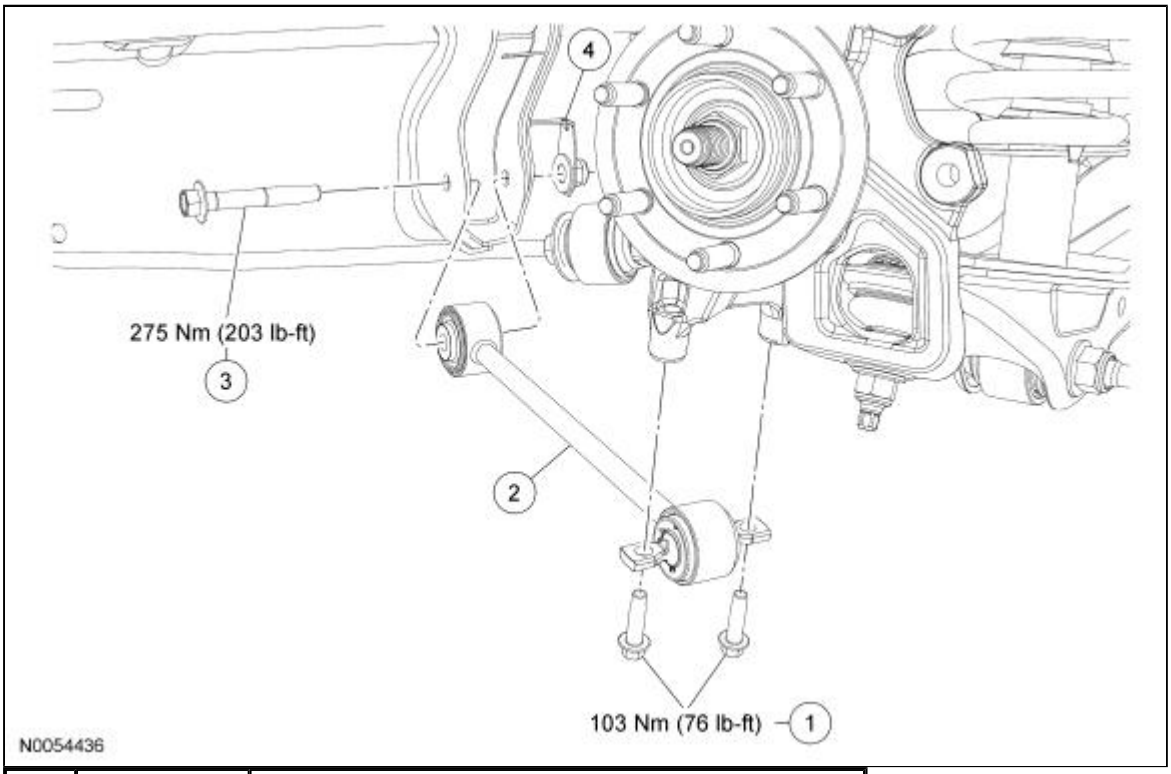
    Remove the upper trailing arm.

5. **CAUTION: Do not tighten the upper arm-to-frame bolt or upper arm-to-knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    To install, reverse the removal procedure.

Trailing Arm — Lower

Printable View (173 KB)



Item	Part Number	Description
1	W711170	Lower trailing arm-to-wheel knuckle bolts (2 required)
2	5B674	Lower trailing arm
3	W711478	Lower trailing arm-to-frame bolt
4	W711480	Lower trailing arm-to-frame flagnut

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the lower trailing arm-to-frame bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove and discard the 2 lower trailing arm-to-wheel knuckle bolts.
   - To install, tighten to 103 Nm (76 lb-ft).

3. Remove and discard the lower trailing arm-to-frame bolt and flagnut.
    - To install, tighten to 275 Nm (203 lb-ft).

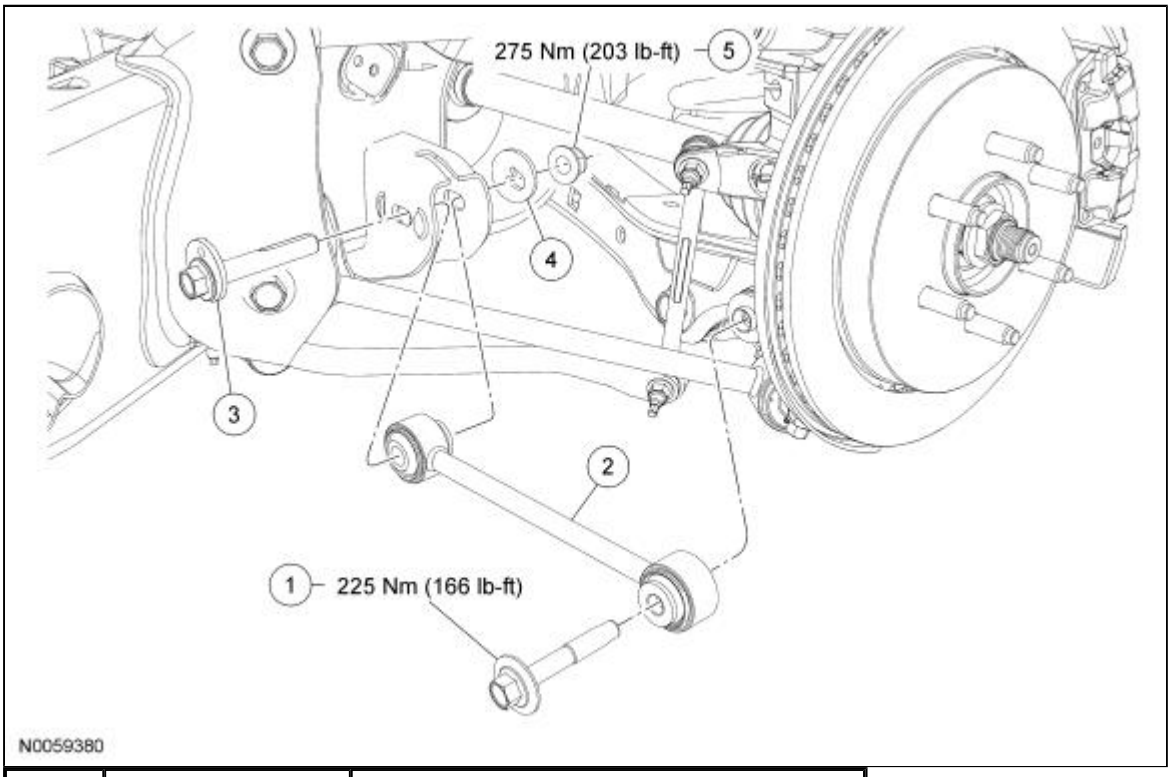
4. Remove the lower trailing arm.

5. **CAUTION: Do not tighten the lower trailing arm-to-frame bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    To install, reverse the removal procedure.

Toe Link

Printable View (189 KB)



Item	Part Number	Description
1	W711237	Toe link-to-wheel knuckle bolt
2	5A972	Toe link
3	W711172	Toe link-to-frame cam bolt
4	W711173	Cam washer
5	W520216	Toe link-to-frame nut

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the toe link-to-frame cam bolt or toe link-to-wheel knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Index-mark the cam bolt and cam washer positions.

3. Remove and discard the bolt and washer.
    - To install, tighten to 225 Nm (166 lb-ft).

4. Remove the toe link-to-frame cam bolt, cam washer and nut.
    - To install, tighten to 275 Nm (203 lb-ft).

5. Remove the toe link.

6. **CAUTION: Do not tighten the toe link-to-frame cam bolt or the toe link-to-wheel knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    NOTE: Using the index marks made in Step 5, transfer the marks onto the new cam bolt and cam washer. Use these index marks when installing the toe link.

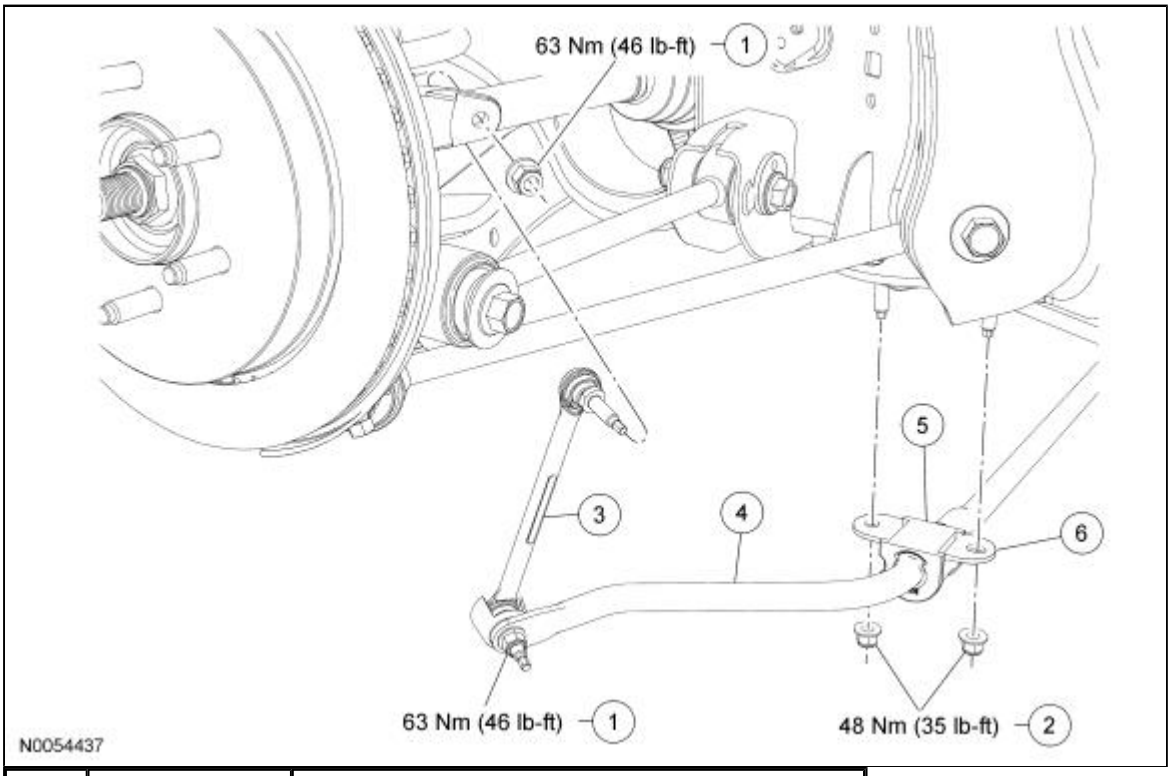
    To install, reverse the removal procedure.

7. Check and, if necessary, adjust the rear toe. For additional information, refer to Section 204-00 .

Stabilizer Bar and Link

Printable View (173 KB)

NOTE: RH side shown, LH side similar.



Item	Part Number	Description
1	W520213	Stabilizer bar link nuts (4 required)
2	W520213	Stabilizer bar link lower nuts (4 required)
3	5K484	Stabilizer bar link (2 required)
4	5A772	Stabilizer bar
5	4A037	Stabilizer bar bushing (2 required)
6	5B491	Stabilizer bar bracket (2 required)

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

   NOTE: The stabilizer bar links are designed with low friction ball joints that have a low breakaway

torque.

Remove the 4 stabilizer bar link nuts and the links.

- Discard the nuts.
- To install, tighten to 63 Nm (46 lb-ft).

3. Remove the 4 stabilizer bar bracket nuts, the 2 stabilizer bar brackets and the stabilizer bar.
   - Discard the nuts.
   - To install, tighten to 48 Nm (35 lb-ft).

4. **NOTE:** Inspect and, if necessary, install new bushings.

   NOTE: The rear stabilizer must be installed with the center hump facing down.

   NOTE: The rear stabilizer bar bushings must be installed outboard of the upset rings on the stabilizer bar.

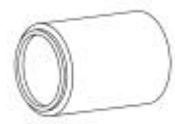
   NOTE: The stabilizer bar link stone shields must be installed on the stabilizer bar attachment point.

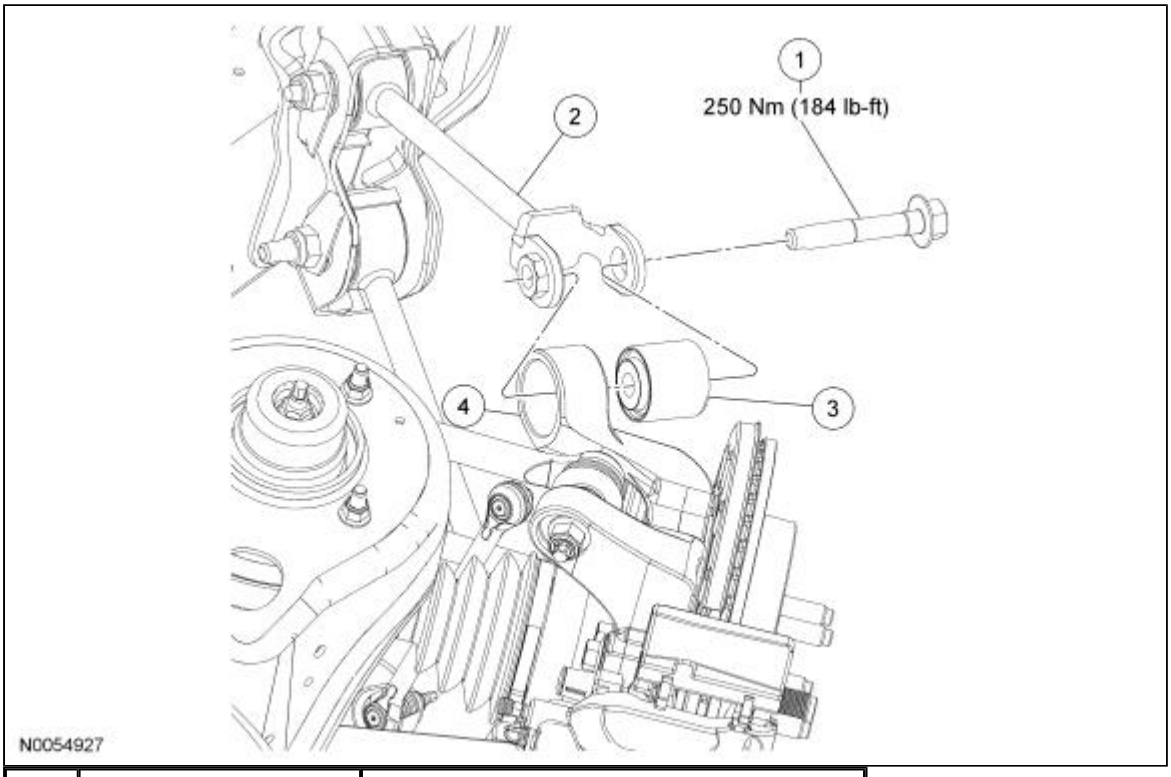
   To install, reverse the removal procedure.

Wheel Knuckle Bushing

Printable View (379 KB)

Special Tool(s)

 ST2233-A	Bushing Remover 204-034
ST2002-A	Bushing Remover/Installer 204-608
ST2238-A	Bushing Remover 204-589/1
ST2951-A	Forcing Screw, Bearings and Washers 205-813



Item	Part Number	Description
1	W711865	Upper trailing arm-to-wheel knuckle bolt
2	5B672	Upper trailing arm
3	—	Wheel knuckle bushing
4	5A970 LH/ 5A971 RH	Wheel knuckle

Removal

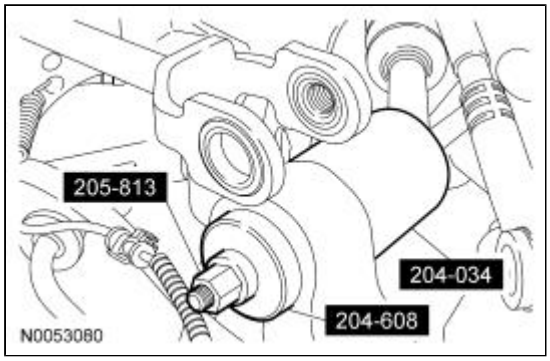
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Do not tighten the upper trailing arm-to-knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

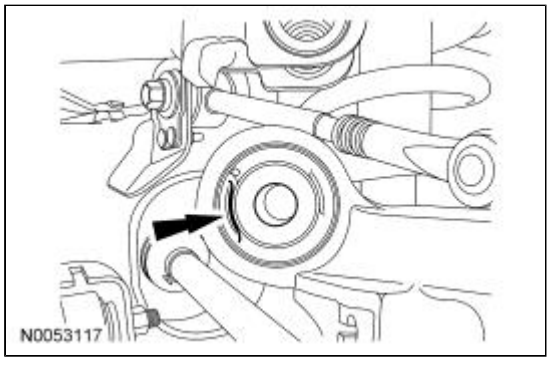
2. Remove and discard the upper trailing arm-to-wheel knuckle bolt.
   - Position the upper trailing arm upward to access the wheel knuckle bushing.

3. Using the special tools, remove the wheel knuckle bushing.

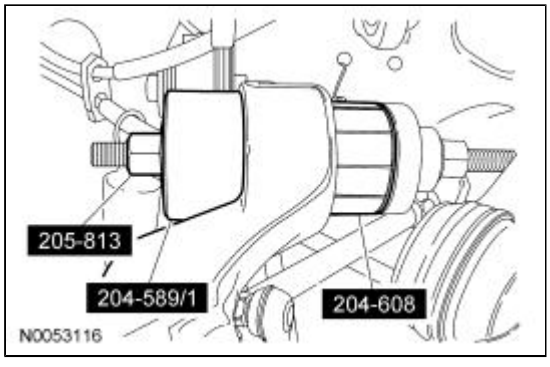


Installation

1. Clean and inspect the wheel knuckle bushing bore for damage or excessive wear.
2. Position the new wheel knuckle bushing with the larger void facing towards the upper trailing arm.

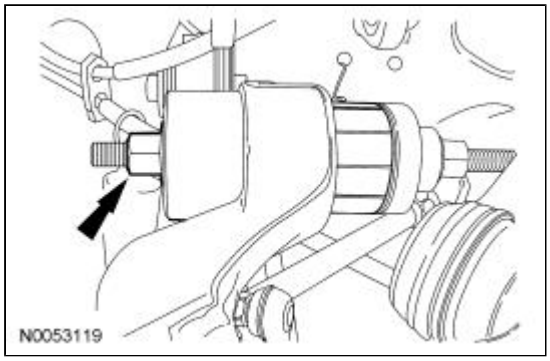


3. Install the special tools.



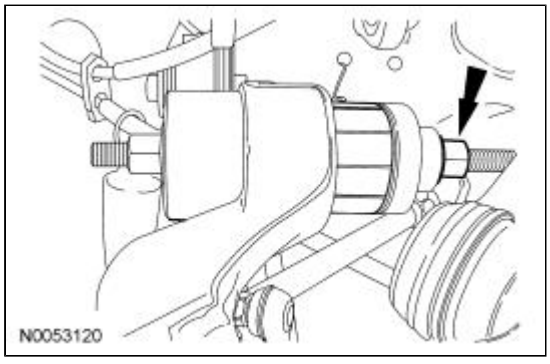
4. **CAUTION: Do not use the forward forcing screw nut to install the bushing. The forward forcing screw nut is only used to properly position and align the bushing for installation.**

   Hand tighten the forward forcing screw nut to align the bushing with the rearward side of the wheel knuckle bore.



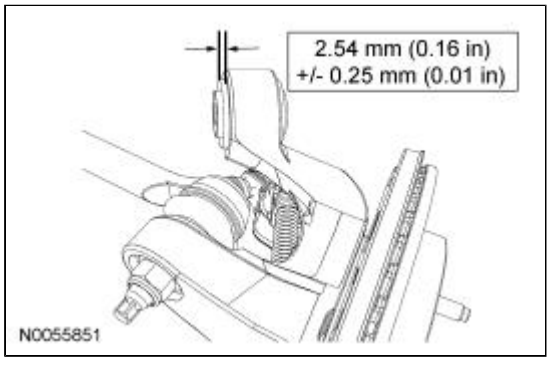
5. **CAUTION: Use the rearward forcing screw nut to install the bushing or damage to the bushing and/or the wheel knuckle bushing bore can result.**

   Tighten the rearward forcing screw nut and install the bushing until it is centered in the wheel knuckle.



6. **NOTE:** After installing the wheel knuckle bushing, make sure to measure the bushings position in the wheel knuckle bore. The measurement from the bushings outer metal surface to the machined face surface of knuckle bore should be 2.54 mm (0.16 in) +/- 0.25 mm (0.01 in).

   If necessary, use the special tool to adjust the bushing position in the wheel knuckle bushing bore.



7. **CAUTION: Do not tighten the upper trailing arm-to-knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

   Connect the upper trailing arm to the wheel knuckle.
   - Tighten the bolt to 250 Nm (184 lb-ft).

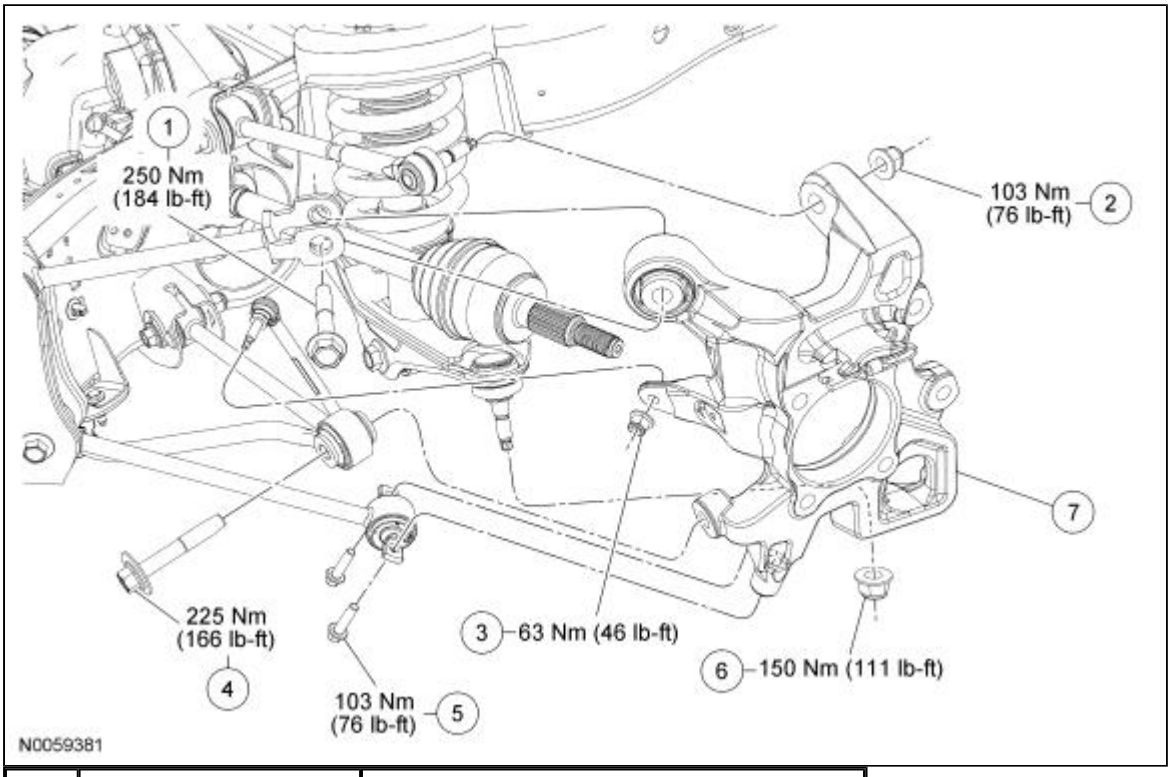
8. Remove the jack stand from under the lower arm.

Wheel Knuckle

Printable View (312 KB)

Special Tool(s)

ST2945-A	Separator, Ball Joint 204-592



Item	Part Number	Description
1	W711865	Upper trailing arm-to-wheel knuckle bolt
2	W520215	Upper arm-to-wheel knuckle nut
3	W520213	Stabilizer bar link nut
4	W711237	Toe link-to-wheel knuckle bolt
5	W71170	Lower trailing arm-to-wheel knuckle bolt
6	W520216	Lower ball joint nut
7	5A970 LH/ 5A971 RH	Wheel knuckle

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the

same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

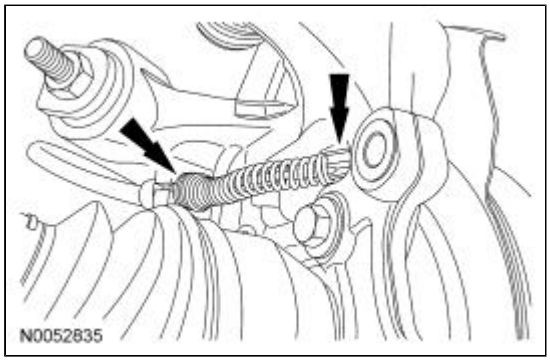
CAUTION: Do not tighten the upper arm-to wheel knuckle bolt or the toe link-to-wheel knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.

1. Remove the wheel bearing and wheel hub assembly. For additional information, refer to Wheel Bearing and Wheel Hub in this section.

2. Remove the parking brake shoes. For additional information, refer to Section 206-05 .

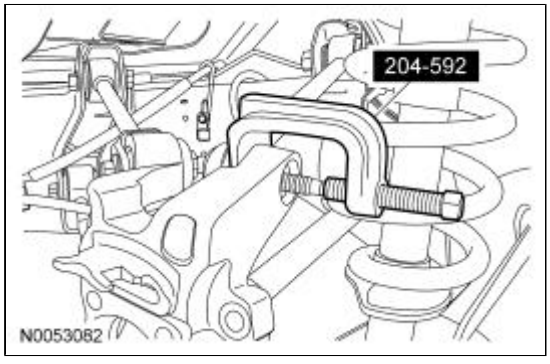
3. Remove the brake disc shield.

4. Compress the spring and depress the retaining tabs and detach the parking brake cable from the wheel knuckle.



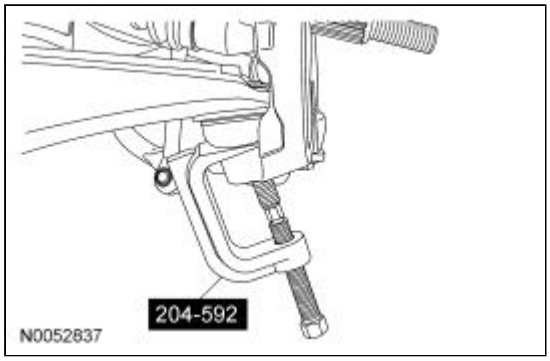
5. Remove and discard the upper arm-to-wheel knuckle nut.
    - To install, tighten to 103 Nm (76 lb-ft).

6. Using the special tool, separate the upper arm from the wheel knuckle.



7. Remove and discard the lower ball joint nut.
    - To install, tighten to 150 Nm (111 lb-ft).

8. Using the special tool, separate the lower ball joint from the wheel knuckle.



9. Remove and discard the 2 bolts and disconnect the lower trailing arm from the wheel knuckle.
    - To install, tighten to 103 Nm (76 lb-ft).

10. **CAUTION: Do not tighten the toe link-to- wheel knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    Remove and discard the bolt and disconnect the toe link from the wheel knuckle.
    - To install, tighten to 225 Nm (166 lb-ft).

11. **NOTE:** Use the hex holding feature to prevent the stud from turning while removing the nut.

    Using the hex hold feature, remove and discard the stabilizer bar link nut and disconnect the link from the wheel knuckle.
    - To install, tighten to 63 Nm (46 lb-ft).

12. **CAUTION: Do not tighten the upper arm-to wheel knuckle until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

    Remove the upper trailing arm-to-wheel knuckle bolt and the wheel knuckle.
    - Discard the bolt.
    - To install, tighten to 250 Nm (184 lb-ft).

13. **CAUTION: Do not tighten the upper arm-to wheel knuckle bolt or the toe link-to-wheel knuckle bolt until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies.**

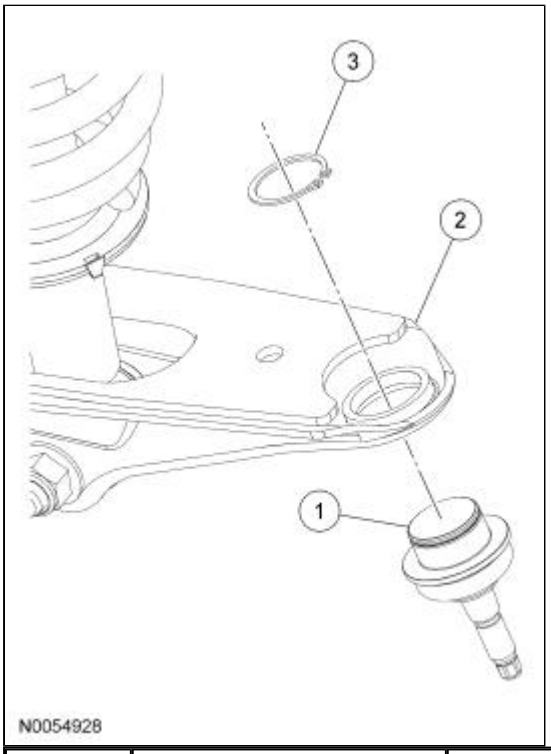
    To install, reverse the removal procedure.

Ball Joint — Lower

Printable View (185 KB)

Special Tool(s)

ST1172-A	Installer/Remover, C-Frame and Screw 205-086
ST2929-A	Installer/Remover, Ball Joint 204-358



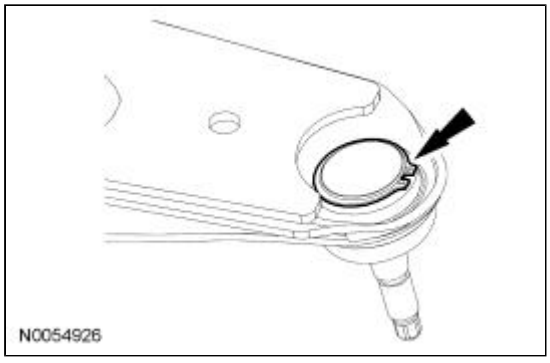
Item	Part Number	Description
1	—	Ball joint
2	5B530	Lower arm
3	—	Ball joint snap ring

Removal

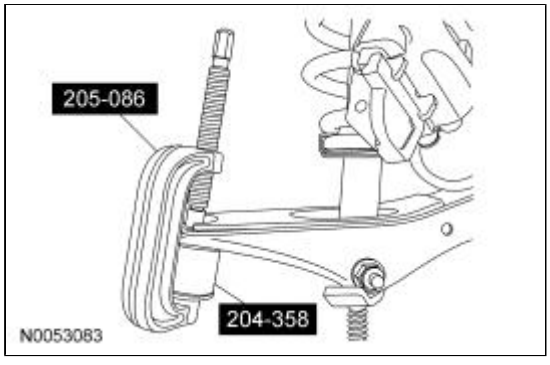
CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the

same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.
2. Remove and discard the ball joint snap ring.



3. Using the special tools, remove the ball joint.

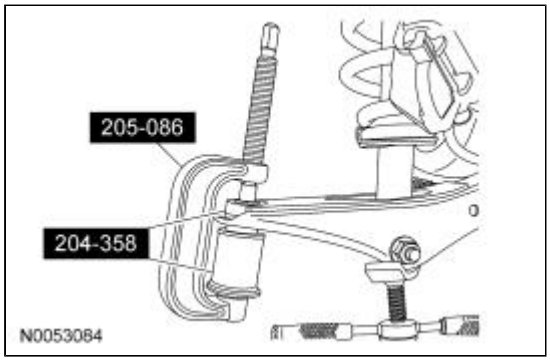


Installation

1. **CAUTION: Do not damage the ball joint boot when installing the special tool.**

   NOTE: Clean and inspect the ball joint bore for bore damage before installing a new ball joint.

   Using the special tool, install the ball joint.



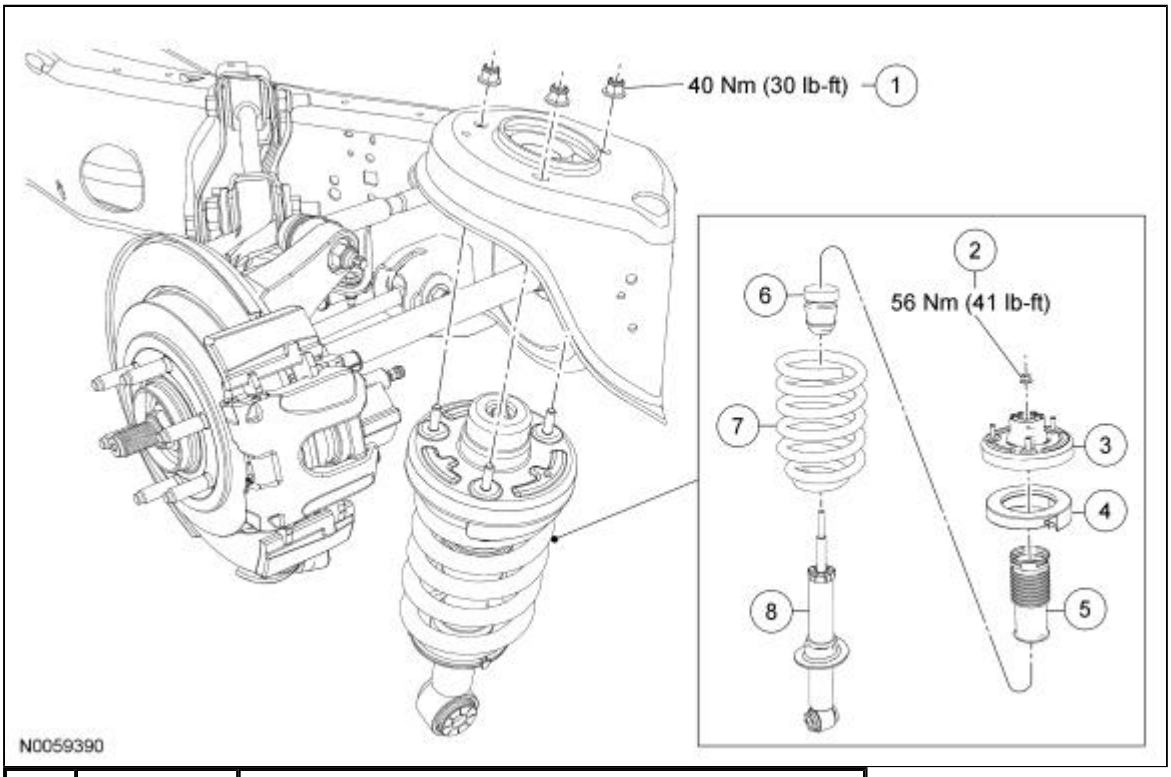
2. **NOTE:** Always use a new ball joint snap ring.

   Install a new snap ring.

3. Install the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.

Shock Absorber and Spring Assembly

Printable View (241 KB)



Item	Part Number	Description
1	—	Shock absorber upper mount nut (3 required) (part of 18080 kit)
2	—	Shock rod nut (part of 18080 kit)
3	18A099	Upper mount
4	5536	Insulator
5	18A047	Dust boot
6	—	Jounce bumper (part of 18080 kit)
7	5534	Spring
8	18080	Shock absorber

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the lower arm. For additional information, refer to Lower Arm in this section.
2. Remove and discard the upper mount nuts.

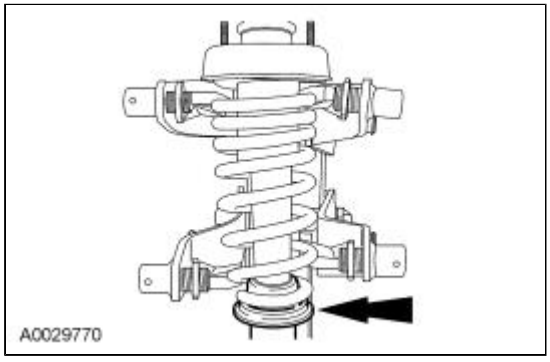
- To install, tighten to 40 Nm (30 lb-ft).

3. Remove the shock absorber and spring assembly.

4. **NOTE:** If the individual spring and/or shock components are not being serviced, continue with Step 7.

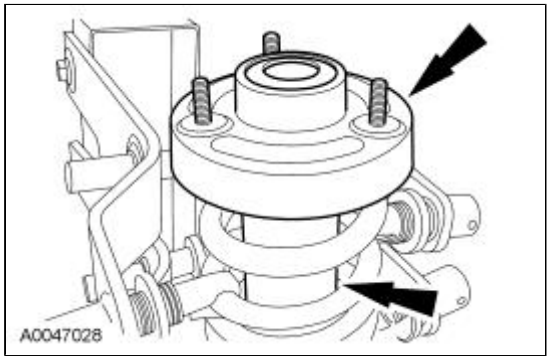
   NOTE: For reference during assembly, index the upper mount, spring and shock absorber.

   Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.



5. While holding the shock rod, remove the nut and washer.
   - Remove the shock absorber.
   - Discard the nut.
   - To install, tighten to 56 Nm (41 lb-ft).

6. Remove the upper mount, dust boot and insulator.



7. To install, reverse the removal procedure.

Printable View (80 KB)

General Specifications

Item	Specification
Lubricants	
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Wheel and Tire Cleaner ZC-37-A or B	—

General Specifications

Item	Specification
Wheel Balance Weight	
Maximum balance weight per wheel flange	170 g (6 oz)
Wheel rim runout (maximum radial or lateral)	1.12 mm (0.044 in)
Tire Inflation	
Tires	See safety certification sticker located on driver door or door pillar.

CAUTION:Use only special tool 204-354 anytime tire pressures are measured to be sure that accurate values are obtained.
For accuracy, Ford recommends the use of a digital or dial-type tire pressure gauge rather than a stick-type pressure gauge.

Inflate the tire to the pressure specified on the safety certification sticker located on the driver door or door pillar.

Torque Specifications

Description	Nm	lb-ft	lb-in
Sensor strap (worm gear)	3	—	27
Wheel nuts	204	150	—

Wheels And Tires

Printable View (86 KB)

WARNING: Do not mix different types of tires on the same vehicle such as radial, bias or bias-belted tires except in emergencies (temporary spare usage), because vehicle handling may be seriously affected and may result in loss of control. Failure to follow these instructions may result in personal injury.

Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

To equalize tire wear, the tires should be rotated at recommended intervals.

Safety Precautions

WARNING: Never run the engine with one wheel off the ground, for example, when changing a tire. The wheel(s) resting on the ground could cause the vehicle to move. Failure to follow these instructions may result in personal injury.

WARNING: The tire and wheel must always be correctly matched. It is very important to determine the size of each component before any assembly operations commence. Failure to adhere to these instructions can result in an explosive separation and cause serious bodily injury or death.

WARNING: Aftermarket aerosol tire sealants are extremely flammable. Always question the customer to make sure these products have not been used. Failure to follow these instructions may result in personal injury.

WARNING: Aftermarket wheel assemblies may not be compatible with the vehicle. Use of incompatible wheel assemblies can result in equipment failure and possible injury. Use only approved wheel assemblies. Failure to follow these instructions may result in personal injury.

WARNING: Use only wheels and wheel nuts that have been designed for current model Ford trucks. Aftermarket wheels or wheel nuts may not fit or function correctly. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety goggles or a face shield when performing any work with the tire and wheel assemblies. Failure to follow these instructions may result in personal injury.

CAUTION: Reduce the air pressure as much as possible by pushing the valve core plunger in prior to removing the valve core. Avoid working in a position in which the face or body is directly over a tire in which there is pressure.

CAUTION: Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents. Use Wheel and Tire Cleaner ZC-37-A or -B or equivalent.

When carrying out any inspection or repair procedures on wheels and tires, follow the preceding safety precautions.

Tire Pressure Monitoring System (TPMS)

The TPMS includes:

- the smart junction box (SJB), TPMS functionality is integrated within the SJB.
- four tire pressure sensors.
- four tire pressure sensor cradles.
- four tire pressure sensor straps.
- an instrument cluster indicator.
- a message center (if equipped).

TPMS System Module

The SJB contains the TPMS functionality. Refer to Tire Pressure Monitoring System in Diagnosis and Testing for TPMS fault diagnosis and repair.

The SJB compares the information of each tire pressure sensor transmission against a pressure limit. If the SJB determines that the tire pressure has fallen below the low limit, the SJB communicates this to the instrument cluster on the vehicle communication bus.

TPMS Pressure Sensor

The SJB monitors the air pressure in the 4 road tires with tire pressure sensors. The sensors transmit radio frequency (RF) signals to the SJB approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph).

The tire pressure sensors are battery operated and are mounted to metal brackets (called cradles) on the wheels inside the tires. The sensors are mounted 180 degrees from the valve stem.

The tire pressure sensor can be serviced separately from the cradle and the strap.

TPMS Pressure Sensor Cradle

The tire pressure sensor cradles are mounted to the wheels with metal straps and have an adhesive strip to aid in their retention to the wheel.

To service the sensor cradle, the strap must also be removed.

TPMS Pressure Sensor Strap

The sensor strap is what keeps the sensor and the cradle retained to the wheel. A factory-installed strap is joined together with a one-time use buckle and a dealer-installed strap is joined together with a worm gear (similar to a radiator hose clamp). Both straps should be discarded after removal and should not be re-used.

The strap can be serviced separately from the sensor and the cradle. The sensor is available separately from the cradle and the strap. The cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter, all strap kits share the same base part number.

Instrument Cluster and Message Center

The instrument cluster illuminates the TPMS indicator when it receives a message from the SJB to do so and displays the appropriate message(s) in the message center (if equipped).

The instrument cluster and message center are diagnosed and serviced in their own respective workshop manual sections.

Wheels And Tires

Printable View (310 KB)

Special Tool(s)

ST2869-A	Digital Tire Gauge 204-354

Inspection and Verification

WARNING: A vehicle equipped with a Traction-Lok® differential will always have both wheels driving. If, while the vehicle is being serviced, only one wheel is raised off the ground and the rear axle is driven by the engine, the wheel on the ground could drive the vehicle off the stand or jack. Be sure both rear wheels are off the ground. Failure to follow these instructions may result in personal injury.

WARNING: Never run the engine with one wheel off the ground, for example, when changing a tire. The wheel(s) resting on the ground could cause the vehicle to move. Failure to follow these instructions may result in personal injury.

WARNING: Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration or differential failure could result, causing personal injury and extensive component damage. Use off-vehicle wheel and tire balancer only. Failure to follow these instructions may result in personal injury.

Be sure to follow all warnings when carrying out Inspection and Verification.

Road Test

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, refer to Section 100-04 .

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.

- tire construction type.

The use of any other tire size or type can seriously affect:

- ride.
- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- brake cooling.

New wheels need to be installed when the vehicle's wheels:

- are bent.
- are cracked.
- are dented.
- are heavily corroded.
- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect the tires for signs of uneven wear. Refer to the following descriptions to identify the type of wear and the Symptom Chart for the appropriate repair action to be carried out.

2. Check the tires for:
    - cuts.
    - stone bruises.
    - abrasions.
    - blisters.
    - embedded objects.

3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become visible.

Tire Wear

Tire wear is commonly defined as a loss of tread depth. Tire tread wear occurs due to friction with the contact surface (road/pavement). The tread should wear down uniformly all the way around the circumference of the tire and all the way across the tread face. When this does not occur, the tire may have abnormal/incorrect wear.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire, etc.) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates performance-related issues.

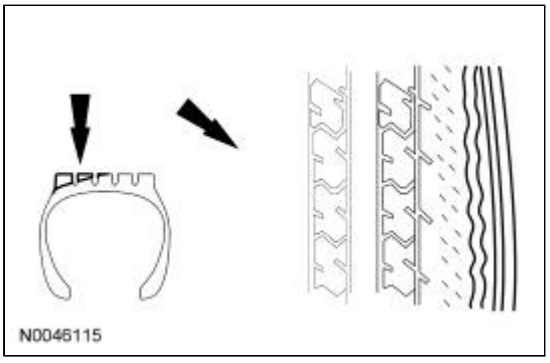
Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive, passive), climate (hot, cold), road conditions, vehicle loading and maintenance. It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than 1.58 mm (2/32 in.) and the tire is not causing a vehicle performance (noise/vibration) concern

Some abnormal/incorrect wear patterns look the same all the way around the tread of the tire, other wear patterns are not consistent and can occur in various spots on the tread area. The underlying causes of the 6 wear categories are different. Refer to the following descriptions to identify the type of wear and the Symptom Chart for the appropriate repair action to be carried out.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe-out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, you may need to measure the tread depth of each rib and compare it to that of the shoulder.

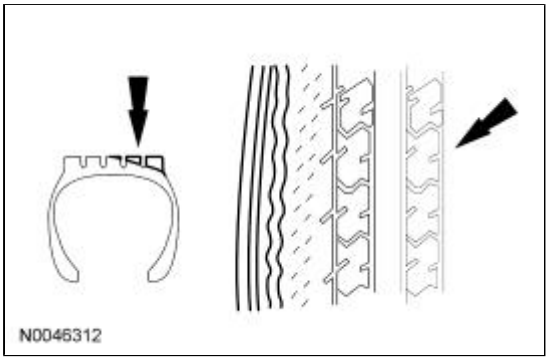
NOTE: RF tire shown, others similar.



Outer Edge/Shoulder Wear

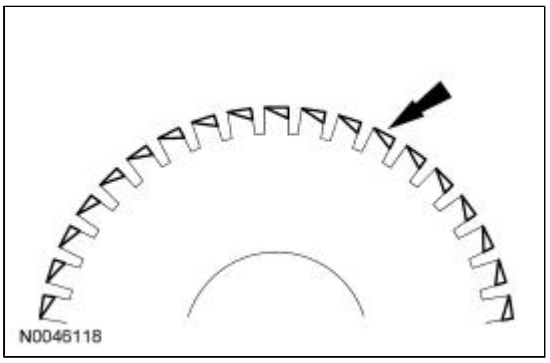
Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe-in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, you may need to measure the tread depth of each rib and compare it to that of the shoulder.

NOTE: RF tire shown, others similar.



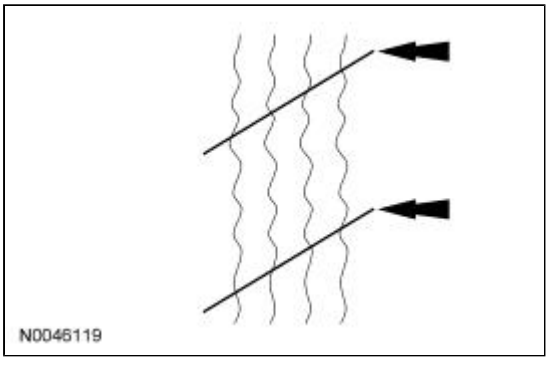
Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, you may need to measure the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib.



Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, you may need to measure the difference in tread depth along the diagonal wear pattern.



Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Inner edge/shoulder wear	• Excessive toe-out and/or negative camber	• Go To Pinpoint Test A .
	• Incorrect wheel and tire assembly rotation intervals	• Go To Pinpoint Test A .
	• High-speed cornering	• Go To Pinpoint Test A .
• Outer edge/shoulder wear	• Excessive toe-in and/or positive camber	• Go To Pinpoint Test B .
	• Incorrect wheel and tire assembly rotation intervals	• Go To Pinpoint Test B .
	• High-speed cornering	• Go To Pinpoint Test B .
• Heel/toe wear	• Excessive toe-in/out	• ROTATE the wheel and

	• Incorrect wheel and tire assembly rotation intervals	tire assemblies. CHECK the alignment, ADJUST as necessary.
• Diagonal wear	• Excessive toe-in/out • Incorrect tire rotation intervals • Loose, worn or damaged suspension components	• Go To Pinpoint Test C . • Go To Pinpoint Test C . • REFER to Section 204-00 .
• Wobble or shimmy	• Damaged wheel bearings • Loose or damaged suspension components • Bent wheel • Damaged tire • Loose wheel nuts	• REFER to Section 204-00 . • INSTALL a new wheel as necessary. • INSTALL a new tire as necessary. • TIGHTEN to specification.
• High-speed shake	• Tires/wheels • Wheel hub face/pilot/bolt circle runout • Wheel bearings • Suspension/steering linkage • Engine • Transmission • Brake discs/imbalance	• REFER to Wheel and Tire Runout Component Test in this section • REFER to Section 100-04 .
• Vehicle vibration	• Tires/wheels	• REFER to Wheel and Tire Runout Component Test in this section
• Vehicle vibration	• Driveline — engine	• REFER to Section 100-04 .

Pinpoint Tests

For a description of the various tire wear patterns, refer to Inspection and Verification.

Pinpoint Test A: Inner Edge/Shoulder Wear

Possible Causes

- Excessive toe-out
- Incorrect wheel and tire rotation

PINPOINT TEST A: INNER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
A1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the inside	**Yes** ROTATE the wheel and tire assemblies.

edge/shoulder tread depth. • **Is the tread depth greater than 1.58 mm (2/32 in)?**	CHECK and ADJUST the toe to nominal +0.15° (toe-in). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test B: Outer Edge/Shoulder Wear

Possible Causes

- Excessive toe-in
- Incorrect wheel and tire rotation

PINPOINT TEST B: OUTER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
B1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the outside edge/shoulder tread depth. • **Is the tread depth greater than 1.58 mm (2/32 in)?**	**Yes** ROTATE the wheel and tire assemblies. CHECK and ADJUST the toe to nominal -0.15° (toe-out). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test C: Diagonal Wear

Possible Causes

- Incorrect wheel and tire rotation
- Excessive toe-in/out
- Incorrect tire inflation
- Loose, worn or damaged suspension components

PINPOINT TEST C: DIAGONAL WEAR

Test Step	Result / Action to Take
C1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the tread depth of the	**Yes** If no performance concerns (noise/vibration) are

wear pattern. • **Is the tread depth greater than 1.58 mm (2/32 in)?**	present, the tire can remain in service. CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 .

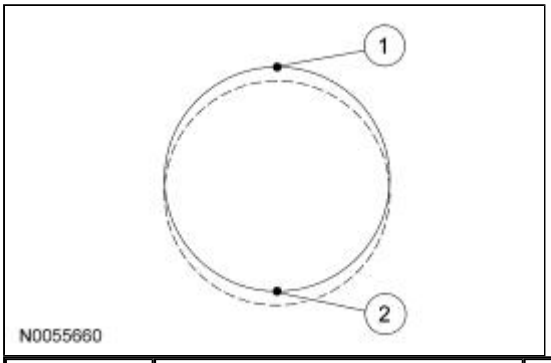
Component Tests

Wheel and Tire Runout

Some vehicles may exhibit a wheel and tire vibration caused by excessive runout. Runout measurements of the wheel and tire assembly can be taken both on and off the vehicle. Runout measurements can be taken both radially and laterally using a runout gauge. The runout gauge is a delicate, precision instrument and should be handled as such. The runout gauge should be mounted on a heavy solid base to eliminate gauge movement when measuring runouts. The measurements are taken using a runout gauge, which defines total runout in 64th or thousandths of an inch (depending on the brand of gauge used) and locates the high and low points of the runout.

Radial Runout

Radial runout is the egg-shaped deviation from a perfect circle and is measured perpendicular on a circumference. On a wheel and tire assembly this usually means measuring the center tire tread rib, although other tread ribs can be measured as well. The center rib is usually a solid rib, easy to measure and normally indicative of the condition of the tire as a whole. It is important to keep in mind that any rib with excessive runout can cause a concern. Total runout is the reading from the gauge. The high spot is the location of maximum runout.



Item	Part Number	Description
1	—	High spot
2	—	Low spot

NOTE: Warm up the tires prior to taking any measurements, this will eliminate slight flat spotting. This is done during a road test.

1. **CAUTION: Use only special tool 204-354, any time tire pressures are measured, to be sure that accurate values are obtained.**

   CAUTION: Place the air chuck straight on the valve stem to inflate the tire. Do not cock the air chuck during the inflation cycle. Doing so can damage the valve stem and cause air leaks.

   CAUTION: Ford Motor Company suggests using a round head air chuck on tire pressure sensors; it is not recommended to use air chucks with long shanks. Doing so can cause tire pressure sensor valve stem damage and loss of tire pressure.

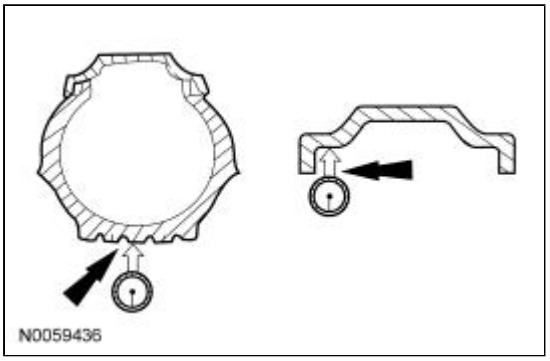
   Make sure that the tire pressures are set to the correct pressure as indicated on the vehicle label.

2. With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-04 .

3. Make sure that all 4 positions can be measured. If measurements are to be taken with the wheel and tire assembly off the vehicle, mount each assembly on a suitable dynamic balancing machine.

4. For future reference of the original wheel and tire assemblies position on the wheel hub, index-mark the wheel and a wheel stud.

5. Position the runout gauge to take a radial measurement.
   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.
   - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the runout gauge dial returns to a 0 reading.

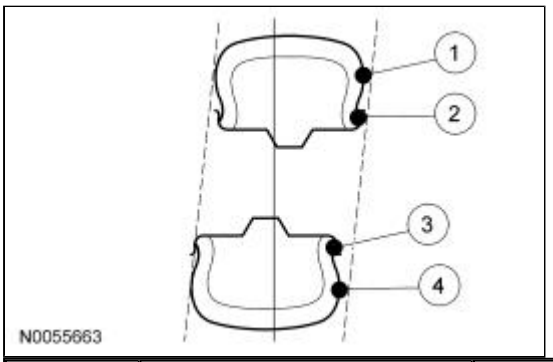


6. **NOTE:** If there is a vast difference in measurements taken from a wheel and tire assembly checked (on the vehicle) compared to readings taken (off the vehicle), check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.

   While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the radial runout.
   - Note the variance (runout) from 0 on the dial of the gauge.
   - If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting Step 1 to correct the concern.
   - If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

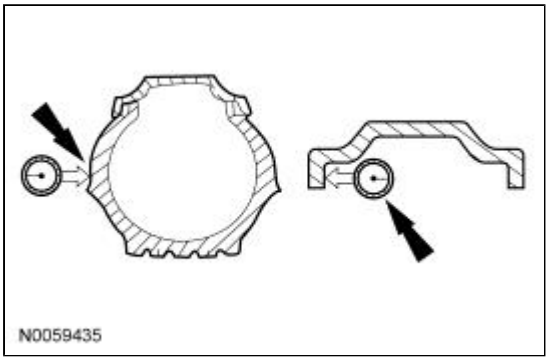
Lateral Runout

Lateral runout is a sideways variation causing a twist or wobble and is measured on a side surface. On the wheel and tire assembly, the lateral runout measurement should be taken as close to the tread shoulder as possible. Total runout is the reading from the gauge.



Item	Part Number	Description
1	—	Tire high spot
2	—	Wheel high spot
3	—	Tire low spot
4	—	Wheel low spot

1. Position the runout gauge to take a lateral measurement.
   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.
   - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the dial returns to a 0 reading.



2. **NOTE:** If there is a vast difference in measurements taken from a wheel and tire assembly checked (on the vehicle) compared to readings taken (off the vehicle), check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.

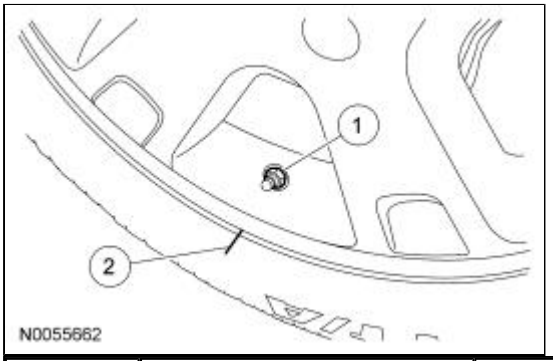
   While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the lateral runout.
   - Note the variance (runout) from 0 on the dial of the gauge.
   - If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting Step 1 to correct the concern.
   - If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

Match Mounting

Match mounting is a technique used to reduce radial and lateral runouts on wheel and tire assemblies. Excessive runout is a source of ride quality complaints and match mounting can be used to minimize the runout. Match mounting can be accomplished by changing the position of the tire on the wheel or by changing the position of the wheel and tire assembly on the hub.

1. Remove the wheel and tire assembly. Refer to Wheel and Tire in this section.

2. Position the wheel and tire assembly on a suitable tire machine and put a reference mark on the tire sidewall at the valve stem position.



Item	Part Number	Description
1	—	Valve stem
2	—	Reference mark

3. **CAUTION: For tires equipped with a tire pressure monitoring system (TPMS), the sensor, cradle and strap can be damaged by incorrect tire mounting or dismounting. Dismount the tire from the wheel as instructed in the Disassembly and Assembly procedure. Failure to follow these instructions can result in TPMS component damage.**

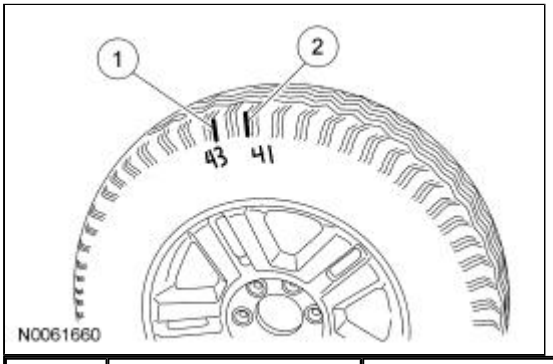
   Using a suitable tire machine, break the tire down from the wheel.

- Position the tire 180 degrees (half-way around) on the rim so the tire reference mark made in Step 2 is opposite the valve stem.

4. Re-inflate the wheel and tire assembly to the specified air pressure and measure the assembly runout again. Mark the second high spot on the tire.
   - If the runout is reduced to within specifications, the problem has been solved.

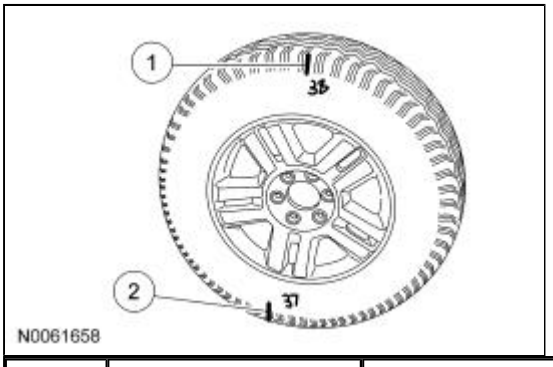
5. If the second runout measurement is still not within specification and both measurements are close to each other (within 101.6 mm [4 in]), the root cause is probably the tire.
   - **NOTE:** To be **SURE** that the tire is causing the high runout, you must have 2 runout measurements that are not within specification and the high spots must be in approximately the same location on the tire's sidewall. In other words, the high spot followed the tire when it was repositioned 180 degrees on the wheel.

     If the second high spot is not within 101.6 mm (4 in) of the first high spot, proceed to the next step.



Item	Part Number	Description
1	—	First high spot on the tire
2	—	Second high spot on the tire

6. If the second high spot is still above specification and is within 101.6 mm (4 in) of being opposite the first high spot on the wheel, the root cause is probably the wheel (the high spot followed the wheel). Dismount the tire from the wheel, mount the wheel on a balancer and check the wheel runout. Install a new wheel if the wheel runout exceeds 1.27 mm (0.050 in).



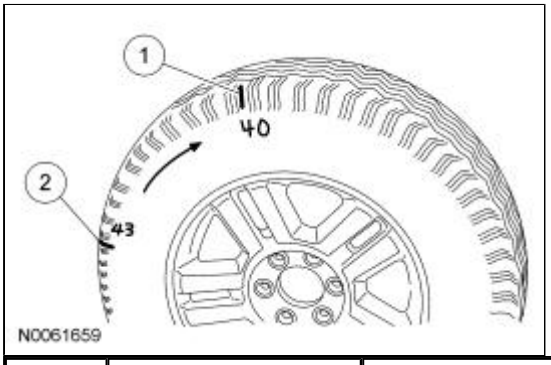
Item	Part Number	Description
1	—	First high spot on the tire
2	—	Second high spot on the tire

7. **NOTE:** If the second high spot did not follow the wheel or the tire and the runout is still not within specification, you may make improvements by rotating the tire 90 degrees (1/4 of a turn).

   Draw an arrow on the tire sidewall from the second high spot towards the first high spot (in the

shortest direction).

- Rotate the tire 90 degrees (1/4 of a turn) in the direction of the arrow.



Item	Part Number	Description
1	—	First high spot on the tire
2	—	Second high spot on the tire

8. Install the wheel and tire assembly. Refer to Wheel and Tire in this section.
    - Align the wheel and tire assembly using the index mark made on the wheel and wheel stud during removal.

Tire Pressure Monitoring System

Printable View (269 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2869-A	Digital Tire Gauge 204-354

Principles of Operation

The tire pressure monitoring system (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency (RF) signals, to the smart junction box (SJB). TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

The system is not affected by wheel and tire rotation.

Ambient Temperature Change and Tire Pressure

CAUTION: Do not inflate tire higher than maximum pressure stamped on tire sidewall.

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the tire pressure monitoring system (TPMS) and activate the TPMS warning lamp.

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified vehicle certification label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70˚F. Max Pressure Adjustment is 7 psi.

Outside Temperature (˚F)	Tire Placard Pressure (PSI)																	
	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21˚C. Max Pressure Adjustment is 50 kPa.

Outside Temperature (˚C)	Tire Placard Pressure (kPa)																	
	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1]When Outside (Ambient) Temperature is greater than 21˚C (70˚F), Inflate tires to placard pressure.
[1]Use the table to adjust tire pressure for P-metric and LT tires only.
[1]Do NOT use table for Commercial Truck Tires (i.e. 19.5 inch tires for F450 & F550). See F-Super Duty Service Manual for tire inflation procedure.

N0057700

TPMS Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

TPMS Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

1. The TPMS indicator remains on continuously for the following condition:
    - Low Tire Pressure — The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the

recommended cold pressure as indicated on the vehicle certification label.

2. **NOTE:** The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

   If the vehicle has been stationary for more than 30 minutes, perform the following procedure to wake up the TPMS sensors.
   1. Turn the ignition switch to the ON position.
   2. Adjust the air pressure in the LF tire (as necessary).
   3. Activate the LF TPMS sensor, at least 2 times, using the tire pressure monitor activation tool.
   4. Repeat Steps 2 and 3 for the remaining tires.
   5. If the TPMS indicator remains illuminated after adjusting and activating each sensor, GO to Symptom Chart .

TPMS Indicator Flashes

The TPMS indicator flashes for 70 seconds, then remains ON solid when the ignition switch is turned to the ON position, for the following conditions:

1. Tire Pressure Sensor Fault — If equipped, the message center will display TPMS SENSOR FAULT when a tire pressure sensor is malfunctioning. GO to Symptom Chart .

2. No communication with the SJB (TPMS is integral to the SJB) — The TPMS indicator is illuminated when the instrument cluster has received no signals from the SJB for more than 5 seconds. If equipped, the message center displays TPMS MONITOR FAULT. GO to Symptom Chart .

3. Tire Pressure Monitor Fault — If equipped, the message center will display TPMS MONITOR FAULT when the tire pressure monitoring system is malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart .

Inspection and Verification

1. **NOTE:** The tire pressure sensors are not designed to be used with aftermarket wheels.

   NOTE: The use of run-flat tires (tires with steel body cord plies in the tire sidewall) where not originally equipped, may cause the TPMS system to malfunction and is therefore not recommended.

   Verify the customer concern by inspecting the vehicle and observing the message center (if equipped) and the TPMS indicator.

2. **NOTE:** The valve-mounted TPMS sensors and the strap-mounted TPMS sensors are not compatible. Swapping wheels from one vehicle to another with the different systems will set a TPMS fault.

   NOTE: Swapping wheels between vehicles with the same tire pressure monitoring system will cause a TPMS fault to be set if the sensors are not trained. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

   NOTE: Non-original equipment manufacturer (OEM) modifications made to the vehicle may result in false TPMS warnings.

Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
• Low tire pressure • TPMS sensor damaged or missing • Spare tire installed as a road wheel • Incorrect TPMS sensor installed • TPMS sensor installed incorrectly • Non-OEM wheels installed (aftermarket rims) • Non-OEM equipped run-flat tires installed • Other non-OEM modifications (roll cages, service barriers, part racks, ladder racks)	• Circuitry • Electrical connectors • SJB missing or damaged • Aftermarket electronic accessories

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the tire pressure monitoring system (TPMS) module.

9. If the DTCs retrieved are related to the concern, go to the Tire Pressure Monitoring System (TPMS) Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Tire Pressure Monitor System (TPMS) Diagnostic Trouble Code (DTC) Chart

Tire Pressure Monitor System (TPMS) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B106A	Pressure Sensor Range Bit Incorrect State	SJB	Go To Pinpoint Test H .
B2477	Module Configuration Failure/Mismatch	SJB	DTC B2477 is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. Make sure the SJB is configured correctly. If DTC B2477 is still present, REFER to Section 418-00 .
B2868	Left Front Tire Pressure Sensor Fault	SJB	DTC B2868 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2869	Right Front Tire Pressure Sensor Fault	SJB	DTC B2869 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2870	Right Rear Tire Pressure Sensor Fault	SJB	DTC B2870 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2871	Left Rear Tire Pressure Sensor Fault	SJB	DTC B2871 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2872	Tire Pressure Sensor Fault	SJB	**NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). POSITION the tire pressure monitor activation tool against the LH tire sidewall 180 degrees from the tire valve stem. PRESS the test button on the activation tool. The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor. REPEAT this procedure for the remaining 3 sensors. Go To Pinpoint Test G .
B287A	Tire Pressure System Fault	SJB	Go To Pinpoint Test G .
C2780	ECU in Manufacturing Mode	SJB	DTC C2780 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
U0155	Lost Communication with Instrument Cluster	SJB	REFER to Section 418-00 to diagnose the no communication problem.

Symptom Chart

NOTE: The tire pressure monitoring system (TPMS) is not affected by wheel and tire rotation.

Failure of a TPMS component may not cause the message center to display a fault message or a DTC

to be stored. The Symptom Chart is a starting point to begin diagnosis of these concerns.

Symptom Chart

Condition	Possible Sources	Action
• TPMS indicator ON continuously and message center (if equipped) displays LOW TIRE PRESSURE	• Spare tire currently in use • Air pressure not set to specifications listed on the vehicle certification label	• INSTALL the repaired road wheel/tire in place of the spare tire. • Go To Pinpoint Test E .
• SJB will not enter sensor training mode when using the TPMS sensor training procedure	• Brake on/off (BOO) switch • Ignition switch • Vehicle communication bus • Smart junction box (SJB)	• Go To Pinpoint Test F .
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position and DTC B2872 is present	• TPMS sensor(s) • TPMS sensor(s) not trained to the SJB • SJB	• **NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). POSITION the tire pressure monitor activation tool against the LH tire sidewall 180 degrees from the tire valve stem. PRESS the test button on the activation tool. The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor. REPEAT this procedure for the remaining 3 sensors. Go To Pinpoint Test G .
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE MONITOR FAULT and DTC B287A is present	• All TPMS sensors not trained to the SJB or all TPMS sensors are not installed	• **NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). POSITION the tire pressure monitor activation tool against

		the LH tire sidewall 180 degrees from the tire valve stem. PRESS the test button on the activation tool. The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor. REPEAT this procedure for the remaining 3 sensors. Go To Pinpoint Test G .
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE MONITOR FAULT and there are no DTCs present	• Vehicle communication issue between the SJB and the instrument cluster • SJB	• REFER to Section 418-00 to diagnose the no communication concern. • REFER to Section 419-10 to diagnose the SJB.
• One or more sensors will not train	• Tire pressure sensor(s) • Vehicle communication issue • SJB	• RETRIEVE and RECORD DTCs. REFER to Tire Pressure Monitor System (TPMS) Diagnostic Trouble Code (DTC) Chart.

Pinpoint Tests

Pinpoint Test E: TPMS Indicator ON Continuously And Message Center (If Equipped) Displays LOW TIRE PRESSURE

Normal Operation

The tire pressure monitoring system (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency (RF) signals, to the smart junction box (SJB). TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function (integral to the SJB) compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

Possible Causes

- Low air pressure in tire(s)
- Tire pressure sensor(s)

PINPOINT TEST E: TPMS INDICATOR ON CONTINUOUSLY AND MESSAGE CENTER (IF EQUIPPED) DISPLAYS LOW TIRE PRESSURE

CAUTION: Use only special tool 204-354 any time tire pressures are measured to be sure that accurate values are obtained.

NOTE: If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.

Test Step	Result / Action to Take
E1 CHECK THE TIRE PRESSURE	
• Measure and record the air pressure in all 4 road tires. • Adjust the air pressure for those found to be below the specification listed on the vehicle certification label. • **NOTE:** If the vehicle has been stationary for more than 30 minutes, activate each TPMS sensor at least 2 times with the tire pressure monitor activation tool. The TPMS sensor does not transmit when the vehicle is stationary. • Verify system operation. • **Have the TPMS indicator and the message center (if equipped) warnings gone out?**	**Yes** The system is functioning normally, diagnosis is complete. INFORM the customer of correct tire pressure maintenance as instructed in the scheduled maintenance guide and the owner guide. **No** GO to E2 .
E2 CHECK THE SYSTEM COMPONENTS	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • Using the scan tool, read and record the tire pressures: LF_PRES, RF_PRES, RR_PRES and LR_PRES. • Compare the air pressure readings recorded from the function test to those recorded in A1. • **Do the compared tire pressure values match within ±5 psi, and have the TPMS indicator and the message center (if equipped) warnings gone out?**	**Yes** The system is functioning normally, diagnosis complete. **No** **Before installing a new sensor(s):** If a sensor(s) does not respond to the special tool, ATTEMPT to activate the same sensor(s) with the special tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least 1/4 of a turn and ATTEMPT to activate the same sensor(s) again. INSTALL new tire pressure sensors for those with discrepancies. REFER to Tire Pressure Monitoring System (TPMS) Sensor in this section.

Pinpoint Test F: SJB Will Not Enter Sensor Training Mode

Normal Operation

For the smart junction box (SJB) to enter tire pressure monitoring system (TPMS) sensor training mode, the SJB must receive valid inputs from the brake pedal position switch (OFF-ON-OFF) and ignition switch (both OFF and RUN), and it must receive valid vehicle speed sensor input (0 km/h [0 mph]). Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section for the complete sensor training procedure.

Possible Causes

- Circuit open
- Circuit shorted
- Brake on/off (BOO) switch
- Ignition switch
- Smart junction box (SJB)

PINPOINT TEST F: SJB WILL NOT ENTER SENSOR TRAINING MODE

Test Step	Result / Action to Take
F1 CHECK THE BRAKE PEDAL POSITION (BPP)/BRAKE ON/OFF (BOO) SWITCH	
• Using the scan tool, monitor the SJB BPP/BOO switch PID (SJB reads the brake switch directly). • Press and release the brake pedal while monitoring the PID. • **Do the brake pedal PID values match the brake pedal positions?**	**Yes** GO to F2 . **No** REFER to Section 417-01 to continue diagnosis of the brake pedal switch.
F2 CHECK THE IGNITION SWITCH	
• Using the scan tool, monitor the SJB ignition switch status PID. • Cycle the ignition switch to the ON and OFF position while monitoring the PID (SJB reads the ignition switch directly). • **Do the ignition switch status PID values match the ignition switch positions?**	**Yes** GO to F3 . **No** REFER to Section 211-05 to continue diagnosis of the ignition switch.
F3 CHECK THE VEHICLE SPEED INPUT TO THE SJB	
• Using the scan tool, monitor the SJB vehicle speed PID (SJB receives vehicle speed from the powertrain control module [PCM]). • **Does the vehicle speed PID value match the speed of the vehicle?**	**Yes** GO to F4 . **No** REFER to Section 413-01 to diagnose the vehicle speed concern.
F4 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check the connectors for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the SJB connectors and make sure that they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: TPMS Indicator FLASHES For 70 Seconds And Then Remains ON Solid When The Ignition Key Is Turned To The ON Position And DTC B2872 or B287A are Present

Normal Operation

If there is a fault in the tire pressure monitoring system (TPMS), such as a damaged or missing sensor

(s), damaged module or a communication issue within the vehicle, DTCs are set in the smart junction box (SJB), the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

If the SJB does not get a response from all of the TPMS sensors, DTC B287A may be set and the message center (if equipped) will display TIRE PRESSURE MONITOR FAULT.

Possible Causes

- TPMS sensor(s) missing
- TPMS sensor(s) not trained to the vehicle
- TPMS sensor(s) swapped due to wheel swap
- TPMS sensor(s) damaged
- Vehicle communication issue
- SJB

PINPOINT TEST G: TPMS INDICATOR FLASHES FOR 70 SECONDS AND THEN REMAINS ON SOLID WHEN THE IGNITION KEY IS TURNED TO THE ON POSITION AND DTC B2872 OR B287A ARE PRESENT

NOTE: If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.

Test Step	Result / Action to Take
G1 CHECK FOR DTCs • Connect the scan tool. • Using the scan tool, read the TPMS sensor IDs currently trained to the SJB. • Using the scan tool, read the TPMS system status PID: TP_STAT. • **Is the TP_STAT PID equal to SENSOR FAULT?**	**Yes** GO to G2 . **No** If the TP_STAT PID is equal to SYSTEM FAULT, GO to G3 .
G2 CARRY OUT THE SENSOR TRAINING PROCEDURE • Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**	**Yes** Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB module. COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position (the system is not affected by tire rotation), any sensor IDs that do not match those retrieved from the module were changed but not retrained. The sensors are now trained to the vehicle, diagnosis is complete. DOCUMENT all TPMS sensor IDs on the applicable warranty claim. VERIFY system operation. **No** **Before installing a new sensor(s)** : If a sensor(s) does not respond to the special tool, ATTEMPT to activate the same sensor(s) with the special tool. If the sensor(s)

	still does not respond, MOVE the vehicle to rotate the wheels at least 1/4 of a turn and ATTEMPT to activate the same sensor(s) again. If the sensor(s) fail to train a second time, INSTALL a new tire pressure sensor(s). REFER to Tire Pressure Monitoring System (TPMS) Sensor .
G3 TP_STAT PID EQUALS SYSTEM FAULT WITH DTC B287A PRESENT • Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**	**Yes** Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB module. COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position (the system is not affected by tire rotation), any sensor IDs that do not match those retrieved from the module were changed, but not retrained. The sensors are now trained to the vehicle, diagnosis is complete. DOCUMENT all TPMS sensor IDs on the applicable warranty claim. VERIFY system operation. **No** **Before diagnosing the SJB** : If the sensors do not respond to the special tool, ATTEMPT to activate the same sensors with the special tool a second time. If the sensors still do not respond, MOVE the vehicle to rotate the wheels at least 1/4 of a turn and ATTEMPT to activate the same sensors again. **Note:** the sensors may not be present. DISMOUNT the tire, REFER to Wheel and Tire in this section. VERIFY that the sensors are present and mounted to the wheels. If missing, INSTALL new sensors. If the sensors are present but all 4 sensors failed to train the second time, GO to G4 .

G4 CHECK FOR CORRECT SJB OPERATION
 	
• Disconnect all the SJB electrical connectors.
• Check the connectors for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the SJB connectors and make sure that they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB module. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: DTC B106A — Pressure Sensor Range Bit Incorrect State

Normal Operation

This DTC may be encountered if a high-pressure sensor (designed for trucks with much higher tire

pressures and molded in green plastic) was installed. The SJB will only allow a low-pressure sensor to be trained using the TPMS sensor training procedure. Make sure the correct sensors are used to avoid compatibility issues.

Possible Causes

- Tire pressure sensor(s)
- Incorrect tire pressure sensor(s) installed
- SJB

PINPOINT TEST H: DTC B106A — PRESSURE SENSOR RANGE BIT INCORRECT STATE

Test Step	Result / Action to Take
H1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH AN INCORRECT SENSOR	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**	**Yes** CLEAR the DTCs. REPEAT the self-test. VERIFY system operation. **No** **Before installing a new sensor(s)** : If a sensor(s) does not respond to the special tool, ATTEMPT to activate the same sensor(s) with the special tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least 1/4 of a turn and ATTEMPT to activate the same sensor(s) again. If the sensor(s) fail to train a second time, INSTALL a new tire pressure sensor(s). REFER to Tire Pressure Monitoring System (TPMS) Sensor .

Tire Pressure Monitoring System (TPMS) Sensor Training

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Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2941-A	Activation Tool, Tire Pressure Monitor 204-363

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). Refer to TPMS Indicator Illuminates Continuously in the Principles of Operation portion of the Tire Pressure Monitoring System Diagnosis and Testing section.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency (RF) noise and at least 1 meter (3 feet) away from other vehicles equipped with TPMS.

RF noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

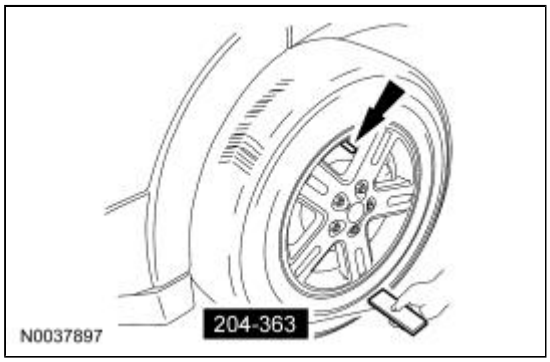
NOTE: The SJB has a 2 minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

NOTE: The tire pressure monitoring system is not affected by wheel and tire rotation.

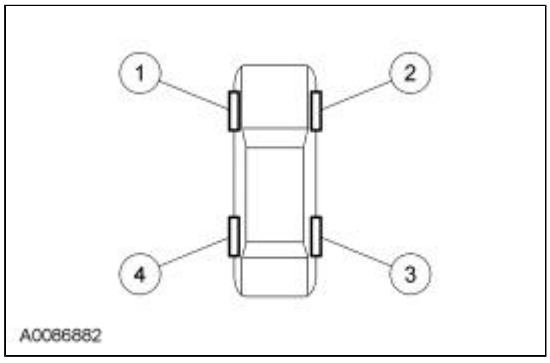
1. Turn the ignition switch to the OFF position, then press and release the brake pedal.
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
3. Press and release the brake pedal.
4. Turn the ignition switch to the OFF position.
5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
    - The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. **NOTE:** It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from the valve stem.

   Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the smart junction box (SJB).



7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and release the test button to train the RF tire pressure sensor.



8. **NOTE:** Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

   Repeat Step 7 for the RR and LR tires.
   The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.
   For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. **NOTE:** This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns with a newly programmed SJB.

    If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self-test.

Wheel and Tire

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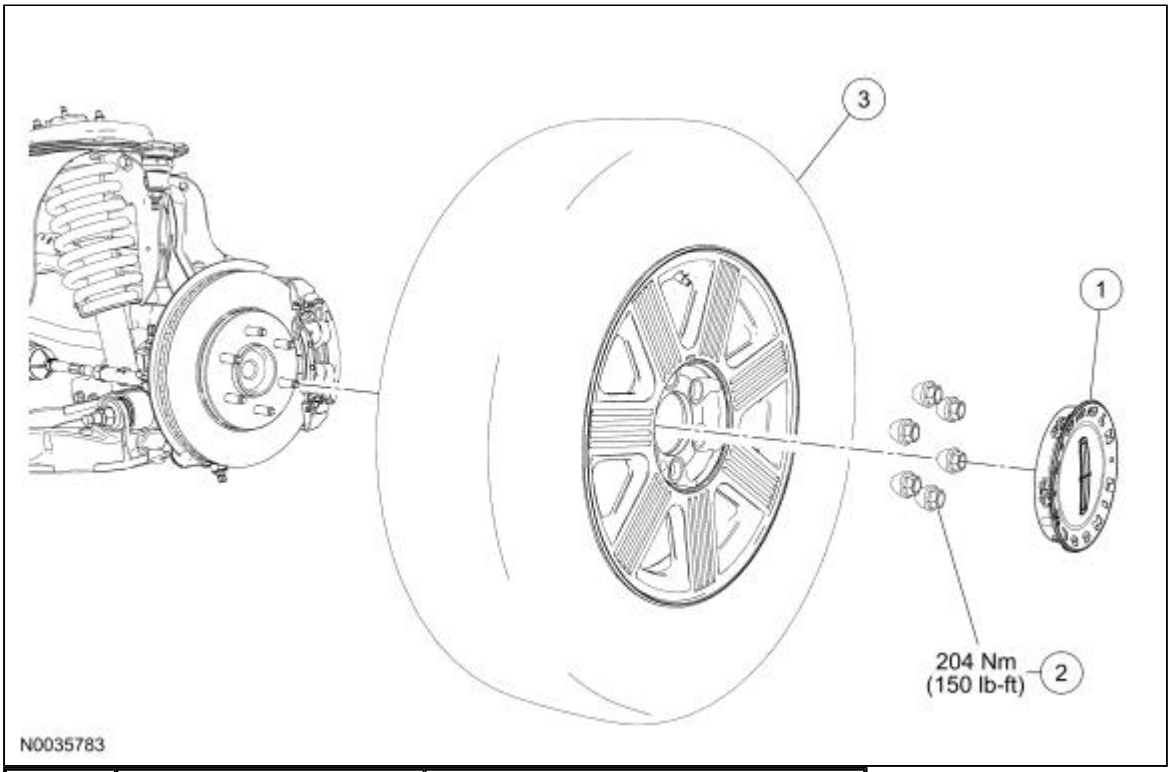
Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A



Item	Part Number	Description
1	1A096	Center cap
2	W706943/1012	Wheel nut (6 required)
3	1007/1508	Wheel/tire assembly

Removal

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the LH rear quarter trim panel. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

1. If equipped, turn the air suspension switch to the OFF position.

2. **NOTE:** To avoid damage or scratching to the center cap, place facing up when removed.

If equipped, remove the center cap.

3. **CAUTION: Do not use heat to loosen a seized wheel nut. Heat can damage the wheel and wheel bearings.**

   With the weight of the vehicle on the wheels, loosen the wheel nuts.

4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

5. Remove the wheel nuts and the wheel and tire assembly.

Installation

1. **WARNING: Before a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surfaces of the wheel or the surface of the wheel hub, brake drum or brake disc that contacts the wheel. Installing wheels without correct metal-to-metal contact at the wheel mounting surfaces can cause the wheel nuts to loosen and the wheel to come off while the vehicle is in motion, causing loss of control. Failure to follow these instructions may result in personal injury.**

   WARNING: Retighten the wheel nuts at 160 km (100 miles) after any wheel change or any time the wheel nuts are loosened. Failure to follow these instructions may result in personal injury.

   WARNING: Failure to retighten wheel nuts at the mileage specified can allow wheels to come off while the vehicle is in motion, possibly causing loss of vehicle control and collision. Failure to follow these instructions may result in personal injury.

   Clean the wheel-to-wheel hub mounting surface(s).

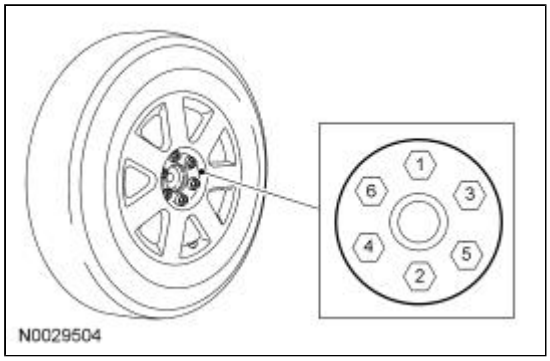
2. **CAUTION: Make sure to apply a thin coat of anti-seize lubricant only to the area of the wheel that contacts hub pilot surface. Do not allow the lubricant to make contact with the wheel studs, brake pads or brake disc.**

   Apply a thin coat of anti-seize lubricant to the wheel hub pilot surface.

3. Position the tire and wheel assembly and install the wheel nuts hand-tight, then lower the vehicle.

4. **CAUTION: Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder and vibration.**

   Tighten the wheel nuts, using the pattern indicated, to 204 Nm (150 lb-ft).



5. If removed, install the center cap.
6. If equipped, turn the air suspension switch to the ON position.

Wheel and Tire

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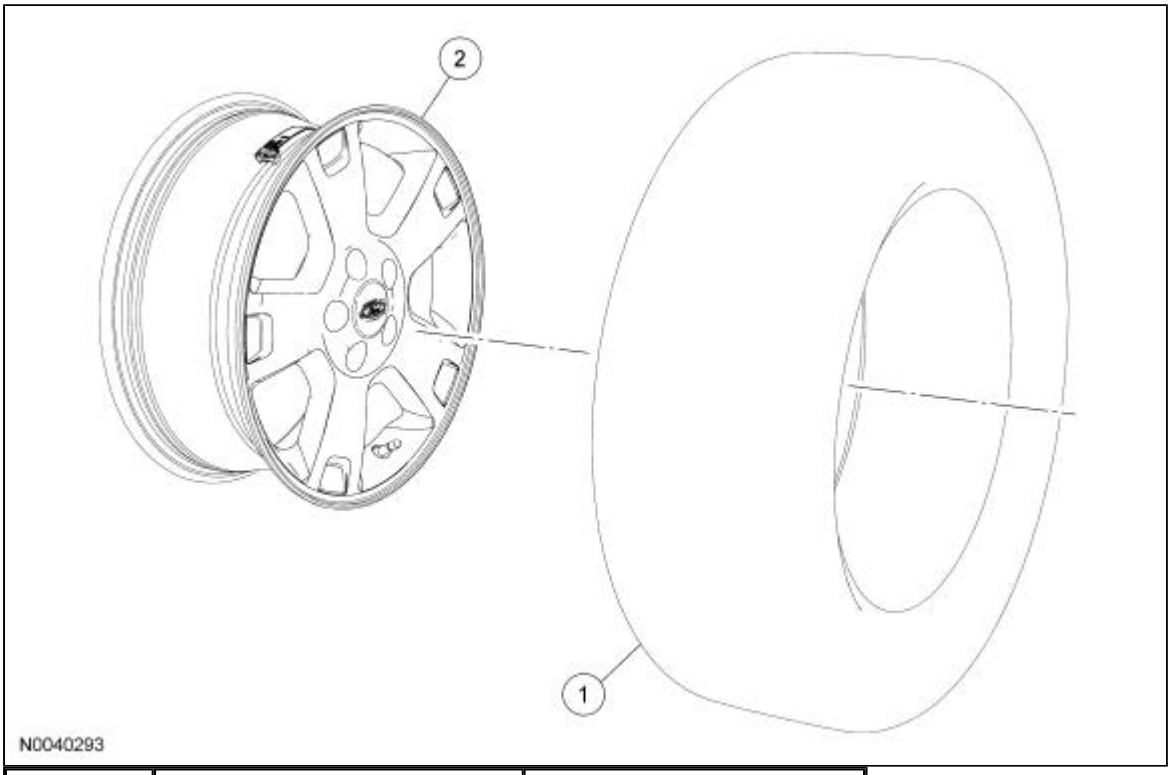
Special Tool(s)

ST2869-A	Digital Tire Gauge 204-354



Item	Part Number	Description
1	1508	Tire
2	1007	Wheel

Disassembly

CAUTION: Use only special tool 204-354 any time tire pressures are measured to be sure that accurate values are obtained.

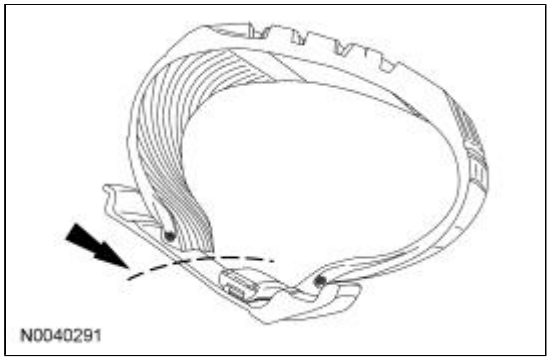
CAUTION: Failure to follow the instructions below may result in damage to the tire pressure monitoring system (TPMS) sensor.

NOTE: A wheel and tire assembly equipped with a TPMS sensor will have the following verbiage stamped or cast on the wheel: SENSOR MAY BE INSIDE.

NOTE: The TPMS sensor is mounted to the wheel 180 degrees opposite of the valve stem and is held in place by a stainless steel strap. The sensor is not mounted to the valve stem.

1. Remove the wheel and tire assembly. For additional information, refer to Wheel and Tire in this section.

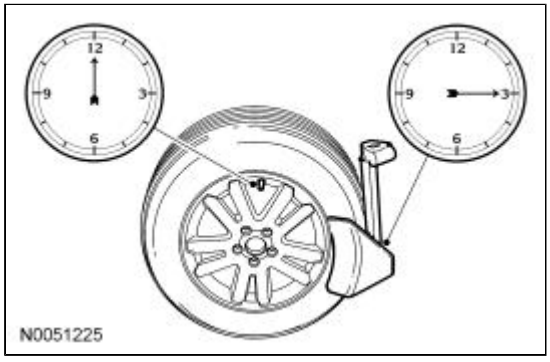
CAUTION: Do not allow the tire beads to move beyond the wheel mid-plane (middle of the wheel) when separating the beads from the wheels, damage to the TPMS sensor may occur.

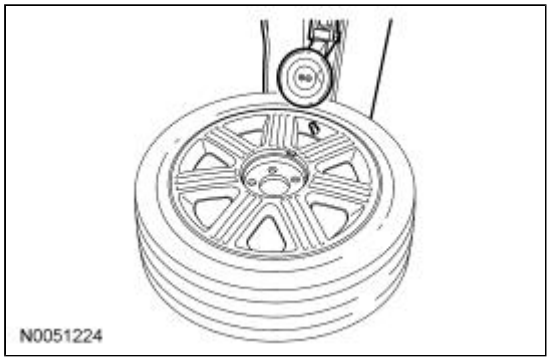


2. **CAUTION: Tire and valve stem position is critical to prevent damage to the TPMS sensor when using a paddle-type bead separator.**

   NOTE: Some machines may have a nylon roller bead separator at the 12 o'clock position instead of the paddle-type bead separator at the 3 o'clock position.

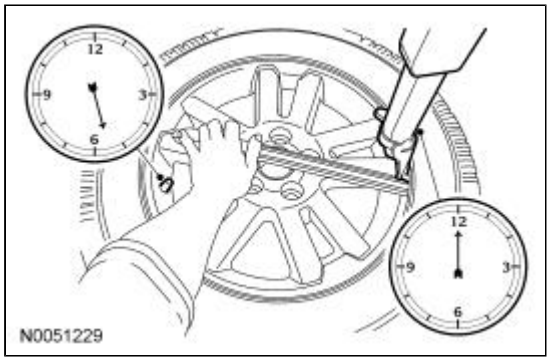
   Position the wheel and tire assembly on a suitable tire machine and separate both beads of the tire from the wheel.
   - For a paddle-type tire machine, position the valve stem at the 12 o'clock or 6 o'clock position and the paddle at the 3 o'clock position.
   - For a roller-type tire machine, align the valve stem with the roller at any position.



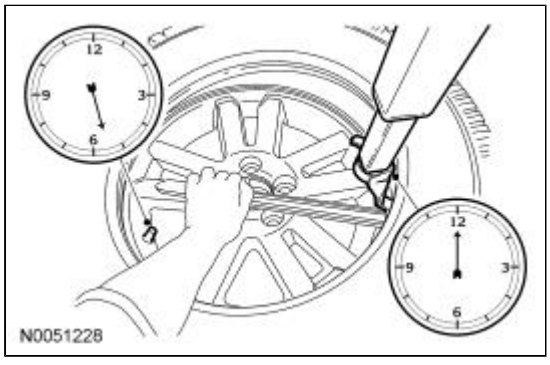


3. **NOTE:** Index-mark the valve stem and wheel weight positions on the tire.

   Place the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the outer bead from the wheel.



4. Reset the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the inner bead from the wheel.



5. Inspect the TPMS sensor, cradle and strap for damage, install new parts as necessary.
   - For information on removal and installation of the TPMS sensor, refer to Tire Pressure Monitoring System (TPMS) Sensor in this section.
   - When installing a new wheel, reuse the TPMS sensor from the previous wheel if possible. The TPMS will not have to be trained if the sensor is reused. The new wheel will not come with a sensor strap. A sensor strap kit will need to be ordered with the new wheel.

Assembly

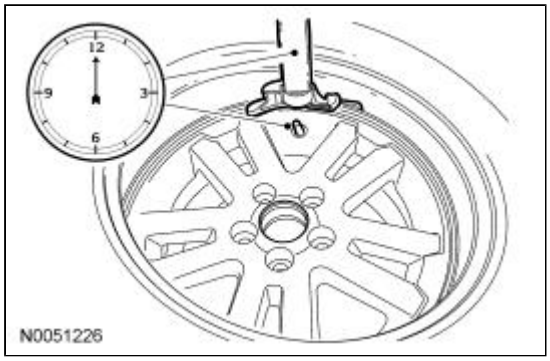
CAUTION: Damage to the TPMS sensor may result if the tire mounting is not carried out as instructed.

1. **CAUTION: Use only a soap and water solution to lubricate the tire. Use of anything other than soap and water may result in damage to the TPMS sensor.**

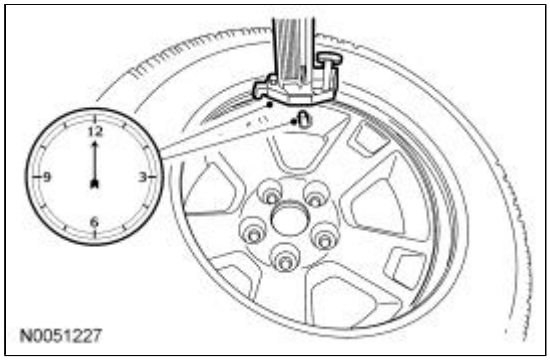
   CAUTION: Do not mount the tire at this time.

   Position the wheel on the turntable of the tire machine, then lubricate and position the inner bead of the tire on the wheel.

2. Position the wheel to align the valve stem with the machine arm, at the 12 o'clock position, and mount the bottom bead of the tire.



3. Reposition the wheel to align the valve stem with the machine arm, at the 12 o'clock position, and mount the top bead of the tire.



4. **CAUTION: Use only special tool 204-354 any time tire pressures are measured to be sure that accurate values are obtained.**

   Inflate the tire to the pressure specified on the vehicle certification label located on the driver door or door pillar.

5. Install the wheel and tire assembly. For additional information, refer to Wheel and Tire in this section.

Tire Pressure Monitoring System (TPMS) Sensor

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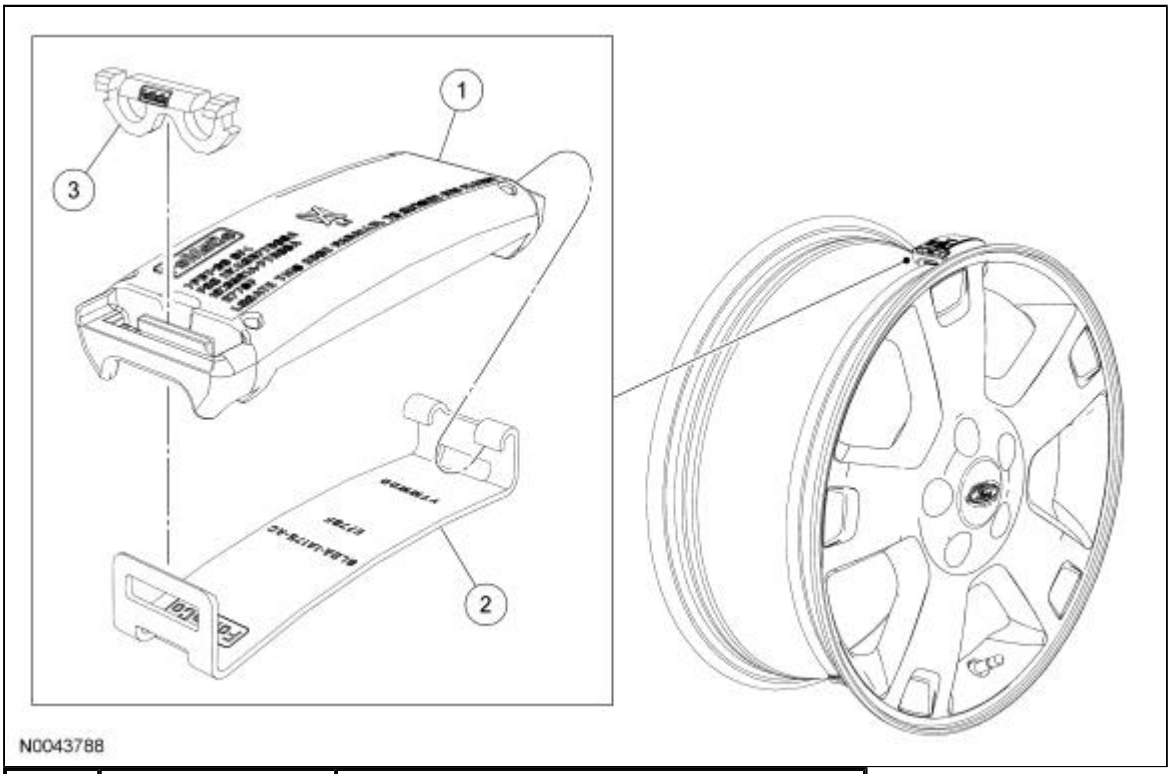


Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle
3	14C202	Locking clip (also part of 1A189)

Disassembly

CAUTION: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

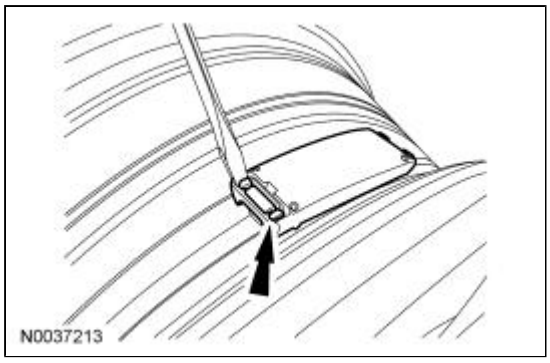
NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

1. **CAUTION: The sensor, cradle and strap can be damaged by incorrect tire mounting or dismounting. Dismount the tire only as instructed.**

   Remove the tire from the wheel. For additional information, refer to Wheel and Tire in this section.

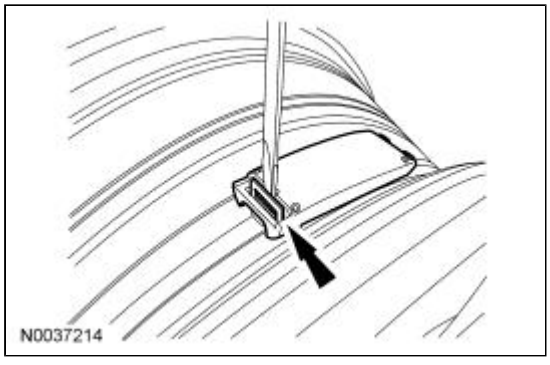
2. **CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip can occur.**

Using a pocket screwdriver, or similar tool, remove the sensor locking clip.



3. **CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor can occur.**

   Using a pocket screwdriver or similar tool, detach the sensor from the cradle.



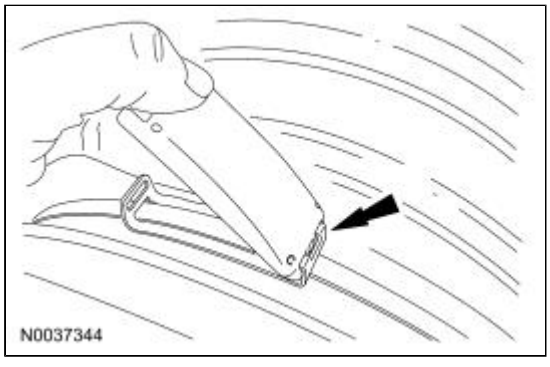
4. Remove the sensor.

Assembly

1. **CAUTION: Damage to the sensor can occur if excessive force is applied during sensor installation.**

   NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

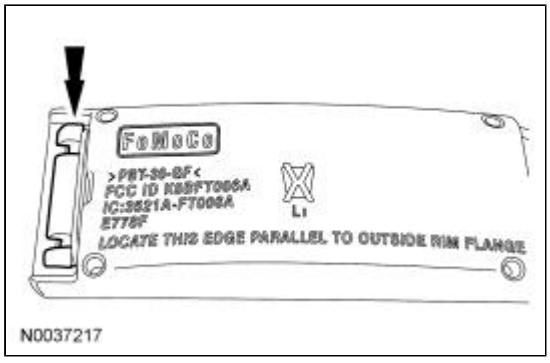
   Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.



2. **NOTE:** The locking clip can only be fully seated when installed in the correct orientation. If the

sensor locking clip cannot be fully inserted, then the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.



3. **CAUTION: The sensor, cradle and strap can be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

   Install the tire onto the wheel. For additional information, refer to Wheel and Tire in this section.

4. **NOTE:** A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

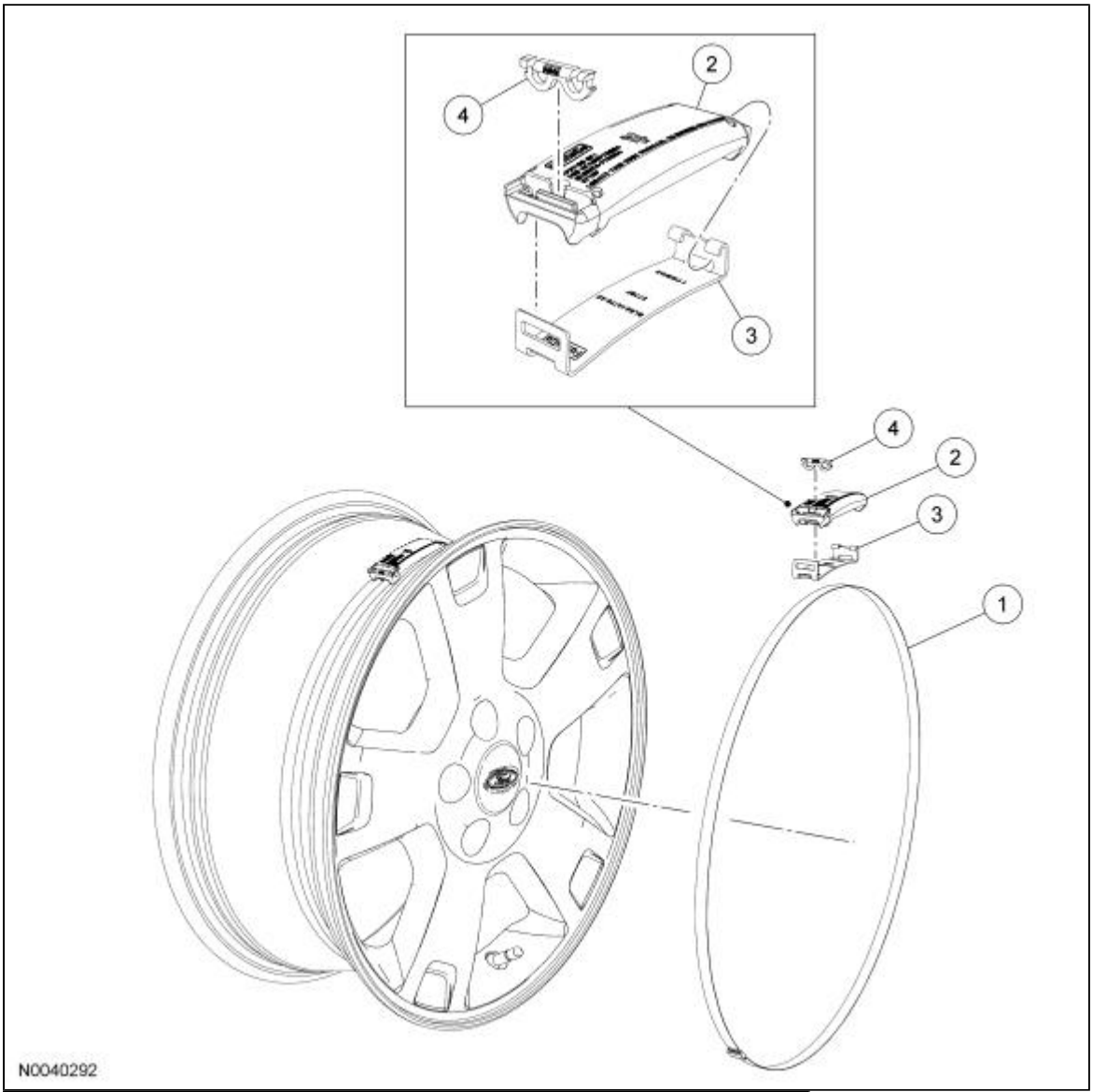
   Train the tire pressure sensor(s). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Printable View (299 KB)

Material

Item	Specification
Wheel and Tire Cleaner ZC-37-A or -B	—



Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Disassembly

CAUTION: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

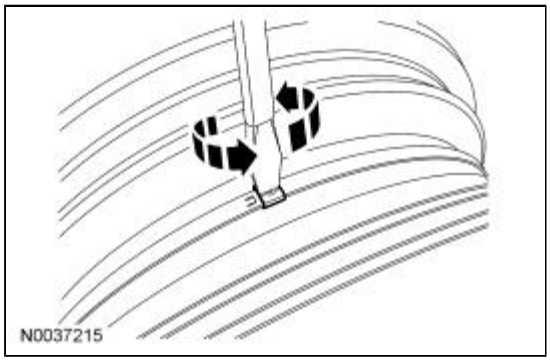
NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

1. Remove the tire pressure monitoring system (TPMS) sensor. For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor in this section.

2. **WARNING: The TPMS band is under tension. Always use safety goggles or a face shield and gloves when removing the TPMS band/strap. Failure to follow these instructions may result in personal injury.**

   Remove a factory installed strap in the following sequence:
   1. Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 in) from the buckle.
   2. Using a large screwdriver and a twisting motion, unbuckle the strap.
   3. Discard the strap.



3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.
   - Discard the strap.

4. **NOTE:** To aid assembly, mark the location of the cradle prior to disassembly.

   Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

1. **NOTE:** Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

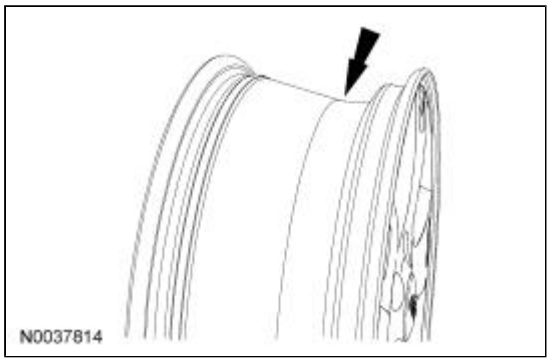
   Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. **CAUTION: Metal scrapers can damage the wheel. Use only plastic or non-metallic**

scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

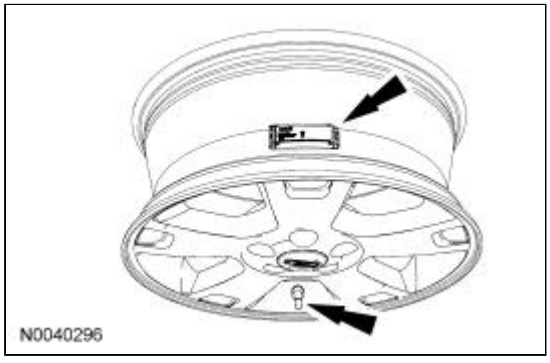
Clean the area where the sensor and cradle are to be installed.



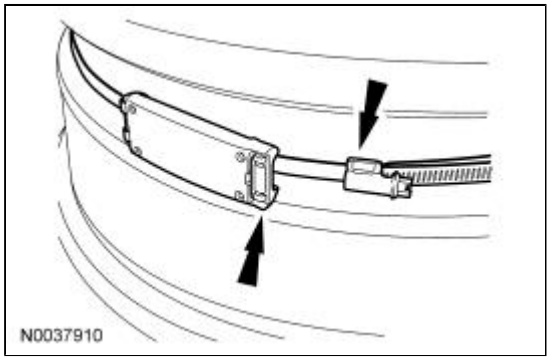
3. **NOTE:** The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side) of the wheel.

   NOTE: The sensor has raised markings indicating how to position the sensor.

   Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.



4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the locking clip side of the sensor.

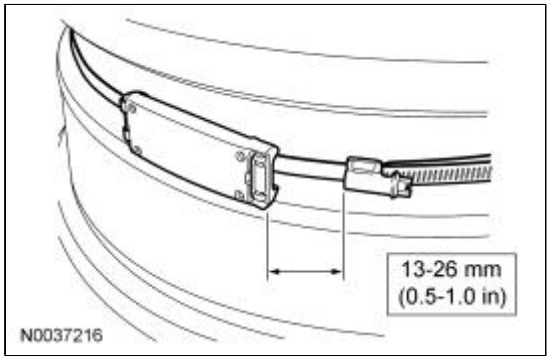


5. **CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap is positioned in the lowest spot possible for correct sensor and cradle retention.**

   NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 in) away from the sensor and tighten the worm gear.

- Tighten to 3 Nm (27 lb-in).



6. **CAUTION: The sensor, cradle and strap can be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

   Install the tire onto the wheel. For additional information, refer to Wheel and Tire in this section.

7. **NOTE:** A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

   Train the tire pressure sensor(s). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

Printable View (79 KB)

General Specifications

Item	Specification
Lubricants	
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C193-B
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Air compressor bracket bolts	15	11	—
Air suspension module bracket nuts	8	—	71
Height sensor ball stud	20	15	—
Height sensor bolts	11	8	—
Shock absorber lower bolt	475	350	—
Shock rod nut	45	33	—
Shock upper nuts	40	30	—

Vehicle Dynamic Suspension

Printable View (98 KB)

WARNING: The air suspension system must be shut off prior to hoisting or jacking an air suspension equipped vehicle. Failure to do so may result in unexpected inflation or deflation of the air springs, which may result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

WARNING: Do not remove an air spring under any circumstances when there is pressure in the air spring. Do not remove any components supporting an air spring without either exhausting the air or providing support for the air spring. Failure to follow these instructions may result in personal injury.

The rear air suspension system is comprised of the following components:

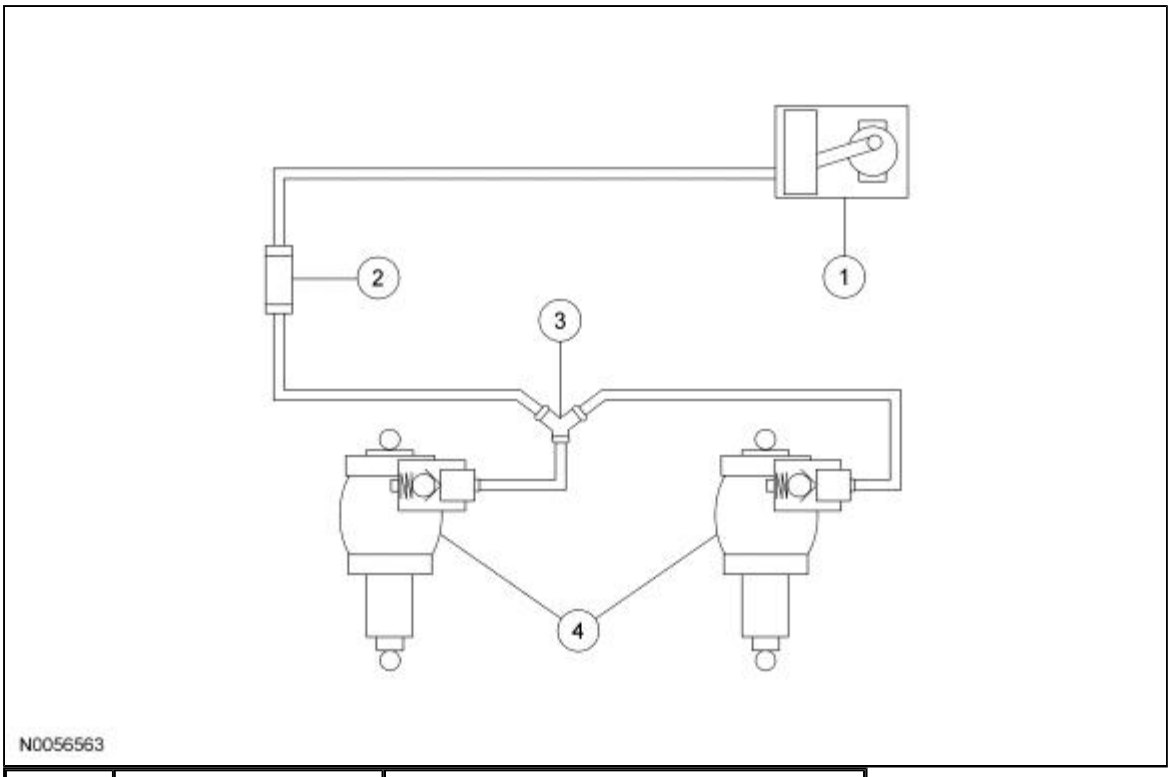
- Message center
- Control module
- Two suspension ride height sensors
- Compressor and drier assembly (includes vent solenoid)
- Air tubes
- Rear air spring and shock absorber assemblies
- Two air spring solenoid valves
- Compressor relay

Air Suspension System Operation

The rear wheel air suspension system operates in the following manner:

- Vehicle height is controlled by the rear air suspension module (vehicle dynamic module (VDM).
- Each air spring has a solenoid that must open to vent (or compress).
- The air suspension compressor has a vent solenoid that must open to vent the system.
- The rear air springs raise or vent together.
- The system does not operate when:
  - any of the doors are open.
  - the liftgate or liftgate glass is open.
  - the power running boards are deployed.
- The system will vent/compress when the vehicle speed exceeds 24 km/h (15 mph) even if the air suspension has been set to the OFF position.
- Trim height is normal driving height.
- The height sensor:
  - system uses RH and LH rear height sensors.
  - output voltage is between 0.5 and 4.5 volts.
  - voltage output decreases (goes from high to low) as the suspension system raises the vehicle.
- The suspension ride height changes when:
  - the key is in the ON position, the load leveling feature automatically makes adjustments to the vehicle height so that the vehicle is always at target height and constant front-to-rear vehicle attitudes are maintained over the load range of the vehicle.
  - the key is in the OFF position, the system will remain active for 40 minutes after the ignition is turned off to make limited height adjustments as necessary.

Air Suspension Pneumatic Diagram

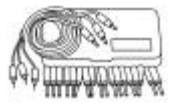


Item	Part Number	Description
1	5319	Air compressor and drier
2	5B321	Air line union
3	—	Air line Y-fitting
4	18945/5311	Air springs and solenoids

Vehicle Dynamic Suspension

Printable View (444 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1176-A	Vacuum Tester or equivalent 014-R1054
ST1137-A	73 Digital Multimeter or equivalent 105-R0051 or equivalent
 ST1138-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

WARNING: Before repairing or installing any air suspension component(s), disable the air suspension system through the message center or disconnect the battery ground cable. Failure to follow these instructions may result in personal injury.

WARNING: Do not attempt to inflate any air spring which has collapsed while deflated from the rebound hanging position to the jounce stop. Failure to follow these instructions may result in personal injury.

WARNING: When installing a new air spring, care must be taken to not apply a load to the suspension until the air springs have been inflated using the air spring fill procedure. Failure to follow these instructions may result in personal injury.

WARNING: After inflating an air spring in the hanging position, it must be inspected for correct shape. Failure to follow these instructions may result in personal injury.

The air suspension system is designed to improve ride handling and general vehicle driving performance. A microprocessor controls the air suspension system. The microprocessor and the supporting hardware are contained in the air suspension module. The air suspension module responds to signals from various sensors in the vehicle to maintain the programmed ride height while the vehicle is either moving or stopped. This is accomplished by opening and closing the solenoid valves to control the amount of air in the air spring(s). The air suspension module controls the air compressor by applying voltage through the compressor relay to inflate the air spring(s) and raise the vehicle. The air suspension module opens the vent solenoid to lower the vehicle by releasing air from the air spring(s) in response to signal inputs from the air suspension height sensor. The air suspension module has a preprogramming trim height.

The load leveling feature automatically makes adjustments in vehicle height so that the vehicle is always at target height and constant front-to-rear vehicle attitudes are maintained over the load range of the vehicle.

The system will remain active for 40 minutes after the ignition is turned off to make limited height adjustments as necessary.

Air Suspension Disable Feature

The air suspension system can be disabled through the message center. Refer to Air Suspension System Disable/Enable in this section. When the driver elects to disable the air suspension system, the message center sends a message over the high speed controller area network (HS-CAN) to the air suspension module. Once the message is received, the air suspension module will take no further action to inflate or deflate the air springs, below 15 MPH. The system will remain ON or OFF when the ignition key is cycled.

When the air suspension system has been disabled, the message center will display SUSPENSION SWITCHED OFF.

Air Compressor

The air compressor:

- consists of the compressor and vent solenoid; neither are serviced as individual items.
- is a single cylinder electric motor driven unit that provides pressurized air as required.
- is powered by an electromechanical relay, which is controlled by the air suspension module.
- passes pressurized air through the compressor air drier that contains silica gel (a drying agent). Moisture is then removed from the compressor air drier when vented air passes out of the system during vent operation.
- has a single port drier that can be serviced separately.

The vent solenoid:

- allows air to escape from the system during venting actions.
- is part of the air compressor cylinder head.
- shares a common electrical connector with the air compressor motor.
- is enclosed in the cylinder head casting and forms an integral valve housing.
- has an O-ring seal that prevents air leakage past the dryer tip.
- opens when the air suspension module determines that lowering is required.
- provides an escape route for pressurized air when system pressures exceed safe operating levels.
- has a 1,034 kPa (150psi) internal relief valve.
- is installed with the air compressor as a unit.

Air Spring

The air suspension system has 2 rear air springs. The air springs provide a varying spring rate

proportional to the system air pressure and volume. The air suspension system regulates the air pressure in each air spring by compressing and venting the air. Increasing air pressure (compressing) raises the vehicle; decreasing air pressure (venting) lowers the vehicle. Vehicle height is maintained by the addition and removal of air in each air spring through an air spring solenoid installed in the upper spring cap and energized through the air suspension module.

Air Tubes and Fittings

NOTE: Apply a soapy water solution to the air tubes to verify the location of air leaks. If the air tubes are cut, ruptured or leaking, a service repair kit is available.

Nylon air tubes with quick connect fittings connect to the air compressor and air spring solenoids. A Y-fitting is also used to divide the air supply to the RH and LH air spring solenoids.

Air Suspension Height Sensors

There are 2 suspension height sensors used for the rear suspension. The sensors send a voltage signal to the air suspension module. The output ranges from approximately 4.5 volts at minimum height (when the vehicle is low or in full jounce) to 0.5 volt at maximum height (when the vehicle is high or in full rebound).

The sensors have a usable range of ±45 degrees. The sensors are mounted to the suspension at a point where full suspension travel at the wheel is relative to the travel at the height sensor. The sensors are mounted to the frame and the link is attached to a ball stud on the rear lower arm. The left and right sensors have opposite polarity and are not interchangeable.

When the height sensor indicates that the vehicle is lower than trim under normal driving conditions, the air compressor will turn on and pump compressed air to the system. When the sensor indicates that the vehicle is raised above trim under normal driving conditions, this will cause the air to be vented from the system to lower the vehicle to the trim height level.

Compressor Relay

An electromechanical relay is used in the air suspension system for compressor control. The relay switches high current loads in response to low power signals and is controlled by the air suspension module.

The compressor relay is energized by the air suspension module to have high current flow from the battery to the compressor motor.

Air Suspension Module

CAUTION: The air suspension module must receive a ride height adjustment calibration and pass a pneumatic test when it is installed new or swapped. Failure to follow these instructions will result in the air suspension system operating incorrectly.

The air suspension module controls the air compressor motor (through an electromechanical relay), all air spring solenoids and provides power to the rear height sensors. The module also controls vehicle height adjustments by monitoring the 2 height sensors and other HS-CAN messages. The module conducts all fail-safe and diagnostic strategies and contains self-test and communication software for testing the vehicle and related components.

The module monitors and controls the air suspension system through an 8-pin connector and a 16-pin connector. The connectors and the module are keyed so that the connectors cannot be plugged in incorrectly. The air suspension module uses the HS-CAN communications network for sending and receiving various information.

Air Spring Solenoid

WARNING: Never rotate an air spring solenoid valve to the release slot in the end cap fitting until all pressurized air has escaped from the spring. Failure to follow this instruction may result in personal injury.

The air spring solenoid:

- allows air to enter and exit the air spring during leveling operations.
- is electrically operated and controlled by the air suspension module.
- is serviced separately from the air spring.

Inspection and Verification

1. Verify the customer concern.

2. **NOTE:** If the door ajar indicator is illuminated when all the doors, the liftgate and the liftgate glass are closed, the air suspension will not work correctly. Repair the door ajar indicator. Refer to Section 413-01 .

   Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Restricted suspension movement
• Excessive vehicle load
• Damaged or disconnected air tube(s) and/or fitting(s)
• Unmounted or damaged height sensor(s)
• Damaged rear air spring(s)
• Damaged solenoid valve(s)
	• Battery junction box (BJB) fuses:
	  ▪ 6 (50A)
	  ▪ 47 (30A)
	  ▪ 65 (10A)
	• Damaged wiring harness(es)
	• Loose, corroded or disconnected electrical connectors
	• Damaged air suspension module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module

(PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the air suspension module. Refer to Self-Test in this section.

9. If the DTCs retrieved are related to the concern, go to Air Suspension Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Pneumatic Test

This test verifies that the air tubes are connected and that they are not restricted. It also verifies that the air compressor, air compressor vent solenoid and air spring solenoid valves are functioning correctly. This test is used to clear DTCs C1990 and C1991. Verify that the following conditions are met before running the Pneumatic Test.

- All the doors, the liftgate and the liftgate glass must be closed.
- The transmission is in PARK.
- The vehicle speed is less the 10 km/h (6 mph).
- The ignition switch is in the ON position.
- The air suspension system is enabled.
- Battery voltage is greater than 11 volts for the duration of the test.

1. Fulfill the pre-conditions.

2. Install a battery charger for the Pneumatic Test to prevent battery drain.

3. Using the scan tool, run the Pneumatic Test.

Trim Height Test (or Accurate Trim Test)

NOTE: The Trim Height Test is used to verify trim height only. If trim height needs to be adjusted, refer to Ride Height Adjustments in this section.

The trim height test is used to make the vehicle level to within 2 mm (0.08 in) of the calibrated trim height. An accurate trim test should be run before setting vehicle alignment.

The following conditions must be met for the trim height test to run:

- All the doors, the liftgate and the liftgate glass must be closed.
- The transmission is in PARK.
- The vehicle speed is less than 10 km/h (6 mph).
- The ignition switch is in the ON position.
- The air suspension system is enabled.
- Battery voltage is greater than 11 volts for the duration of the test.

1. Fulfill the pre-conditions.

2. Install a battery charger for the Trim Height Test to prevent battery drain.

3. Using the scan tool, run the Trim Height Test.

Self-Test

Verify that the following conditions are met before running the On-Demand Self Test.

- All doors, the liftgate and the liftgate glass must be closed.
- The transmission is in PARK.
- The vehicle speed is less than 10 km/h (6 mph).
- The ignition switch is in the ON position.

1. Fulfill the pre-conditions.
2. Install a battery charger for the On-Demand Self Test to prevent battery drain.
3. Run the air suspension module On-Demand Self Test.
4. Record all listed DTCs.
5. Retrieve stored DTCs.
6. Troubleshoot any On-Demand Self Test DTCs first.
7. Repeat the On-Demand Self Test and clear DTCs after repairs are completed.

Air Suspension Module Diagnostic Trouble Code (DTC) Chart

Air Suspension Module Diagnostic Trouble Code (DTC) Chart

NOTE: Repair all other DTCs before repairing C1726, repair DTCs C1990 and C1991 last.

DTCs	Description	Source	Action
B1317	Battery Voltage High	Air Suspension Module	Go To Pinpoint Test A .
B1318	Battery Voltage Low	Air Suspension Module	Go To Pinpoint Test A .
B1342	ECU is Faulted	Air Suspension Module	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. SET the ride height. REFER to Ride Height Adjustments in this section. CARRY OUT the pneumatic test. TEST the system for normal operation.
B1566	Door Ajar Circuit Short to Ground	Air Suspension Module	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. SET the ride height. REFER to Ride Height Adjustments in this section. CARRY OUT the pneumatic test. TEST the system for normal operation.
B2477	Module Configuration Failure	Air Suspension Module	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. SET the ride height. REFER to Ride Height Adjustments in this section. CARRY OUT the pneumatic test. TEST the system for normal operation.
C1724	Air Suspension Height	Air	Go To Pinpoint Test B .

	Sensor Power Circuit Failure	Suspension Module	
C1726	Air Suspension Rear Pneumatic Failure	Air Suspension Module	Go To Pinpoint Test C .
C1770	Air Suspension Vent Solenoid Output Circuit Failure	Air Suspension Module	Go To Pinpoint Test D .
C1790	Air Suspension LR Air Spring Solenoid Output Circuit Failure	Air Suspension Module	Go To Pinpoint Test E .
C1795	Air Suspension RR Air Spring Solenoid Output Circuit Failure	Air Suspension Module	Go To Pinpoint Test E .
C1810	Air Suspension Height Sensor Delta Out of Range	Air Suspension Module	Go To Pinpoint Test L .
C1830	Air Suspension Compressor Relay Circuit Failure	Air Suspension Module	Go To Pinpoint Test F .
C1885	Air Suspension RR Height Sensor Circuit Failure	Air Suspension Module	Go To Pinpoint Test G .
C1893	Air Suspension LR Height Sensor Circuit Failure	Air Suspension Module	Go To Pinpoint Test G .
C1990	New Control Module Initialization (requires ride height calibration and pneumatic test pass)	Air Suspension Module	REFER to Clearing DTC C1990 or C1991.
C1991	Plant Ride Height Setting and/or Tests Incomplete	Air Suspension Module	REFER to Clearing DTC C1990 or C1991.
C1964	Compressor Run Time Exceeded	Air Suspension Module	ALLOW the compressor to cool for at least 10 minutes, REPEAT the self-test.
C2001	Ride Height Calibration Error	Air Suspension Module	ADJUST the ride height, REFER to Ride Height Adjustments in this section. CLEAR the DTCs. REPEAT the self-test.
C2002	Pneumatic Test Failure	Air Suspension Module	VERIFY that all pneumatic test pre-conditions are met, REFER to Pneumatic Test in this section. REPEAT the pneumatic test. If all conditions are met, the scan tool can communication with the air suspension module and the module is still unable to complete the pneumatic test, Go To Pinpoint Test C .
U0073	Control Module Communication Bus A Off	Air Suspension Module	REFER to Section 418-00 to diagnose the HS-CAN bus.
U0100	Lost Communication with Powertrain Control Module (PCM)	Air Suspension Module	REFER to Section 418-00 to diagnose the HS-CAN bus.
U0140	Lost Communication with Body Control Module	Air Suspension Module	REFER to Section 418-00 to diagnose the HS-CAN bus.

U0155	Lost Communication with Instrument Cluster	Air Suspension Module	REFER to Section 418-00 to diagnose the HS-CAN bus.
U2011	Module Transmitted Invalid Data	Air Suspension Module	CLEAR the DTC. REPEAT the self-test. If DTC U2011 returns, INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTC. REPEAT the self-test.
U2050	Application Not Present	Air Suspension Module	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTC. REPEAT the self-test.

Clearing DTC C1990, C1991, C2001 and C2002

NOTE: Before proceeding with the following steps, make sure that the air suspension system is fully functional. The vehicle must pass the pneumatic test and have both ride height sensors calibrated for these codes to clear.

1. Connect the scan tool to the vehicle.
2. If C1990, C1991 and C2002 are present, carry out the pneumatic test. The tester will indicate if the vehicle has passed the test.
3. **NOTE:** The vehicle must be on a level surface before calibrating the ride height sensors. Failure to follow this instruction will result in system malfunction.

   If C1990, C1991 and C2001 are present, use the scan tool to manually raise and lower the vehicle to the correct ride height on an alignment machine and calibrate the ride heights. Refer to Ride Height Adjustments in this section.
4. Using the scan tool, retrieve the DTCs. Verify that all DTCs have been cleared.
5. Drive the vehicle and verify the repair. Verify that the message center does not display "Check Suspension".

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the air suspension module	• Fuse(s) • Circuitry • Air suspension module	• REFER to Section 418-00 to diagnose the no communication problem.
• **NOTE:** Make sure that the ignition switch is in the ON position and the air suspension is enabled before determining that the air suspension module will not enter the self-test.	• Air suspension system disabled	• VERIFY that the air suspension system is enabled. REFER to Air Suspension System Disable/Enable in this section. REPEAT the self-test.

Unable to enter self-test	• One or more self-test preconditions not fulfilled	• VERIFY that all self-test preconditions are fulfilled, REFER to Self-Test in this section. REPEAT the self-test. If all conditions are met and the scan tool cannot communicate with the air suspension module, REFER to Section 418-00 to diagnose the no communication problem.
	• Air suspension module	• VERIFY that all self-test preconditions are met, REFER to Self-Test in this section. REPEAT the self-test. If all conditions are met, the scan tool can communicate with the air suspension module and the module is still unable to enter self-test, INSTALL a new air suspension module. REFER to Air Suspension Module in this section.
• Vehicle raises and/or lowers too slowly	• Dryer restricted • Compressor vent solenoid • Air tube(s) blocked or pinched • Air leaks • Air spring solenoid(s) • Air compressor assembly	• Go To Pinpoint Test C .
• Uneven vehicle height	• Air leaks • Circuitry • Height sensor(s) • Air spring solenoid(s) • Air compressor assembly • Air tube(s) blocked or pinched	• Go To Pinpoint Test C .
• The air compressor continuously cycles with the ignition switch in the OFF position and no DTC is set	• Circuitry • Air suspension relay • Air suspension module	• Go To Pinpoint Test H .
• The air suspension system is inoperative without DTCs and with the vehicle at rest	• Fuse • Circuitry • HS-CAN network communication fault	• Go To Pinpoint Test I .
• Excessive air compressor noise	• Bracket isolator (s)	• Go To Pinpoint Test J .

	• Mounting bracket • Air compressor assembly • Air compressor assembly in contact with other components	
• The air compressor is inoperative	• Fuse(s) • Air compressor assembly • Circuitry • Air suspension relay	• Go To Pinpoint Test K .
	• Compressor run time exceeded	• ALLOW the air compressor to cool for at least 10 minutes. TEST the system for normal operation.

Pinpoint Tests

CAUTION: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage to the module may result.

Refer to Inspection and Verification, the Air Suspension Module Diagnostic Trouble Code (DTC) Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: DTC B1317 or B1318 — Battery Voltage High or Low

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The air suspension module is supplied fused battery voltage through battery junction box (BJB) fuse 47 (30A) along circuit SBB47 (WH/RD), and fused ignition voltage through BJB fuse 65 (10A) along circuit CBB65 (WH/OG). A ground path is provided along circuits GD133 (BK) and GD120 (BK/GN).

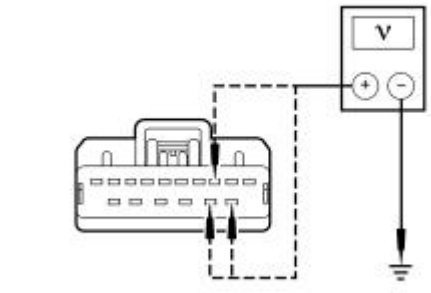
Possible Causes

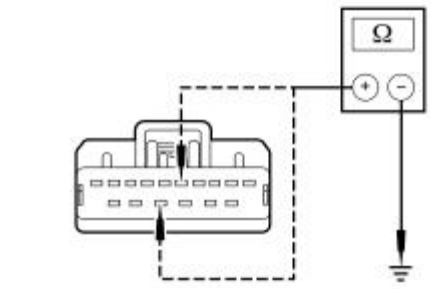
- Fuse(s)
- Circuit open
- Air suspension module

PINPOINT TEST A: DTC B1317 OR B1318 — BATTERY VOLTAGE HIGH OR LOW

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take

A1 CHECK FOR ACTIVE DTCs	
• Repeat the self-test • **Are the DTCs active?**	**Yes** GO to A2 . **No** The system is operating correctly at this time. Concern may have been caused by low battery or charging system voltage. VERIFY that the battery and charging system are OK. REFER to Section 414-00 .
A2 CHECK THE BATTERY VOLTAGE	
• Measure the battery voltage between the positive and negative battery posts with the key on/engine off (KOEO) and with the engine running. • **Is the battery voltage between 10 and 13 volts with KOEO and between 11 and 16 volts with the engine running?**	**Yes** GO to A3 . **No** REPAIR the battery or charging system. REFER to Section 414-00 . TEST the system for normal operation.
A3 CHECK FOR VOLTAGE TO THE AIR SUSPENSION MODULE	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131a. • Key in ON position. • Both with the key on/engine off (KOEO) and with the engine running, measure the voltage between ground and: ▪ air suspension module 2131a-3, circuit CBB65 (WH/OG), harness side. ▪ air suspension module 2131a-11, circuit SBB47 (WH/RD), harness side. ▪ air suspension module 2131a-12, circuit SBB47 (WH/RD), harness side.  N0055980 • **Is the voltage between 10 and 13 volts with KOEO, and between 11 and 16 volts with the engine running?**	**Yes** GO to A4 . **No** VERIFY BJB fuse 65 (10A) is OK. If OK, REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
A4 CHECK CIRCUIT GD133 (BK) AND GD120 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between ground and: ▪ air suspension module 2131a-5, circuit GD133 (BK), harness side. ▪ air suspension module 2131a-14, circuit GD120	**Yes** GO to A5 . **No** REPAIR the affected circuit(s).

(BK/GN), harness side.  N0055981 • **Is the resistance less than 5 ohms?**	CLEAR the DTCs. REPEAT the self-test.

A5 CHECK THE AIR SUSPENSION MODULE CONNECTOR
• Check air suspension module C2131a for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Module C2131a.
• Make sure the connector is seated correctly then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC C1724 — Air Suspension Height Sensor Power Circuit Failure

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

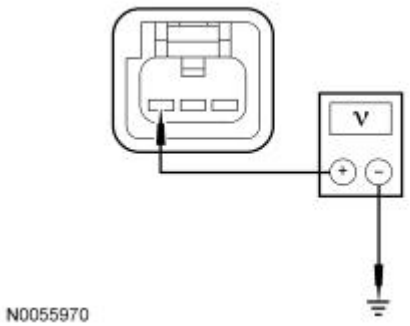
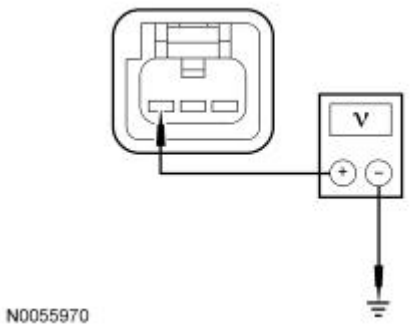
The 2 rear height sensors receive a 5-volt reference voltage from the air suspension module along circuit LCL12 (VT/OG), both sensors share a common return path along circuit RCL12 (GN/WH). The RR sensor sends the suspension height voltage back to the air suspension module along circuit VCL12 (WH/VT) and the LR sensor sends the suspension height voltage back to the module along circuit VCL13 (BN/BU). The air suspension module monitors the 2 height sensors and makes adjustments to the rear suspension based on sensor input.

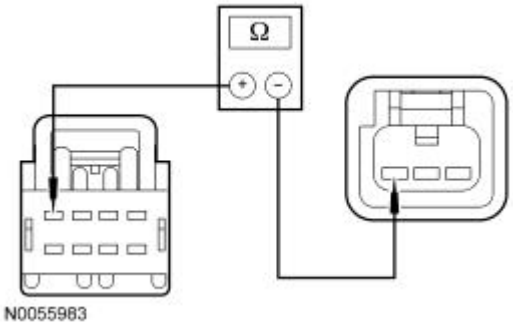
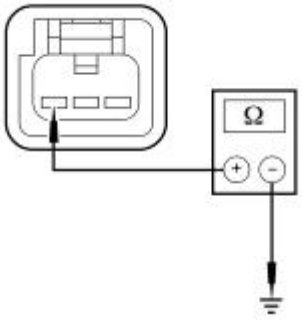
Possible Causes

- Circuit open
- Circuit shorted
- Height sensor(s)
- Air suspension module

PINPOINT TEST B: DTC C1724 — AIR SUSPENSION HEIGHT SENSOR POWER CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
B1 CHECK THE AIR SUSPENSION HEIGHT SENSOR VOLTAGE PIDs	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Connect the diagnostic tool. • Key in ON position. • Disconnect the sensor arm linkage from both rear air suspension height sensors. • **NOTE:** The voltage will increase as the suspension is compressed. • While monitoring both rear height sensor voltage PID displays, slowly move the height sensors through their full range of travel up and down. • **Do the voltages vary from approximately 0.50 volt and 4.50 volts?**	**Yes** INSPECT the height sensor electrical connectors for corrosion and damage, REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the sensor arm linkages to the height sensors. For the LR height sensorGO to B2 . For the RR height sensor GO to B3 .
B2 CHECK FOR AIR SUSPENSION MODULE OUTPUT (LR HEIGHT SENSOR VOLTAGE)	
• Key in OFF position. • Disconnect: LR Height Sensor C4092. • Key in ON position. • Measure the voltage between LR height sensor C4092-3, circuit LCL12 (VT/OG), harness side and ground.  N0055970 • **Are 5 volts present?**	**Yes** GO to B3 . **No** If less than 5 volts are present, GO to B4 . If more than 5 volts are present, GO to B6 .
B3 CHECK FOR AIR SUSPENSION MODULE OUTPUT (RR HEIGHT SENSOR VOLTAGE)	
• Key in OFF position. • Disconnect: RR Height Sensor C4093. • Key in ON position. • Measure the voltage between RR height sensor C4093-3, circuit LCL12 (VT/OG), harness side and ground.  N0055970	**Yes** GO to B7 . **No** If less than 5 volts are present, GO to B4 . If more than 5 volts are present, GO to B6 .

• **Are 5 volts present?**	
B4 CHECK CIRCUIT LCL12 (VT/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Air Suspension Module C2131b. • **For the RR height sensor** , measure the resistance between air suspension module C2131b-4, circuit LCL12 (VT/OG), harness side and RR height sensor C4093-3, circuit LCL12 (VT/OG), harness side. • **For the LR height sensor** , measure the resistance between air suspension module C2131b-4, circuit LCL12 (VT/OG), harness side and LR height sensor C4092-3, circuit LCL12 (VT/OG), harness side.  N0055983 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR circuit LCL12 (VT/OG). CLEAR the DTCs. REPEAT the self-test.
B5 CHECK CIRCUIT LCL12 (VT/OG) FOR A SHORT TO GROUND	
• **For the RR height sensor** , measure the resistance between RR height sensor C4093-3, circuit LCL12 (VT/OG), harness side and ground. • **For the LR height sensor** , measure the resistance between LR height sensor C4092-3, circuit LCL12 (VT/OG), harness side and ground.  N0055969 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B7 . **No** REPAIR circuit LCL12 (VT/OG). CLEAR the DTCs. REPEAT the self-test.
B6 CHECK CIRCUIT LCL12 (VT/OG) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Air Suspension Module C2131b. • Key in ON position. • **For the LR height sensor,** measure the voltage between LR height sensor C4092-3, circuit LCL (VT/OG). harness side and ground. • **For the RR height sensor,** measure the voltage between RR height sensor C4093-3, cuircuit LCL (VT/OG). harness side and ground. • **Is voltage present?**	**Yes** REPAIR circuit LCL12 (VT/OG). CLEAR the DTCs. REPEAT the self-test. **No** GO to B7 .
B7 CHECK THE AIR SUSPENSION MODULE CONNECTOR	
• Key in OFF position.	**Yes**

• Disconnect: Air Suspension Module C2131b.
• Check the air suspension module connector for:
  ■ corrosion.
  ■ pushed-out pins.
  ■ spread terminals.
• Connect: Air Suspension Module C2131b.
• Make sure the connector is seated correctly, then operate the system and verify the concern is still present.
• **Is the concern still present?**
	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTC C1726 — Air Suspension Rear Pneumatic Failure

Normal Operation

The air suspension height sensor sends a voltage signal to the air suspension module. The output ranges from approximately 4.5 volts at minimum height (when the vehicle is low or in full jounce) to 0.5 volt at maximum height (when the vehicle is high or in full rebound).

When the suspension height sensor indicates that the rear of the vehicle is lower or higher than trim height under normal driving conditions, the air suspension module will command the air compressor and air solenoid valves to either fill or vent the air springs depending on the input from the 2 height sensors. The air compressor sends the air to the air springs first through the drier then along the air tubes, passing through a Y-fitting and connections, through the air solenoid valves and finally to the air springs.

Possible Causes

- Air leak(s)
- Air tube restricted or leak(s)
- Air tube(s)
- Mounting bracket(s)
- Air compressor drier
- Air spring solenoid valve(s)
- Height sensor(s)
- Air compressor
- Air spring(s)
- Air suspension module

PINPOINT TEST C: DTC C1726 — AIR SUSPENSION REAR PNEUMATIC FAILURE

NOTE: It may be necessary to vent air from the front air suspension air springs during this pinpoint test.

Test Step	Result / Action to Take
C1 CHECK THE AIR SUSPENSION HEIGHT SENSORS	
• Inspect the air suspension height sensors for correct installation. • Inspect the air suspension height sensor mounting brackets for damage. • While listening for air leaks, verify that all air tubes are fully seated. • **Are the air suspension height sensors, mounting brackets and air tubes OK?**	**Yes** GO to C2 . **No** REPAIR as necessary. If one or both height sensor assemblies are installed or repaired, both height sensors must be

	calibrated. RESET the vehicle ride height. REFER to Ride Height Adjustments in this section. CLEAR the DTCs. REPEAT the self-test.
C2 CHECK THE AIR SUSPENSION HEIGHT SENSOR VOLTAGE PIDs • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Disconnect the sensor arm linkage from both rear air suspension height sensors. • Connect the diagnostic tool. • Key in ON position. • **NOTE:** The voltage will increase as the suspension is compressed. • While monitoring both height sensor voltage PIDs, slowly move the height sensors through their full range of travel up and down. • **Do the voltages vary from approximately 0.50 volt and 4.50 volts?**	**Yes** CONNECT the sensor arm linkages to the height sensors.GO to C3 . **No** INSTALL a new height sensor(s) and CALIBRATE both height sensors. REFER to Suspension Height Sensor in this section. CLEAR the DTCs. RESET the vehicle ride height. REFER to Ride Height Adjustments in this section. REPEAT the self-test.
C3 VERIFY THAT THE REAR OF THE VEHICLE CAN BE RAISED • Trigger the LR and RR air spring solenoid active command ON. Trigger the air compressor active command ON. • Trigger the air suspension module active commands OFF. • While monitoring both height sensor voltage PIDs, allow the vehicle to raise for 30 to 45 seconds. • **Does the rear of the vehicle raise normally and hold the new height?**	**Yes** GO to C4 . **No** GO to C5 .
C4 VERIFY THAT THE REAR OF THE VEHICLE CAN BE LOWERED • Trigger the LR and RR air spring solenoid active command OFF. Trigger the vent solenoid active command ON. • **NOTE:** Allow the rear to lower for 30 seconds. • Trigger air suspension module active commands OFF. • **Does the rear lower normally?**	**Yes** CARRY OUT the pneumatic test and VERIFY system operation. **No** GO to C7 .
C5 CHECK OPERATION OF THE AIR COMPRESSOR **CAUTION: The air suspension module limits the air compressor run time. If the air compressor overheats, it will not restart until it cools down. The ignition switch must be in the OFF position to allow the compressor thermal switch to cool.** • Trigger the air compressor active command ON. • **Does the air compressor run (slight buzzing noise from RF corner of vehicle)?**	**Yes** TRIGGER the air compressor active command OFF. GO to C6 . **No** TRIGGER the air compressor active command OFF. Go To Pinpoint Test K .
C6 CHECK THE AIR COMPRESSOR PRESSURE OUTPUT **CAUTION: The air suspension module limits the air compressor run time. If the air compressor overheats, it will not restart until it cools down. The ignition switch must be in the OFF position to allow the compressor thermal switch to cool. NOTE:** If fluid is present when disconnecting an air tube, clear the air	**Yes** GO to C9 . **No** INSTALL a new air suspension compressor. REFER to Air Suspension Compressor in this

tubes. Refer to Air Line Fluid Purge procedure in this section. Check the compressor air drier for water or the front air spring for oil. • Disconnect the air tube at the air compressor drier. • Connect an air pressure gauge (1,723 kPa [250 psi] maximum reading) with common fittings to the air drier. • **NOTE:** The vehicle will lower quickly. • **NOTE:** When triggering the compressor ON, the vent solenoid will open as well. To prevent the vent solenoid from opening during this test, first trigger a single spring solenoid ON, then trigger the compressor ON. • Trigger the LR spring solenoid active command ON. • Trigger the air compressor active command ON. • Operate the air compressor for 30 seconds then trigger the air compressor active command OFF. • **Did the compressor produce 1,034 kPa (150 psi) within 30 seconds?**	section. CARRY OUT the pneumatic test. VERIFY system operation.
C7 CHECK THE PNEUMATIC SYSTEM — VENT THE AIR SPRINGS	
NOTE: If fluid is present when disconnecting the air tube, clear the air tubes. Refer to Air Line Fluid Purge . Check the air compressor drier for water or the air compressor for oil contamination. **NOTE:** The rear springs must be partially inflated in order to carry out this test. Add air as necessary. • Disconnect the air tube at the air compressor drier. • Trigger the LR air spring solenoid active command ON. This will activate both the LR and RR air spring solenoids. • **Does the air vent from the air compressor drier air tube?**	**Yes** TRIGGER the LR air spring solenoid active command OFF. GO to C9 . **No** CONNECT the air tube to the air compressor drier. TRIGGER the LR air spring solenoid active command OFF. GO to C8 .
C8 CHECK THE PNEUMATIC SYSTEM — AIR TUBE	
NOTE: If fluid is present when disconnecting the air tube, clear the air tubes. Refer to Air Line Fluid Purge . Check the air compressor drier for water or the air compressor for oil contamination. • Disconnect the suspected rear air spring solenoid air tube. • Connect the vacuum tester to the air tube and try to pull a vacuum. • **Can a vacuum be developed?**	**Yes** REPAIR or INSTALL a new air tube. CLEAR the DTC. REPEAT the self-test. **No** GO to C11 .
C9 CHECK THE VENT SOLENOID OPERATION	
• Disconnect the air tube at the drier. • Connect the vacuum tester to the drier and try to pull a vacuum. • Trigger the vent solenoid active command ON. • Try to pull a vacuum again. • **Can a vacuum be developed with the vent solenoid active command OFF and no vacuum developed with the vent solenoid active command ON?**	**Yes** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** If a vacuum **cannot** be developed with the vent solenoid OFF, GO to C10 . If a vacuum **can** be developed with the vent solenoid OFF, INSTALL a new air compressor. REFER to Air Suspension Compressor in this section.
C10 CHECK THE AIR TUBE AND CONNECTIONS	

• Check the air tube and connections between the vacuum tester and the air compressor. • **Are the air tube and connections OK?**	**Yes** INSTALL a new air compressor. REFER to Air Suspension Compressor in this section. CLEAR the DTC. REPEAT the self-test. **No** REPAIR the air tube. GO to C9.
C11 CHECK THE SPRING SOLENOID VALVE	
NOTE: The air springs must be inflated for this test. • Disconnect the air tube at the air spring solenoids. • Using the scan tool, open the solenoids. • **Does air vent from the solenoids?**	**Yes** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. **No** INSTALL a new air spring solenoid. REFER to Air Spring Solenoid Valve in this section.

Pinpoint Test D: DTC C1770 — Air Suspension Vent Solenoid Output Circuit Failure

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The air suspension module will command the air suspension system vent solenoid ON or OFF when certain conditions are met. The air suspension module supplies voltage to the vent solenoid through circuit CCL14 (BN/VT), which activates the vent solenoid and vents the air suspension system. The vent solenoid is grounded through circuit GD123 (BK/GY).

The vent solenoid is part of the air suspension compressor, if a new vent solenoid is needed, an air suspension compressor must be installed.

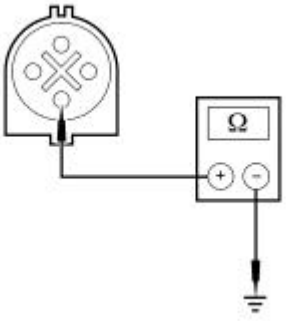
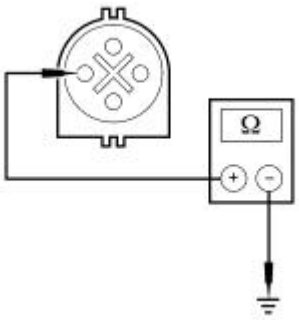
Possible Causes

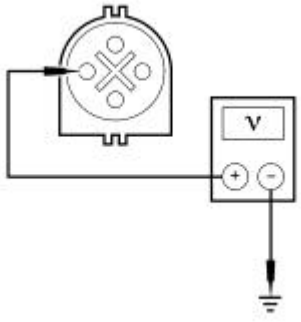
- Circuit open
- Circuit shorted
- Air suspension compressor
- Air suspension module

PINPOINT TEST D: DTC C1770 — AIR SUSPENSION VENT SOLENOID OUTPUT CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
D1 CHECK THE VENT SOLENOID PID	
• Connect the diagnostic tool. • Key in ON position. • Monitor the vent solenoid PID.	**Yes** For a short to ground GO to D3 .

• **Does the PID indicate a short to ground or a short to voltage?**	For a short to voltage GO to D4 . **No** GO to D2 .
D2 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Key in OFF position. • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Disconnect: Air Suspension Compressor C1179. • Measure the resistance between air compressor assembly C1179-3, circuit GD123 (BK/GY), harness side and ground.  N0055962 • **Is the resistance less than 5 ohms?**	**Yes** INSPECT the air suspension compressor C1179 for corrosion and damage. If the connector is corroded or damaged, REPAIR as necessary. If the connector is OK, GO to D5 . **No** REPAIR circuit GD123 (BK/GY). CLEAR the DTCs. REPEAT the self-test.
D3 CHECK THE VENT CONTROL CIRCUIT FOR A SHORT TO GROUND	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Compressor C1179. • Disconnect: Air Suspension Module C2131a. • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Measure the resistance between air compressor C1179-4 circuit CCL14 (BN/VT), harness side, and ground.  N0059653 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D5 . **No** REPAIR cuircuit CCL14 (BN/VT). CLEAR the DTCs. REPEAT the self-test.
D4 CHECK THE VENT CONTROL CIRCUIT FOR A SHORT TO VOLTAGE	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Compressor C1179. • Disconnect: Air Suspension Module C2131a. • Key in ON position. • Measure the voltage between air compressorC1179-4 circuit CCL14 (BN/VT), harness side and ground.	**Yes** REPAIR cuircuit CCL14 (BN/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to D6 .

 N0059654 • **Is voltage present?**	
D5 CHECK THE VENT SOLENOID FOR AN OPEN OR A SHORT	**Yes** GO to D6 . **No** INSTALL a new air compressor. REFER to Air Suspension Compressor in this section. CLEAR the DTCs. REPEAT the self-test.
• Measure the resistance between air compressor C1179 pin-2, component side, and C1179 pin-1, component side. • **Is the resistance between 17 and 22 ohms?**	
D6 CHECK THE AIR SUSPENSION MODULE CONNECTOR	**Yes** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test. Both height sensors must be calibrated. RESET the vehicle ride height. REFER to Ride Height Adjustments in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

• Key in OFF position.
• Check air suspension module C2131a for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Module C2131a.
• Make sure the connector is seated correctly then operate the system and verify the concern is still present.
• **Is the concern still present?**	

Pinpoint Test E: DTC C1790 (LR) and C1795 (RR) — Air Suspension Air Spring Solenoid Output Circuit Failure

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The air suspension module will command the air spring solenoid(s) ON or OFF when certain conditions are met. The left solenoid receives voltage from the air suspension module along circuit CCL05 (WH/BN), the right solenoid receives voltage from the air suspension module along circuit CCL07 (YE/GY). The 2 solenoids share a common ground along circuit GD120 (BK/GN).

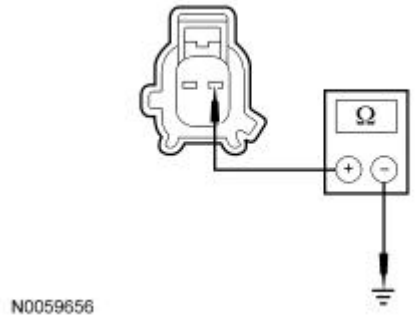
Possible Causes

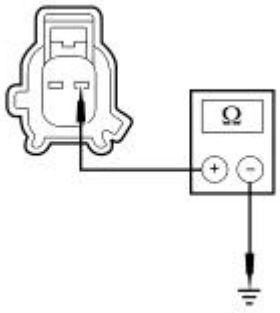
- Circuit open
- Circuit shorted
- Air spring solenoid(s)

- Air suspension module

PINPOINT TEST E: DTC C1790 (LR) AND C1795 (RR) — AIR SUSPENSION AIR SPRING SOLENOID OUTPUT CIRCUIT FAILURE

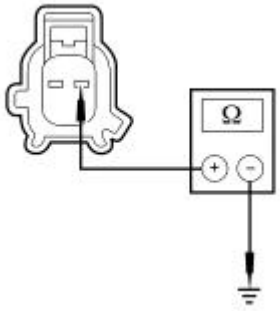
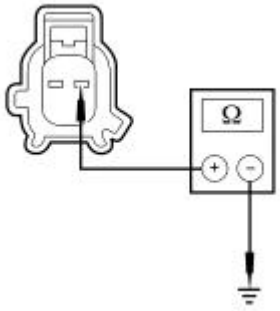
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

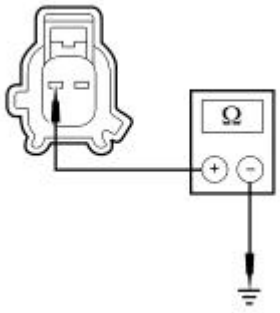
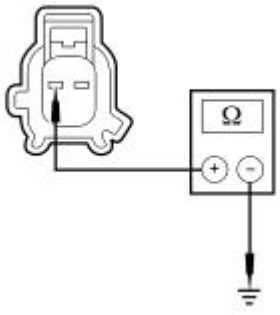
Test Step	Result / Action to Take
E1 CHECK THE AIR SPRING SOLENOID PID • Connect the diagnostic tool. • Key in ON position. • Monitor the suspect air spring solenoid PID: • **Does the PID indicate a short to ground or a short to voltage?**	**Yes** For a short to ground GO to E3 . For a short to voltage GO to E4 . **No** GO to E2 .
E2 CHECK THE AIR SPRING SOLENOID CONNECTOR(S) • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Using the DTCs obtained after running the air suspension module self-test, determine which air spring solenoid is causing the concern. • Key in OFF position. • Disconnect: Suspect Air Spring Solenoid Connector. • Inspect the pins and terminals of the air spring solenoid connector(s) for corrosion, damage, pushed-out pins, spread terminals, moisture or other damage. • **Is the air spring solenoid connector(s) OK?**	**Yes** GO to E3 . **No** REPAIR the connector(s) as necessary. CLEAR the DTCs. REPEAT the self-test.
E3 CHECK THE AIR SPRING SOLENOID CONTROL CIRCUIT(S) FOR A SHORT TO GROUND • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131b. • Disconnect: Air Spring Solenoids C4044 LR, and C4045 RR. • Measure the resistance between C4044-1, circuit CCL05 (WH/BN), harness side and ground.  • Measure the resistance between C4045-1, circuit CCL07 (YE/GY), harness side and ground.	**Yes** GO to E4 . **No** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.



N0059656

- **Is the resistance greater than 10,000 ohms?**

E4 CHECK THE AIR SPRING SOLENOID CONTROL CIRCUIT FOR SHORT TO VOLTAGE	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension ModuleC2131b. • Disconnect: Air Spring Solenoids C4044 LR, and C4045 RR. • Key in ON position. • **For the LR air spring solenoid,** measure the resistance between C4044-1, circuit CCL05 (WH/BN), harness side and ground.  N0059656 • **For the RR air spring solenoid,** measure the resistance between C4045-1, circuit CCL07 (YE/GY), harness side and ground.  N0059656 • **Is voltage present?**	**Yes** GO to E5 . **No** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
E5 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Key in OFF position. • **For the RR air spring solenoid** , measure the resistance between C4045-2, circuit GD120 (BK/GN), harness side and ground.	**Yes** REPAIR circuit GD120 (BK/GN). CLEAR the DTCs. REPEAT the self-test. **No** GO to E6 .

 N0055959 • **For the LR air spring solenoid** , measure the resistance between C4044-2, circuit GD120 (BK/GN), harness side and ground.  N0055959 • **Is the resistance greater than 10,000 ohms?**	
E6 CHECK THE AIR SPRING SOLENOID COIL(S) FOR AN OPEN • **For the RR air spring solenoid** , measure the resistance between air spring solenoid C4045 pin-1, component side and air spring solenoid C4045 pin-2, component side. • **For the LR air spring solenoid** , measure the resistance between air spring solenoid C4044 pin-1, component side and air spring solenoid C4044 pin-2, component side. • **Is the resistance between 15 and 19 ohms (if the solenoid is very hot, the resistance may be as high as 22 ohms)?**	**Yes** GO to E7 . **No** INSTALL a new air spring solenoid(s). REFER to Air Spring Solenoid Valve in this section. CLEAR the DTCs. REPEAT the self-test.
E7 CHECK THE AIR SUSPENSION MODULE CONNECTOR • Check the air suspension module connector for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals. • Connect: Air Suspension Module C2131b. • Make sure the connector is seated correctly then enable the air suspension system, operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test F: DTC C1830 — Air Suspension Compressor Relay Circuit Failure

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The air suspension module will command the air compressor ON or OFF when certain conditions are met. The air suspension module supplies voltage to the air suspension compressor relay through circuit CCL01 (WH/VT), which engages the relay and supplies fused battery voltage along circuit CCL08 (BU/BN) to the air compressor. The air compressor and the relay are both supplied a ground through circuit GD123 (BK/GY).

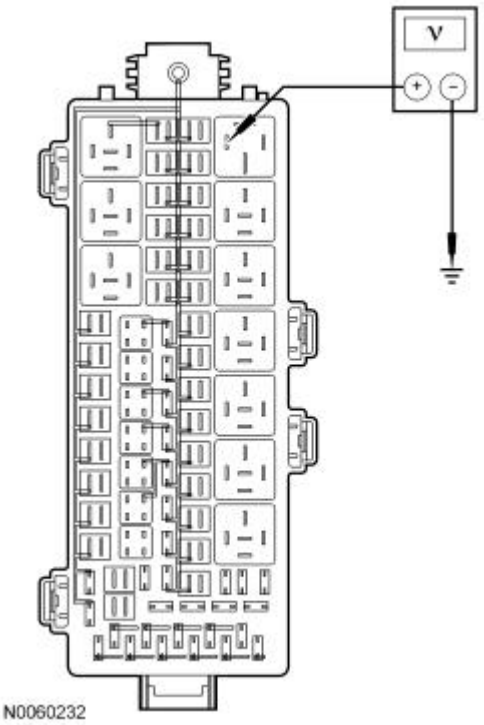
Possible Causes

- Circuit open
- Circuit shorted
- Air compressor relay
- Air suspension module

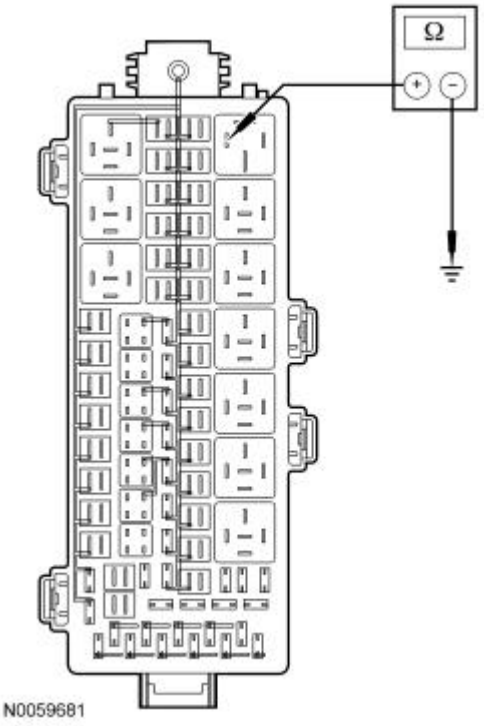
PINPOINT TEST F: DTC C1830 — AIR SUSPENSION COMPRESSOR RELAY CIRCUIT FAILURE

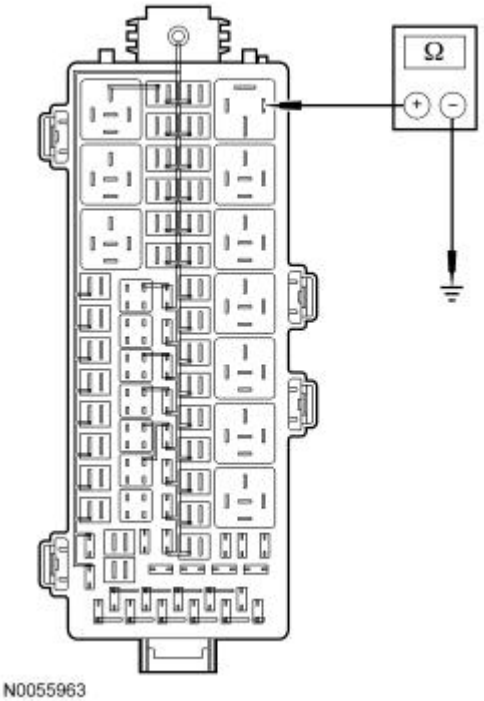
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
F1 CHECK THE AIR COMPRESSOR RELAY OUTPUT PID	
• Connect the diagnostic tool. • Key in ON position. • Monitor the air compressor relay output PID. • **Does the PID indicate a short to ground, short to voltage or an open circuit?**	**Yes** For a short to voltage, GO to F2 . For a short to ground GO to F3 . For an open circuit GO to F4 . **No** GO to F5 .
F2 CHECK THE RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131a. • Disconnect: Air Compressor Relay. • Key in ON position. • Measure the voltage between air compressor relay socket pin-1, circuit CCL01B (WH/VT), harness side and ground.	**Yes** REPAIR circuit CCL01B WH/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to F3 .



- **Is voltage present?**

F3 CHECK THE RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131a. • Disconnect: Air Compressor Relay. • Measure the resistance between air compressor relay socket pin-1, circuit CCL01B (WH/VT), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F4 . **No** REPAIR circuit CCLO1B (WH/VT). CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE RELAY CONTROL CIRCUIT FOR AN OPEN	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131a. • Disconnect: Air Compressor Relay. • Measure the resistance between air compressor relay socket pin-1, circuit CCL01B (WH/VT) and the air suspension module C2131a-6. • **Is the resistance less than 5 ohms?**	**Yes** GO to F5 . **No** REPAIR circuit CCL01B (WH/VT). CLEAR the DTCs and REPEAT the self-test.
F5 CHECK THE AIR COMPRESSOR RELAY AND SOCKET	
• Disconnect: Air Compressor Relay. • Carry out the Air Compressor Relay Component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • Inspect the terminals of the air compressor relay socket for corrosion, spread or pushed-out terminals, moisture or other damage. • **Are the relay and connector OK?**	**Yes** GO to F6 . **No** REPAIR the connector or INSTALL a new air compressor relay. CLEAR the DTCs. REPEAT the self-test.
F6 CHECK THE RELAY GROUND CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Measure the resistance between air compressor relay socket pin-2, circuit GD123 (BK/GY), harness side and ground.  N0055963 • **Is the resistance less than 5 ohms?**	**Yes** GO to F7 . **No** REPAIR circuit GD123 (BK/GY). CLEAR the DTCs. REPEAT the self-test.
F7 CHECK THE AIR SUSPENSION MODULE CONNECTOR	
• Check the air suspension module connector for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals. • Connect: Air Suspension Module C2131a. • Make sure the connector is seated correctly then enable the	**Yes** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self-test.

air suspension system, operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test G: DTC C1883 (LR) and C1885 (RR) — Air Suspension Height Sensor Signal Circuit Failure

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The 2 rear height sensors receive a 5-volt reference voltage from the air suspension module along circuit LCL12 (VT/OG), both sensors share a common return path along circuit RCL12 (GN/WH). The RR sensor sends the suspension height voltage back to the air suspension module along circuit VCL12 (WH/VT). The LR sensor sends the suspension height voltage back to the module along circuit VCL13 (BN/BU). The air suspension module monitors the 2 height sensors and makes adjustments to the rear suspension based on sensor input.

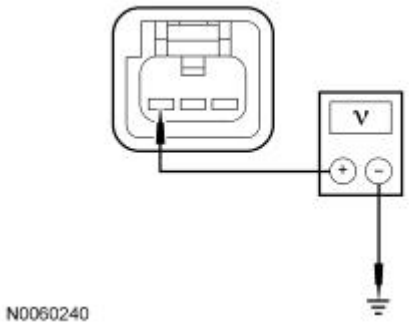
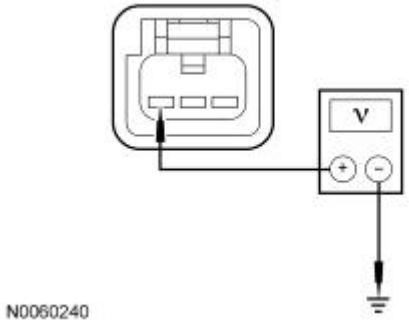
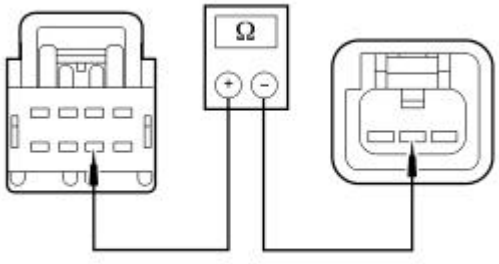
Possible Causes

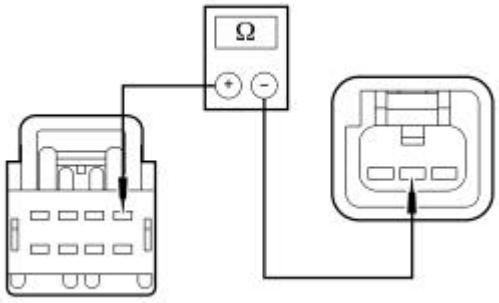
- Circuit open
- Circuit shorted
- Height sensor(s)
- Air suspension module

PINPOINT TEST G: DTC C1883 (LR) AND C1885 (RR) — AIR SUSPENSION HEIGHT SENSOR SIGNAL CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

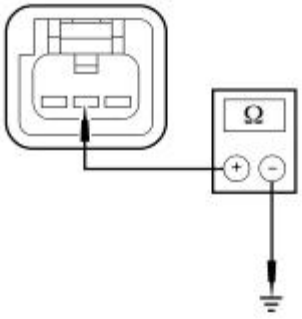
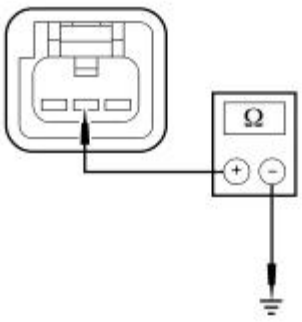
Test Step	Result / Action to Take
G1 CHECK THE AIR SUSPENSION HEIGHT SENSOR VOLTAGE PIDs	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Connect the diagnostic tool. • Key in ON position. • Disconnect the sensor arm linkage from both rear air suspension height sensors. • **NOTE:** The voltage will increase as the suspension is compressed. • While monitoring both height sensor voltage PIDs, slowly move the height sensors through their full range of travel up and down. • **Do the voltages vary from approximately 0.50 volt and 4.50 volts?**	**Yes** INSPECT the height sensor electrical connector(s) for corrosion and damage, REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the sensor arm linkages to the air suspension height sensors GO to G2 .
G2 CHECK CIRCUIT VCL12 (VT/OG) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Suspect Height Sensor. • Key in ON position.	**Yes** GO to G3 .

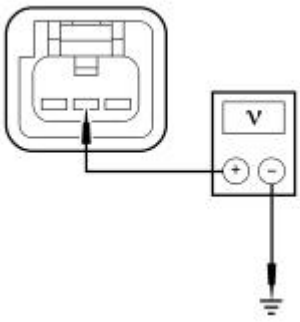
• **For the LR height sensor** , measure the voltage between LR height sensor C4092-3, circuit VCL12 (VT/OG), harness side and ground.  N0060240 • **For the RR height sensor** , measure the voltage between RR height sensor C4093-3, circuit VCL12 (VT/OG), harness side and ground.  N0060240 • **Are 5 volts present?**	**No** Go To Pinpoint Test B .
G3 CHECK CIRCUITS VCL13 (BN/BU) AND VCL12 (WH/VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: Air Suspension Module C2131b. • **For the LR height sensor** , measure the resistance between air suspension module C2131b-6, circuit VCL13 (BN/BU), harness side and LR height sensor C4092-2, circuit VCL13 (BN/BU), harness side.  N0055984 • **For the RR height sensor** , measure the resistance between air suspension module C2131b-1, circuit VCL12 (WH/VT), harness side and RR height sensor C4093-2, circuit VCL12 (WH/VT), harness side.	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to G4 .



N0055985

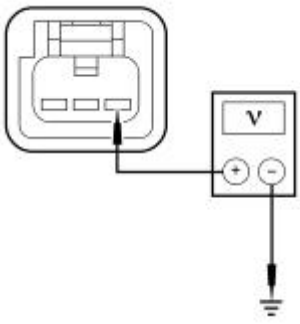
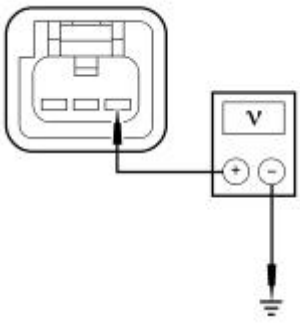
- **Is the resistance greater than 10,000 ohms?**

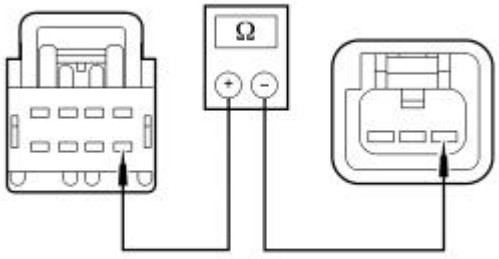
G4 CHECK CIRCUITS VCL13 (BN/BU) AND VCL12 (WH/VT) FOR A SHORT TO GROUND	
• **For the LR height sensor** , measure the resistance between LR height sensor C4092-2, circuit VCL13 (BN/BU), harness side and ground.  N0055968 • **For the RR height sensor** , measure the resistance between RR height sensor C4093-2, circuit VCL12 (WH/VT), harness side and ground.  N0055968 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to G5 .
G5 CHECK CIRCUITS VCL13 (BN/BU) AND VCL12 (WH/VT) FOR A SHORT TO VOLTAGE	
• Key in ON position. • **For the LR height sensor** , measure the voltage between LR height sensor C4092-2, circuit VCL13 (BN/BU), harness side and ground. • **For the RR height sensor** , measure the voltage between RR height sensor C4093-2, circuit VCL12 (WH/VT), harness side and ground.	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to G6 .



N0055967

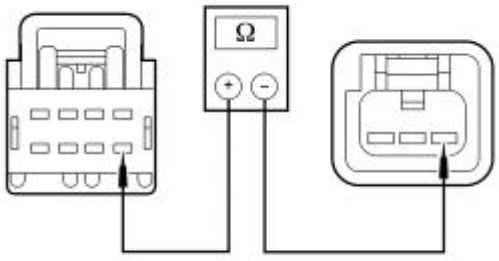
- **Is voltage present?**

G6 CHECK FOR SIGNAL RETURN SHORTED TO VOLTAGE	
• **For the LR height sensor** , measure the voltage between LR height sensor C4093-1, circuit RCL12 (GN/WH), harness side and ground.  N0060242 • **For the RR height sensor** , measure the voltage between RR height sensor C4092-1, circuit RCL12 (GN/WH), harness side and ground.  N0060242 • **Is 5 volts present?**	**Yes** GO to G7 . **No** Go To Pinpoint Test B .
G7 CHECK CIRCUIT RCL12 (GN/WH) FOR AN OPEN	
• Key in OFF position. • **For the LR height sensor** , measure the resistance between air suspension module C2131b-5, circuit RCL12 (GN/WH), harness side and LR height sensor C4092-1, circuit RCL12 (GN/WH), harness side.	**Yes** REPAIR circuit VCL12 (WH/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to G8 .



N0060248

- **For the RR height sensor** , measure the resistance between air suspension module C2131b-5, circuit VCL12 (WH/VT), harness side and RR height sensor C4093-2, circuit VCL12 (WH/VT), harness side.



N0060248

- **Is the resistance greater than 10,000 ohms?**

G8 VERIFY HEIGHT SENSOR(S) OUTPUT VOLTAGE	
• Connect: Air Suspension Module C2131b. • Connect: RH Height Sensor C4093 and LH Height Sensor C4092. • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Back probe RR height sensor C4093-2, circuit VCL12 (WH/VT) and LR height sensor C4092-2, circuit VCL12 (WH/VT). • **Is the voltage reading the same as the sensor PID reading?**	**Yes** GO to G9 . **No** INSTALL a new height sensor(s) and CALIBRATE both height sensors. REFER to Suspension Height Sensor in this section, CLEAR the DTCs. REPEAT the self-test.
G9 CHECK THE AIR SUSPENSION MODULE CONNECTOR	

• Disconnect: Air Suspension Module C2131b.
• Check air suspension module C2131b for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Module C2131b.
• Make sure the connector is seated correctly then enable the air suspension system, operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new air suspension module. REFER to Air Suspension Module in this section. CLEAR the DTCs. REPEAT the self test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Air Compressor Continuously Cycles With the Ignition Switch in the OFF Position and No DTC is Set

Normal Operation

The air suspension module will command the air compressor ON or OFF when certain conditions are met. The air suspension module supplies voltage to the air suspension compressor relay through circuit CCL01 (WH/VT), which engages the relay and supplies fused battery voltage along circuit SBB39 (WH/RD) through the air compressor relay and then to the air compressor along circuit CCL08 (BN/BU). The air compressor is supplied a ground along circuit A_GD123 (BK/GY) and the air compressor relay is supplied a ground along circuit GD123 (BK/GY).

Possible Causes

- Circuit shorted
- Air compressor relay
- Air suspension module

PINPOINT TEST H: THE AIR COMPRESSOR CONTINUOUSLY CYCLES WITH THE IGNITION SWITCH IN THE OFF POSITION AND NO DTC IS SET

Test Step	Result / Action to Take
H1 CHECK THE AIR COMPRESSOR RELAY OUTPUT PIDs	
• Connect the diagnostic tool. • Key in ON position. • Monitor the air compressor relay output PIDs. • **Do the letters YES appear next to any of the PIDs?**	**Yes** REPAIR circuit CCL01 (WH/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to H2 .
H2 CHECK THE AIR COMPRESSOR CONNECTOR	

• Key in OFF position.
• Disconnect: Air Suspension Compressor C1179.
• Check air compressor C1179 for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Compressor C1179.
• Make sure the connector is seated correctly then enable the air suspension system, operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to H3 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

H3 CHECK THE AIR SUSPENSION MODULE CONNECTOR	

• Key in OFF position.
• Disconnect: Air Suspension Module C2131a.
• Check air suspension module C2131a for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Module C2131a.
• Make sure the connector is seated correctly then enable the air suspension system, operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to H4 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

H4 CHECK FOR MODULE ACTIVITY	
NOTE: If the key has been off for 3 minutes and 30 seconds or more, the compressor is permitted	**Yes** GO to H5 .

to run for a maximum of 30 seconds. • Key in OFF position. • Verify the air compressor still cycles for a maximum of 30 seconds after the ignition is turned OFF. • **Does the air compressor still cycle after the module turns off?**	**No** The system is OK. INFORM the owner of system operations.
H5 CHECK THE AIR SUSPENSION MODULE	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Suspension Module C2131a. • Disconnect: Air Suspension Module C2131b. • **Does the air compressor still cycle?**	**Yes** GO to H6 . **No** INSTALL a new air suspension module. REFER to Air Suspension Module in this section. REPEAT the self-test.
H6 CHECK CIRCUIT CCL08 (BN/BU) FOR A SHORT TO VOLTAGE	
• Disconnect: Air Compressor Relay. • **Does the air compressor still cycle?**	**Yes** REPAIR circuit CCL08 (BN/BU). TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test I: Air Suspension System Inoperative Without DTCs and With the Vehicle at Rest

Normal Operation

The scan tool is used to communicate with the air suspension module and run the self-test. The air suspension module is supplied fused battery voltage through battery junction box (BJB) fuse 47 (30A) along circuit SBB74 (WH/RD), and fused ignition circuit through BJB fuse 65 (10A) along circuit CBB65 (WH/OG). A ground path is provided for the module along circuits GD120 (BK/GN) and GD133 (BK). The air suspension module communicates with the other modules along the high speed communication area network (HS-CAN). The air suspension module must receive inputs from several different components before it will allow the vehicle dynamic suspension system to operate.

Possible Causes

- Fuse(s)
- Circuit open
- Door switch is indicating door ajar status
- Vehicle speed
- System is not enabled
- Air suspension module

PINPOINT TEST I:

NOTE: If the vehicle has been sitting with the key in the run position, it may be necessary to open and close the drivers side door. This will enable the system to carry out the pump or vent functions quicker.

Test Step	Result / Action to Take

I1 VERIFY THAT THE SYSTEM IS ENABLED	
• Verify that the air suspension system is enabled. Refer to Air Suspension System Disable/Enable in this section. • **Is the air suspension system enabled?**	**Yes** GO to I2. **No** ENABLE the air suspension system. Refer to Air Suspension System Disable/Enable in this section.
I2 CHECK THE AIR SUSPENSION MODULE FOR IGNITION SWITCH INPUT	
• Connect the diagnostic tool. • Key in ON position. • While cycling the ignition key from ON to OFF and then back to ON, monitor the air suspension module ignition run detection PID. • **Does the PID display NO with the key in the OFF position and YES with the key in the ON position?**	**Yes** GO to I3. **No** VERIFY battery junction box (BJB) fuse 65 (10A) is OK. If OK, REPAIR circuit CBB65 (WH/OG). TEST the system for normal operation.
I3 CHECK THE AIR SUSPENSION MODULE FOR DOOR AJAR INPUT	
• Key in ON position. • Monitor air suspension module door ajar PID. • Close all the doors, liftgate, liftgate glass and power running boards. • While observing the scan tool, open and close one door. • **Does the door ajar PID change from CLOSED to OPEN?**	**Yes** GO to I4. **No** REFER to Section 418-01 to diagnose the HS-CAN concern.
I4 CHECK THE AIR SUSPENSION MODULE FOR VEHICLE SPEED INPUT	
• Monitor the air suspension module vehicle speed PID. • Test drive the vehicle at different speeds. • **Does the vehicle speed PID match the speedometer within 8 km/h (5 mph)?**	**Yes** GO to I5. **No** REFER to Section 418-01 to diagnose the HS-CAN concern.
I5 CHECK THE AIR SUSPENSION MODULE CONNECTORS	

• Key in OFF position.
• Disconnect: Air Suspension Module C2131a.
• Disconnect: Air Suspension Module C2131b.
• Check the air suspension module connectors for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: Air Suspension Module C2131a.
• Connect: Air Suspension Module C2131b.
• Make sure the connectors are seated correctly then enable the air suspension system, operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to I6.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

I6 VERIFY THE SYSTEMS OPERATION	
• Using the scan tool, carry out the pneumatic test. • **Does running the pneumatic test generate any DTCs?**	**Yes** RECORD the DTCs and REFER to the Air Suspension Module Diagnostic Trouble Code (DTC) Chart.

	No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test J: Excessive Air Compressor Noise

Normal Operation

The air compressor is isolated from the rest of the vehicle and other components by 3 rubber isolators and a bracket. The bracket is mounted to the vehicle using 3 rubber isolators with metal inserts. The air compressor should not be in contact with the vehicle or other components.

Possible Causes

- Compressor bracket
- Bracket isolators
- Compressor mounts
- Component routing
- Wire harness routing

PINPOINT TEST J: EXCESSIVE AIR COMPRESSOR NOISE

Test Step	Result / Action to Take
J1 CHECK FOR THE AIR COMPRESSOR AND/OR THE AIR COMPRESSOR WIRING CONTACTING OTHER COMPONENTS	
• Check the air compressor wiring to see if it is contacting other components inside the engine compartment at any place other than the mounting points. • Check for anything contacting the air compressor (other wire harnesses, air tubes, hoses, loose fasteners, stones or other foreign material). • Check for any contact between the wire harness and other compressor components. • **Is any portion of the wire harness contacting the compressor motor components or is anything contacting the compressor assembly other than the mounts?**	**Yes** REMOVE the air compressor assembly, REFER to Air Suspension Compressor in this section. ADJUST the air compressor wiring harness so that it does not contact the compressor motor or FASTEN/REMOVE objects so they no longer contact the air compressor assembly. INSTALL the air compressor assembly, REFER to Air Suspension Compressor in this section. TEST the system for normal operation. **No** GO to J2.
J2 CHECK FOR A BENT AIR COMPRESSOR BRACKET	
• Check the air compressor bracket for any damage/bends that may contact other components within the engine compartment. • Check the bracket rubber isolators and inserts for any excessive wear or damage. • **Is the air compressor bracket making contact with other components or are the bracket**	**Yes** INSTALL a new air compressor assembly or REPAIR other components as necessary. Refer to Air Suspension Compressor in this section. TEST the system for normal operation. **No** GO to J3.

isolators damaged?	
J3 CHECK THE AIR COMPRESSOR MOUNTS FOR DAMAGE	
• Check the air compressor mounts for signs of cracks or tearing away from the inner sleeve. • **Is damage present in the mounts?**	**Yes** INSTALL a new air compressor assembly. Refer to Air Suspension Compressor in this section. TEST the system for normal operation. **No** GO to J4 .
J4 CHECK THE AIR COMPRESSOR FOR NOISE	
CAUTION: Do not run the air compressor for more than 3 minutes. The air compressor can overheat and stop operating due to an internal temperature sensitive thermal breaker. **The air suspension module will limit run time to protect the air compressor. When DTC C1964 is present, the compressor will not operate for approximately 10 minutes.** • Remove the air compressor assembly, but leave it connected electrically. Refer to Air Suspension Compressor in this section. • Connect the diagnostic tool. • Key in ON position. • Trigger the air suspension module air compressor active command ON. • **Is the air compressor exhibiting any unusual noise?**	**Yes** INSTALL a new air compressor. REFER to Air Suspension Compressor in this section. TEST the system for normal operation. **No** RECHECK the mountings and bracket for damage. If damaged, INSTALL a new air compressor bracket. REFER to Air Suspension Compressor in this section. TEST the system for normal operation.

Pinpoint Test K: The Air Compressor is Inoperative

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

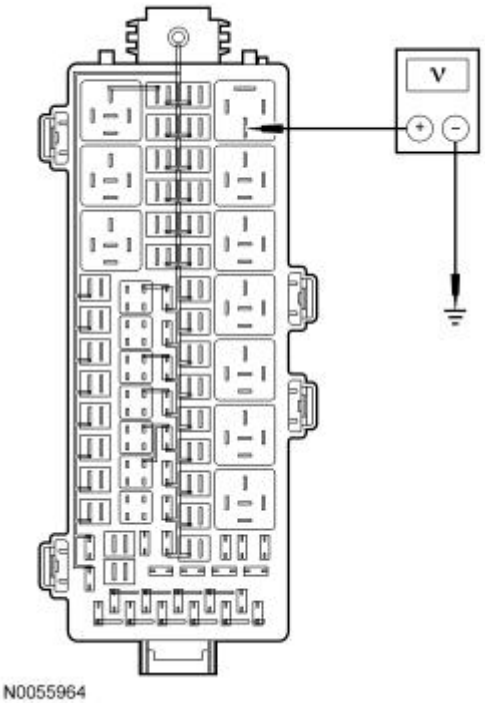
The air suspension module will command the air compressor ON or OFF when certain conditions are met. The air suspension module supplies voltage to the air suspension compressor relay through circuit CCL01 (WH/VT), which engages the relay and supplies fused battery voltage along circuit SBB39 (WH/RD) through the air compressor relay and then to the air compressor along circuit CCL08 (BN/BU). The air compressor is supplied a ground along circuit GD123 (BK/GY) and the air compressor relay is supplied a ground along circuit GD123 (BK/GY).

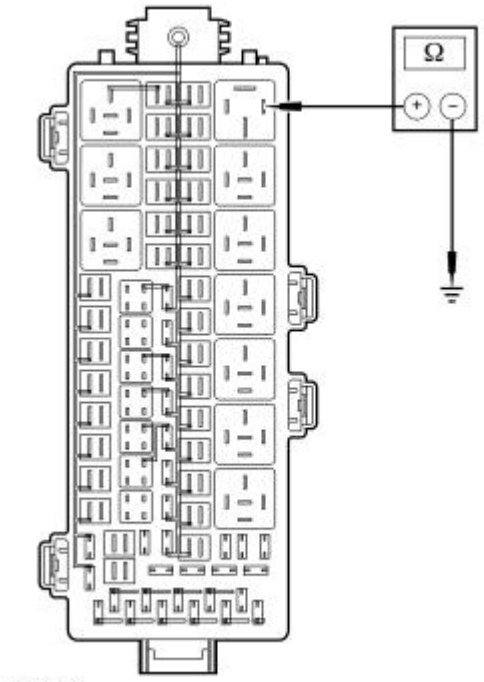
Possible Causes

- Fuse(s)
- Circuit open
- Circuit shorted
- Air compressor relay
- Air compressor
- Air suspension module

PINPOINT TEST K: THE AIR COMPRESSOR IS INOPERATIVE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
K1 CHECK THE AIR COMPRESSOR RELAY AND SOCKET	
• Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in OFF position. • Disconnect: Air Compressor Relay. • Inspect the pins and terminals of the air compressor relay socket for corrosion, spread or pushed-out terminals, moisture or other damage. Carry out the Air Compressor Relay Component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Are the relay and connector OK?**	**Yes** GO to K2. **No** REPAIR the connector or INSTALL a new air compressor relay. CLEAR the DTCs. REPEAT the self-test.
K2 CHECK CIRCUIT SBB39 (WH/RD) FOR VOLTAGE	
NOTE: Make sure the battery voltage is greater than 10 volts before testing the compressor relay voltage. • Measure the voltage between air compressor relay socket pin-3, circuit SBB39 (WH/RD), harness side and ground.  N0055964 • **Is the voltage greater than 10 volts?**	**Yes** GO to K3. **No** Verify BJB fuse 6 (50A) is OK. If OK, REPAIR circuit SBB39 (WH/RD). TEST the system for normal operation.
K3 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Measure the resistance between air compressor relay socket pin-2, circuit GD123 (BK/GY), harness side and ground.	**Yes** REPAIR circuit GD123 (BK/GY). TEST the system for normal operation.

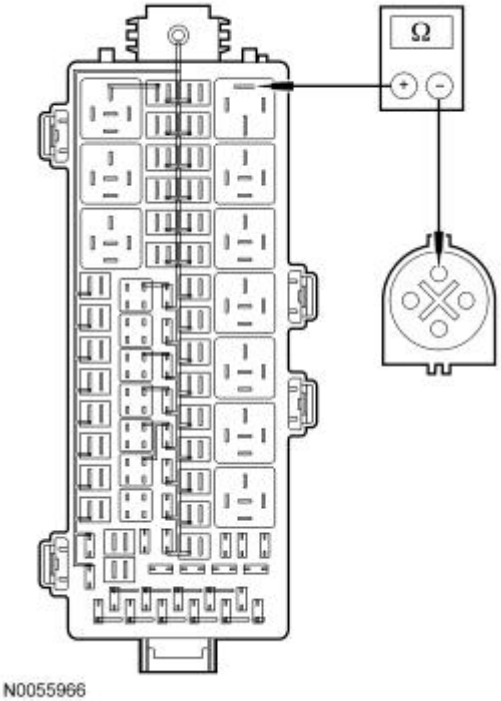


- **Is the resistance greater than 10,000 ohms?**

No
GO to K4 .

K4 CHECK CIRCUIT CCL08 (BN/BU) FOR AN OPEN

- Disconnect: Air Compressor Assembly C1179.
- Measure the resistance between air compressor relay socket pin-5, circuit CCL08 (BN/BU), harness side and air compressor assembly C1179-2, circuit CCL08 (BN/BU), harness side.



- **Is the resistance greater than 10,000 ohms?**

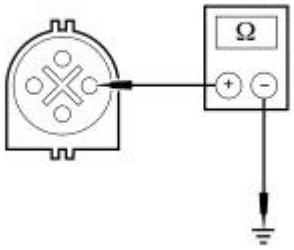
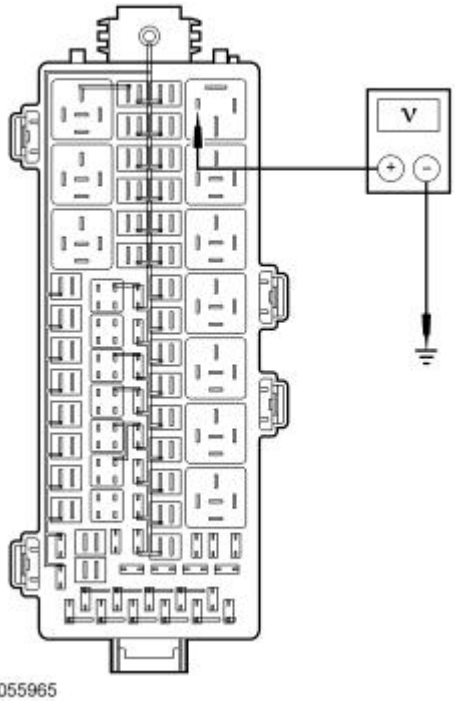
Yes
REPAIR circuit CCL08 (BN/BU). TEST the system for normal operation.

No
GO to K5 .

K5 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

- Measure the resistance between air compressor assembly C1179-1, circuit GD123 (BK/GY), harness side and ground.

Yes
REPAIR circuit GD123 (BK/GY). TEST the

 N0055960 • **Is the resistance greater than 10,000 ohms?**	system for normal operation. **No** GO to K6 .
K6 CHECK THE AIR COMPRESSOR RELAY POWER	
CAUTION: Do not run the air compressor for more than 3 minutes. The air compressor can overheat and stop operating due to an internal temperature sensitive thermal breaker. The air suspension module will limit run time to protect the air compressor. • Connect: Air Compressor Assembly C1179. • Connect the diagnostic tool. • Key in ON position. • Enable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Trigger the air compressor active command ON. • Measure the voltage between air compressor relay socket pin-1, circuit CCL01 (WH/VT), harness side and ground.  N0055965 • **Is the voltage greater than 5 volts?**	**Yes** GO to K7 . **No** REPAIR circuit CCL01 (WH/VT). TEST the system for normal operation.
K7 CHECK THE AIR COMPRESSOR STATUS	
• Key in OFF position. • Connect: Air Compressor Relay. • Key in ON position. • Carry out the On-Demand Self Test. • **Is DTC C1964 present?**	**Yes** If the air suspension compressor run time has been exceeded, DISCONNECT the air suspension module connectors for 10

	minutes. GO to K8 . **No** If no DTC is present, GO to K9 .
K8 CHECK THE AIR COMPRESSOR AFTER COOL DOWN PERIOD • Key in OFF position. • Disable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. Allow the vehicle to sit for 10 minutes to give the air compressor assembly time to cool off. • Enable the air suspension system. Refer to Air Suspension System Disable/Enable in this section. • Key in ON position. • Trigger the vent solenoid active command ON. • Trigger the air compressor active command ON. • **Does the air compressor assembly operate?**	**Yes** GO to K9 . **No** INSTALL a new air compressor. REFER to Air Suspension Compressor in this section. TEST the system for normal operation.
K9 CHECK THE AIR COMPRESSOR THERMAL BREAKER • Trigger the air suspension LR and RR air spring solenoid active commands ON. • Run the air compressor assembly for 60 seconds. • **Did the air compressor assembly run for 60 seconds?**	**Yes** The thermal breaker was overheated. RETEST to validate the system is OK. **No** INSTALL a new air compressor assembly. REFER to Air Suspension Compressor in this section. TEST the system for normal operation.

Pinpoint Test L: DTC 1810 — Height Sensor Delta Out of Range

Normal Operation

The 2 rear height sensors receive a 5-volt reference voltage from the air suspension module along circuit LCL12 (VT/OG), both sensors share a common return path along circuit RCL12 (GN/WH). The RR sensor sends the suspension height voltage back to the air suspension module along circuit VCL12 (WH/VT). The LR sensor sends the suspension height voltage back to the module along circuit VCL13 (BN/BU). The air suspension module monitors the 2 height sensors and makes adjustments to the rear suspension based on sensor input.

Possible Causes

- Vehicle lean (air spring leak, asymmetric loading)
- Height sensor bracket bent or loose
- Height sensor link arm bent, loose or disconnected
- Height sensor(s) out of calibration
- Air tube restriction

PINPOINT TEST L: DTC 1810 — HEIGHT SENSOR DELTA OUT OF RANGE

Test Step	Result / Action to Take

L1 VERIFY THAT DTC C1810 IS PRESENT AND ACTIVE	
NOTE: The air suspension module will log code DTC C1810 if the left and right calculated ride height value differs by 100 mm (3.93 in) or more. • Connect the diagnostic tool. • Key in ON position. • Carry out the pneumatic system test: • **Does DTC C1810 set after carrying out the pneumatic system test?**	**Yes** GO to L2 . **No** GO to L3 .
L2 INSPECT THE RH AND LH HEIGHT SENSORS	
• Verify that both height sensor arms are fastened to the ball studs on the height sensor(s) and lower control arm(s). • Verify that the height sensor arms are installed correctly, and not positioned on backwards. • Inspect for loose or bent height sensor(s) and height sensor(s) arms. • **Are any of the height sensor components damaged?**	**Yes** INSTALL new component(s) as necessary, RESET the vehicle ride height. REFER to Ride Height Adjustments in this section. REPEAT the self-test. **No** GO to L3 .
L3 CHECK THE VEHICLE FOR ASYMMETRICAL LOADING	
• Check for unbalanced or heavy load on one side of the vehicle. • **Is the vehicle heavily loaded on one side causing the ride height to be incorrect?**	**Yes** REPAIR the loading issue and REPEAT the self-test. **No** GO to L4 .
L4 CHECK FOR VEHICLE LEANING	
• Key in OFF position. • Position the vehicle on a level surface. • Using the scan tool, carry out the accurate trim test. • **Are both the LR and RR ride heights within specification?**	**Yes** GO to L7 . **No** GO to L5 .
L5 CHECK THE HEIGHT SENSOR OPERATION DURING PUMP	
• Using the scan tool, inflate the system to for 30 seconds and monitor the LR and RR height sensor voltage pids. • **Does the system inflate evenly?**	**Yes** GO to L6 . **No** Go To Pinpoint Test C .
L6 CHECK HEIGHT SENSOR OPERATION DURING VENT	
• Using the scan tool, command the system to vent for 20 seconds and monitor the LR and RR height sensor voltage PIDS. • **Does the system deflate evenly?**	**Yes** GO to L7 . **No** Go To Pinpoint Test C .
L7 CHECK THE AIR SPRING(S) FOR LEAKS.	
• Inspect both the LR and RR air spring for leaks. • **Are any leaks present?**	**Yes** REPAIR the leaks, REPEAT the self-test. **No**

	System operating correctly at this time.

Component Test

Relay

Refer to Wiring Diagrams Cell 149 for schematic and connector information.

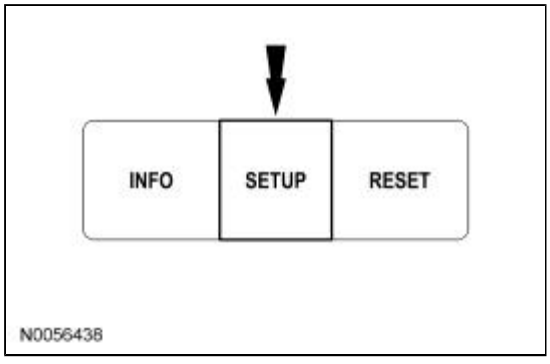
Air Suspension System Disable/Enable

Printable View (92 KB)

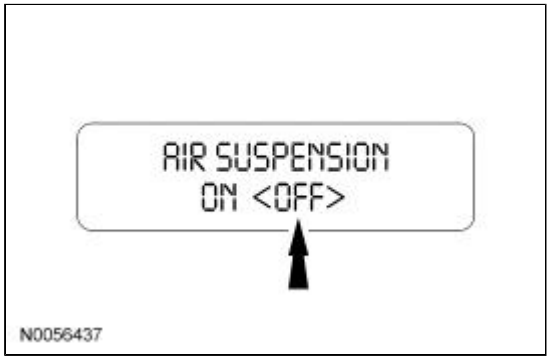
WARNING: The air suspension system must be shut off prior to hoisting or jacking an air suspension equipped vehicle. Failure to do so may result in unexpected inflation or deflation of the air springs, which may result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

NOTE: The message center is located on the instrument cluster and displays important information through a constant monitoring of vehicle systems. You may select display features on the message center for a display of status proceeded by a brief chime. The system will also notify you of potential vehicle problems with a display of system warnings followed by a long indicator chime. The message center is used to disable and enable the vehicle air suspension system. When the driver elects to disable the air suspension system, the message center sends a message over the high speed controller area network (HS-CAN) to the air suspension module. Once the message is received, the air suspension module will take no further action to inflate or deflate the air springs. The system will default to ON when the ignition key is cycled.

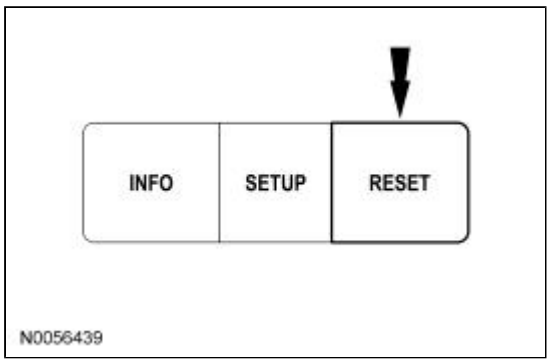
1. Turn the ignition to the ON position, close all doors and clear warnings.
2. Select the SETUP control function on the message center.



3. Select the AIR SUSPENSION function to display the current status of the air suspension system.



4. Press the RESET control to turn the air suspension OFF or ON.


INFO
SETUP
RESET
N0056439

Ride Height Adjustments

Printable View (109 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

CAUTION: The suspension height D dimensions are for reference only. The vehicle attitude must be controlled by the correct dimensions to prevent vehicle damage.

NOTE: If one or both height sensors are installed new, both height sensors must be calibrated.

NOTE: Incorrect air suspension ride height D dimension can be caused by an air suspension system that is incorrectly set.

NOTE: The air suspension module has a preprogrammed trim height.

1. **NOTE:** The vehicle must be on a level surface, such as a drive on alignment hoist.

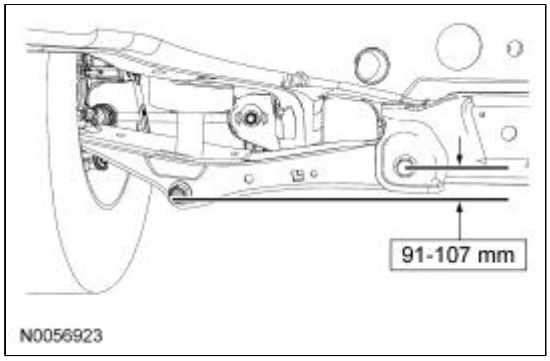
   Position the vehicle on a level surface.

2. Using the vehicle message center, verify that the air suspension is in the ON mode. For additional information, refer to Air Suspension System Disable/Enable in this section.

3. Using the scan tool, run the accurate trim test.

4. Measure the ride height D dimension. For additional information, refer to Section 204-00 .

5. If ride height dimension D is not within specification, use the scan tool to vent or fill the air suspension to the correct dimension.



6. **NOTE:** The air suspension height sensor sends a signal to the air suspension module. The output ranges from approximately 4.5 volts at minimum height (when the vehicle is low or in full jounce) to 0.5 volt at maximum height (when the vehicle is in high or in full rebound).

Using the scan tool, monitor the 2 suspension height sensors voltage parameter identifications (PIDs).

7. Using the scan tool, save the vehicle's trim height for both sensors.

Air Leaks

Printable View (97 KB)

1. Apply a soapy water solution to the air lines, air line fittings, air springs, upper spring shock mount and the air compressor.

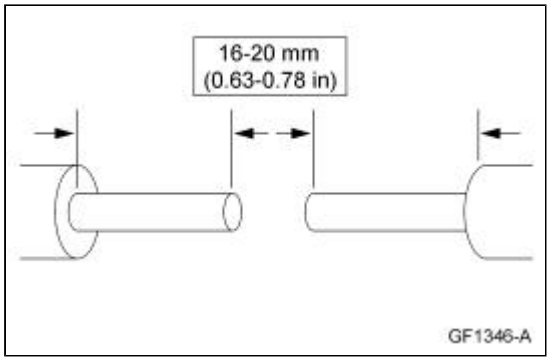
2. **NOTE:** If a leak is detected within the air compressor, install a new compressor. If a leak is detected in a line, carry out the air line repair procedure.

   Verify the location of air leak(s) and repair or install new components as necessary.

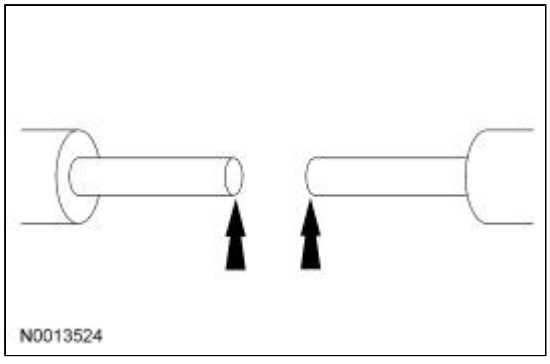
Air Line Repair

1. Cut the line at the damaged area.

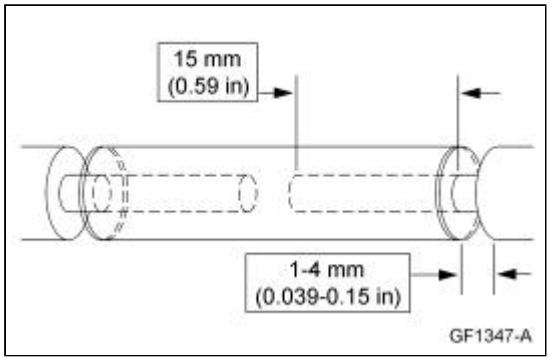
2. Trim the sleeve material from both ends of the damaged line.



3. Taper both ends of the tube by shaving or sanding it 3 mm (0.11 in) from the tips.



4. Install the repair filling.



5. **NOTE:** Check system for leaks.

   Inflate the air suspension system. For additional information, refer to Ride Height Adjustments in this section.

Air Line Fluid Purge

Printable View (80 KB)

WARNING: Do not remove an air spring under any circumstances when there is pressure in the air spring. Do not remove any components supporting an air spring without either exhausting the air or providing support for the air spring. Failure to follow these instructions may result in personal injury.

WARNING: Disconnecting an air tube that is connected to the air compressor can cause damage to components as high pressure air is vented uncontrolled. Failure to follow these instructions may result in personal injury.

CAUTION: Suspension fasteners are critical parts because they effect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. **NOTE:** Carry out this procedure if fluid (water and/or oil) is found in the air tube. Purge fluid from rear air tubes and install new components if affected.

   Disconnect the air tube at the air compressor drier.

2. Disconnect the air tube from the air springs.

3. Connect shop air to the disconnected air tube and blow any fluid out.

4. **NOTE:** When installing the air tubes, make sure the white tube is fully inserted into the fitting for correct installation.

   Reconnect the air tubes at the air springs.

5. Install a new air compressor drier. For additional information, refer to Air Suspension Compressor .

6. Reconnect the air tube to the air compressor drier.

7. Make sure that all air tube fittings are sealed.

Air Spring Inflation and Deflation

Printable View (86 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

WARNING: Do not remove an air spring under any circumstances when there is pressure in the air spring. Do not remove any components supporting an air spring without either exhausting the air or providing support for the air spring to prevent vehicle damage. Failure to follow these instructions may result in personal injury.

CAUTION: Suspension fasteners are critical parts because they effect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

CAUTION: Failure to observe the following instructions can result in a sudden failure of the air spring or suspension system.

- **Any rear spring which is unfolded must be refolded prior to being installed in a vehicle.**
- **The air spring refolding procedure should only be used for an air spring which has never supported the vehicle's weight while in the incorrectly folded position.**
- **Improperly folded air springs found on vehicles during pre-delivery inspection or after use must be replaced.**
- **When installing a new air spring, care must be taken not to apply a load to the suspension until the springs have been inflated using the air spring fill procedure.**
- **After inflating an air spring in the hanging position, it must be inspected for correct shape.**

CAUTION: Prior to installing an air spring, make sure the air spring is in the correct shape with no folds or creases. If the air spring is not in the correct shape, carry out air spring refold before installing the air spring.

1. Turn the ignition switch to the RUN position.

2. Connect the scan tool to the data link connector (DLC).

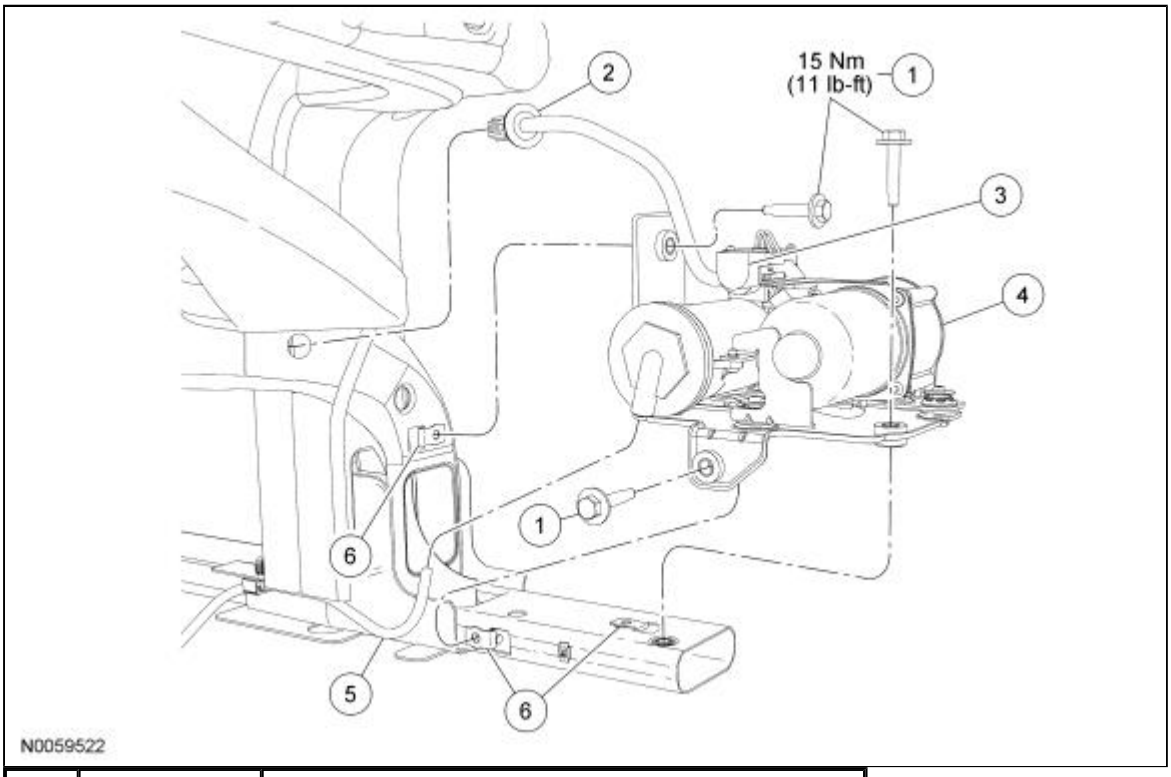
3. Select the air suspension control module active command LR_SOL (LR) or RR_SOL (RR) from OFF to ON.

4. **NOTE:** When using the air suspension control module active command AS_COMP, do not run the air compressor for more than 3 minutes to prevent overheating and shutdown. If this occurs, wait for the system to cool down before resuming the inflation procedure.

Select the air suspension control module active command AS_VENT to deflate the air springs or AS_COMP to inflate the air springs.

Air Suspension Compressor

Printable View (156 KB)



Item	Part Number	Description
1	W505436	Compressor bolts (3 required)
2	—	Compressor air intake hose
3	—	Compressor electrical connector (part of 14624)
4	3B484	Compressor and bracket assembly
5	3C002	Air line
6	W520823	Clip nuts (3 required)

Removal and Installation

1. Remove the inner fender splash shield. For additional information, refer to Section 501-02 .
2. Disconnect the air line from the compressor drier.
   - Compress the quick connect lock ring inward, then pull the line outward from the air drier.
3. Disconnect the air compressor air intake hose.
4. Disconnect the air compressor electrical connector.
5. Remove the 3 air compressor bracket bolts and remove the air compressor and bracket assembly.
   - To install, tighten to 15 Nm (11 lb-ft).
6. **NOTE:** When installing the air lines, make sure the white inner air line is fully inserted into the

fitting for correct installation.

NOTE: Make sure that there are no objects trapped under or on the bracket.

Make sure that the air compressor is not in contact with any surrounding components that could cause vibration noises.

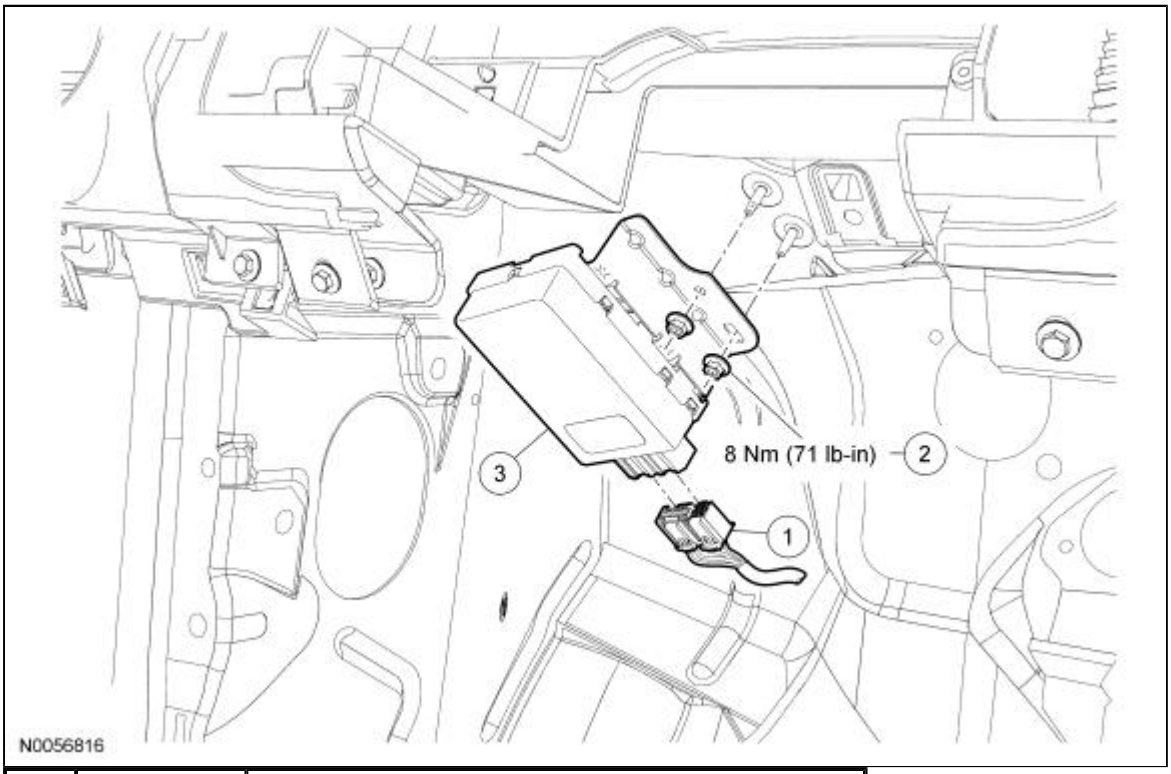
NOTE: Make sure that the air compressor moves freely in the rubber isolators.

Make sure that the bracket has no deformations that could cause the 3 rubber isolators to load against each other.

To install, reverse the removal procedure.

Air Suspension Module

Printable View (197 KB)



Item	Part Number	Description
1	—	Module electrical connectors (2 required) (part of 14489)
2	W707142	Module bracket nut (2 required)
3	3C142	Air suspension control module and bracket assembly

Removal and Installation

1. **CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

   Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. **NOTE:** The air suspension control module is mounted to the lower left side of the dash above the parking brake control.

   Disconnect the 2 air suspension control module electrical connectors.

3. Remove the air suspension control module nuts and the air suspension control module.
   - To install, tighten to 8 Nm (71 lb-in).

4. **NOTE:** The air suspension control module is calibrated with information from the ride height sensors. A new or exchanged air suspension control module requires that the LH and RH ride

height sensors are calibrated and a pneumatic test is carried out. For additional information, refer to Vehicle Dynamic Suspension Calibration Initialize System — Clear C1990 and C1991 DTCs in this section.

To install, reverse the removal procedure.

Air Shock Absorber — Rear

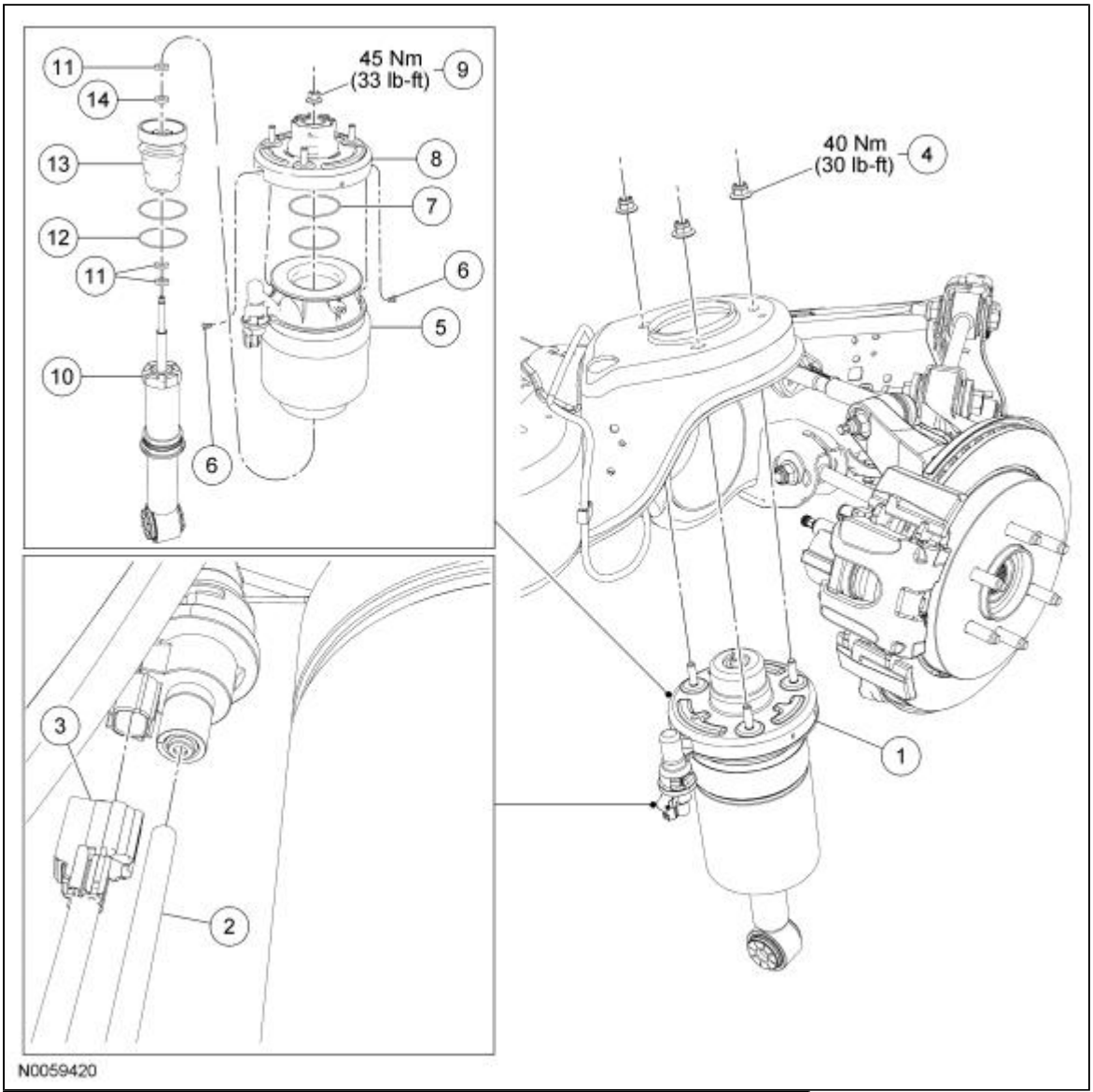
Printable View (278 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B



Item	Part Number	Description
1	5A980	Air shock and spring assembly
2	—	Air line (part of 3209)
3	—	Air valve electrical connector (part of 14A464)
4	W712334	Shock upper nuts (3 required)
5	5A891	Air spring assembly
6	—	Screws (part of 5B302)
7	—	Air spring upper O-ring seals (2 required) (part of 5B302)
8	18A099	Upper mount
9	W712134	Shock rod nut
10	18080	Shock absorber
11	—	Shock rod O-ring seals (2 required) (part of 5B302)
12	—	Air spring lower O-ring seals (2 required) (part of 5B302)
13	—	Jounce bumper (part of 18080)

14	—	Shock rod washer (part of 18080)

Removal and Installation

WARNING: Do not remove an air spring under any circumstances when there is pressure in the air spring. Do not remove any components supporting an air spring without either exhausting the air or providing support for the air spring. Failure to follow these instructions may result in personal injury.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be used if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Using the scan tool, vent the appropriate air spring.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the lower arm. For additional information, refer to Section 204-02 .

4. Disconnect the air spring solenoid valve electrical connector.

5. Disconnect the air line at the air valve.
   - Compress the orange quick connect lock ring, then pull downward on the air supply line.

6. Remove and discard the 3 shock upper nuts.
   - To install, tighten to 40 Nm (30 lb-ft).

7. Remove the air shock absorber.

8. **NOTE:** If the individual spring and/or shock components are not being serviced, continue with Step 14.

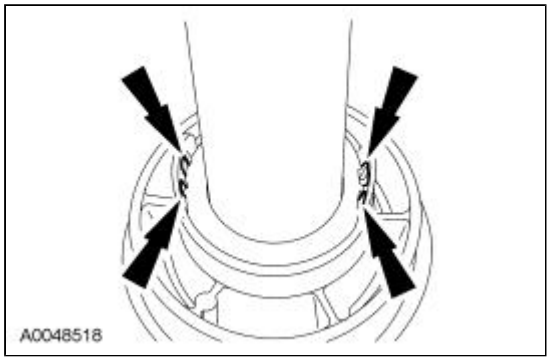
   NOTE: Use the hex holding feature to prevent the shock rod from turning while removing the nut.

   Remove and discard the shock rod nut.
   - To install, tighten to 45 Nm (33 lb-ft).

9. **CAUTION: If the retainer tabs are broken, a new air spring must be installed.**

   NOTE: Index-mark the air spring and shock absorber for reference during the installation procedure.

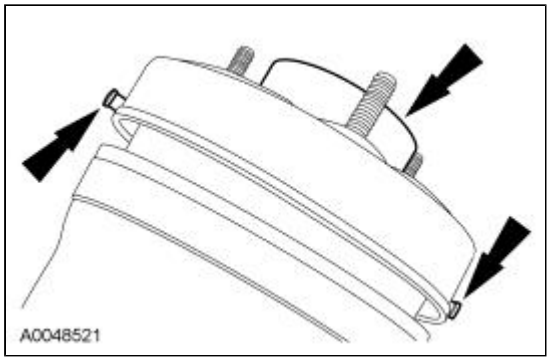
   Depress the retainer tabs and remove the air spring.



10. Remove the shock rod O-ring seal, washer and jounce bumper.
    - Discard the seal and washer.

11. Remove and discard the 2 air spring lower O-ring seals.

12. Remove the 2 retainer screws and the upper mount.
    - Discard the screws.



13. Remove and discard the 2 air spring upper O-ring seals.

14. **CAUTION: Use a suitable press to install the upper mount retainer pins. Do not use a hammer or damage may occur.**

    NOTE: Make sure that all seals are clean and free of debris.

    NOTE: Apply a thin coat of grease to the new O-ring seals.

    To install, reverse the removal procedure.

Air Spring Solenoid Valve

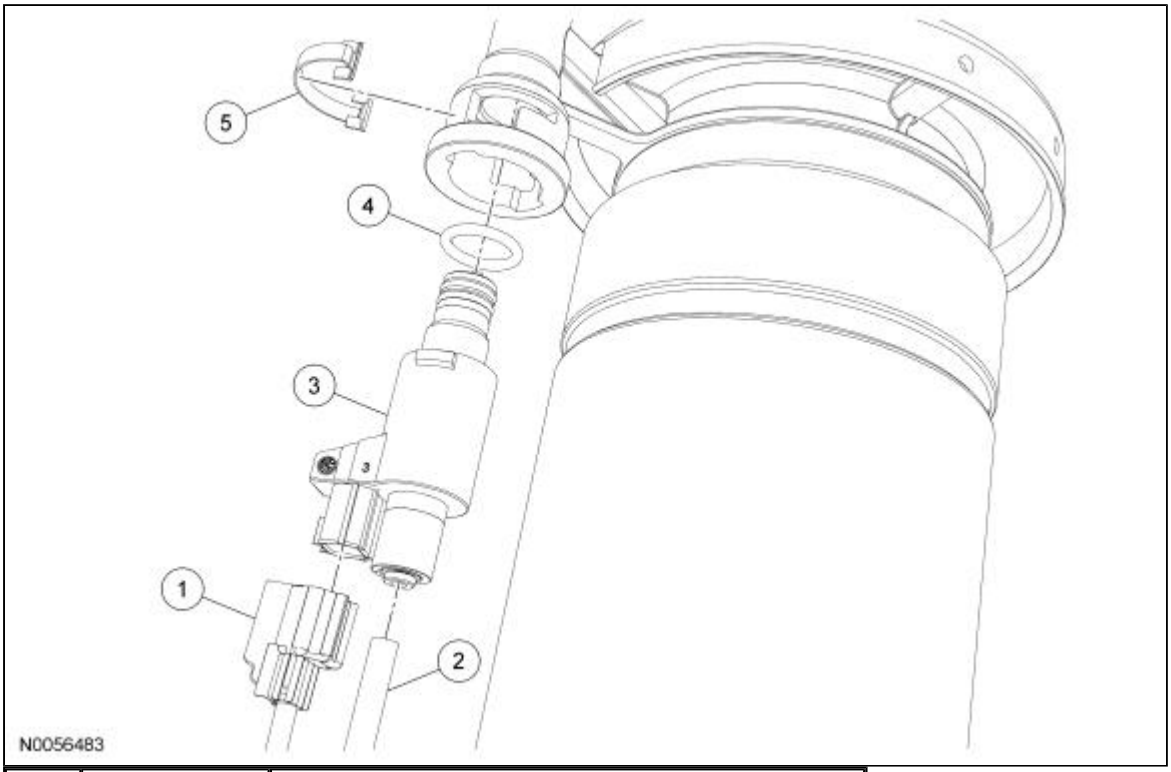
Printable View (153 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A



Item	Part Number	Description
1	—	Air valve electrical connector (part of 14A464)
2	—	Air line (part of 3C002)
3	—	Air spring solenoid valve (part of 3C199)
4	—	Solenoid valve O-ring (part of 3C199)
5	—	Air spring solenoid clip (part of 3C199)

Removal and Installation

WARNING: Do not remove an air spring under any circumstances when there is pressure in the air spring. Do not remove any components supporting an air spring without either exhausting the air or providing support for the air spring. Failure to follow these instructions may result in personal injury.

1. If the air spring solenoid valve is functional, use the scan tool to vent the appropriate air spring(s).

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Disconnect the air spring solenoid valve electrical connector.

4. Disconnect the air line at the air valve.
   - Compress the orange quick connect lock ring, then pull downward on the air supply line.

5. **CAUTION: Remove any dirt or other foreign material from the air spring assembly prior to removing the air spring solenoid valve from the air spring assembly.**

   Remove the air spring solenoid clip.

6. **WARNING: The air spring solenoid valve has a 2-stage release. When removing a non-functional solenoid and the air spring is inflated, carefully rotate the solenoid counterclockwise until it reaches the first stage to release the air from the air spring. Turn the solenoid to the second stage to remove the solenoid. Failure to follow these instructions when removing a non-functional air spring solenoid may result in personal injury or damage to components as high pressure air is vented uncontrolled.**

   Rotate the air spring solenoid and remove the solenoid.

7. **NOTE:** Inspect the air spring O-ring for damage and install a new O-ring as necessary. Lightly lubricate the solenoid seal area with silicone grease.

   NOTE: After installing the solenoid, it is necessary to inflate the air suspension system. For additional information, refer to Ride Height Adjustments in this section.

   NOTE: When installing the air spring solenoid, make sure that the electrical connector is positioned away from the air spring.

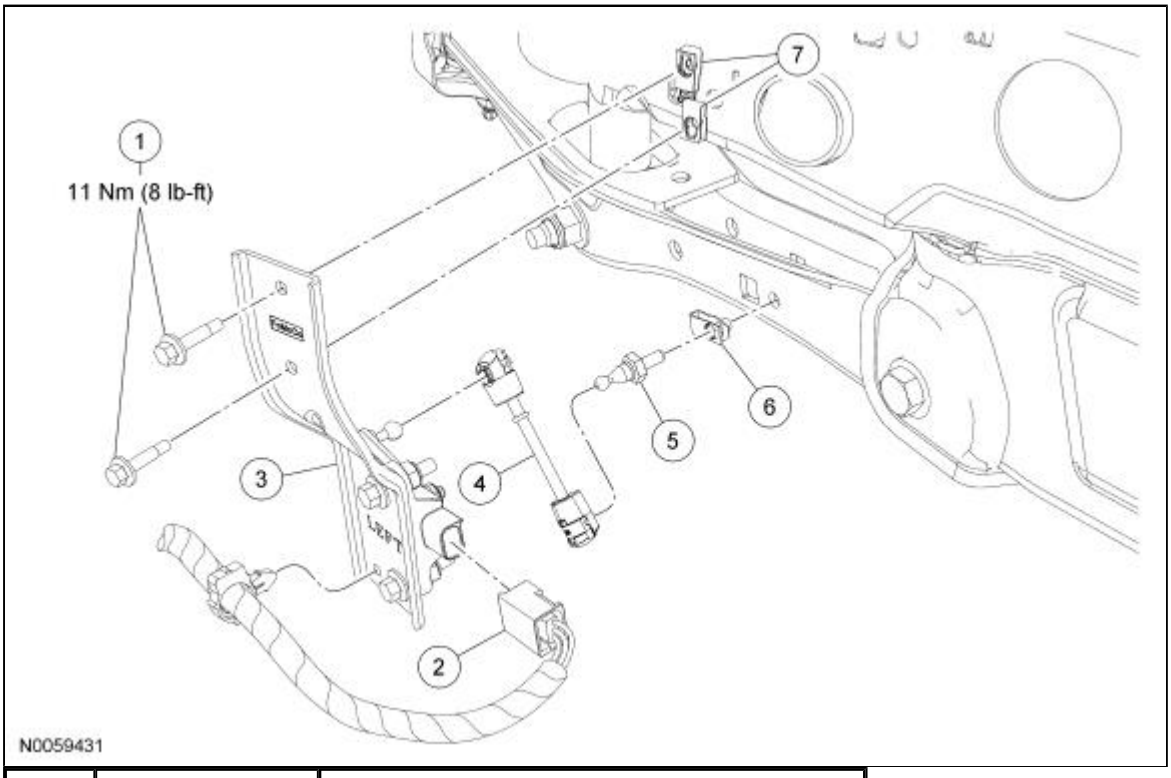
   NOTE: When installing the air lines, make sure the air line is fully inserted into the fitting for correct installation.

   To install, reverse the removal procedure.

Suspension Height Sensor

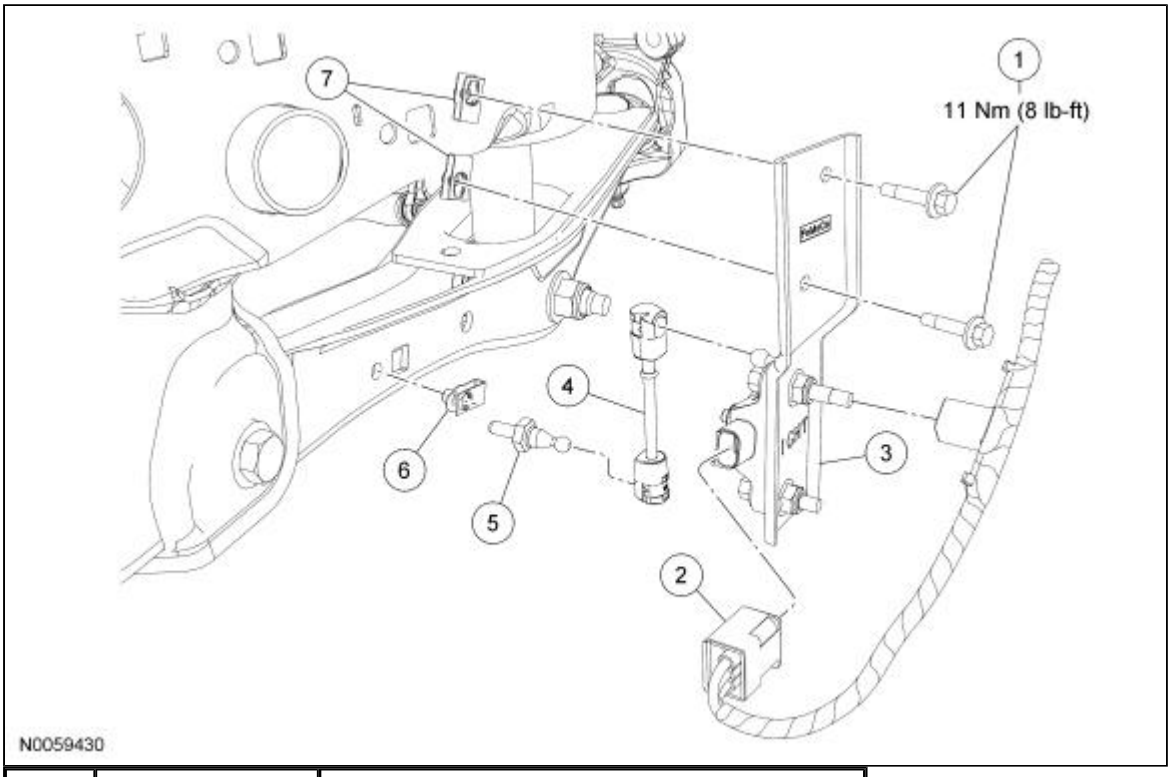
Printable View (248 KB)

LH Side



Item	Part Number	Description
1	W506014	Sensor assembly bolts (4 required)
2	—	Sensor electrical connector
3	5A690	Ride height sensor
4	—	Sensor arm (part of 3C034)
5	5A945	Ride height sensor ball stud
6	W711660	Ball stud nut clip
7	W712408	Frame nut clips (2 required)

RH Side



Item	Part Number	Description
1	W506014	Sensor assembly bolts (4 required)
2	—	Sensor electrical connector
3	5A967	Ride height sensor
4	—	Sensor arm (part of 3C034)
5	5A945	Ride height sensor ball stud
6	W711660	Ball stud nut clip
7	W712408	Frame nut clips (2 required)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the senor harness from the sensor bracket.

3. Disconnect the sensor electrical connector.

4. Disconnect the sensor arm from the ball stud on the lower control arm.

5. Remove and discard the 2 sensor bolts.
   - To install, tighten to 11 Nm (8 lb-ft).

6. **NOTE:** The RH and LH height sensor assemblies **cannot** be used on opposite sides of the vehicle.

   To install, reverse the removal procedure.

7. Calibrate the LH and RH height sensors. For additional information, refer to Ride Height Adjustments in this section.

Printable View (78 KB)

General Specifications

Item	Specification
Driveline Angles	
Universal Joint Operating Angle	0.5°-3.0°
Epoxy Sealer	M-3D35A(E)

Driveline System

Printable View (188 KB)

The source of the drivetrain's power is generated by the engine and delivered to the transmission. The driveline transfers the engine torque through the driveshaft to the axle.

- On rear wheel drive (RWD) vehicles, power is transmitted through the transmission to the driveshaft and then to the rear axle.
- On four wheel drive (4WD) vehicles, power is transmitted through the transmission and the transfer case. The transfer case directs the power to the rear driveshaft and then to the rear axle. When engaged, it also transmits power through the front driveshaft to the front axle.

The rear driveshaft is connected to the output shaft of the transmission and to the rear axle. The front driveshaft is connected to the transfer case and to the front axle. For Expedition, slip yokes are used to allow for any changes to the length of the driveshaft. Navigator RWD vehicles use a fixed flange at the transmission with a flex coupling. Changes in length are self adjusted up in the driveshaft slip mechanism. The engine torque enters the axle through the drive pinion, which rotates the ring gear. The ring gear is mounted to the differential case, which contains the gears that transmit power to the rear axle shafts or front halfshafts. These shafts rotate the drive wheels.

For additional information on the front axle assembly, refer to Section 205-03 .

For additional information on the halfshafts, refer to Section 205-04 or Section 205-05 .

For additional information on the driveshaft, refer to Section 205-01 .

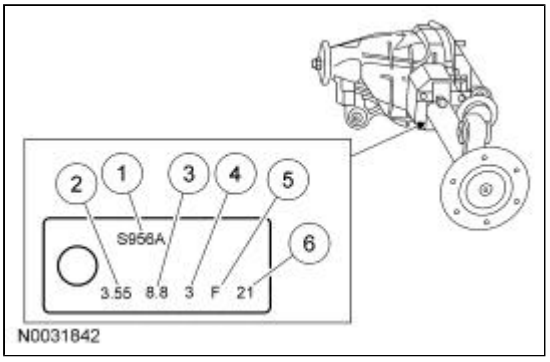
For additional information on the rear axle, refer to Section 205-02 .

The engine angle is built into the engine mounts. If the engine angle is out of specification, the engine mounts must be inspected for damage. For additional information, refer to Section 303-01 .

Vehicle Certification (VC) Label Example

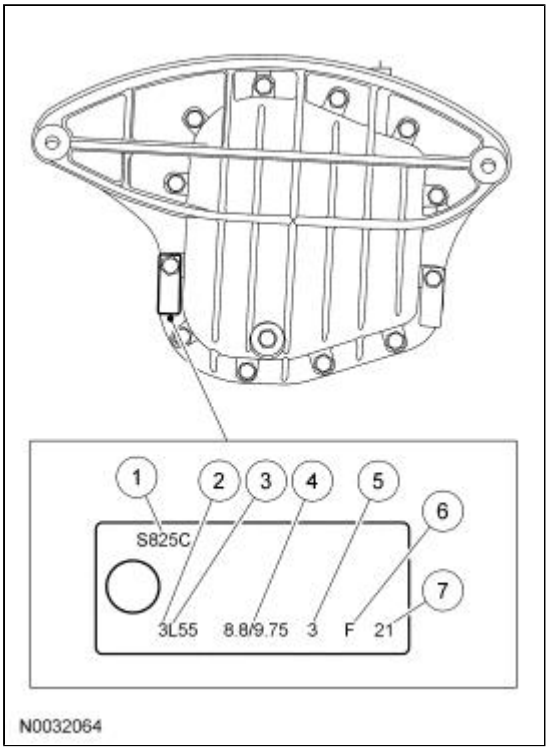
The vehicle certification (VC) label is located in the driver door jamb. The first 2 digits of the axle code indicate the rear axle and the third digit refers to the front axle, if so equipped. For additional information on the VC label, refer to Section 100-01 .

Front Axle Identification Tag



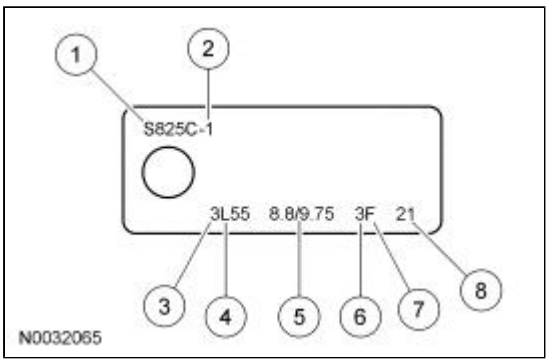
Item	Description
1	Plant code
2	Axle ratio
3	Ring gear diameter (in)
4	Build year
5	Build month
6	Build day

Rear Axle Identification Tag



Item	Description
1	Plant code
2	Axle ratio
3	Denotes Traction-Lok®
4	Ring gear diameter (in)
5	Build year
6	Build month
7	Build day

Axle Identification Tag Denoting Interchangeability Affected Internally



Item	Description
1	Plant code
2	Denotes interchangeability affected internally
3	Axle ratio
4	Denotes Traction-Lok®
5	Ring gear diameter (in)

6	Build year
7	Build month
8	Build day

CAUTION: The axle identification tag is the official service identifier. Do not damage the tag. Always reinstall the tag after removing it for axle inspection/repair.

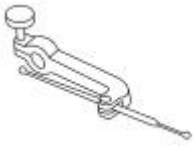
The plant code denotes a particular axle design, a specific ratio, and if it is a conventional or limited slip (Traction-Lok®) type. In addition, the plant code will not change as long as that particular axle assembly never undergoes an external design change. If, however, an internal design change takes place during the production life of the axle and that internal change affects component interchangeability, a dash and numerical suffix is added to the plant code.

Note that the plant code in the front and rear axle identification tag illustrations is similar, but the illustration denoting interchangeability affected internally shows the addition of the suffix. This means that as an assembly both axles are interchangeable; however, internally they are different. Each axle requires different internal components at the time of repair.

Driveline System

Printable View (629 KB)

Special Tool(s)

ST1268-A	Clamp Plate, Driveshaft 205-320 (T92L-4851-C)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1267-A	Runout Gauge, Drive Pinion Flange 205-319 (T92L-4851-B)
ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1266-A	Dial Indicator Gauge with Holding Fixture 100-D002 (D78P-4201-B) or equivalent
ST1863-A	Gauge, Differential (Traction-Lok) 205-385 (T97T-4205-B)

Inspection and Verification

Certain axle noise or vibration symptoms are also common to the engine, transmission, wheel bearings, tires and other components of the vehicle. For this reason, make sure that the cause of the trouble is in the axle before disassembling, adjusting or repairing the axle. For additional information, refer to Section 100-04 .

Certain driveshaft vibration symptoms are common to the front engine accessory drive (FEAD), the engine, transmission or tires. Make sure the cause of the concern is the driveshaft before repairing or installing a new driveshaft. For additional information, refer to Section 100-04 .

Certain symptoms may be caused by Traction-Lok® differentials. Check the vehicle certification label and axle identification tag to determine the type of differential. For additional information, refer to Section 100-01 .

Noise Acceptability

NOTE: A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions such as a newly paved blacktop road. Slight noise is not detrimental to the operation of the axle and is considered normal.

With the Traction-Lok® differential axle, slight chatter noise on slow turns after extended highway driving is considered acceptable and has no detrimental effect on the locking axle function.

Universal Joint (U-Joint) Inspection

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

Position the vehicle on a frame hoist and rotate the driveshaft by hand. Check for rough operation or seized U-joint. Install a new U-joint if it shows signs of seizure, excessive wear or incorrect seating. For additional information, refer to Section 205-01 .

Analysis of Leakage

Clean up the leaking area enough to identify the exact source. An axle leak can be caused by the following:

- Axle lubricant level is too high
- Worn or damaged axle shaft seals or differential seals
- Differential housing is cracked
- Flange yoke seal is worn or damaged
- Pinion flange is scored or damaged
- Axle cover is not sealed
- Vent is plugged

Repair the axle as necessary. Make sure the axle lubricant is at the correct level. For additional information, refer to Specifications in this section.

Axle Vent

NOTE: If a plugged vent cannot be cleared, install a new one.

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. Make sure the vent hose is not kinked. Remove the hose from the vent nipple and clear the hose of any foreign material. While the hose is removed, pass a length of mechanics wire or a small diameter Allen wrench in and out of the vent to clean it. Connect the hose when done.

Flange Yoke Seal

Leaks at the drive pinion seal originate for the following reasons:

- Drive pinion seal was not correctly installed.
- Poor quality drive pinion seal journal surface.

Any damage to the seal bore (dings, dents, gouges or other imperfections) will distort the seal casing and allow leakage past the outer edge of the axle drive pinion seal.

The drive pinion seal can be torn, cut or gouged if it is not installed carefully. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow leakage past the lip.

The rubber lips can occasionally become hard (like plastic) with cracks at the oil lip contact point. The contact point on the pinion flange may blacken, indicating excessive heat. Marks, nicks, gouges or rough surface texture on the drive pinion seal journal of the pinion flange will also cause leaks.

Drive pinion seal wear 1.27 mm (0.050 in) or greater is considered excessive.

A new pinion flange must be installed if any of these conditions exist.

Metal chips or sand trapped at the sealing lip may also cause oil leaks. This can cause a wear groove on the pinion flange and heavy drive pinion seal wear.

When a drive pinion seal leak occurs, install a new drive pinion seal and check the vent and the vent hose to make sure they are clean and free of foreign material.

Axle Shaft Seals

Axle shaft oil seals are susceptible to the same kinds of damage as drive pinion seals if incorrectly installed. The axle shaft oil seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. Axle shaft journal surface must be free of nicks, gouges, and rough surface texture.

Differential Seals

For additional information on differential seals, refer to Section 205-02 for the rear axle or Section 205-03 for the front axle.

Analysis of Vibration

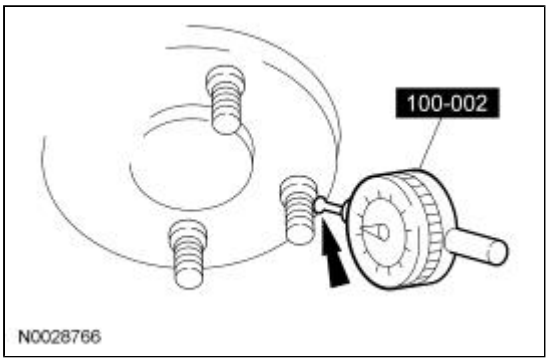
WARNING: A vehicle equipped with a Traction-Lok® differential will always have both wheels driving. If only one wheel is raised off the floor and the rear axle is driven by the engine, the wheel on the floor could drive the vehicle off the stand or jack. Be sure both rear wheels are off the floor.

Few vibration conditions are caused by the front or rear axle. On a vibration concern, follow the diagnosis procedure in Section 100-04 unless there is a good reason to suspect the axle.

Wheel Hub or Axle Flange Bolt Circle Runout

NOTE: The brake discs must be removed to carry out all runout measurements.

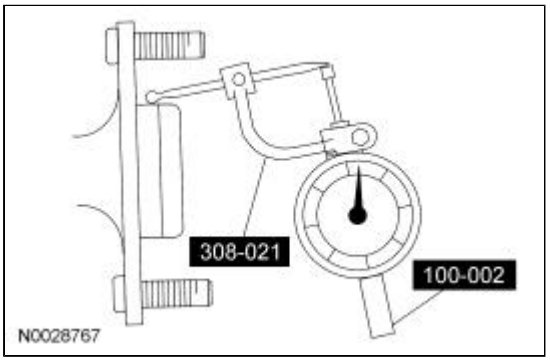
1. Position the special tool perpendicular to the wheel hub or axle flange bolt, as close to the hub or flange face as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub or flange until the next bolt is contacted. Record the measurement and continue until each bolt is checked. The difference between the maximum and minimum contact readings will be the total wheel hub or axle flange bolt pattern runout. The runout must not exceed 0.38 mm (0.015 in).

Pilot Runout

1. Position the special tool as close to the hub or axle flange face as possible. Zero the indicator to allow the pointer to deflect either way.

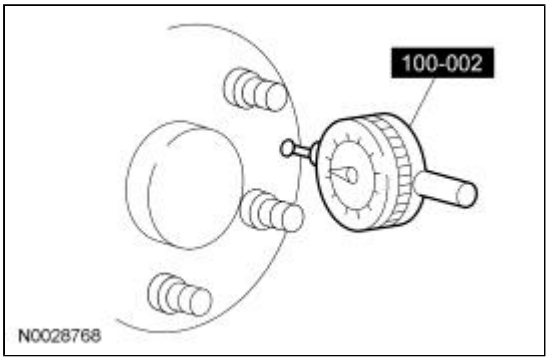


2. Rotate the hub or flange one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total pilot runout. Pilot runout must not exceed 0.15 mm (0.006 in).

Wheel Hub or Axle Flange Face Runout

NOTE: If the axle shaft assembly is removed, check runout of the shaft itself. The forged (unmachined) part of the shaft is allowed to have as much as 3 mm (0.11 in) runout. This alone will not cause a vibration condition.

1. Position the special tools on the wheel hub or axle flange face, as close to the outer edge as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub or flange one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total face runout. The runout must not exceed 0.254 mm (0.010 in).

Drive Pinion Stem and Pinion Flange

Check the pinion flange runout when all other checks have failed to show the cause of vibration.

One cause of excessive pinion flange runout is incorrect installation of the drive pinion seal. Check to see if the spring on the seal lip has been dislodged before installing a new ring gear and pinion.

Halfshafts

NOTE: New constant velocity (CV) joints must not be installed unless disassembly and inspection reveals unusual wear. For additional information, refer to Section 205-04 or Section 205-05 .

NOTE: Inspect the boots for indentations ("dimples") in the boot convolutions. Indentations must be removed.

- Inspect the boots for evidence of cracks, tears or splits.
- Inspect the underbody for any indication of grease splatter near the boots outboard and inboard locations. This is an indication of boot/clamp damage.

Axle Noise

NOTE: Before disassembling the axle to diagnose and correct gear noise, eliminate the tires, exhaust, trim items, roof racks, axle shafts and wheel bearings as possible causes. Follow the diagnostic procedures. For additional information, refer to Section 100-04 .

The noises described as follows usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard during the road test.

Gear Howl and Whine

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

Bearing Whine

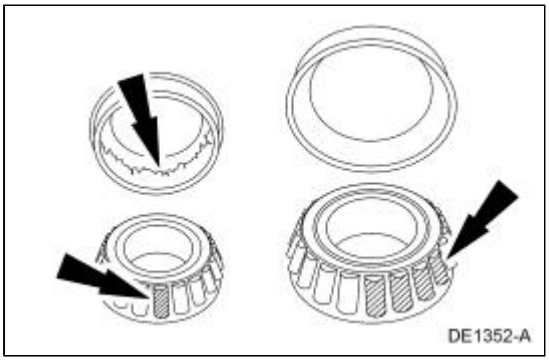
Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which usually comes and goes as speed changes.

As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is

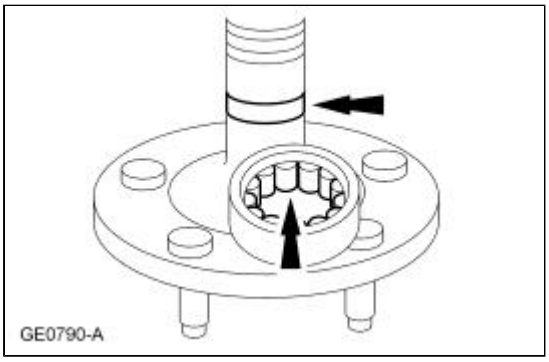
only one pinion bearing that is worn/damaged, the noise may vary in different driving phases. New pinion bearings must not be installed unless scoring or damage is found or there is a specific pinion bearing noise. A worn/damaged bearing will normally be obvious at disassembly. Examine the large end of the rollers for wear. If the pinion bearings original blend radius has worn to a sharp edge, a new pinion bearing must be installed.

NOTE: A low-pitched rumble normally associated with a worn/damaged wheel bearing can be caused by the exterior luggage rack or tires.

A wheel bearing noise can be mistaken for a pinion bearing noise. On rear wheel drive (RWD) vehicles, check the wheel bearing for a spalled cup, and spalled/damaged rollers. Install a new wheel bearing if any of these concerns are detected.



If the wheel bearing is damaged, the roller surface on the axle shaft may also be damaged. Install a new axle shaft if any damage is detected.



On four wheel drive (4WD) vehicles, check the wheel bearing for rotating smoothness and end play. Install new wheel bearings as required.

Chuckle

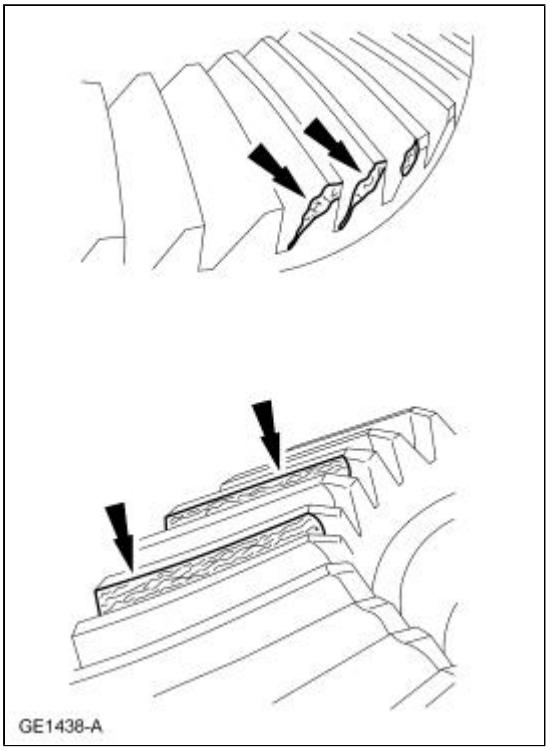
Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore.

Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.

Clean the gear tooth nick or ridge with a small grinding wheel. If the damaged area is larger than 3.2 mm (1/8 in), install a new gearset.

To check the ring gear and pinion, remove as much lubricant as possible from the gears with clean solvent. Wipe the gears dry or blow them dry with compressed air. Look for scored or damaged teeth. Also look for cracks or other damage.

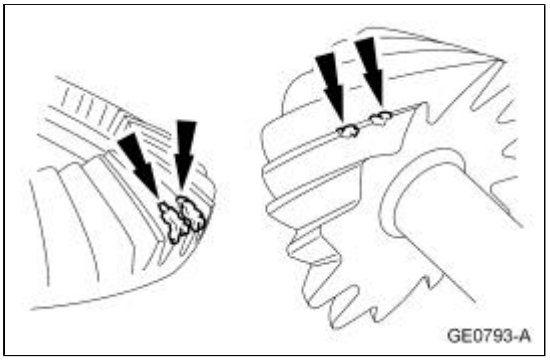
If either gear is scored or damaged badly, a new ring gear and pinion must be installed.



If metal has broken loose, the axle housing must be cleaned to remove particles that will cause damage. At this time if any other damaged components are found in the axle housing, new components must also be installed.

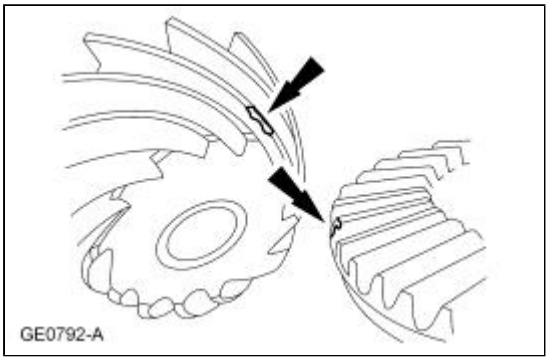
Knock

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset.



In most cases, one of the following conditions will occur:

1. A gear tooth damaged on the drive side is a common cause of the knock. This can usually be corrected by grinding the damaged area.



2. **NOTE:** Measure the end play with a Dial Indicator Gauge with Holding Fixture and not by feel.

   The knock is also caused by excessive end play in the axle shafts. Up to 0.762 mm (0.030 in) is allowed in semi-float axles. The frequency of the knock will be less because the axle shaft speed is slower than the driveshaft.

Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also occur when throttle is applied or released. It is caused by backlash somewhere in the driveline or loose suspension components; it is felt or heard in the axle. Refer to Total Backlash Check in this section.

Additionally, clunk may be heard upon initial drive-away. This occurs as engine torque shifts vehicle weight, forcing changes in driveline angles, preventing the driveshaft slip-yoke from sliding on the output shaft. To correct this condition, lubricate the slip-yoke splines. For additional information, refer to Section 205-01 .

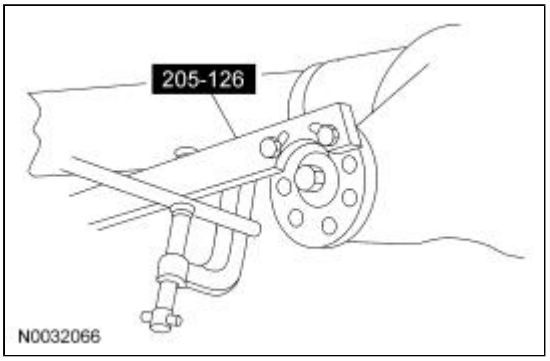
Total Backlash Check

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the driveshaft. For additional information, refer to Section 205-01 .

3. Install the special tool.
   - Clamp a rigid bar or pipe to the tool. Clamp the other end of the bar or pipe to the frame or a body member in order to prevent movement of the pinion flange.



4. Lower the vehicle so that one rear wheel is resting on a wheel chock to prevent it from turning. The other rear wheel will be used to measure total rear axle backlash.

5. Rotate the free wheel slowly, by hand, until the feeling of driving the rear axle is encountered. Place a mark on the side of the tire, 305 mm (12 in) from the center of the wheel, with a crayon or chalk.

6. While holding the crayon or chalk against the tire, rotate the wheel slowly in the opposite direction until the feeling of driving the rear axle is encountered again.

7. Measure the length of the crayon or chalk mark on the tire.
    - If the length of the mark is 25.4 mm (1 in) or less, the rear axle backlash is within allowable limits.
    - If the chalk mark is greater than 25.4 mm (1 in), check for these conditions:
        - Elongation of the differential pinion shaft and holes in the differential case.
        - Missing differential pinion thrust washer or differential side gear thrust washer.
        - Galling of the differential pinion shaft and bore.
        - Excessive ring gear and pinion backlash. Follow the procedure for the type of rear axle to check backlash.

Axle Shaft Bearing Noise

Axle shaft bearing noise is similar to gear noise and differential pinion bearing whine. Axle shaft bearing noise will usually distinguish itself from gear noise by occurring in all driving modes (drive, coast and float), and will persist with the transmission in NEUTRAL while the vehicle is moving at the speed in which the concern is occurring. If the vehicle makes this noise, remove the suspect axle shaft and install a new bearing and axle seal. Re-evaluate the vehicle for noise before removing any internal components.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third of the driveshaft speed. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all 4 driving modes.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Traction-Lok® does not work in snow, mud or on ice	• Differential.	• CARRY OUT the Traction-Lok® Differential Operation Check in this section.

		REPAIR as necessary. REFER to Section 205-02 .
• Lubricant leaking from the pinion seal, axle shaft oil seals or support arm to the housing	• Vent. • Damage in the seal contact area or dust slinger on the pinion flange dust shield.	• CLEAN the axle housing vent. • INSTALL a new pinion flange and the pinion seal if damage is found.
• The vehicle does not shift between the different modes correctly	• Mode switch. • Wiring/relays. • Shift motor. • Transfer case. • GEM.	• REFER to Section 308-07A .
• Front axle will not engage	• Switches • Wiring. • GEM. • Shift motor.	• REFER to Section 308-07A .
• Front axle will not disengage	• Switches. • Wiring. • GEM. • Shift motor.	• REFER to Section 308-07A .
• Differential side gears/pinion gears are scored	• Insufficient lubrication. • Incorrect or contaminated lubricant type.	• INSTALL new gears. REFER to Section 205-02 or Section 205-03 . FILL the axle to specification. • INSTALL new gears. REFER to Section 205-02 or Section 205-03 . CLEAN and REFILL the axle to specification.
• Axle overheating	• Lubricant level too low. • Incorrect or contaminated lubrication type. • Bearing preload adjusted too tight. • Excessive gear wear. • Incorrect ring gear backlash.	• CHECK the lubricant level. FILL the axle to specification. • INSPECT the axle for damage. REPAIR as necessary. CLEAN and REFILL the axle to specification. • CHECK the ring and pinion for damage. INSPECT the ring and pinion wear pattern. ADJUST the preload as necessary. • INSPECT all the axle gears for wear or damaged. INSTALL new components as necessary. • INSPECT the ring gear for scoring. INSPECT the ring and pinion wear pattern. ADJUST the ring gear backlash as necessary.
• Broken gear teeth on the ring gear or pinion	• Overloading the vehicle.	• INSTALL a new ring and pinion. REFER to Section 205-02 or Section 205-03 .
• Axle shaft broken	• Overloading the vehicle.	• INSTALL a new axle shaft. REFER to Section 205-02 or Section 205-03 .

	• Misaligned axle shaft tube.	• INSPECT the axle for damage. CHECK axle shaft tube alignment. INSTALL a new axle shaft. REFER to Section 205-02 or Section 205-03 .

Component Tests

Driveline Vibration

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

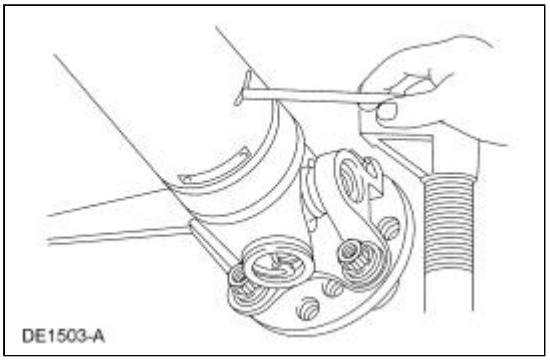
Driveline vibration exhibits a higher frequency and lower amplitude than does high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is usually noticed at various speed ranges. Driveline vibration can be perceived as a tremor in the floor pan or is heard as a rumble, hum, or boom. Driveline vibration can exist in all drive modes, but may exhibit different symptoms depending upon whether the vehicle is accelerating, decelerating, floating or coasting. Check the driveline angles if the vibration is particularly noticeable during acceleration or deceleration, especially at lower speeds. Driveline vibration can be duplicated by supporting the axle upon a hoist or upon jack stands, though the brakes may need to be applied lightly in order to simulate road resistance.

1. Raise the vehicle promptly after road testing. Use twin-post hoist or jack stands to prevent tire flat-spotting. Engage the drivetrain and accelerate to the observed road test speed to verify the presence of the vibration. If the vibration is not evident, check the non-driving wheels with a wheel balancer to rule out imbalance as a possible cause. If required, balance the non-driving wheels and repeat the road test. If the vibration is still evident, proceed to Step 2.

2. Mark the relative position of the drive wheels to the wheel bolts. Remove the wheels. Install all the wheel nuts in the reversed position and repeat the road speed acceleration. If the vibration is gone, refer to the tire and wheel runout procedure in Section 204-04 . If the vibration persists, proceed to Step 3.

3. Inspect the driveshaft(s) for signs of physical damage, missing balance weight, undercoating, incorrect seating, wear and binding universal joints. Clean the driveshaft and install new universal joints or install a new driveshaft if damaged. Check the index marks (paint spots) on the rear of the driveshaft and pinion flange. If these marks are more than 1/4 turn apart, disconnect the driveshaft and re-index to align the marks as closely as possible. After any corrections are made, recheck for vibration at the road test speed. If the vibration is gone, reinstall the wheels and road test. If the vibration persists, proceed to Step 4.

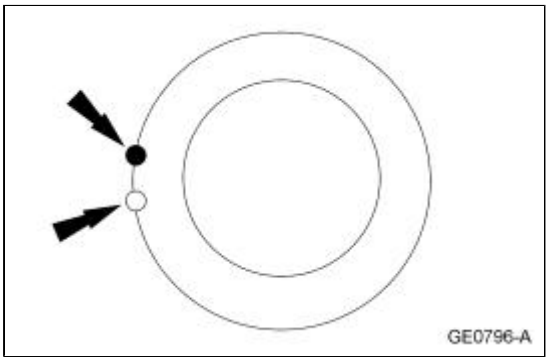
4. Raise the vehicle on a hoist and remove the wheels. Rotate the driveshaft by turning the axle and measure the runout at the front, the center and the rear of the driveshaft with the indicator. If the runout exceeds 0.51 mm (0.020 in) at the front or center, a new driveshaft must be installed. If the front and center are within this limit, but the rear runout is not, mark the rear runout high point and proceed to Step 5. If the runout is within the limits at all points, proceed to Step 7.



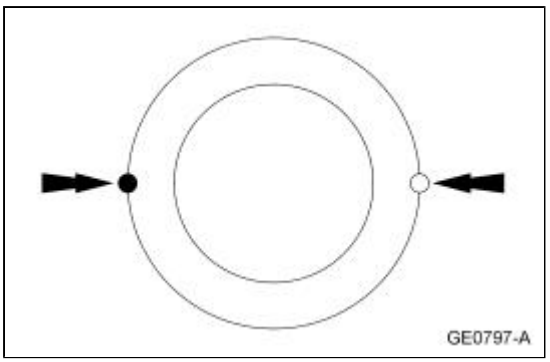
5. **NOTE:** Check the U-joints during re-indexing. If a U-joint feels stiff or gritty, install new U-joints.

   Scribe alignment marks on the driveshaft and the pinion flange. Disconnect the driveshaft, rotate it one half turn, and reconnect it. Circular pinion flanges can be turned in 1/4 increments to fine tune the runout condition; half-round pinion flanges are limited to 2 positions. Check the runout at the rear of the driveshaft. If it is still over 0.51 mm (0.020 in), mark the high point and proceed to Step 6. If the runout is no longer excessive, check for vibration at the road test speed. If vibration is still present, re-index the driveshaft slip-yoke on the transmission output shaft one half turn and road test the vehicle. If the vibration persists, proceed to Step 7.

6. Excessive driveshaft runout may originate in the driveshaft itself or in the pinion flange. To determine which, compare the 2 high points marked in Steps 4 and 5. If the marks are close together, within about 25 mm (1 in), a new driveshaft must be installed and the vehicle road tested.



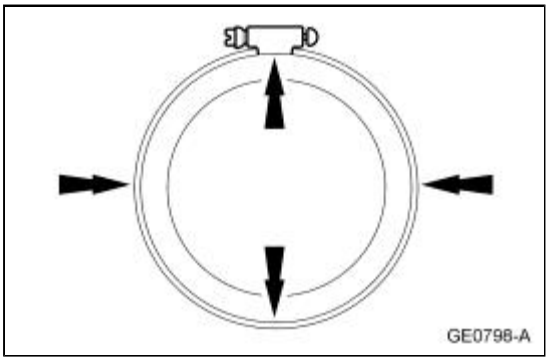
If the marks are on opposite sides of the driveshaft, the yoke or pinion flange is responsible for the vibration.



When installing a new pinion flange, the driveshaft runout must not exceed 0.51 mm (0.020 in). When runout is within limits, recheck for vibration at road speed. If vibration persists, balance the driveshaft.

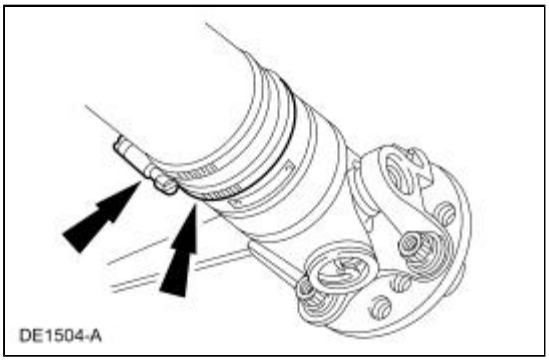
7. To balance the driveshaft, install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined by trial-and-error.

8. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1.

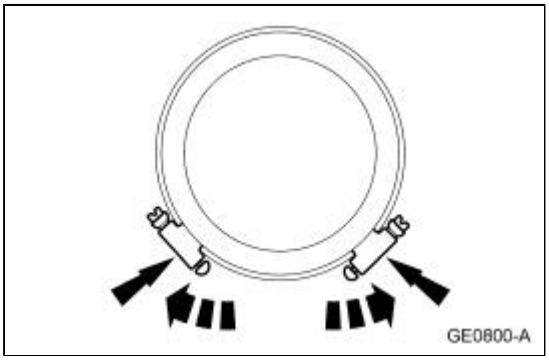


Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.

9. If the vibration persists, add a second clamp at the same position and recheck for vibration.



If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 8. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.



Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

10. Install the wheels and road test (vibration noticeable on the hoist may not be evident during the road test). If the vibration is still not acceptable, install a new axle drive line vibration damper first, if so equipped. If the vibration is still not acceptable, refer to Section 205-02 for differential case and ring gear runout checks.

Driveshaft Vibrates

1. Road test the vehicle to determine the critical vibration points. Note the road speed, the engine rpm, and the shift lever positions at which the vibration occurs. Road test in OD and OD - 1 gear.

2. Stop the vehicle, place the transmission lever in neutral and run the engine through the critical speed ranges determined in Step 1.

3. If no vibration is felt, balance the driveshaft. Refer to Driveline Vibration in this section.

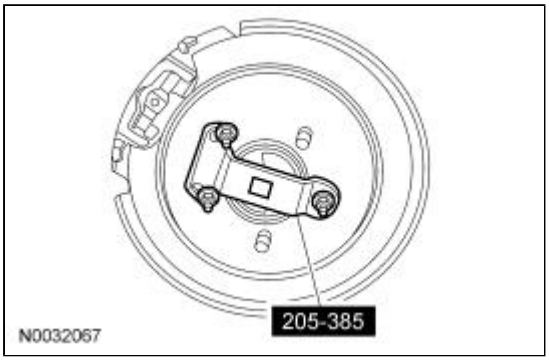
Traction-Lok® Differential Operation Check

A Traction-Lok® differential can be checked for correct operation without removing it from the rear axle housing.

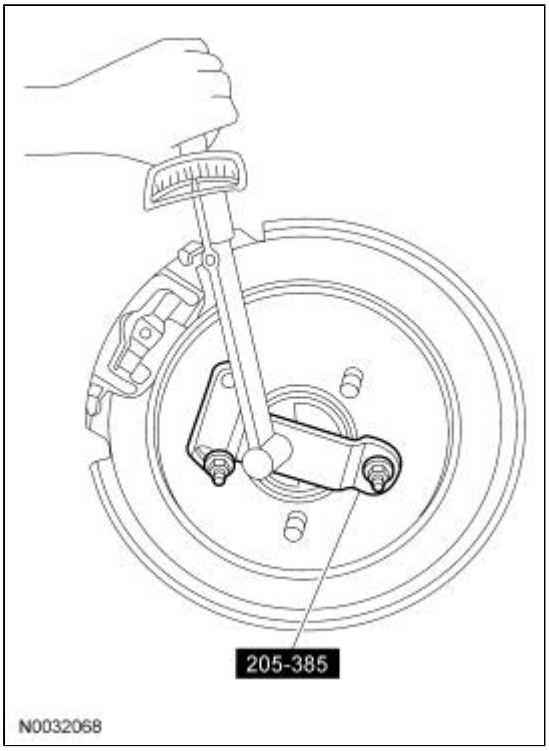
WARNING: A vehicle equipped with a Traction-Lok® differential will always have both wheels driving. If only one wheel is raised off the floor and the rear axle is driven by the engine, the wheel on the floor could drive the vehicle off the stand or jack. Be sure both rear wheels are off the floor.

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

Raise and remove only one rear wheel. Install the special tool on the wheel bolts.



Use a torque wrench with the capacity of at least 271 Nm (200 lb-ft) to rotate the axle shaft. Make sure that the transmission is in NEUTRAL, and that one rear wheel is on the floor while the other rear wheel is raised off the floor. The breakaway torque required to start rotation must be at least 27 Nm (20 lb-ft). The initial breakaway torque may be higher than the continuous turning torque.



The axle shaft must turn with even pressure throughout the check without slipping or binding. If the torque reading is less than specified, check the differential case for incorrect assembly.

Traction-Lok® Differential Check Road Test

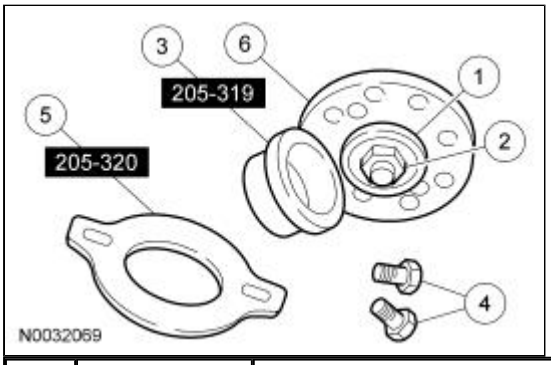
1. Place one wheel on a dry surface and the other wheel on ice, mud or snow.
2. Gradually open the throttle to obtain maximum traction prior to break away. The ability to move the vehicle demonstrates correct performance of a Traction-Lok® rear axle assembly.
3. When starting with one wheel on an excessively slippery surface, a slight application of the parking brake may be necessary to help energize the Traction-Lok® feature of the differential. Release the brake when traction is established. Use light throttle on starting to provide maximum traction.
4. If, with unequal traction, both wheels slip, the limited slip rear axle has done all it can possibly do.
5. In extreme cases of differences in traction, the wheel with the least traction may spin after the Traction-Lok® has transferred as much torque as possible to the non-slipping wheel.

Pinion Flange Runout Check — Circular

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

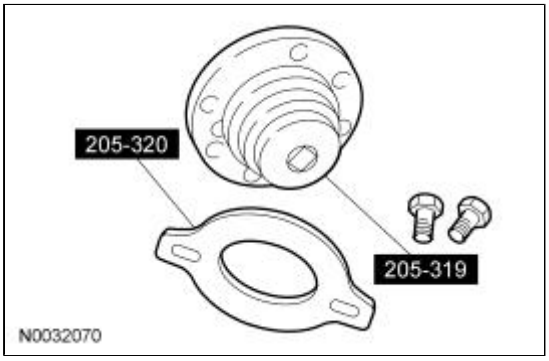
CAUTION: Pinion bearing preload must be reset if the pinion nut has been loosened or removed for pinion flange reindexing or replacement.

1. Raise the vehicle on a twin-post hoist that supports the rear axle.
2. Remove the driveshaft. For additional information, refer to Section 205-01 .
3. Check the pinion flange for damage.
4. Position special tool on the pinion flange.

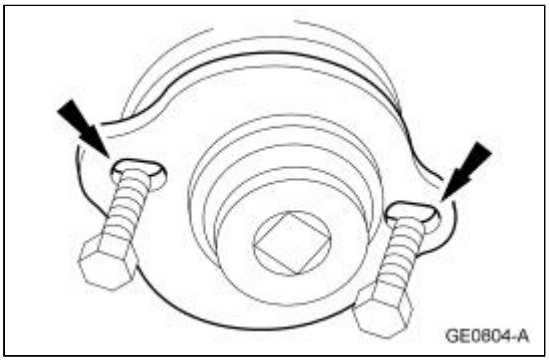


Item	Part Number	Description
1	—	Pilot (part of 205-319) (T92L-4851-B)
2	354845	Pinion nut
3	205-319	Gauge, Companion Flange Runout (T92L-4851-B)
4	—	Bolts (2 required) (part of 205-320) (T92L-4851-C)
5	205-320	Plate, Companion Flange (T92L-4851-C)
6	4851	Pinion flange

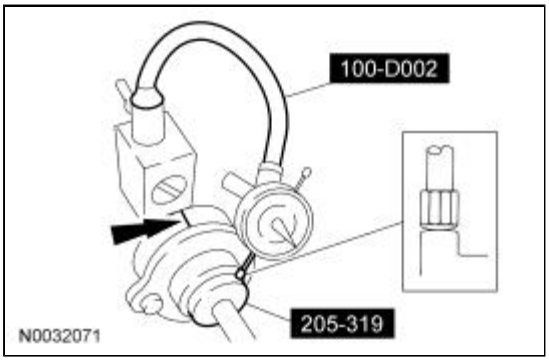
5. Position the special tools onto the pinion flange.



6. Align the holes on the clamp plate with the holes in the pinion flange and install the bolts. Snug the bolts evenly.

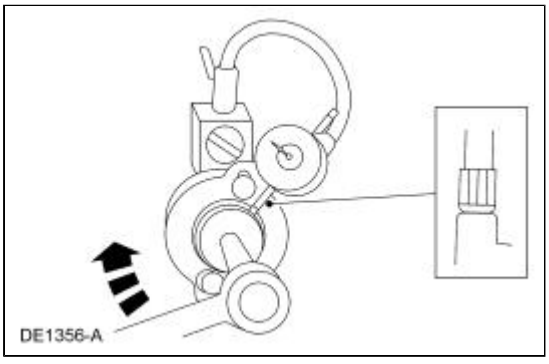


7. Position the special tool as shown. Turn the special tool, and locate and mark the high spot on the pinion flange with yellow paint.



If the flange runout exceeds 0.25 mm (0.010 in), remove the pinion flange, reindex the flange one-half turn on the pinion, and reinstall it. Refer to Section 205-02 or Section 205-03 for the flange removal and installation procedures.

8. Check the runout again. If necessary, rotate the flange until an acceptable runout is obtained. If the flange runout is still more than 0.25 mm (0.010 in), install a new pinion flange.



9. If excessive runout is still evident after replacement of the pinion flange, install a new ring and pinion. Repeat the above checks until the runout is within specifications.

10. Install the driveshaft. For additional information, refer to Section 205-01 .

Tooth Contact Pattern Check — Gearset

1. To check the gear tooth contact, paint the gear teeth with the special marking compound. A mixture that is too wet will run and smear; a mixture that is too dry cannot be pressed out from between the teeth.

2. Use a box wrench on the ring gear bolts as a lever to rotate the ring gear several complete revolutions in both directions or until a clear tooth contact pattern is obtained.

3. Certain types of gear tooth contact patterns on the ring gear indicate incorrect adjustment. Incorrect adjustment can be corrected by readjusting the ring gear or the pinion.

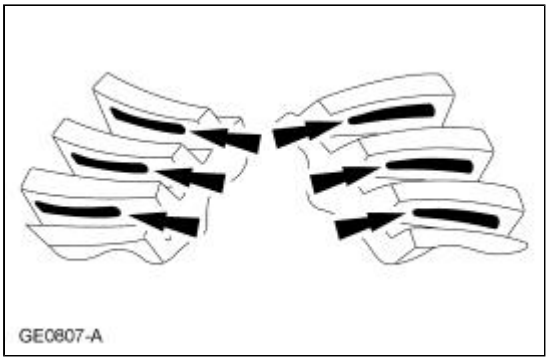
Contact Pattern Location

In general, desirable ring gear tooth patterns must have the following characteristics:

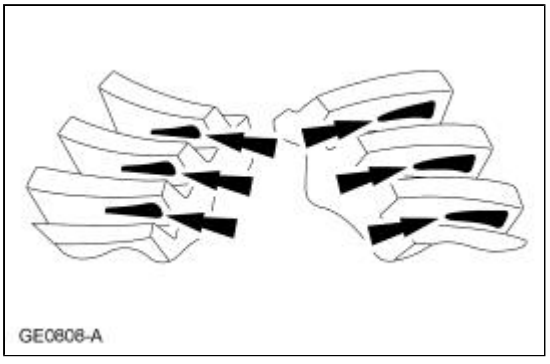
- Drive pattern on the drive side ring gear well centered on the tooth.

- Coast pattern on the coast side ring gear well centered on the tooth.
- Clearance between the pattern and the top of the tooth.
- No hard lines where the pressure is high.

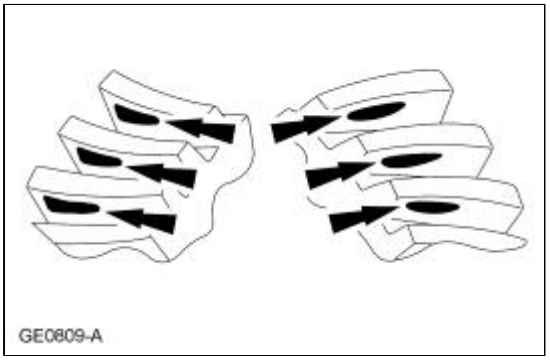
Acceptable ring gear tooth patterns for all axles.



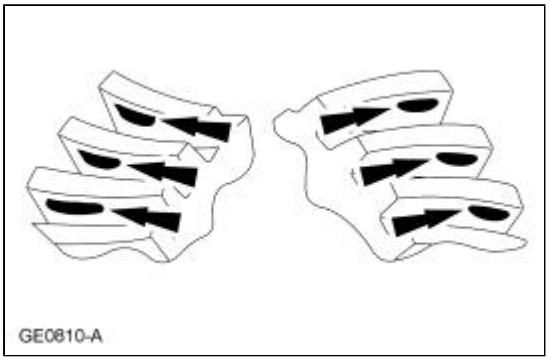
Correct backlash with a thinner pinion position shim required.



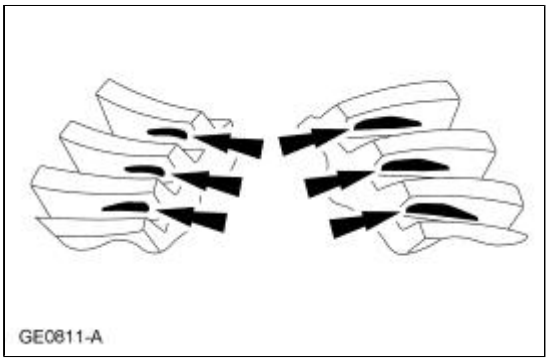
Correct backlash with a thicker pinion position shim required.



Correct pinion position shim that requires a decrease in backlash.



Correct pinion position shim that requires an increase in backlash.



Driveline Angle Measurement

Printable View (178 KB)

Special Tool(s)

ST1622-A	Anglemaster II Driveline Inclinometer/Protractor 164-R2402 or equivalent

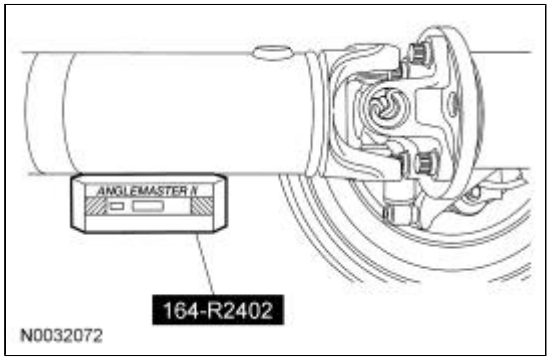
CAUTION: Prior to checking driveline angularity, inspect the U-joints for correct operation.

NOTE: An incorrect driveline angle can cause a vibration or shudder. For additional information, refer to Section 100-04 .

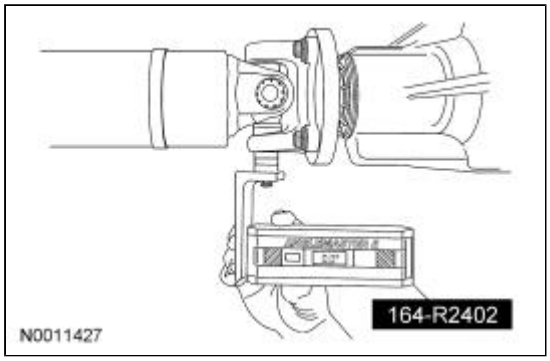
NOTE: Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.

1. Carry out the following preliminary setup steps:
   - Inspect the U-joints for correct operation.
   - Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   - Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   - Rotate the transmission output yoke until vertical. This will simplify taking measurements.
   - Calibrate the special tool by placing the tool on a clean, flat level section of the frame rail and press the ALT-ZERO button.

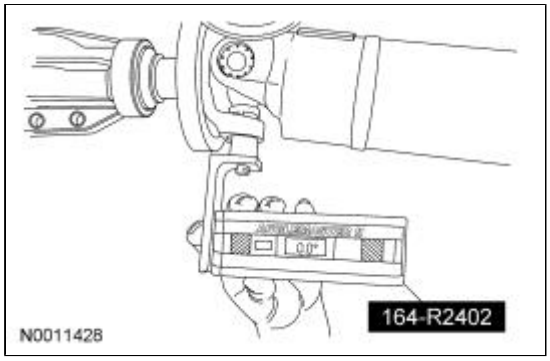
2. Using the special tool, measure the slope of the components. Record the measurements and the direction of the component's slope.



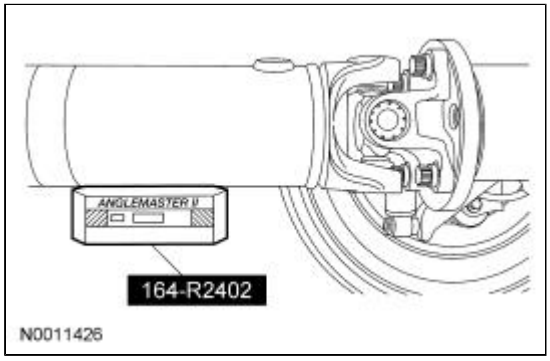
3. To check the pinion operating angle, rotate the driveshaft so that the rear axle pinion flange yoke ear is parallel to the floor. Install the special tool. Check and record the pinion operating angle reading.
   - If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the rear suspension, rear axle, rear axle mounting or the frame for wear or damage.



4. To check the transmission operating angle, place the special tool on a flat and level surface. Press the ALT ZERO button to calibrate the inclinometer.



5. For the driveshaft angle reading, place the special tool flush against the bottom of the driveshaft. Press the ALT ZERO button to calibrate the inclinometer.

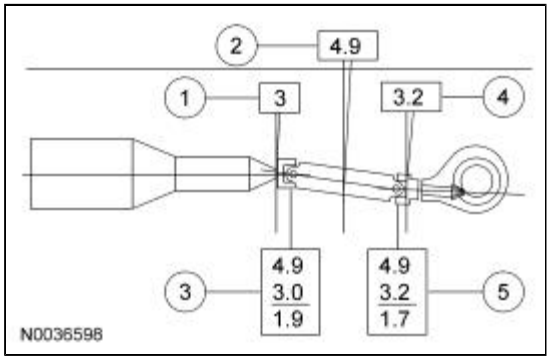


6. Calculate the difference in the slope of the components to determine the U-joint operating angle.

Item	Description
1	Output yoke slope
2	Driveshaft slope
3	The driveshaft slope minus the output yoke slope equals the transmission/driveshaft operating angle
4	Pinion flange slope
5	The driveshaft slope minus the pinion flange slope equals the driveshaft/axle operating angle

- When 2 connected components slope in the same direction, subtract the smaller number from the largest to find the U-joint operating angle. When 2 connected components slope in opposite directions, add the measurements to find the U-joint operating angle.

- The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each end of the driveshaft must:
    - be equal or within 1 degree of each other.
    - have a 3 degree maximum operating angle.
    - have at least 1/2 of 1 degree continuous operating angle.



7. Compare the operating angles. Ideally, the operating angles on each end of the driveshaft must:
    - be equal or within 1 degree of each other.
    - have a 3 degree maximum operating angle.
    - have at least 1/2 degree of operating angle.

Axle Housing Casting Porosity (Holes in Casting) Repair

Printable View (90 KB)

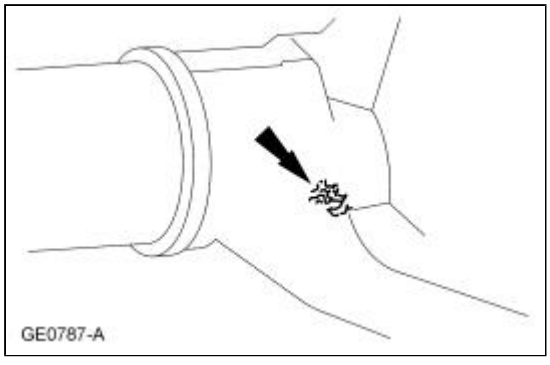
Material

Item	Specification
Epoxy Sealer	M-3D35A (E)

CAUTION: To keep the axle's sound characteristics, do not disassemble the carrier.

NOTE: Casting porosity is a condition where occasionally gas bubbles will form during the casting process leaving small pockets in the metal that will cause the axle housing to leak.

1. To fill small pockets, peen in a small amount of body lead.



2. Seal the pocket.
   - Use Epoxy Sealer meeting Ford specification M-3D35A(E).

3. To fill large pockets, drill and tap a shallow hole for a small setscrew. Install the setscrew and seal it.
   - Use Epoxy Sealer meeting Ford specification M-3D35A(E).

Printable View (63 KB)

General Specifications

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Threadlock and Sealer TA-25	WSK-M2G351-A5

Torque Specifications

Description	Nm	lb-ft
Driveshaft center bearing bolts	48	35
Driveshaft flange bolts	103	76
Flex-coupler-to-flange nuts	150	111
Front flange-to-front drive axle constant velocity (CV) flange bolts	55	41
Rear flange-to-transfer case flange bolts	103	76
Stabilizer bar nuts	55	41

Driveshaft

Printable View (80 KB)

CAUTION: All driveshafts are balanced. If undercoating the vehicle, protect the driveshaft and universal joints to prevent overspray of any undercoating material.

NOTE: Refer to Section 205-00 for driveshaft runout and balance, and indexing procedures.

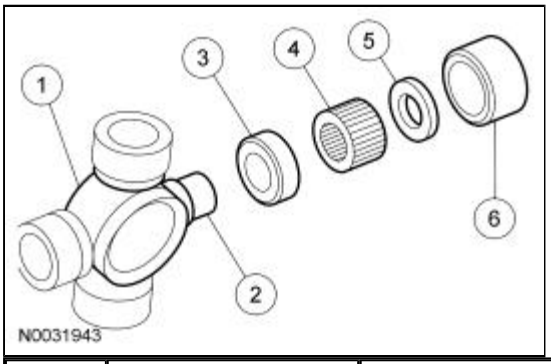
The driveshaft is composed of the universal joints (U-joints), constant velocity (CV) joints, flex couplers, connecting shafts and the attaching yokes. Some vehicles are equipped with a center support bearing. The center support bearing is prelubricated and sealed for the life of the bearing. The vehicles have the following types of driveshafts:

- Driveshaft — the shaft that accommodates the change in length (slip) in the driveshaft system. The driveshaft is the shaft that is the input to the front or rear axle. The front driveshafts are not serviced.
- Coupling shaft — all shafts that connect the transmission to the rear axle, except for the driveshaft. Coupling shafts are attached to the chassis by a center support bearing.

Driveshafts differ in length, diameter and type of yoke to accommodate various wheelbase and powertrain combinations.

Universal Joints

Printable View (84 KB)



Item	Part Number	Description
1	—	Spider (part of 4635)
2	—	Trunnion (part of 4635)
3	—	Grease seal (part of 4635)
4	—	Needle rollers (part of 4635)
5	—	Thrust washer (part of 4635)
6	—	Bearing cup (part of 4635)

The universal joint (U-joint) connects to the drive axle of the driveshaft and allows for up and down movement of the axle. The U-joint is lubricated for the life of the vehicle.

Driveshaft

Printable View (62 KB)

Refer to Section 205-00 .

Driveshaft — Front

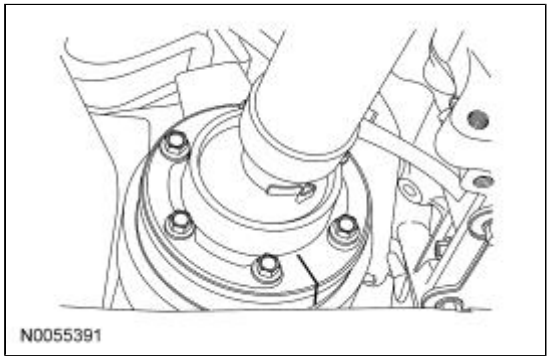
Printable View (203 KB)

Material

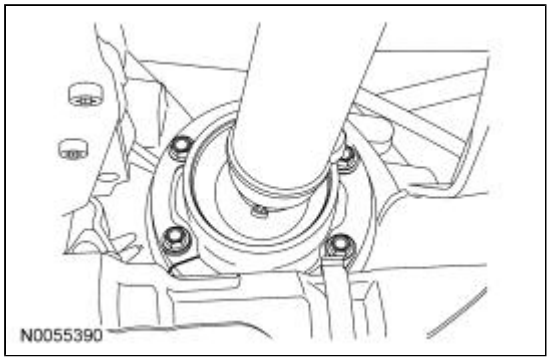
Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

Removal and Installation

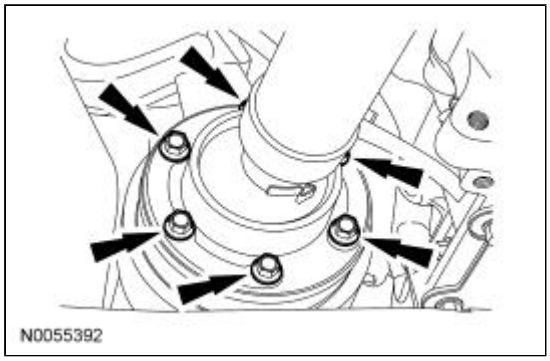
1. Disable the air suspension system. For additional information, refer to Section 204-05 .
2. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .
3. Index-mark the front flange to the pinion flange.



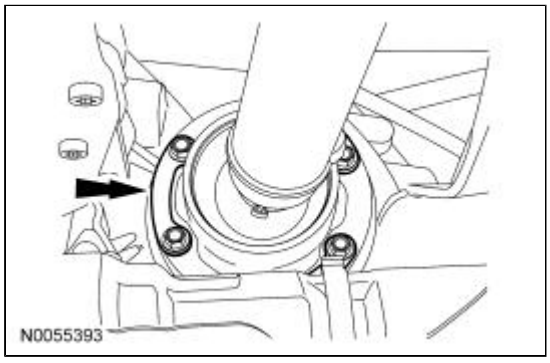
4. Index-mark the rear flange to the transfer case flange.



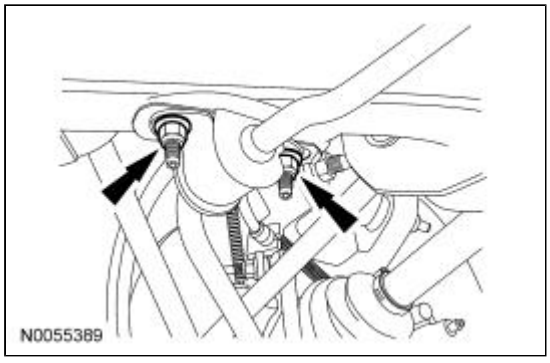
5. Remove and discard the 6 rear flange-to-transfer case flange bolts. Retain the 3 washers.
   - To install, tighten to 103 Nm (76 lb-ft).



6. Remove and discard the 6 front flange-to-pinion flange bolts. Retain the 2 washers.
    - To install, tighten to 103 Nm (76 lb-ft).



7. Remove and discard the 4 stabilizer bracket nuts and allow the stabilizer bar to swing downward.
    - To install, tighten to 55 Nm (41 lb-ft).



8. Remove the front driveshaft from the vehicle.

9. To install, reverse the removal procedure.

Driveshaft — Rear, Expedition

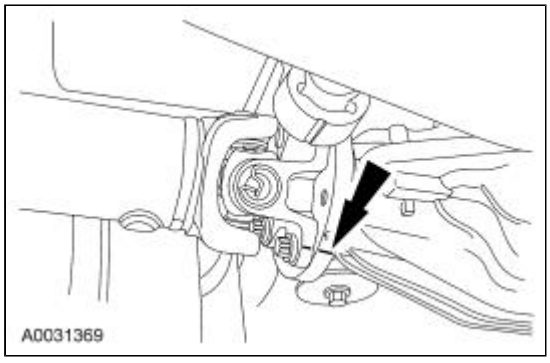
Printable View (191 KB)

Material

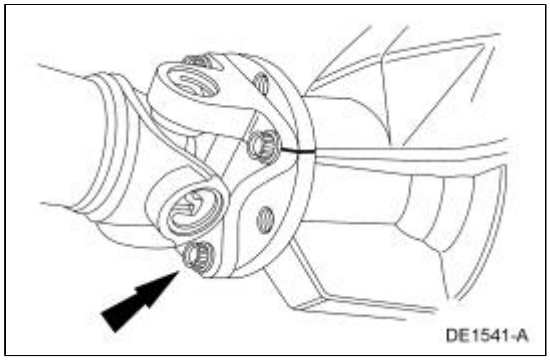
Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Removal and Installation

1. Disable the air suspension system. For additional information, refer to Section 204-05 .
2. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .
3. Index-mark the driveshaft flange to the rear axle pinion flange.

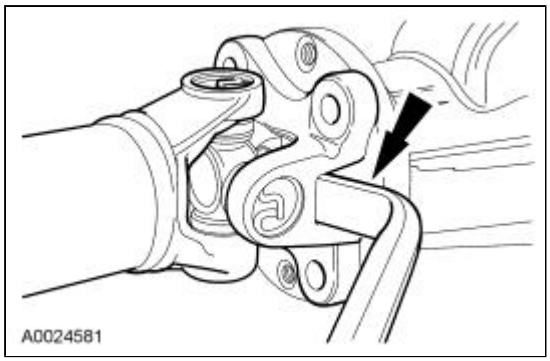


4. Remove the 4 driveshaft flange bolts.
   - To install, tighten to 103 Nm (76 lb-ft).



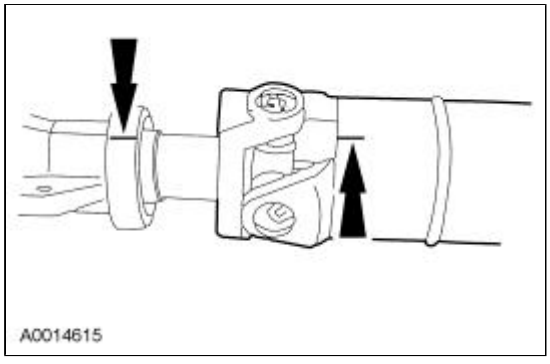
5. **CAUTION: The driveshaft flange fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft from the pinion flange. Pry only in the area shown, with a suitable tool, to disconnect the driveshaft flange from the pinion flange.**

Using a suitable tool, disconnect the driveshaft flange from the rear axle pinion flange.



6. **NOTE:** Do not rotate the driveshaft when removing the slip yoke from the transmission output shaft.

   Index-mark the driveshaft slip yoke and the transmission extension housing.
   - Mark the transmission output shaft to the transmission extension housing after removing the driveshaft.

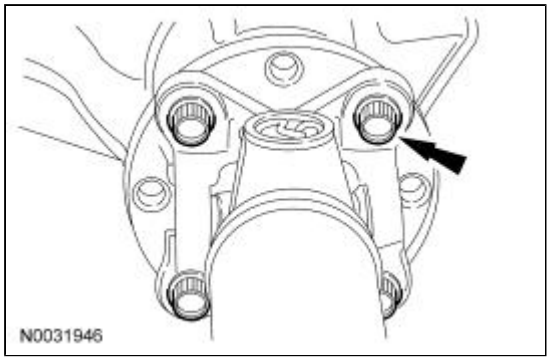


7. **CAUTION: Coat the threads of the original bolts with sealer.**

   CAUTION: The driveshaft flange fits tightly on the rear axle pinion flange pilot. To make sure that the driveshaft flange seats squarely on the pinion flange, tighten the bolts evenly in a cross pattern as shown.

   CAUTION: Make sure all index marks are aligned.

   To install, reverse the removal procedure.
   - Tighten the driveshaft flange bolts to 103 Nm (76 lb-ft).



Driveshaft — Rear, Navigator

Printable View (276 KB)

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

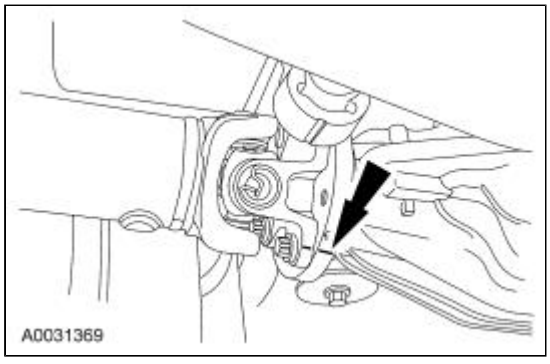
Removal and Installation

All vehicles

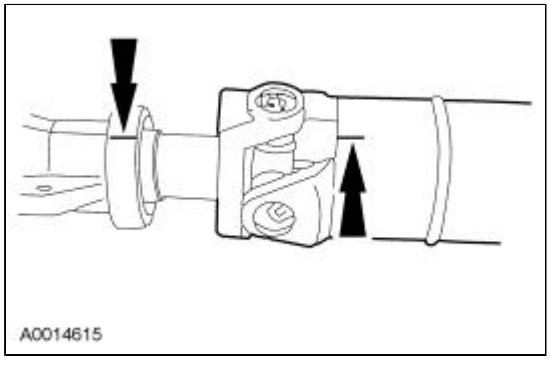
1. Disable the air suspension system. For additional information, refer to Section 204-05 .
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Four wheel drive (4WD) vehicles

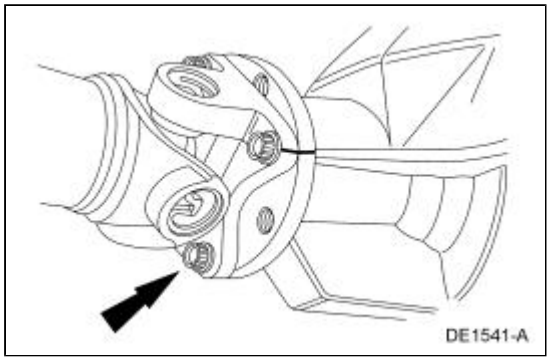
3. Index-mark the driveshaft flange to the pinion flange.



4. Index-mark the driveshaft slip yoke to the transmission extension housing.

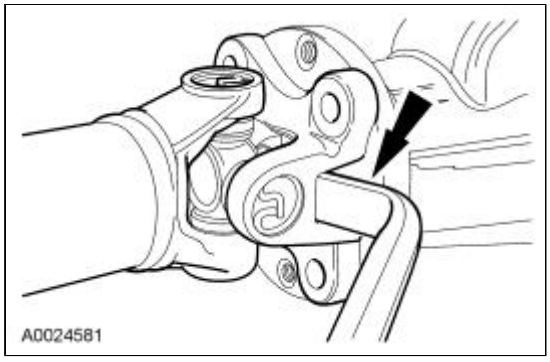


5. Remove and discard the 4 driveshaft flange bolts.



6. **CAUTION: The driveshaft flange fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft from the pinion flange. Pry only in the area shown, with a suitable tool, to disconnect the driveshaft flange from the pinion flange.**

   Using a suitable tool, disconnect the driveshaft flange from the pinion flange.

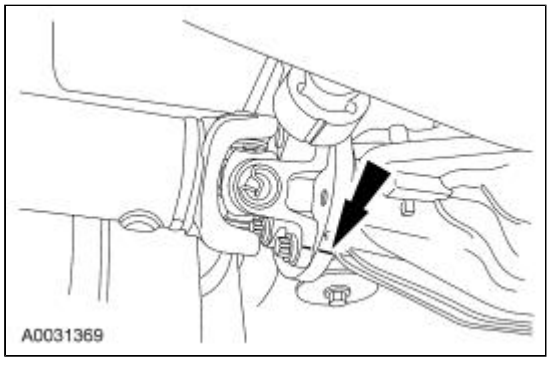


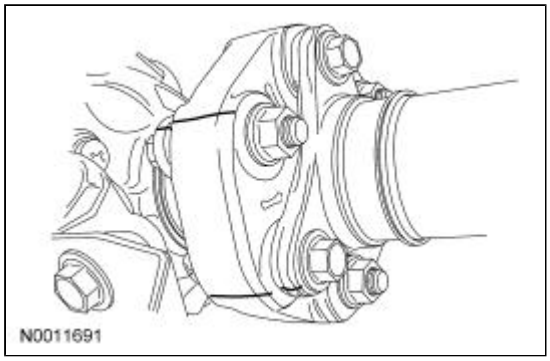
7. **NOTE:** Do not rotate the driveshaft when removing the slip yoke from the transmission output shaft.

   Remove the driveshaft.
   - Mark the transmission output shaft to the transmission extension housing after removing the driveshaft.

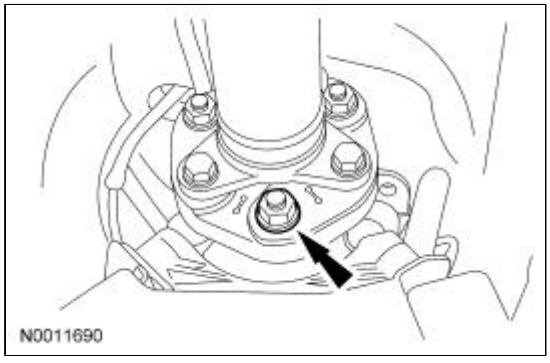
Rear wheel drive (RWD) vehicles

8. Index-mark the driveshaft for correct alignment during installation.

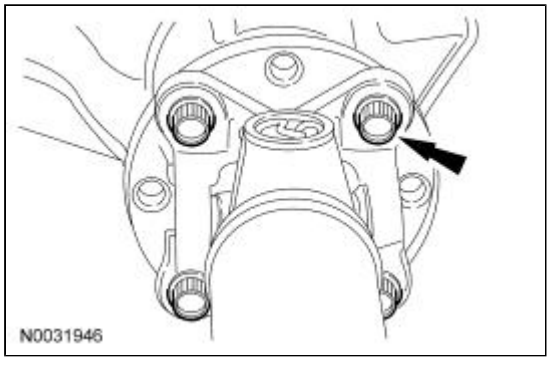




9. Remove and discard the 3 flex-coupler-to-flange nuts and the 3 flex-coupler-to-flange bolts.

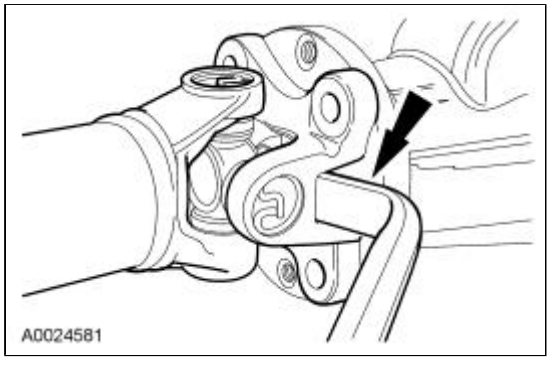


10. Remove and discard the 4 driveshaft flange bolts.

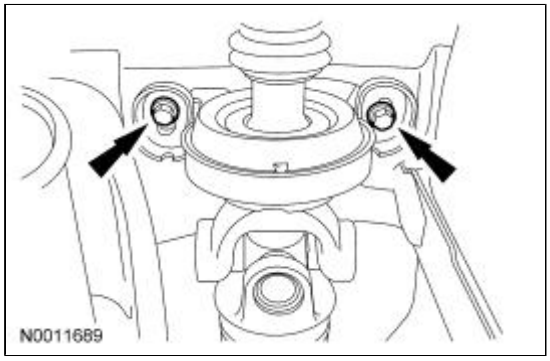


11. **CAUTION: The driveshaft flange fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft from the pinion flange. Pry only in the area shown, with a suitable tool, to disconnect the driveshaft flange from the pinion flange.**

    Using a suitable tool, disconnect the driveshaft flange from the pinion flange.



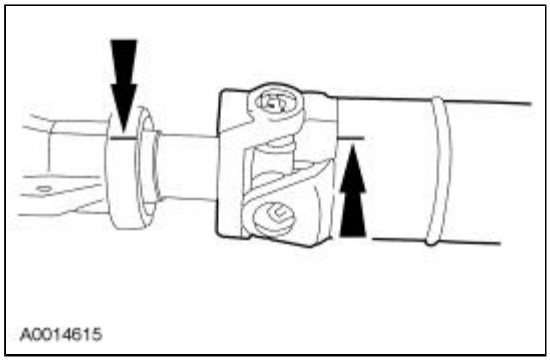
12. Remove the 2 driveshaft center bearing bolts, then remove the driveshaft.
    - Discard the driveshaft center bearing bolts.



Installation

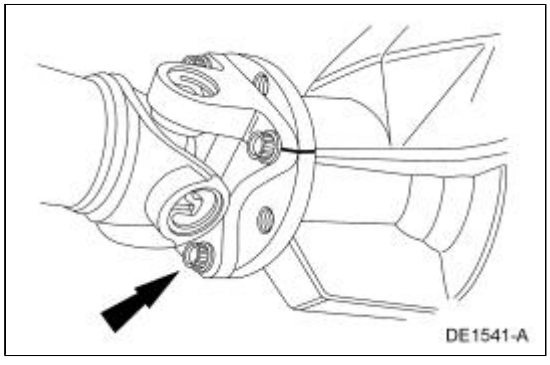
4WD vehicles

1. Align all the index marks and install the driveshaft slip yoke into the transmission extension housing.



2. **CAUTION: The driveshaft flange fits tightly on the pinion flange pilot. To make sure that the driveshaft flange seat squarely on the pinion flange pilot, tighten the driveshaft flange bolts evenly in a cross pattern.**

   Align the index marks and install the driveshaft flange and the driveshaft flange bolts.
   - Tighten to 103 Nm (76 lb-ft).

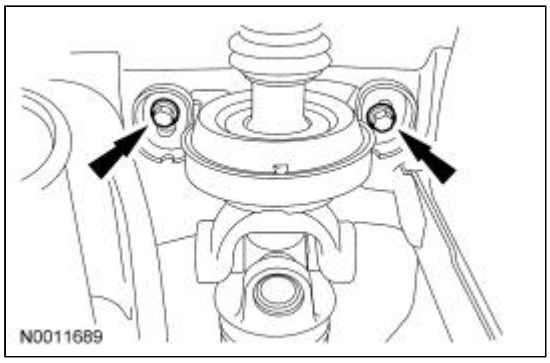


RWD vehicles

3. **CAUTION: If new driveshaft center bearing bolts are not available, coat the threads of the original driveshaft center bearing bolts with Threadlock and Sealer.**

Position the driveshaft center bearing and hand-tighten the 2 new driveshaft center bearing bolts until the driveshaft is mounted to the flanges.

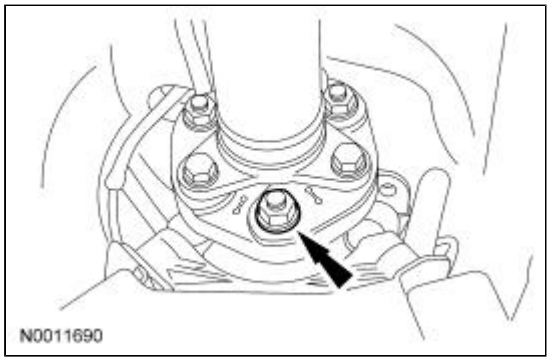
- Tighten to 48 Nm (35 lb-ft).



4. **CAUTION: If new flex-coupler-to-flange bolts and flex-coupler-to-flange nuts are not available, coat the threads of the original flex-coupler-to-flange bolts with Threadlock and Sealer.**

   Install the 3 new flex-coupler-to-flange bolts and the 3 new flex-coupler-to-flange nuts.

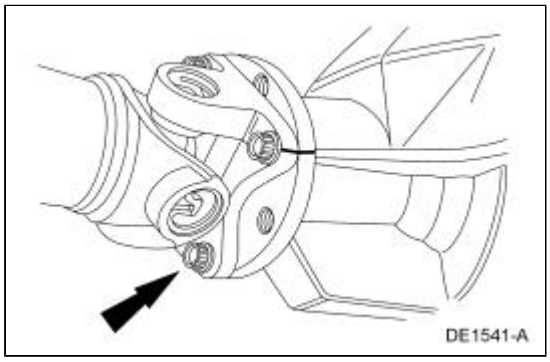
   - Tighten the nuts to 150 Nm (111 lb-ft).



5. **CAUTION: The driveshaft flange fits tightly on the pinion flange pilot. To make sure that the driveshaft flange seat squarely on the pinion flange pilot, tighten the driveshaft flange bolts evenly in a cross pattern.**

   Install the 4 new driveshaft flange bolts.

   - Tighten to 103 Nm (76 lb-ft).



Driveshaft Slip Yoke Boot

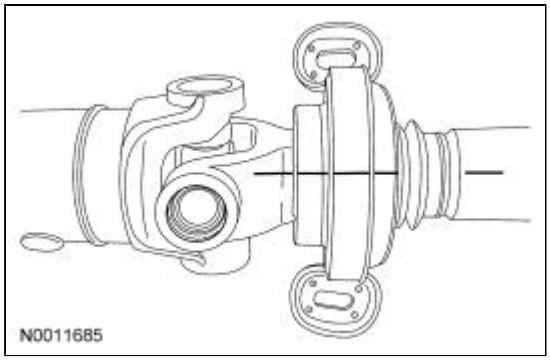
Printable View (222 KB)

Material

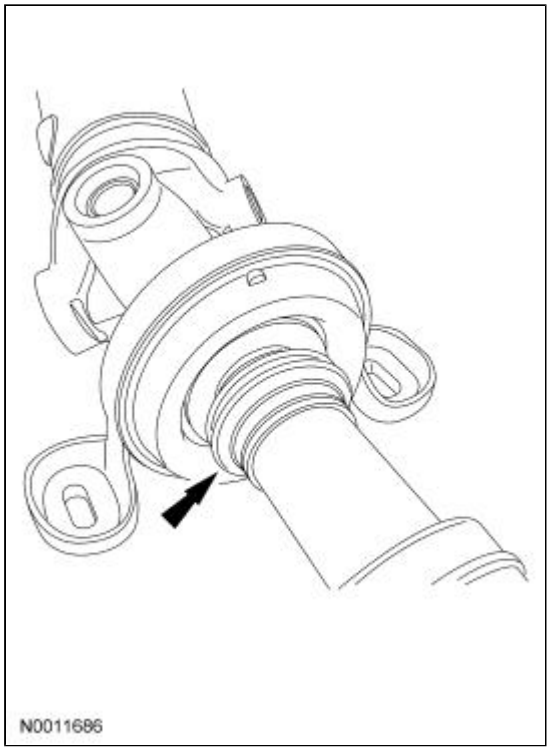
Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Removal and Installation

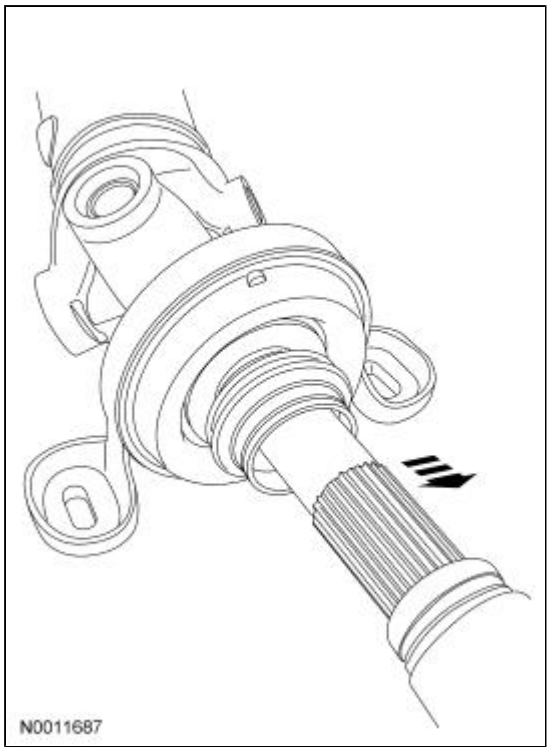
1. Remove the driveshaft. For additional information, refer to Driveshaft — Rear, Navigator
2. Index-mark the driveshaft to the center bearing for correct alignment during installation.



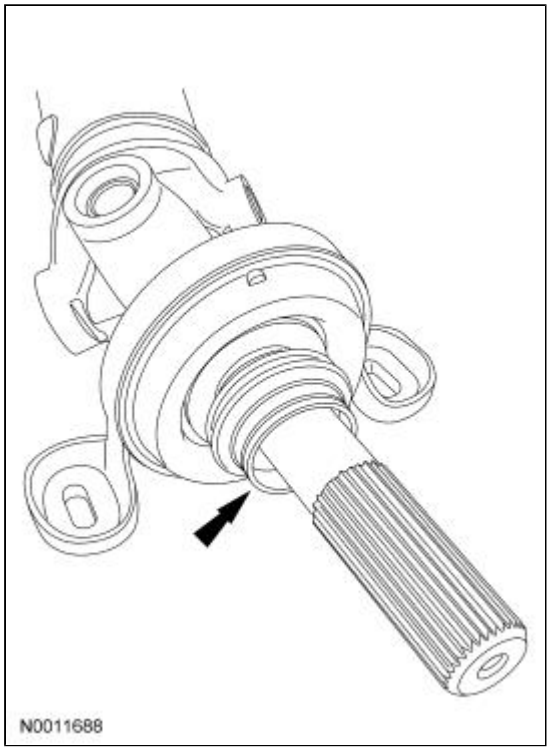
3. Disconnect the slip yoke boot.



4. Separate the driveshaft.



5. Remove the slip yoke boot.



6. **NOTE:** Lubricate the slip yoke splines with premium long-life grease.

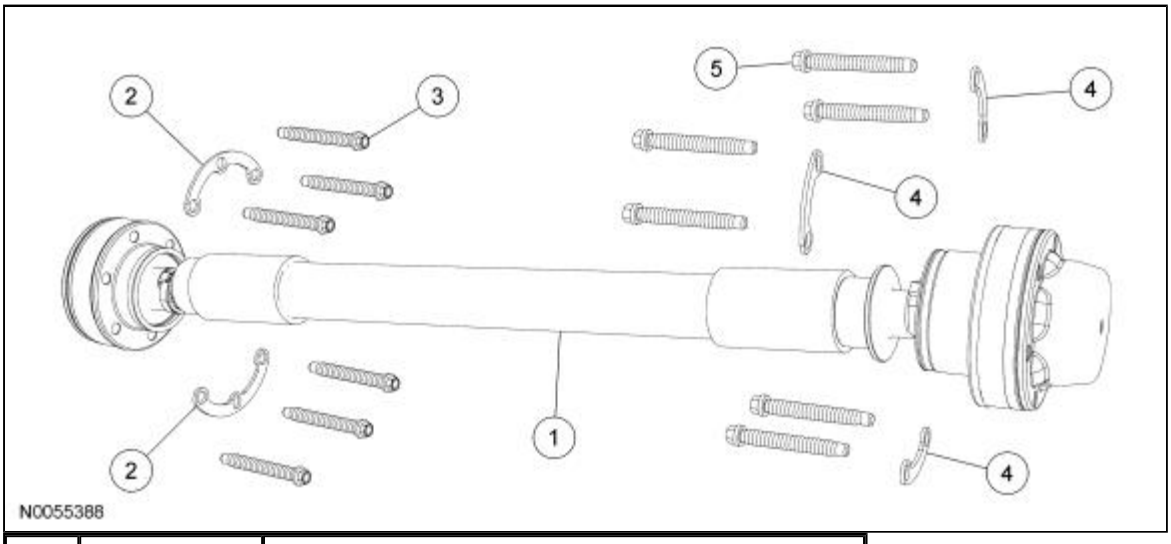
To install, reverse the removal procedure.

- Align the index marks for correct alignment.

Driveshaft — Exploded View

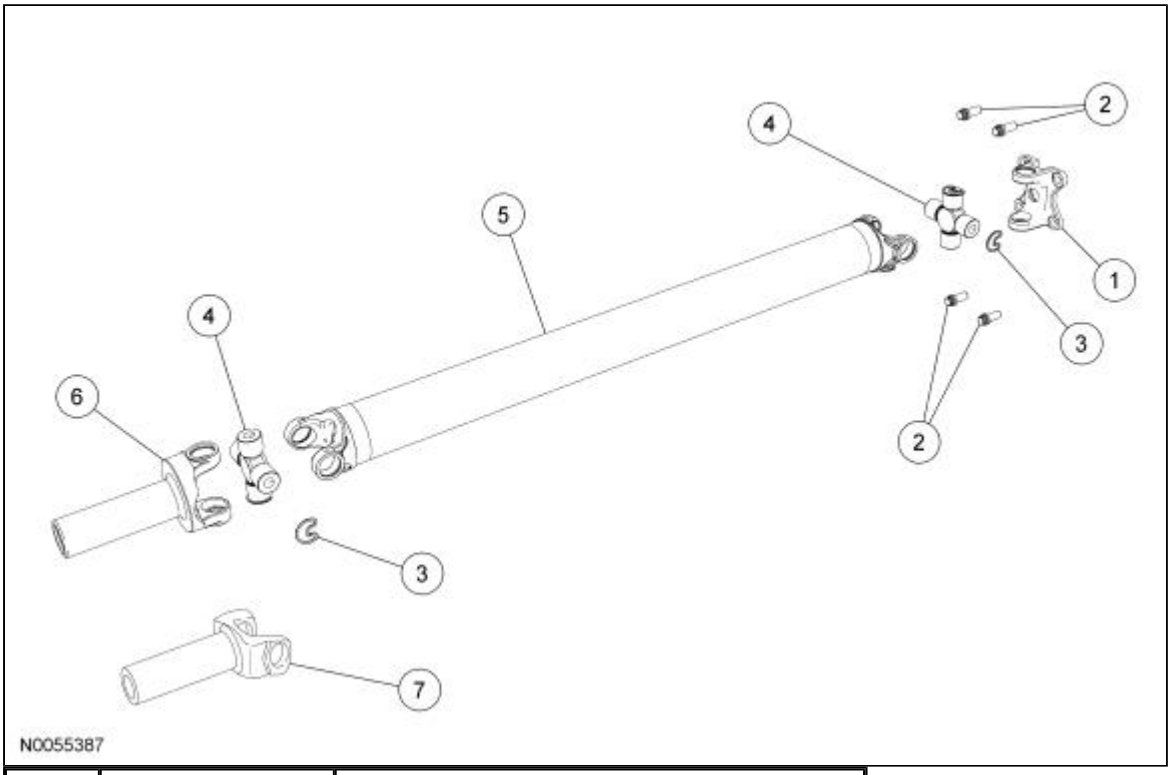
Printable View (211 KB)

Front, Expedition and Navigator



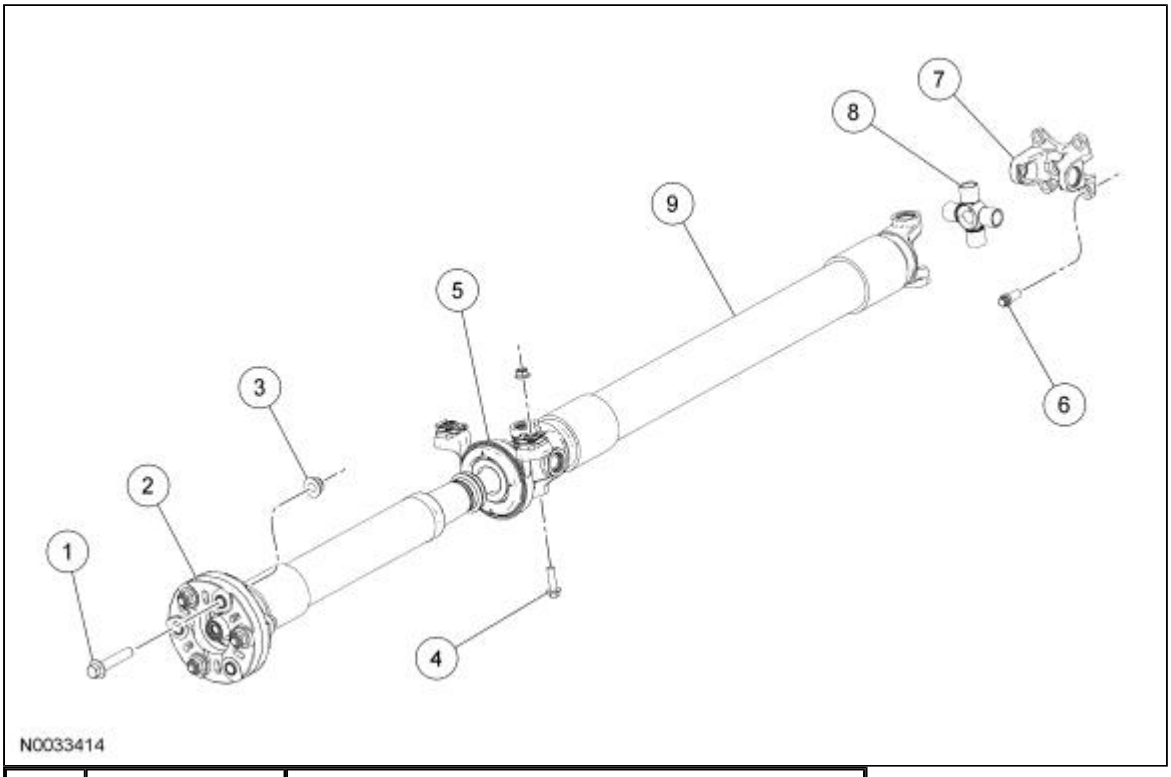
Item	Part Number	Description
1	4A376	Driveshaft assembly
2	4682	Constant velocity (CV) joint washer (2 required)
3	4N272	Front CV bolts (6 required)
4	4682	Rear CV washers (3 required)
5	4N272	Rear CV bolts (6 required)

Rear — Navigator Four Wheel Drive (4WD), Expedition 4WD and Rear Wheel Drive (RWD)



Item	Part Number	Description
1	4A378	Driveshaft flange yoke
2	—	Bolt (part of 4A378)
3	—	Snap rings (part of 4635)
4	4635	Universal joint assembly
5	4602	Driveshaft assembly
6	4841	Driveshaft slip yoke (Expedition)
7	4A331	Driveshaft slip yoke (Navigator)

Rear, Navigator RWD



Item	Part Number	Description
1	—	Flex-coupler-to-flange bolt (3 required)
2	—	Flex coupler (part of 4K145)
3	—	Flex-coupler-to-flange nut (3 required)
4	—	Driveshaft center bearing bolt (2 required)
5	—	Driveshaft center bearing (part of 4K145)
6	—	Driveshaft flange bolt (4 required)
7	—	Driveshaft flange (part of 4K145)
8	4635	U-joint
9	—	Driveshaft assembly

1. For additional information, refer to the procedures in this section.

Driveshaft Universal Joint — Single Cardan

Printable View (211 KB)

Special Tool(s)

ST1172-A	Installer/Remover, C-Frame and Screw 205-086 (T74P-4635-C)

Disassembly

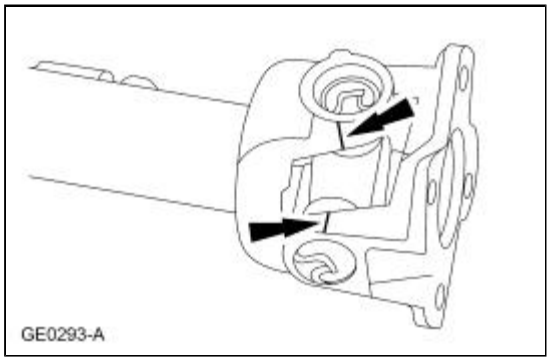
1. Remove the driveshaft. For additional information, refer to Driveshaft — Front , Driveshaft — Rear, Expedition or Driveshaft — Rear, Navigator in this section.

2. **CAUTION: Do not clamp the driveshaft in the jaws of a vise or a similar holding fixture.**

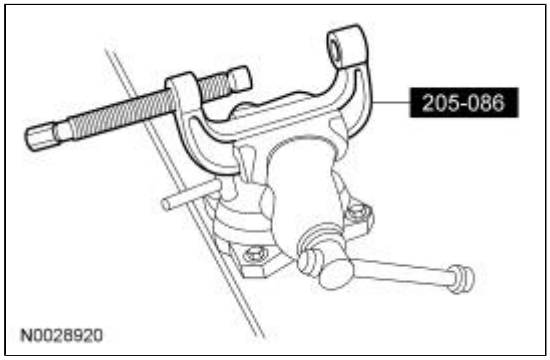
   Carefully place the driveshaft on a suitable workbench.

3. **NOTE:** Index-mark the driveshaft components relative to the driveshaft tube. Make sure all components are reassembled in the same relationship to maintain correct balance.

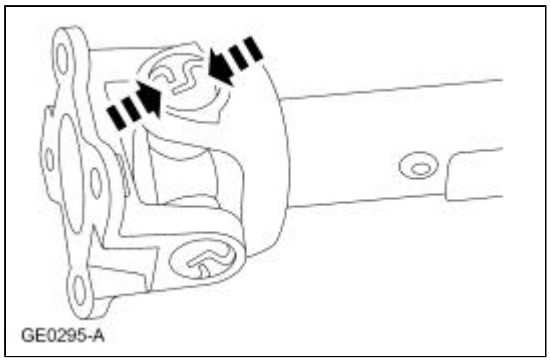
   Index the driveshaft and driveshaft components.



4. Position the special tool in a vise.

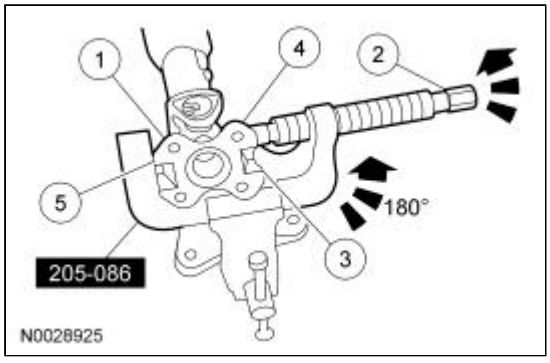


5. Remove the snap rings from the universal joint.



6. **NOTE:** If necessary, use a pair of pliers to remove a bearing cup if it cannot be pressed out all the way.

   Remove the driveshaft flange yoke.
   1. Position the driveshaft flange in the special tool.
   2. Press out the bearing cup.
   3. Rotate the driveshaft flange yoke.
   4. Press on the spider to remove the remaining bearing cup.
   5. Remove the driveshaft flange yoke.



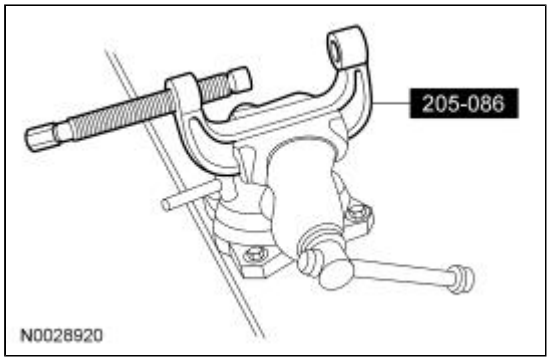
7. Repeat the previous step to remove the remaining bearing cups and spider from the driveshaft.

8. Clean the yoke area at the end of the driveshaft and flange yoke.

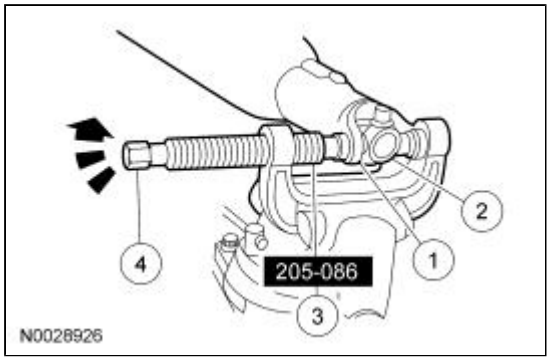
Assembly

NOTE: Universal joint service kits are to be installed as complete assemblies only. Do not use components from other universal joints.

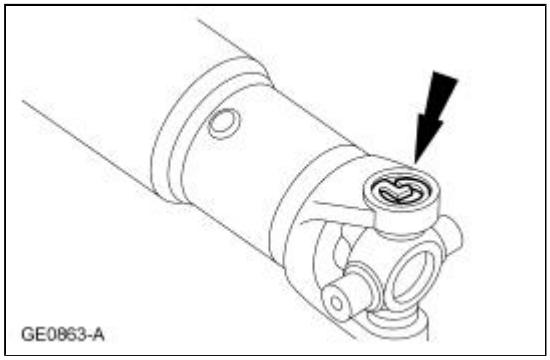
1. Clamp the special tool in a vise.



2. Install a new bearing cup.
    1. Start a new bearing cup into the driveshaft yoke.
    2. Position a new spider in the driveshaft yoke.
    3. Install the driveshaft into the special tool.
    4. Press the bearing cup below the yoke surface.



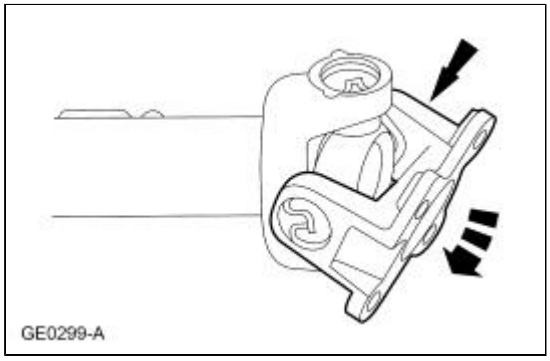
3. Remove the driveshaft from the special tool and install the snap ring.



4. Repeat the previous steps to install the remaining bearing cups.

5. **NOTE:** Do not strike the bearings. If binding, strike the yoke with a brass or plastic hammer.

   Check the universal joint for freedom of movement.



Printable View (82 KB)

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Ultra Silicone Sealant TA-29	—
Threadlock and Sealer TA-25	WSK-M2G351-A5
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Lubricant Capacity	
Axle capacity conventional (ribbed cover)	4.25 pints (0.9 in [23 mm] below fill hole)
Axle capacity Traction-Lok® (ribbed cover)	4 pints + 4 oz. Friction Modifier (0.9 in [23 mm] below fill hole) [a]
Axle capacity conventional (smooth cover)	4.25 pints (to bottom of fill hole)
Axle capacity Traction-Lok® (smooth cover)	4 pints + 4 oz. Friction Modifier (to bottom of fill hole) [a]
Backlash Specifications	
Differential case maximum runout	0.076 mm (0.003 in)
Backlash between ring gear and pinion teeth	0.208-0.305 mm (0.008-0.012 in)
Ring gear maximum backlash variation between teeth	0.102 mm (0.004 in)
Pinion flange maximum radial runout in assembly	0.203 mm (0.008 in T.I.R.)
Rotational Torque Ranges	
Pinion bearing preload	1.8-3.3 Nm (16-29 lb-in)
Minimum breakaway torque (Traction-Lok®)	27 Nm (20 lb-ft)

[a] Install Friction Modifier in axle before installing lubricant.

Torque Specifications

Description	Nm	lb-ft	lb-in
Differential bearing cap bolt	105	77	—
Differential pinion shaft lock bolt	30	22	—
Oil filler plug	30	22	—
Differential housing cover bolts	32	24	—
Driveshaft bolts	112	83	—

Ring gear bolts	150	111	—
Traction-Lok® clutch gauge nut	6.7	—	60
Driver handle	2.2	—	20
Torque arm-to-rear axle housing bolts (4 required)	205	150	—
Torque arm insulator bolt (1 required)	135	100	—
Rear axle insulator stud nut (3 required)	135	100	—
Rear axle studs (2 required)	40	30	—
Rear sway bar links	90	66	—

Rear Drive Axle and Differential

Printable View (63 KB)

- The differential housing consists of a cast iron housing and a cast aluminum differential housing cover. The differential housing cover uses silicone sealant as a gasket.
- The hypoid-design gearset consists of a 9.75-inch differential ring gear and a drive pinion gear. Two opposed pinion bearings support the drive pinion gear in the differential housing.
- A drive pinion collapsible spacer, located on the drive pinion gear shaft, maintains pinion bearing preload. The pinion nut adjusts the preload.
- Differential bearing shims, located between the differential bearing cups and the differential housing, adjust the differential ring gear backlash and the differential bearing preload.
- The differential case is a 1-piece design with 2 openings to allow for assembly of the internal components and lubricant flow. Two opposed differential bearings support the differential case in the differential housing. Removable differential bearing caps retain the differential assembly in the differential housing.
- Inside the differential case, the differential pinion shaft supports 2 differential pinion gears. The pinion gears engage the differential side gears, to which the halfshafts are splined. The differential pinion shaft lock bolt retains the differential pinion shaft in the differential case.
- A circlip, located on the stub shaft, holds the halfshaft in the differential case. When installed, the circlip engages a groove in the differential side gear.
- The rear axle requires SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada); or equivalent meeting Ford specification WSL-M2C192-A. If equipped with a Traction-Lok®, 4 ounces of Friction Modifier XL-3 (US); CXL-3 (Canada); or equivalent meeting Ford specification EST-M2C118-A must be added.
- An embossed metal tag, bolted to the differential housing cover, contains rear axle identification. Refer to Section 205-00.

Rear Drive Axle and Differential

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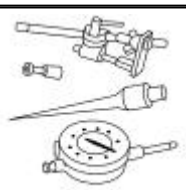
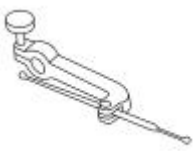
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75-4201-A)

Inspection and Verification

The technician should have a thorough knowledge of driveline system operation and accepted general driveline guidelines to detect any problems.

A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Certain conditions, such as road conditions and weather, will amplify normal vehicle noise.

Certain rear axle and driveline concern symptoms are also common to the engine, transmission, rear wheel bearings and tire. For this reason, be sure the cause of the concern is in the axle before repairing or installing any axle components.

The following is a guide to diagnose a driveline concern:

- Verify and document the customer concern.
- Perform a preliminary investigation.
- Road test the vehicle.
- Find the cause of the problem.
- Inspect the components.

1. Verify and document the customer concern.
    1. When was it first noticed?
    2. Did it appear suddenly or gradually?
    3. Did anything unusual occur that would coincide with it or precede it?
    4. Has the driveline system been repaired before or new components installed?

- Check the vehicle service record. Note any repairs other than driveline, such as brakes or suspension.

5. Are there any special conditions affecting the concern or will alter the concern? For example,
   - road speed.
   - type of road.
   - drive mode.
   - temperature.
   - vehicle loaded or unloaded.
6. Is the condition constant or intermittent? Can the concern be duplicated at any time?
7. Check for TSBs, SSM and OASIS messages.

2. **NOTE:** If the inspection reveals an obvious concern, repair the vehicle.

   Do a preliminary investigation. Visually inspect for obvious signs of damage.
   1. Inspect the driveshaft:
      - for build up of any foreign material.
      - for damage, such as a bent tube or missing weights.
      - U-joints, CV joints or flex couplers for wear or damage.
   2. Inspect the axle:
      - for signs of leakage at the drain or fill plug, differential seal, vent or halfshaft seals.
        - a plugged vent or vent tube will cause a leak.
      - for damage, such as cracks, bent halfshafts or dented rear cover.
      - for missing fasteners.
   3. Inspect other suspect components/systems:
      - inspect the suspension for broken springs, damaged shock absorbers and worn suspension bushings.
      - inspect the rear brake components — lines, cables and calipers.
      - inspect the tires; are they in good condition and do they match?

3. **NOTE:** A road test is necessary for any customer concern of noise or vibration.

   Road test the vehicle.
   1. During the road test, use the following driving methods to diagnose the problem. Is the concern most noticeable:
      - from a stop?
      - on shifts from REVERSE to DRIVE?
      - on turns?
        - sweeping type turn.
        - tight turn (to the stop).
      - in DRIVE?
        - accelerating the vehicle, definite throttle depression, applying engine torque?
      - in CRUISE?
        - maintain a constant speed with the throttle applied?
      - in COAST?
        - decelerating with the throttle closed?
   2. Record when the concern occurs. Write down the kph (mph) range at which the noise/vibration occurs.

4. Find the cause of the problem.
   1. Compare the inspection and road test results with the following chart.
   2. Use the following diagnostic routine chart to identify the probable cause and know what corrective actions should be taken to repair the component/vehicle and to prevent a reoccurrence.

Diagnostic Routine Chart

Condition	Action
· Fluid loss	· GO to Diagnostic Routine — Fluid Loss
· Noise louder on turns (sweeping turn)	· GO to Diagnostic Routine — Noise Louder on Turns (Sweeping)
· Axle noise (growl) [a] in tight turn	· GO to Diagnostic Routine — Noise (Growl) In Tight Turn
· Axle noise (chatter/shudder) [a] in tight turn, limited slip differential	· GO to Diagnostic Routine — Noise (Chatter/Shudder) In Tight Turns, Limited Slip Differential
· Axle noise (whine) [a] in all or more than one drive mode	· GO to Diagnostic Routine — Noise (Whine) In All Or More Than One Drive Modes
· Axle noise (tick/click) [a] in all or more than one drive mode (drive, cruise, coast)	· GO to Diagnostic Routine — Noise (Tick/Click) In All Or More Than One Drive Modes
· Axle noise (howl/moan) [a] in all or more than one drive mode (drive, cruise, coast)	· GO to Diagnostic Routine — Noise (Howl/Moan) In All Or More Than One Drive Modes
· Axle noise (clunk) [a] on changes in speed or direction of power	· GO to Diagnostic Routine — Noise (Clunk) On Changes In Speed Or Direction Of Power
· Front axle will not engage/disengage	· GO to Diagnostic Routine — Front Axle Will Not Engage/Disengage
· Vibration	· REFER to Section 100-04 .

a. Refer to Section 100-04 for a glossary of noise-related terms.

5. **NOTE:** If the conclusion of the road test points to an axle assembly section (ring and pinion or differential case) concern, carry out a visual inspection of the rear axle.

   Inspect the axle components.
   1. Remove the axle assembly.
   2. Remove the differential housing cover. Drain the axle lubricant through a white cloth. Check the fluid for:
      - any foreign material.
      - metal particles.
      - burnt odor.
   3. **NOTE:** When inspecting the axle, do not clean the components immediately. Cleaning may remove diagnostic evidence.

      Inspect the axle components.
      - Look for:
        - loose fasteners.
        - notches or visible steps or grooves created by wear.
        - pitting or cracking along gear contact lines.
        - scuffing or deformations.
        - discolorations.
        - nicks or ridges on gear teeth.
      - Clean the axle components for inspection.
        - Remove as much lubricant as possible with clean solvent. Wipe the components or blow them dry with compressed air.
      - Re-inspect for:
        - loose fasteners.
        - notches or visible steps or grooves created by wear.
        - pitting or cracking along gear contact lines.

- scuffing or deformations.
- discolorations.
- nicks or ridges on gear teeth.

- Check backlash and carry out a ring and pinion pattern test. Refer to Checking Differential Ring Gear Backlash and Checking Tooth Contact Pattern and Condition of the Ring and Pinion in this section.

Diagnostic Routines

Diagnostic Routine — Fluid Loss

Possible Component	Reference/Action
· Vent	· CLEAN the axle vent and vent hose.
· Overfilled axle	· CHECK the lubricant level for specific amount.
· Fill plug	· CLEAN the area around the plug. REMOVE the plug. APPLY pipe sealant and INSTALL the plug.
· Halfshaft oil seal	· INSTALL a new halfshaft oil seal.
· Pinion seal	· INSTALL a new pinion seal.
· Differential housing cover	· RESEAL the differential housing cover.

Diagnostic Routine — Noise Louder On Turns (Sweeping)

Possible Component	Reference/Action
· Wheel end bearing	· CHECK the wheel end bearing for wear or damage. INSTALL a new bearing.

Diagnostic Routine — Noise (Growl) In Tight Turn, Conventional Differential

Possible Component	Reference/Action
· Differential side gears and differential pinion gears	· DISASSEMBLE the differential carrier. INSPECT the differential case assembly. INSTALL new side gears and differential pinion gears or case assembly.

Diagnostic Routine — Noise (Chatter/Shudder) In Tight Turns, Limited Slip Differential

Possible Component	Reference/Action
· Clutch pack	· VERIFY the condition. With the vehicle in cold startup, MAKE SURE that the vehicle is in two wheel drive (2WD), to isolate the rear axle. TURN the wheel fully right (or fully left) and then ACCELERATE the vehicle. If the condition is verified to be in the rear axle, REMOVE and INSTALL new clutch packs.

Diagnostic Routine — Noise (Whine) In All Or More Than One Drive Modes

Possible Component	Reference/Action

· Axle ring and pinion	· REMOVE and INSTALL a new gear set and bearings.

Diagnostic Routine — Noise (Tick/Click) In All Or More Than One Drive Modes

Possible Component	Reference/Action
· Axle ring and pinion	· REMOVE and INSTALL a new ring gear, pinion and bearings.

Diagnostic Routine — Noise (Howl/Moan) In All Or More Than One Drive Modes

Possible Component	Reference/Action
· Axle bearings	· INSPECT differential and pinion bearings. INSTALL new bearings.

Diagnostic Routine — Noise (Clunk) On Changes In Speed Or Direction Of Power

Possible Component	Reference/Action
· Axle and pinion system	· MEASURE total backlash. If end play and total backlash are not within specification, INSTALL a new differential case assembly.
· Differential pinion shaft	· INSTALL a new differential pinion shaft and pin.
· Pinion bearings	· INSTALL new pinion and differential bearings and bearing cups.

Diagnostic Routine — Front Axle Will Not Engage/Disengage

Possible Component	Reference/Action
· Mode switch Wiring Shift motor	· REFER to Section 308-07A .

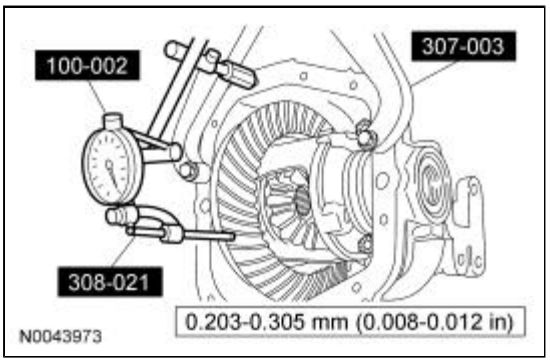
Diagnostic Routine — Vibration

Possible Component	Reference/Action
· For driveline vibration, REFER to Section 100-04 .	

Checking Differential Ring Gear Backlash

1. Remove the differential assembly.
2. Remove the differential housing cover.
3. Secure the differential assembly in a holding fixture.

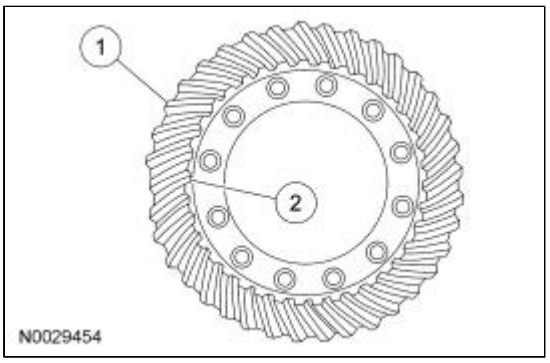
4. Using a suitable dial indicator and the special tool, measure and record the differential ring gear backlash in 4 opposing points on the ring gear.



Checking Tooth Contact Pattern and Condition of the Ring and Pinion

There are 2 basic types of conditions that will produce ring and pinion noise. The first type is a howl or chuckle produced by broken, cracked, chipped, scored or forcibly damaged gear teeth and is usually quite audible over the entire speed range. The second type of ring and pinion noise pertains to the mesh pattern of the gear pattern. This gear noise can be recognized as it produces a constant pitch or whine. Ring and pinion noise tends to peak in a narrow speed range or ranges, and will tend to remain constant in pitch.

NOTE: In the following steps, the movement of the contact pattern along the length is indicated as toward the "heel" or "toe" of the differential ring gear.



Item	Description
1	Heel
2	Toe

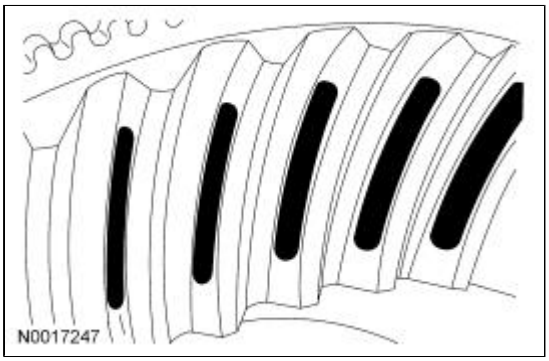
Apply a marking compound to a third of the gear teeth on the differential ring gear. Rotate the differential ring gear several complete turns in both directions until a good, clear tooth pattern is obtained. Compare the contact patterns on the ring gear teeth with the following illustrations.

Good Contact Pattern

Pattern inspection allows the technician to detect gross errors in set up prior to complete assembly of the differential assembly. Pattern contact should be within the primary area of the ring gear tooth section. Avoid narrow or hard contact with the outer perimeter of the ring gear tooth. Pattern inspection should be on the drive side of the tooth. Correct assembly of the drive pattern will result in satisfactory coast performance.

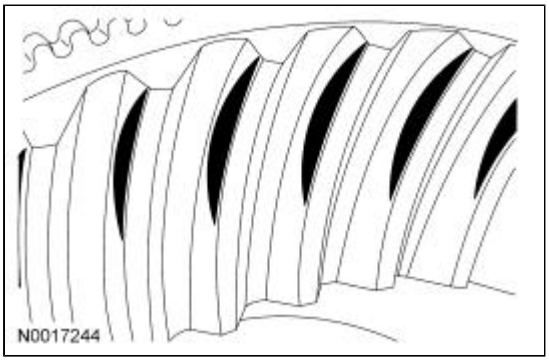
NOTE: If a gross pattern error is detected with the correct backlash, check the pinion shim selection.

Good Contact Pattern



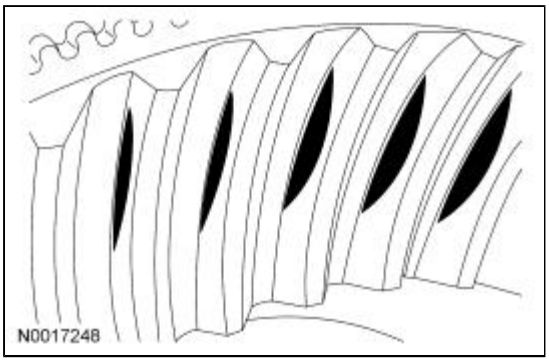
Low Contact Pattern That Is Contacting More Toward the Heel

Gross Pattern Error



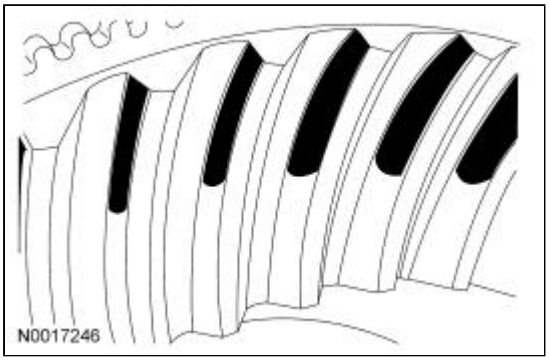
High, Thin Contact Pattern In the Center Of the Tooth

Gross Pattern Error



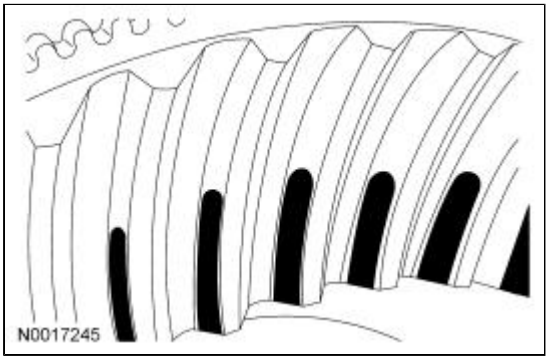
Thick Contact Pattern That Is Contacting Tooth Toward the Heel

Gross Pattern Error



Thick Contact Pattern That Is Contacting Tooth Toward the Toe

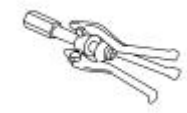
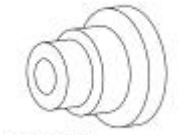
Gross Pattern Error



Stub Shaft Pilot Bearing and Seal

Printable View (171 KB)

Special Tool(s)

 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1721-A	Installer, Halfshaft Pilot Bearing 205-504
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2369-A	Installer, Wheel Speed Sensor Ring 206-034 (T88P-20202-A)

Material

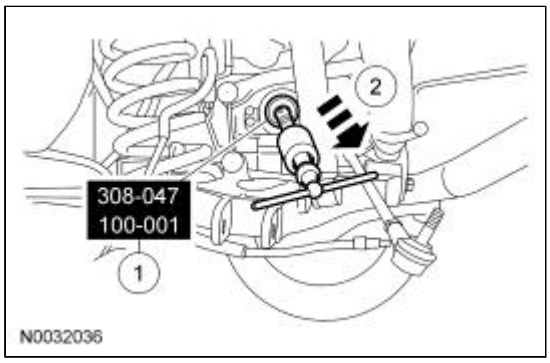
Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

NOTE: The stub shaft seals must be replaced whenever the halfshafts are removed.

1. Remove the halfshaft assembly. For additional information, refer to Section 205-05 .
2. **NOTE:** If removing the stub shaft pilot bearing oil seal only, engage the tangs of the special tool on the stub shaft pilot bearing oil seal.

Using the special tools, remove and discard the stub shaft pilot bearing and the stub shaft pilot bearing oil seal.

1. Firmly engage the tangs of the special tool on the stub shaft pilot bearing.
2. Remove and discard the bearing and the stub shaft pilot bearing oil seal.

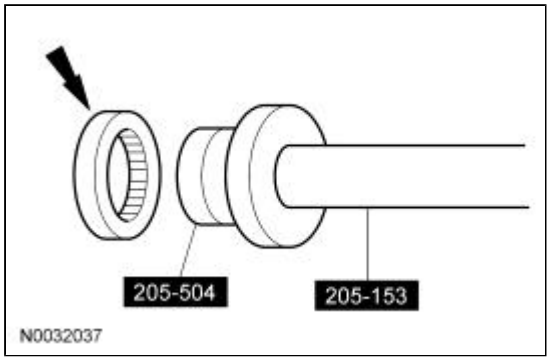


3. Inspect the seal journal for rust, nicks and scratches. Polish the seal journal surface with fine crocus cloth, if necessary.

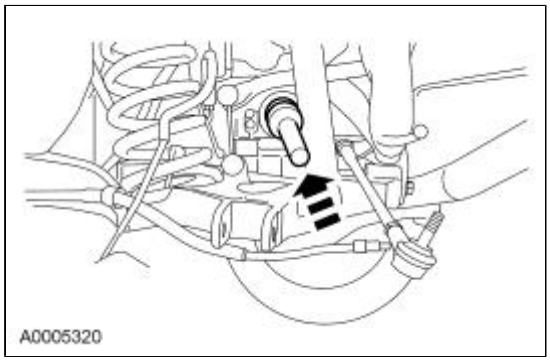
4. Lubricate the new stub shaft pilot bearing with axle lubricant.

5. **CAUTION: Installation of the stub shaft pilot bearing or stub shaft oil seal without the correct tools can result in early bearing or seal failure. If the stub shaft pilot bearing becomes cocked in the bore during installation, remove it and install a new one.**

   Place the stub shaft pilot bearing onto the special tools.

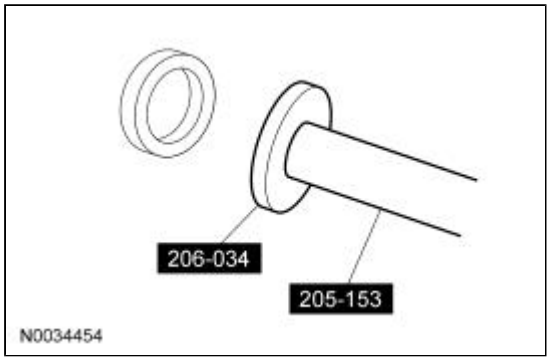


6. Install the stub shaft pilot bearing into the rear axle housing bore.

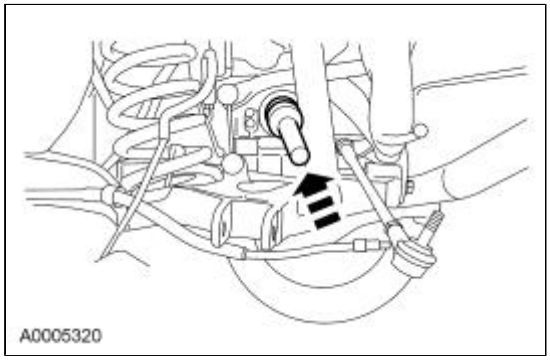


7. **NOTE:** Do not disassemble the new oil seal.

   Install the new seal onto the special tools.



8. Carefully align the stub shaft pilot bearing seal with the housing bore and install the stub shaft pilot bearing seal flush in the differential housing.
    - Strike only the handle. Directly striking the installer tool will damage the seal.



9. **CAUTION: Inspect the stub shaft seal journal for rust, nicks or scratches prior to installing the halfshaft. Polish the seal journal with fine crocus cloth, if required.**

    Install the halfshaft. For additional information, refer to Section 205-05 .

Drive Pinion Flange and Drive Pinion Seal

Printable View (250 KB)

Special Tool(s)

ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1734-A	Installer, Drive Pinion Flange 205-233 (T85T-4851-AH)
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Threadlock and Sealer TA-25	WSK-M2G351-A5 (type II)
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

Removal

CAUTION: Remove the rear wheel and tire assemblies, brake calipers and brake discs to prevent brake drag during the drive pinion bearing preload adjustment.

1. **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the LH rear quarter trim panel. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury and vehicle damage.**

   NOTE: If equipped, turn the air suspension switch to the OFF position.

   With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .

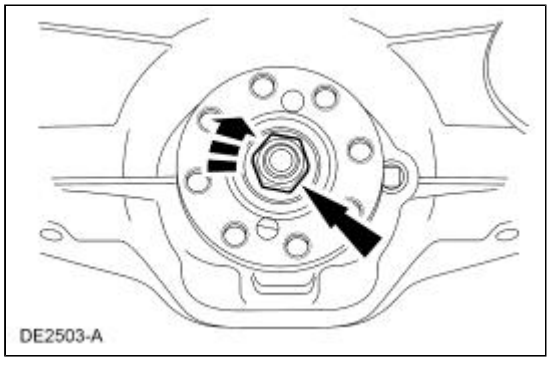
2. Remove the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .

3. **CAUTION: Do not allow the brake caliper to hang from the brake hose. Provide a suitable support.**

   Remove the rear brake calipers and the brake discs. Position the brake calipers aside. For additional information, refer to Section 206-04 .

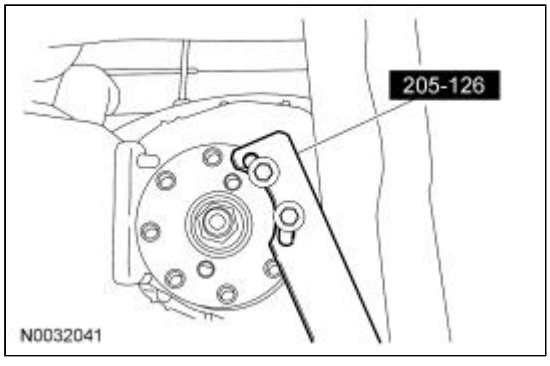
4. Remove the rear driveshaft assembly. For additional information, refer to Section 205-01 .

5. Install a Nm (lb-in) torque wrench on the nut and record the torque necessary to maintain rotation of the drive pinion gear through several revolutions.

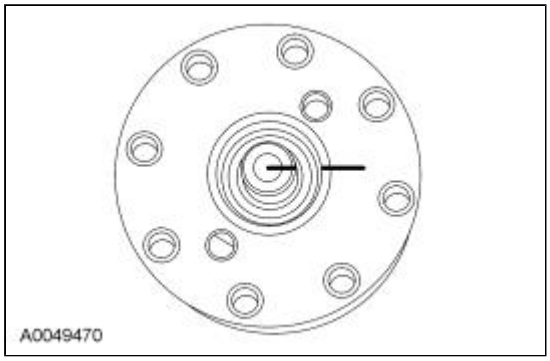


6. **CAUTION: After removing the pinion nut, discard it. Use a new nut for installation.**

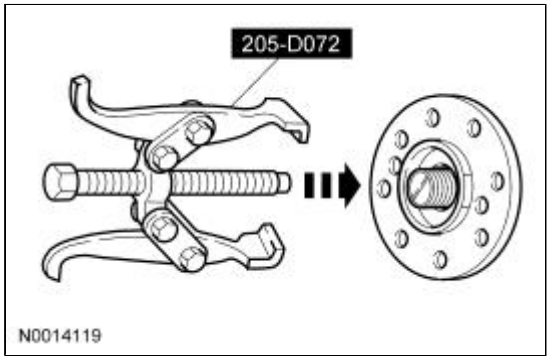
   Use the special tool to hold the pinion flange while removing the pinion nut.



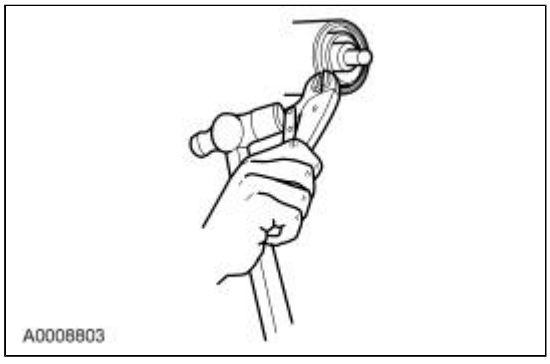
7. Index-mark the drive pinion flange and the drive pinion gear stem to maintain initial balance during installation.



8. Using the special tool, remove the drive pinion flange.



9. Force up on the metal flange of the drive pinion seal. Install gripping pliers and strike with a hammer until the pinion seal is removed.

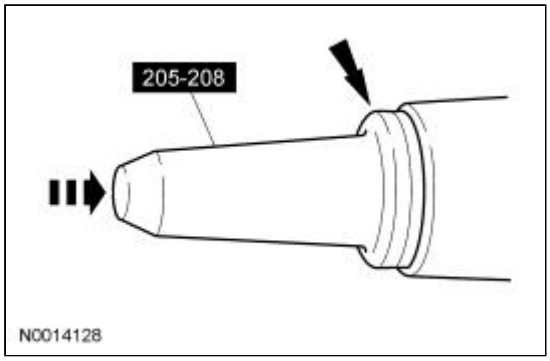


Installation

1. Lubricate the lips of the new drive pinion seal with grease.

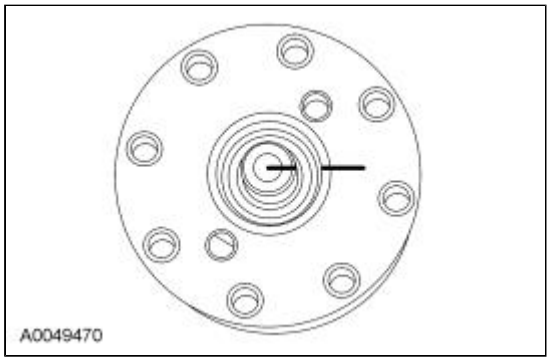
2. **CAUTION: If the drive pinion seal becomes misaligned during installation, remove it and install a new seal.**

   Using the special tool, install the drive pinion seal.

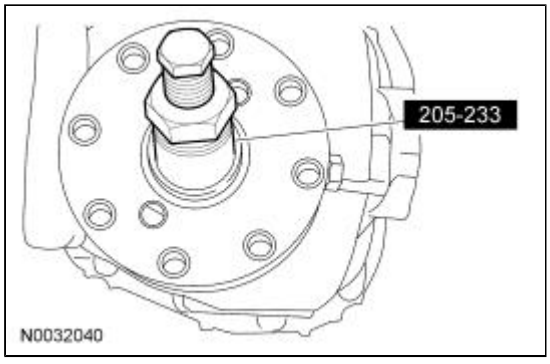


3. Lubricate the drive pinion flange splines with rear axle lubricant.
4. **NOTE:** Disregard the index marks if installing a new drive pinion flange.

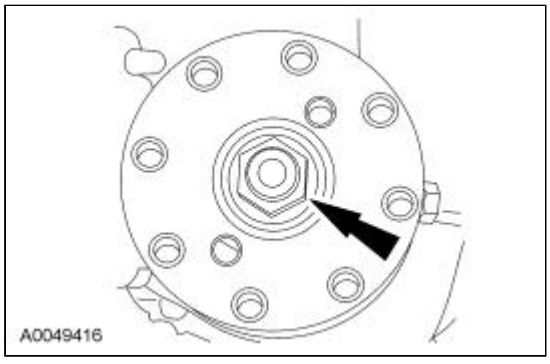
   Position the drive pinion flange.



5. Using the special tool, install the drive pinion flange.



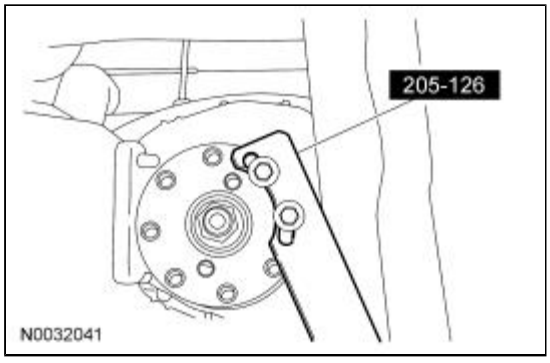
6. Position the new drive pinion nut.



7. **CAUTION: Do not under any circumstance loosen the nut to reduce preload. If it is necessary to reduce preload, install a new drive pinion collapsible spacer and nut.**

   CAUTION: Remove the special tool while taking preload readings with the Nm (inch-pound) torque wrench.

   Use the special tool to hold the pinion flange while tightening the nut.
   - Rotate the pinion occasionally to make sure the pinion bearings seat correctly. Take frequent pinion bearing torque preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.
   - If the preload recorded prior to disassembly is lower than the specification for used bearings, tighten the nut to specification. If the preload recorded prior to disassembly is higher than the specification for used bearings, tighten the nut to the original reading as recorded.
   - Refer to the torque specification for used pinion bearings in the Specifications portion of this section.



8. **CAUTION: Install the driveshaft with new bolts. If new bolts are not available, apply sealer to the threads of the original bolts.**

   CAUTION: Align the index marks.

   CAUTION: The driveshaft flange yoke fits tightly on the pinion flange pilot. To make sure that the yoke seats squarely on the flange, tighten the bolts evenly in a cross pattern as shown.

   Install the rear driveshaft. For additional information, refer to Section 205-01 .

9. Install the rear brake discs and the brake calipers. For additional information, refer to Section 206-04 .

10. Install the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .

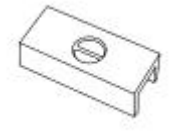
11. Lower the vehicle.

12. If equipped with air suspension, reactivate the system.

Rear Axle Housing Support Insulator

Printable View (219 KB)

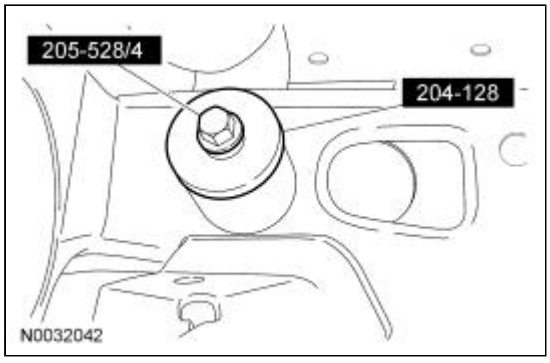
Special Tool(s)

ST2668-A	Forcing Screw, Rear Differential Housing Bushing 205-528/4
ST1970-A	Installer, Rear Differential Housing Bushing 205-528/2
ST2669-A	Receiver Cup, Rear Differential Housing Bushing 205-528/3
ST1965-A	Remover, Rear Differential Housing Bushing 205-528/1
ST1569-A	Adapter for 204-S127 204-128 (T86P-5638-AH1)
ST1367-A	Installer, Drive Pinion Bearing 205-488
 ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)

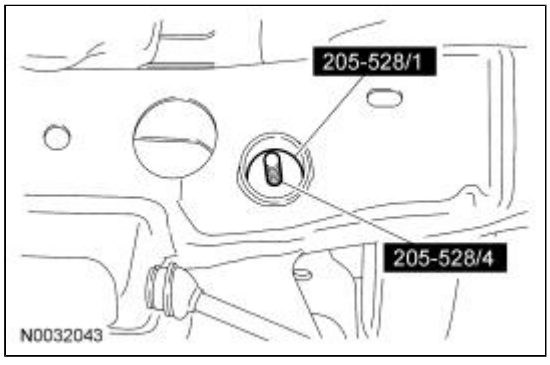
Removal

1. Remove the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

2. Insert the forcing screw through the adapter and the frame support insulator.

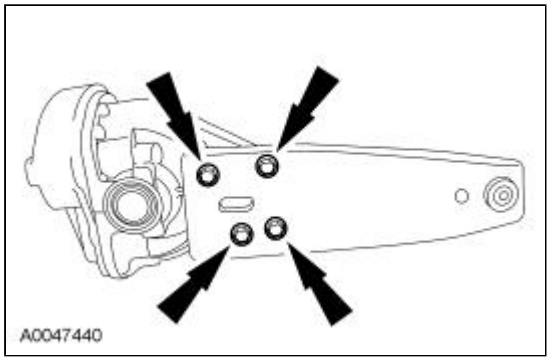


3. Thread the bushing remover on the forcing screw.

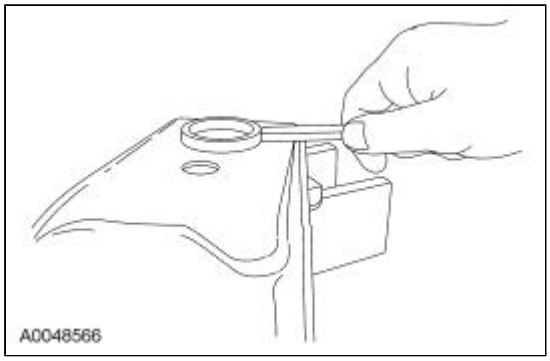


4. Tighten the special tool to remove the frame support insulator.

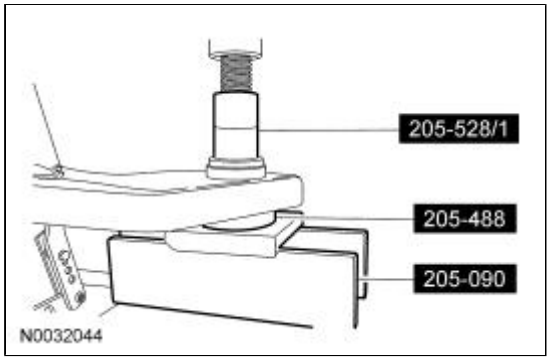
5. Remove the 4 bolts attaching the torque arm to the axle housing.



6. Measure and record the distance the insulator extends from the face of the torque arm.

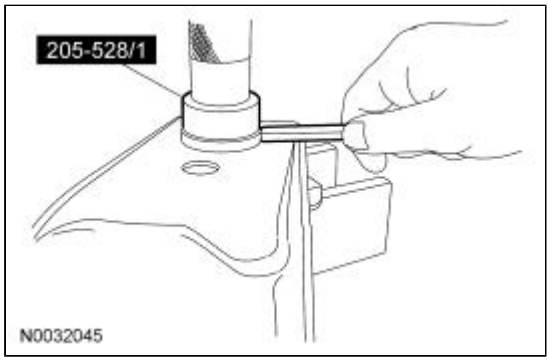


7. Using a suitable press and the special tools, remove the torque arm insulator from the torque arm.

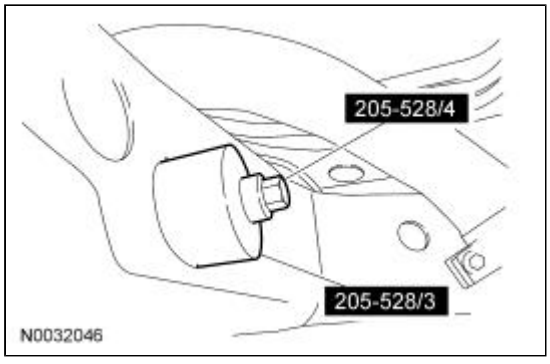


Installation

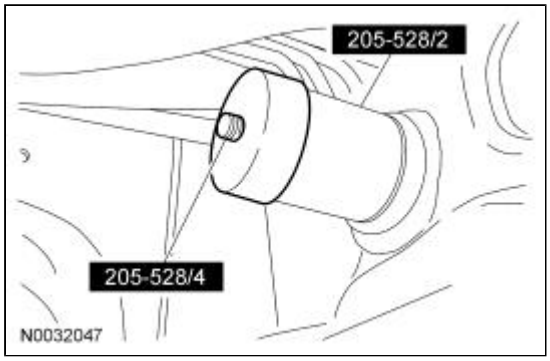
1. Using a suitable press and the special tools, install the new torque arm insulator to the previously recorded depth.



2. Position the special tools on the rear of the crossmember.

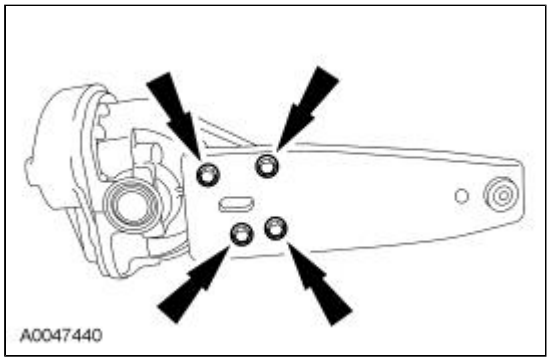


3. Position the new insulator and thread the special tools together.



4. Tighten the forcing screw to seat and position the new insulator.

5. Install the torque arm on the rear axle housing.
   - Tighten to 205 Nm (150 lb-ft).

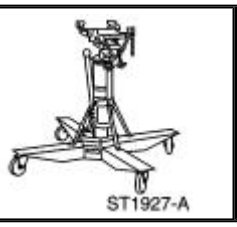


6. Install the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

Axle Assembly — Air Suspension

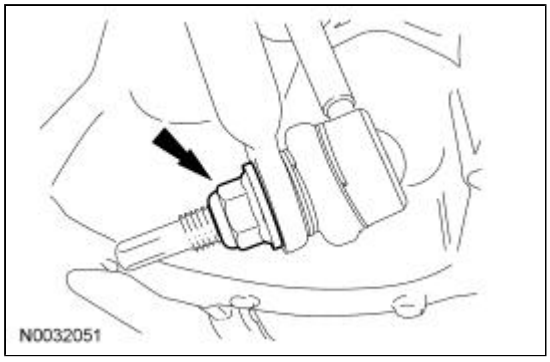
Printable View (220 KB)

Special Tool(s)

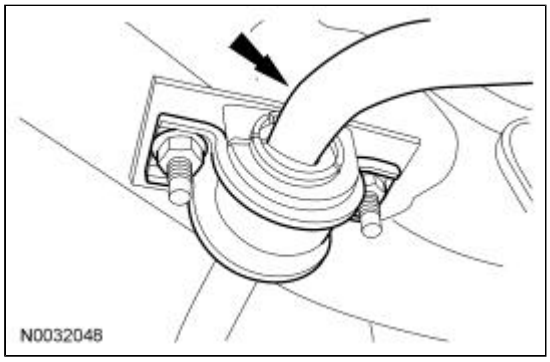
 ST1927-A	Hi-Lift Transmission Jack 164-R3508 or equivalent

Removal and Installation

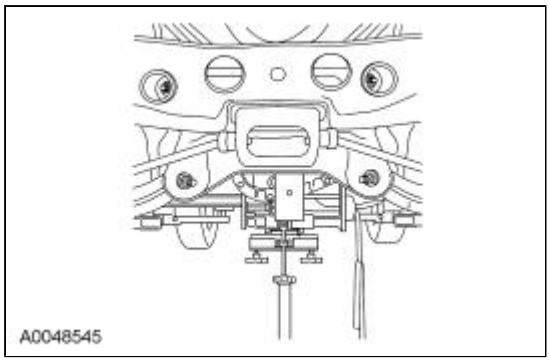
1. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .
2. Deflate the rear air springs. For additional information, refer to Section 204-05 .
3. Remove the rear driveshaft assembly. For additional information, refer to Section 205-01 .
4. Remove the axle halfshafts. For additional information, refer to Section 205-05 .
5. Remove the lower rear sway bar links.
   - To install, tighten to 90 Nm (66 lb-ft).



6. Remove the 4 bracket bolts and remove the rear sway bar.
   - To install, tighten to 40 Nm (30 lb-ft).

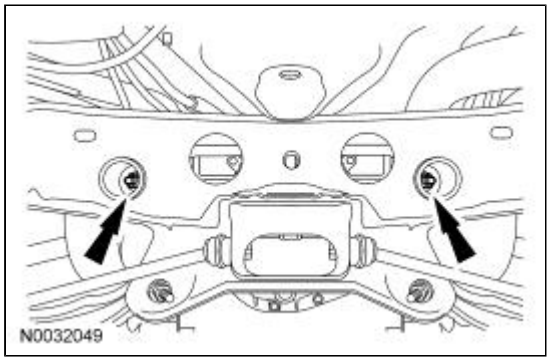


7. Using a suitable jack, support the axle housing.

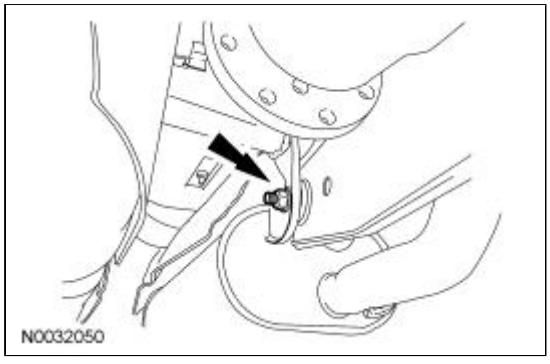


8. **NOTE:** Spare wheel removed for clarity.

   Remove the upper axle housing stud nuts.
   - To install, tighten to 135 Nm (100 lb-ft).

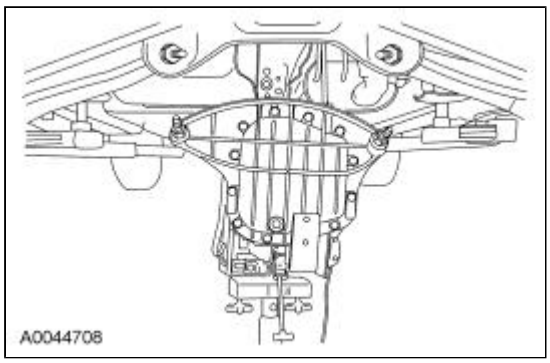


9. Remove the front torque arm bolt.
   - To install, tighten to 135 Nm (100 lb-ft).



10. **NOTE:** Move the axle housing forward to clear the rear mounting studs from the bushings.

    Lower the axle housing from the vehicle.

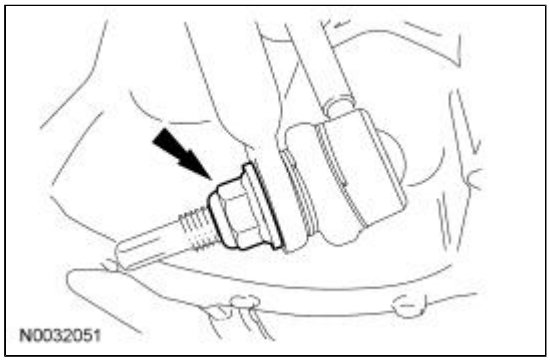


11. To install, reverse the removal procedure.

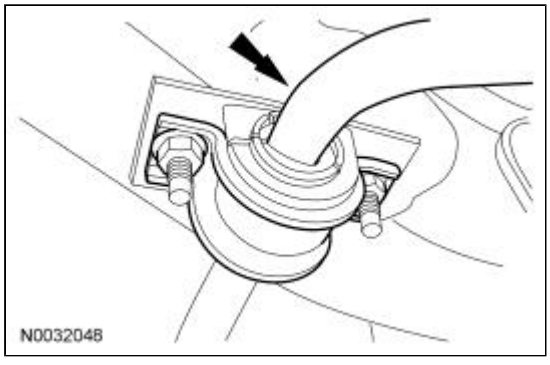
Axle Assembly — Coil Suspension

Printable View (214 KB)

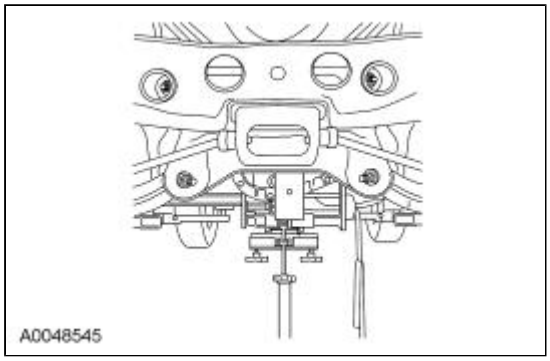
1. Position the vehicle on a hoist. For additional information, refer to Section 100-02 .
2. Remove the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .
3. Remove the rear driveshaft assembly. For additional information, refer to Section 205-01 .
4. Remove the rear halfshafts. For additional information, refer to Section 205-05 .
5. Remove the lower rear sway bar links.
   - To install, tighten to 90 Nm (66 lb-ft).



6. Remove the 4 bracket bolts and remove the rear sway bar.
   - To install, tighten to 40 Nm (30 lb-ft).

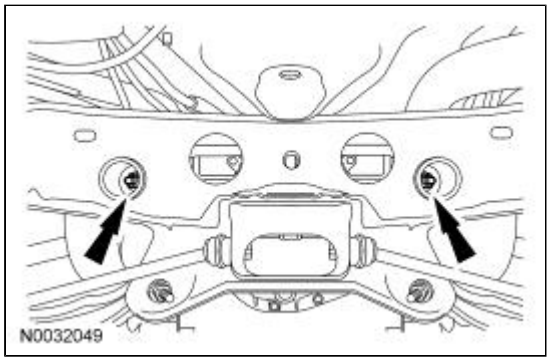


7. Using a suitable jack, support the axle housing.

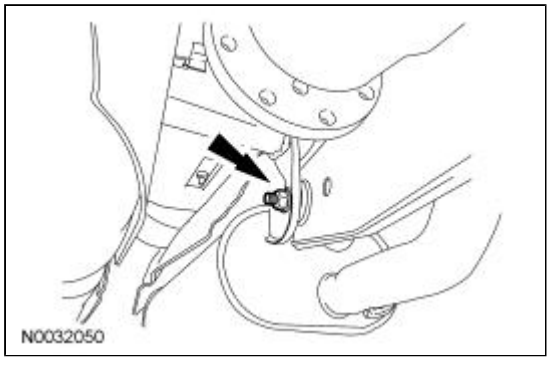


8. **NOTE:** Spare wheel removed for clarity.

   Remove the upper axle housing stud nuts.
   - To install, tighten to 135 Nm (100 lb-ft).

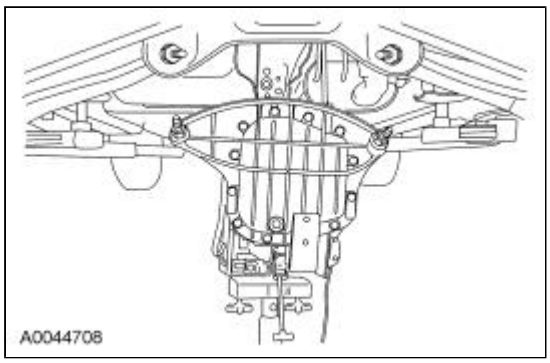


9. Remove the front torque arm bolt.
   - To install, tighten to 135 Nm (100 lb-ft).



10. **NOTE:** Move the axle housing forward to clear the rear mounting studs from the bushings.

    Lower the axle housing from the vehicle.

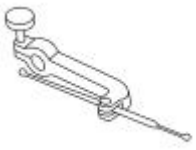
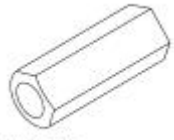


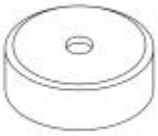
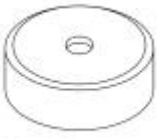
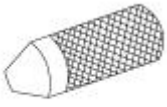
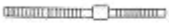
11. To install, reverse the removal procedure.

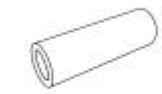
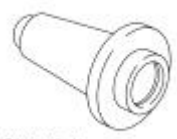
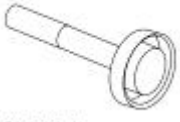
Differential Ring And Pinion

Printable View (1202 KB)

Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1744-A	Protector, Drive Pinion Thread 205-229 (T85T-4209-AH)
	Installer, Drive Pinion Bearing Cup

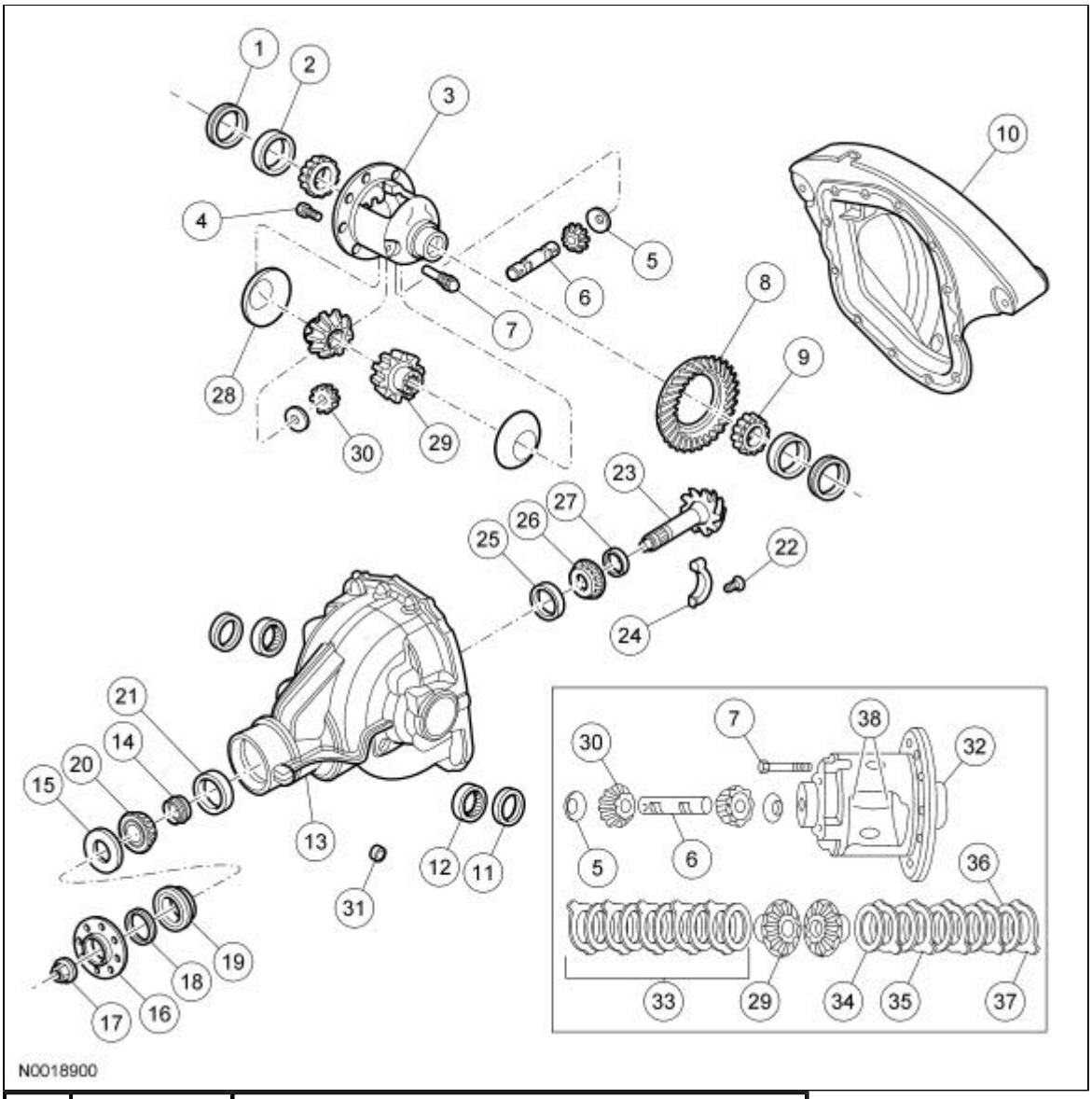
ST1678-A	205-024 (T67P-4616-A)
ST1741-A	Installer, Rear Axle Pinion Bearing Cup 205-852
ST1741-A	Installer, Rear Axle Pinion Bearing Cup 205-387 (T97T-4628-A)
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-226 (T85T-4020-AH1)
ST2468-A	Adapter for 205-S156 205-159 (T80T-4020-F42)
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-383 (T97T-4020-B)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1429-A	Adapter for 205-S156 205-160 (T80T-4020-F43)
	Gauge Tube, Drive Pinion 205-377 (T97T-4020-A)

 ST1434-A	
ST1367-A	Installer, Drive Pinion Bearing Cone 205-488
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
	Installer, Drive Pinion Flange 205-233 (T85T-4851-AH)
 ST2473-A	Installer, Differential Carrier Bearing 205-D044 (D81T-4221-A) or equivalent
ST1485-A	Installer, Differential Shim 205-228 (T85T-4067-AH)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A



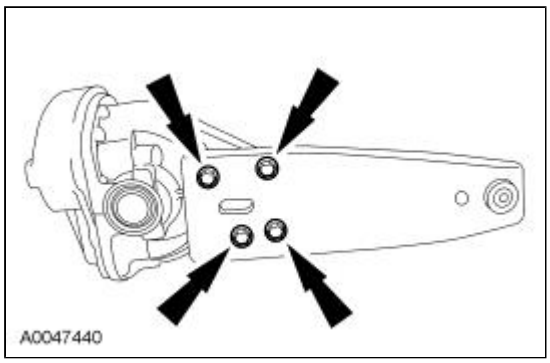
Item	Part Number	Description
1	4067	Differential bearing shim
2	4222	Differential bearing cup
3	4204	Differential case
4	4216	Ring gear bolt
5	4230	Differential pinion gear thrust washer
6	4211	Differential pinion shaft
7	4241	Differential pinion shaft lock bolt
8	—	Differential ring gear (part of 4209)
9	4221	Differential bearing
10	4033	Differential housing cover
11	4B416	Inboard CV joint stub shaft pilot bearing housing

		seal
12	4B413	Inboard CV joint stub shaft pilot bearing
13	4010	Differential housing
14	4662	Differential drive pinion collapsible spacer
15	4670	Drive pinion shaft oil slinger
16	4851	Pinion flange
17	389546-S100	Pinion nut
18	4859	Drive pinion oil seal deflector
19	4676	Drive pinion seal
20	4621	Drive pinion bearing
21	4616	Differential drive pinion bearing cup
22	56187-S	Differential bearing cap bolt
23	—	Drive pinion gear (part of 4209)
24	—	Differential bearing cap (part of 4010)
25	4628	Drive pinion bearing cup
26	4630	Drive pinion bearing
27	4663	Drive pinion bearing adjustment shim
28	4228	Differential side gear thrust washer
29	4236	Differential side gear
30	4215	Differential pinion gear
31	390943-S100	Fill plug
32	4026	Differential housing Traction-Lok®
33	4947	Differential clutch pack
34	—	Steel plate (part of 4947)
35	—	Friction plate (part of 4947)
36	—	Shim (part of 4947)
37	—	Belleville spring (part of 4947)
38	—	Thrust face of differential case (part of 4204)

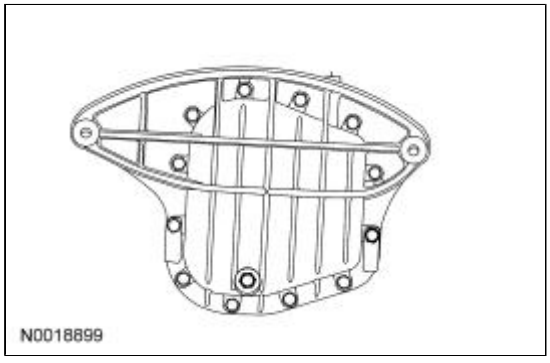
Removal

1. Remove the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

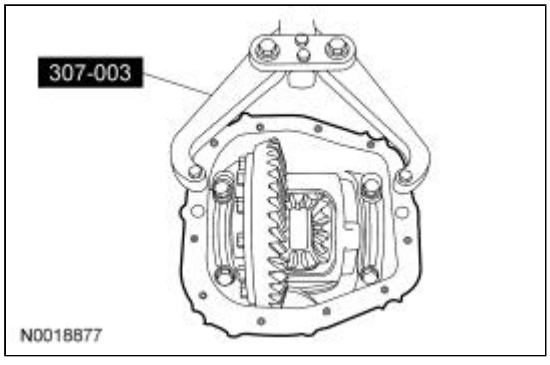
2. Remove the 4 bolts retaining the torque arm to the rear axle housing.



3. Remove the differential housing cover and drain the lubricant.

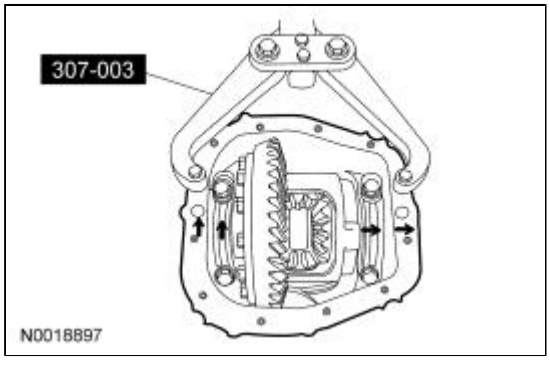


4. Using the special tools, mount the differential housing to a work bench.



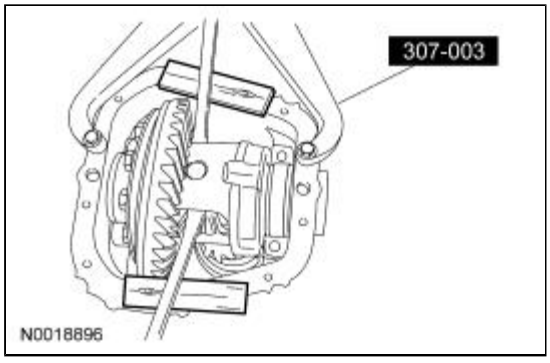
5. **CAUTION: Mark the position and location of the differential bearing caps as the arrows may not be visible. Always install the differential bearing caps in their original locations and positions.**

   Remove the differential bearing caps.

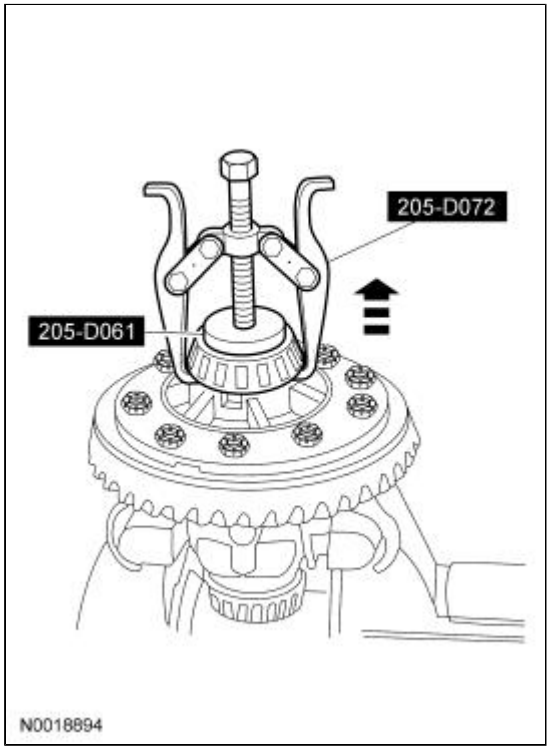


6. **CAUTION: Use wood blocks to avoid damaging the differential housing.**

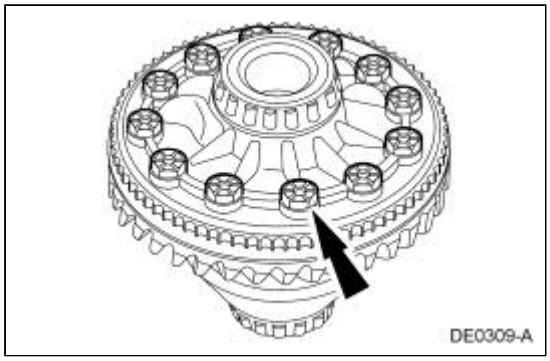
   Remove the differential assembly.
   - Position wood blocks at the top and bottom of the differential assembly.
   - Pry the differential assembly and the differential bearing shims out of the differential housing.



7. Using the special tools, remove the differential bearing.
   - Repeat for the other side.

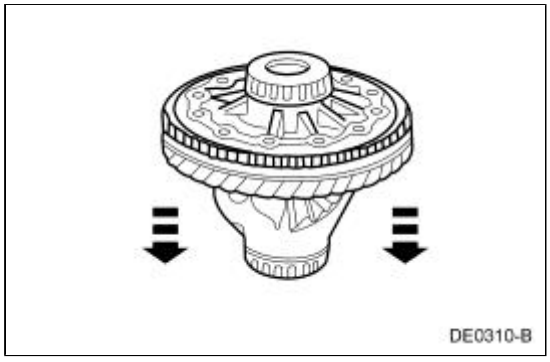


8. Remove the 12 ring gear bolts.



9. **CAUTION: Do not damage the ring gear bolt hole threads.**

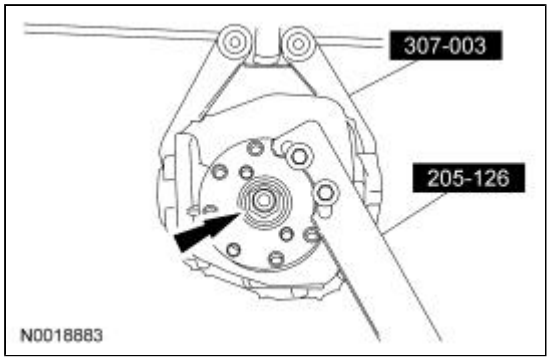
   Insert a punch in the ring gear bolt holes and drive the differential ring gear off.



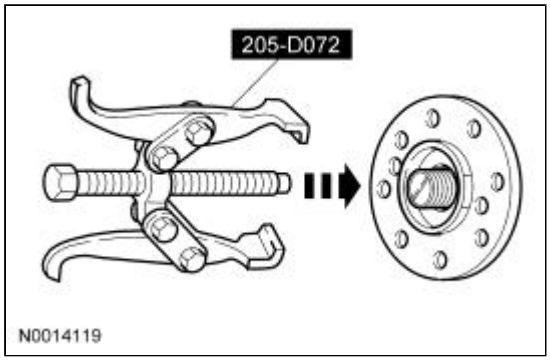
10. **WARNING: The speed sensor ring cannot be reused once removed. Remove the speed sensor ring only if damaged.**

    If necessary, remove the speed sensor ring.

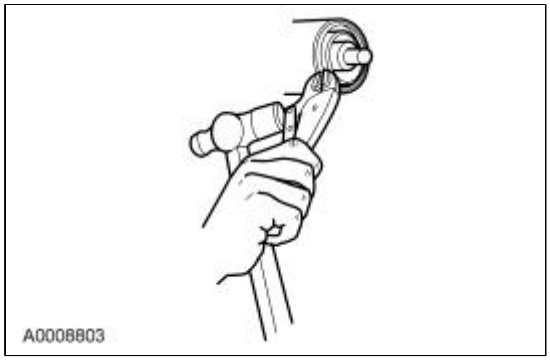
11. Using the special tool, hold the pinion flange to remove and discard the pinion nut.



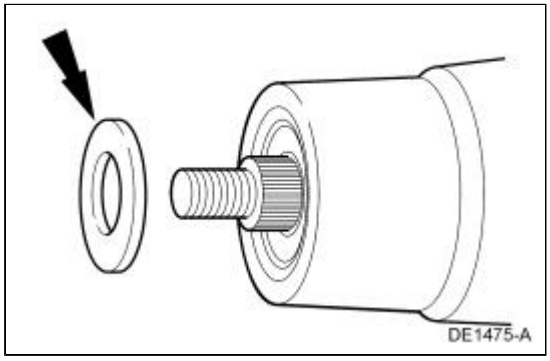
12. Using the special tool, remove the pinion flange.



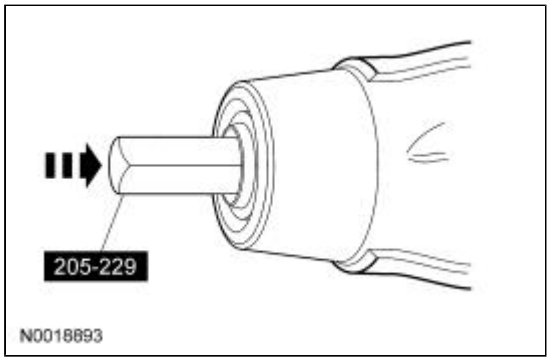
13. Use a screwdriver to force up the metal flange of the drive pinion oil seal. Install gripping pliers and strike with a hammer to remove the drive pinion oil seal.



14. Remove the drive pinion oil seal deflector, drive pinion oil seal slinger and the outer pinion bearing.

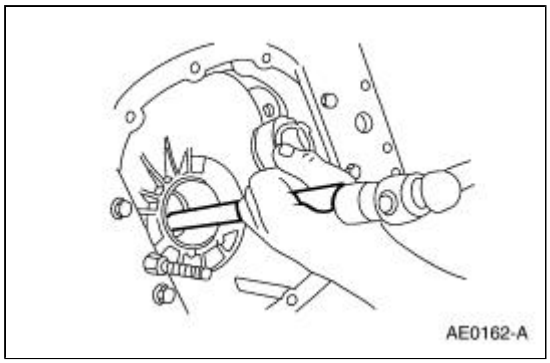


15. Using the special tool and a soft-faced hammer, remove the differential pinion gear from the differential housing.



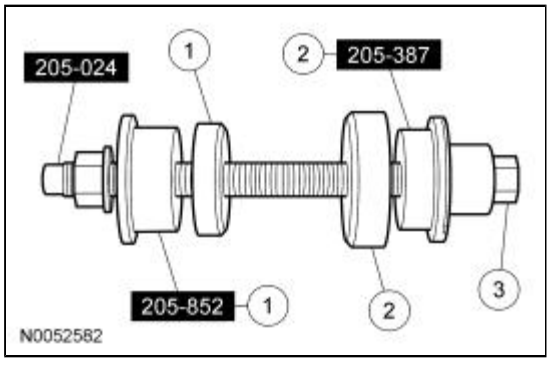
16. Using a brass drift and a hammer, remove any damaged differential drive pinion bearing cups from the differential housing. Tap alternately on each side of the cup to prevent it from cocking in

the bore.

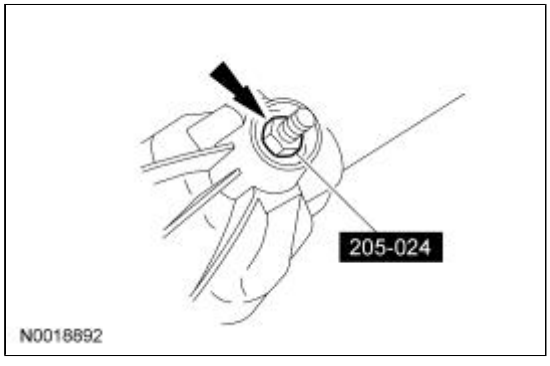


Installation

1. Position the special tools and the inner and outer drive pinion bearing cups in their respective bores.
    1. Place the special tool on the outer drive pinion bearing cup.
    2. Place the special tool on the inner drive pinion bearing cup.
    3. Install the special tool.

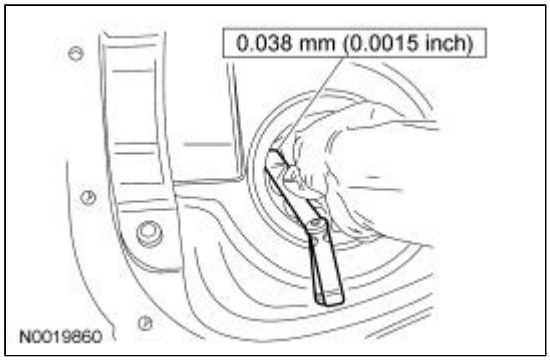


2. Tighten the special tool to fully seat the differential drive pinion bearing.



3. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

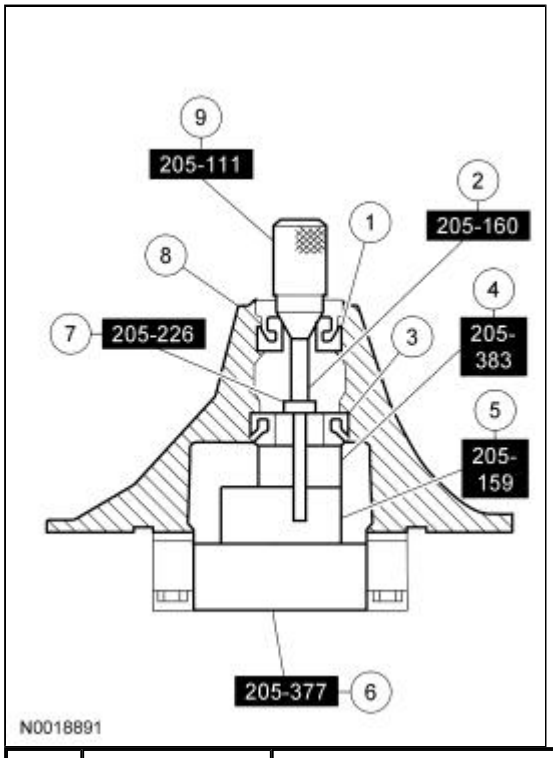
   Make sure the differential pinion bearing cups are correctly seated.



4. **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

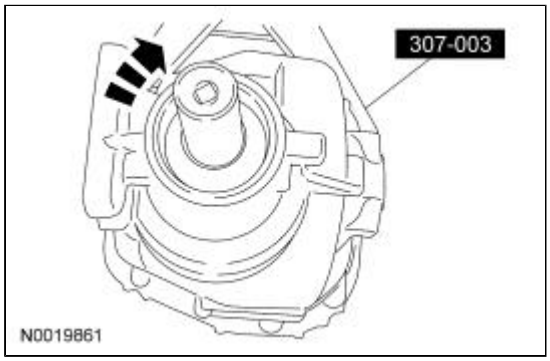
   Install the new drive pinion bearings and special tools as shown.



Item	Part Number	Description
1	4621	Outer pinion bearing
2	205-160	Adapter for 205-S127
3	4630	Inner pinion bearing
4	205-383	Depth Gauge/Aligner, Drive Pinion
5	205-159	Adapter for 205-S127
6	205-377	Drive Pinion Gauge Tube
7	205-226	Depth Gauge/Aligner, Drive Pinion
8	4010	Rear axle housing outer (front) pinion bearing
9	205-111	Adapter for 205-S127

5. **NOTE:** This step duplicates drive pinion bearing preload.

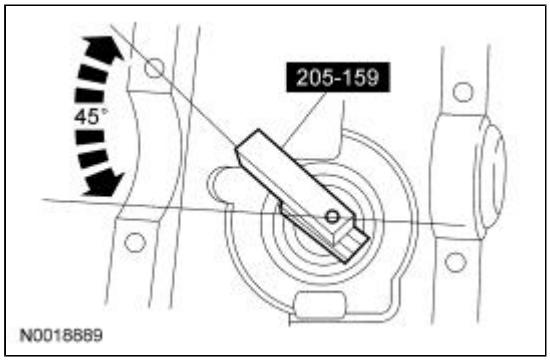
   Thread the special tool onto the screw.
   - Tighten to 2.2 Nm (20 lb-in) rotational torque.



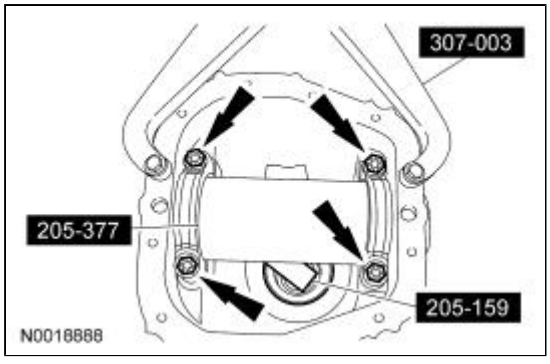
6. **CAUTION: Position the adapter so it does not contact the housing.**

   CAUTION: Offset the special tool to obtain an accurate reading.

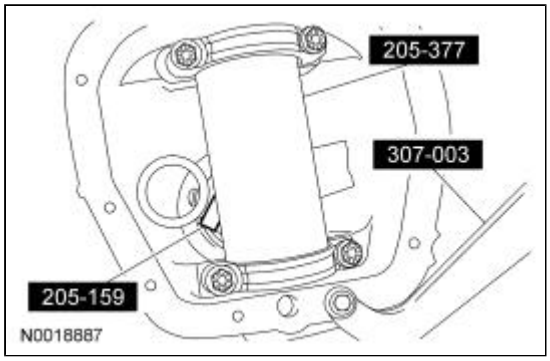
   Rotate the special tool several half turns to seat the drive pinion bearings. Position the special tool as shown.



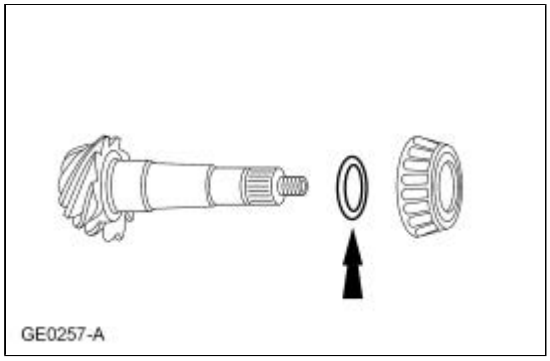
7. Install the special tool and bearing caps.
   - Tighten to 105 Nm (77 lb-ft).



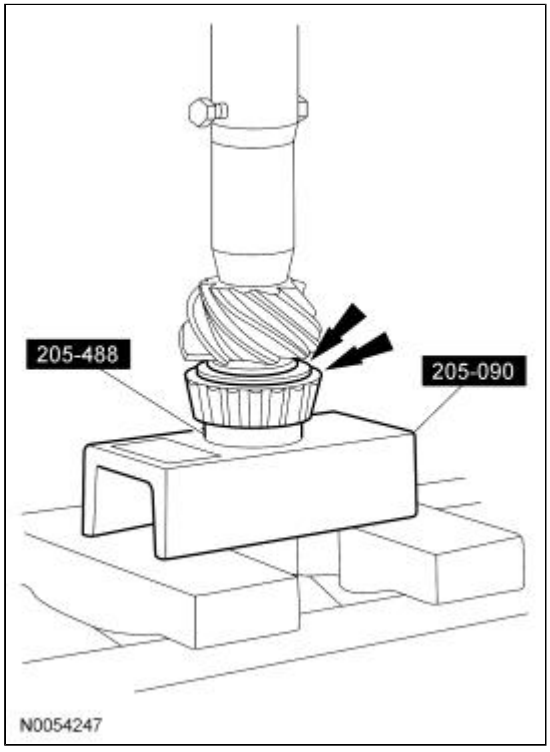
8. Use a drive pinion bearing adjustment shim as a gauge for shim selection. Check the drive pinion bearing adjustment shim thickness between the gauge block and the gauge tube. A slight drag indicates correct shim selection.



9. Position the drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.



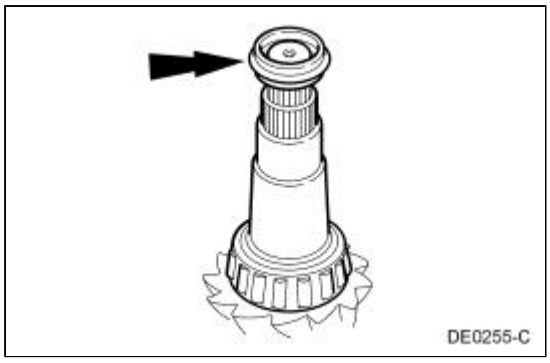
10. Using the special tools and a suitable press, firmly seat the drive pinion bearing adjustment shim and inner pinion bearing on the drive pinion gear stem.



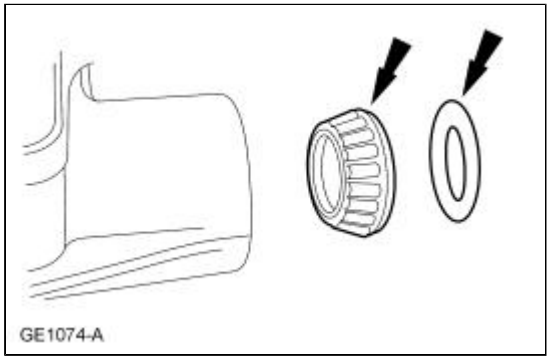
11. **CAUTION: Make sure the splines on the drive pinion gear stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.**

    Place a new differential drive pinion collapsible spacer on the drive pinion gear stem against the

pinion stem shoulder.



12. Install the outer pinion bearing and the drive pinion oil seal slinger.

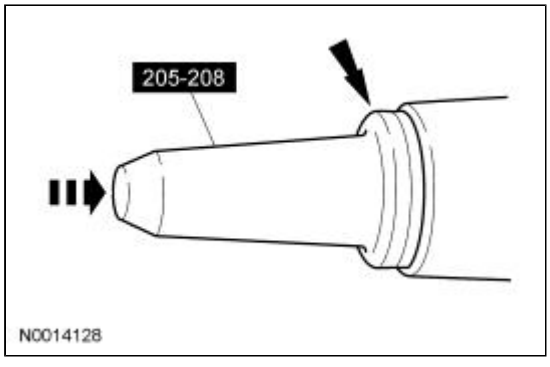


13. **CAUTION: Installation without the correct tool can result in early drive pinion seal failure.**

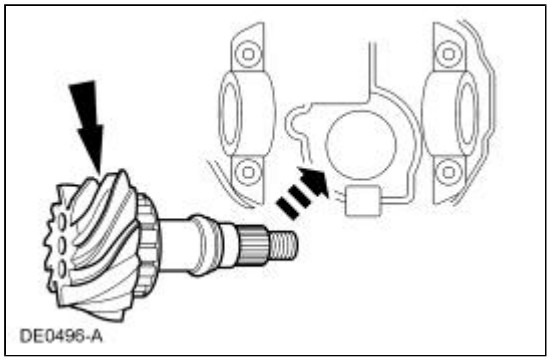
CAUTION: If the drive pinion seal becomes misaligned during installation, remove it and install a new drive pinion seal.

NOTE: Coat the drive pinion seal lips with long-life grease.

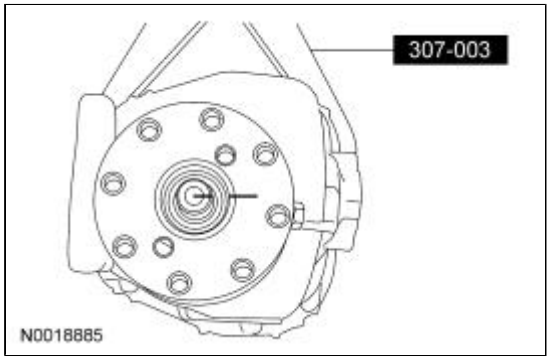
Using the special tool, install the new drive pinion seal.



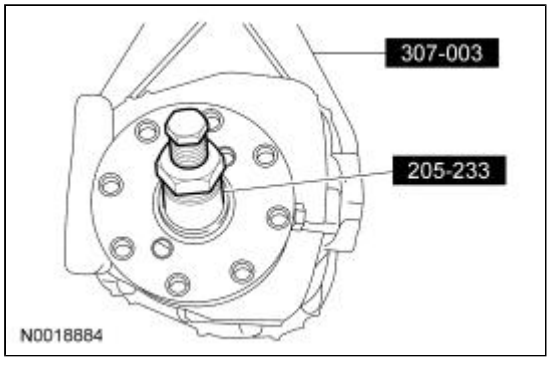
14. Install the drive pinion gear with the differential drive pinion collapsible spacer in the differential housing.



15. Position the pinion flange.



16. Using the special tool, install the pinion flange.

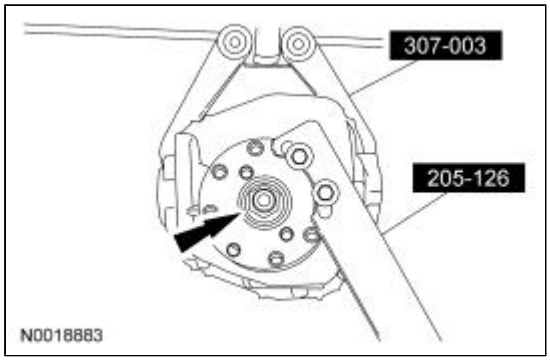


17. **CAUTION: Do not, under any circumstance, loosen the pinion nut to reduce drive pinion bearing preload. If it is necessary to reduce drive pinion bearing preload, install a new differential drive pinion collapsible spacer and pinion nut.**

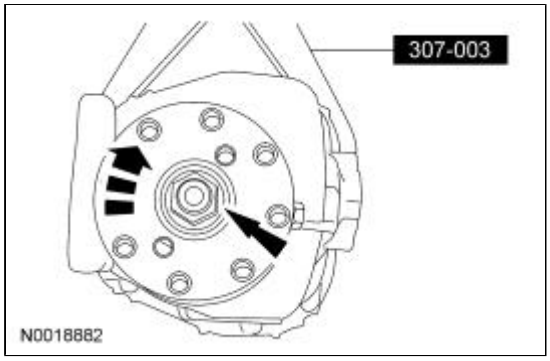
CAUTION: Remove the special tool while taking drive pinion bearing preload readings with the Nm (lb-in) torque wrench.

Use the special tool to hold the pinion flange while tightening the pinion nut.

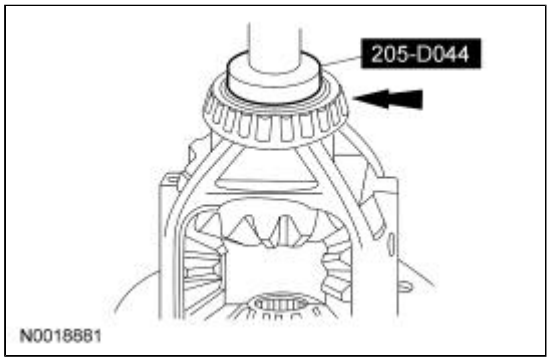
- Rotate the drive pinion gear occasionally to make sure the drive pinion bearings seat correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.



18. Tighten the pinion nut to set the drive pinion bearing preload. Refer to the torque specification for drive pinion bearings in the Specifications portion of this section.

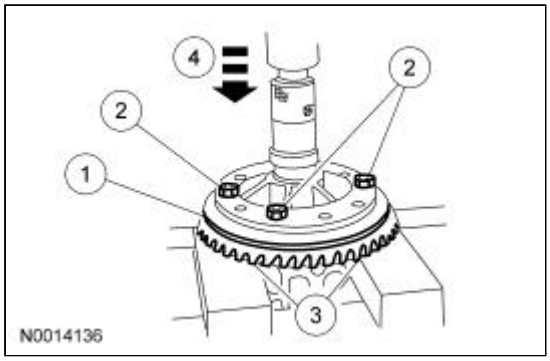


19. Press the left and right differential bearing on the differential assembly.

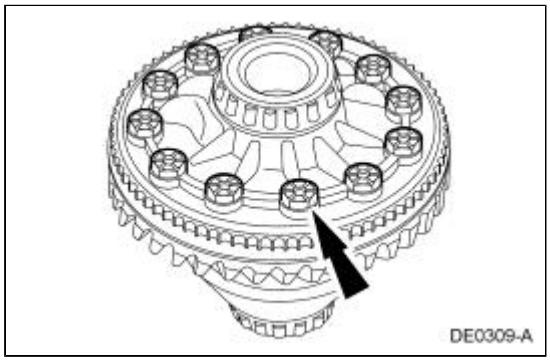


20. **NOTE:** If removed, press the speed sensor ring on with the differential ring gear.

    Install the differential ring gear.
    1. Place the differential ring gear on the differential assembly.
    2. Hand-start 3 ring gear bolts to align the holes in the differential ring gear and the differential assembly.
    3. Place the differential assembly and differential ring gear onto the press bed blocks with the differential ring gear teeth facing downward.
    4. Press the differential ring gear into place.



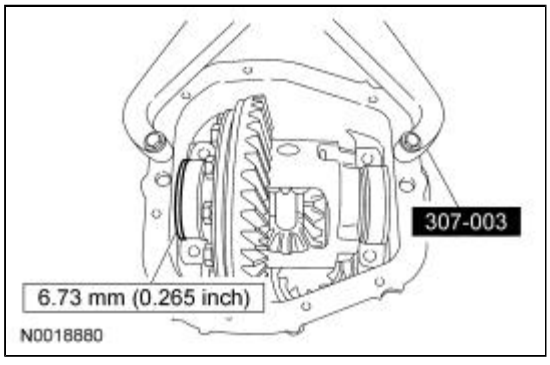
21. Install the remaining ring gear bolts after applying stud and bearing mount to the bolt threads.
    - Tighten to 150 Nm (111 lb-ft).



22. Install the differential assembly.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential assembly in place.

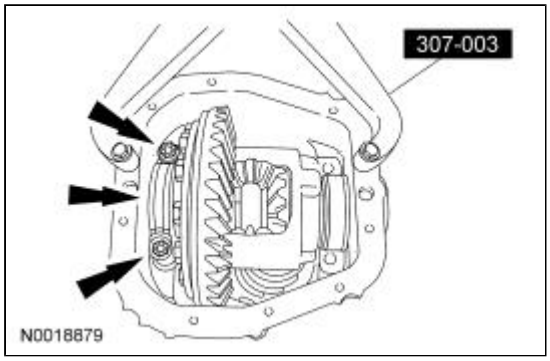
23. **NOTE:** Differential bearing shims are to be installed with the chamfer facing outboard.

    Install a differential bearing shim of the thickness shown on the LH side of the differential case.



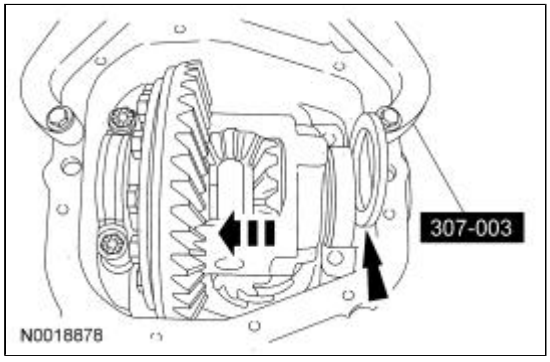
24. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install the left bearing cap and loosely install the bearing cap bolts.



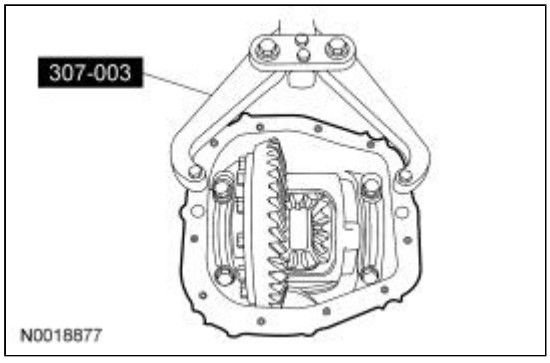
25. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

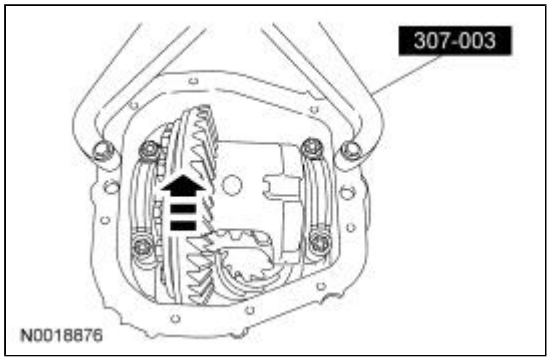


26. Install the right bearing cap and bolts.

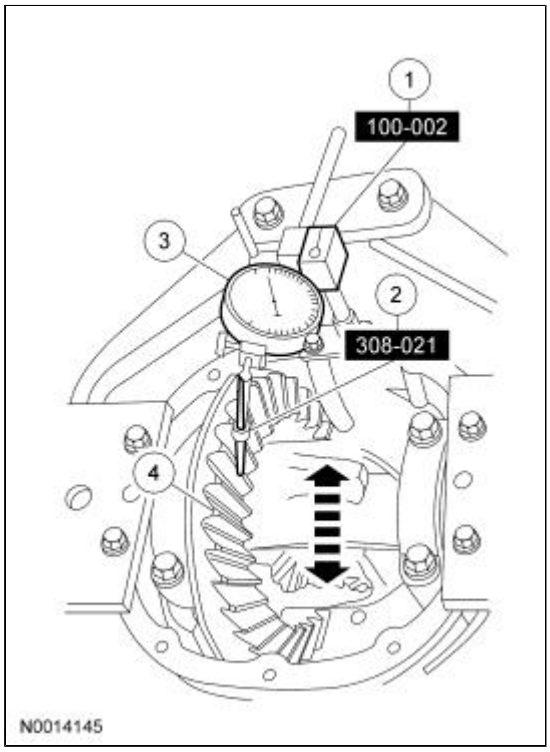
27. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



28. Rotate the differential case to make sure it turns freely.



29. Using the special tools, measure the differential ring gear backlash.
    1. Attach the special tool.
    2. Position the special tool tip centrally on a drive tooth.
    3. Zero the indicator.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the indicator reading. The allowable backlash is mm (0.008 in) to 0.305 mm (0.012 in).
        - To correct for a high or low backlash, proceed as follows.



30. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

Backlash Change Required		Thickness Change Required	
mm	In	mm	In
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008

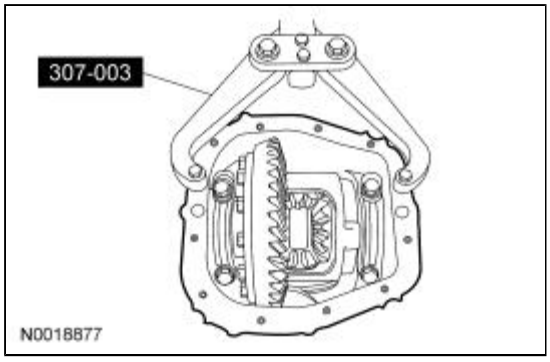
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart — 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	In
2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035
4 — BLU	7.6454- 7.6581	0.3010- 0.3015
3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715
3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515

3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

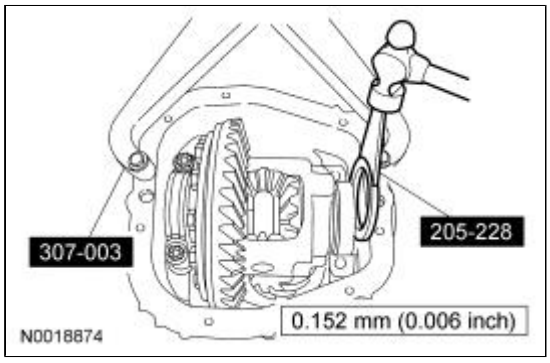
31. Remove the 4 differential bearing cap bolts.
    - Remove the differential assembly.



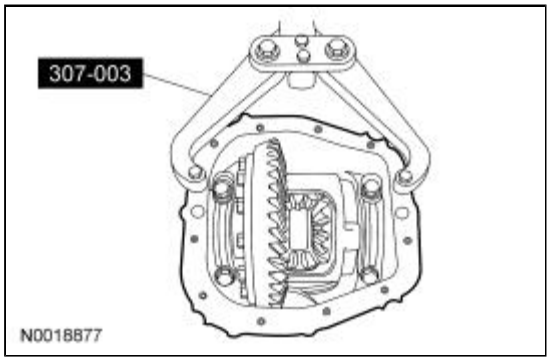
32. Measure the thickness of the selected right and left bearing shims.

33. **NOTE:** Differential bearing shims are to be installed with the chamfer facing outboard.

    To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.152 mm (0.006 inch).

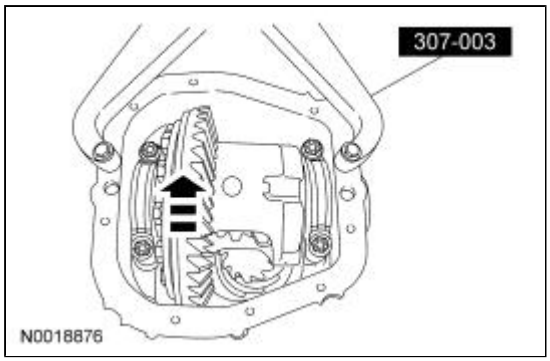


34. Install the bearing caps and bolts.
    - Tighten to 105 Nm (77 lb-ft).

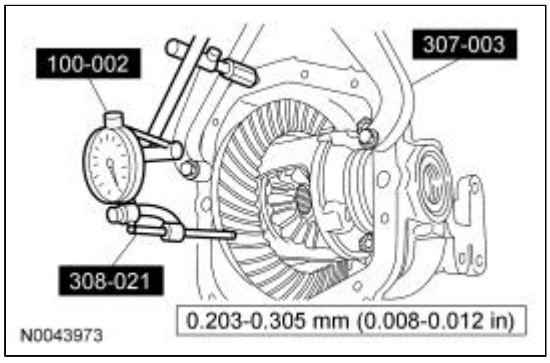


35. Rotate the differential assembly several time to verify the differential bearings have seated

correctly.



36. Recheck the differential ring gear backlash.



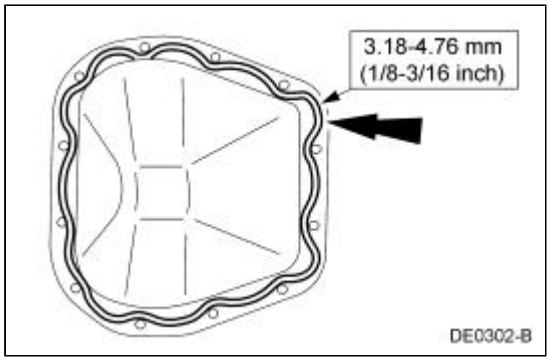
37. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

38. **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone material.

    CAUTION: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface.
    - Use silicone gasket and sealant.



39. Install the differential housing cover.

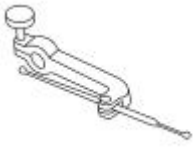
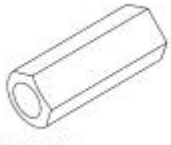
40. Fill the axle assembly with the specified lubricant.

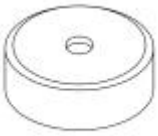
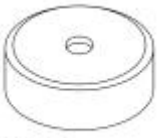
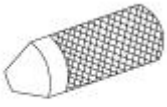
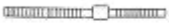
41. Install the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

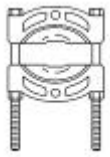
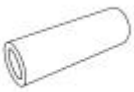
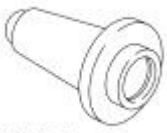
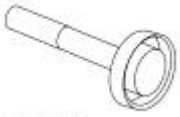
Differential Bearings

Printable View (1156 KB)

Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1744-A	Protector, Drive Pinion Thread 205-229 (T85T-4209-AH)
	Installer, Drive Pinion Bearing Cup

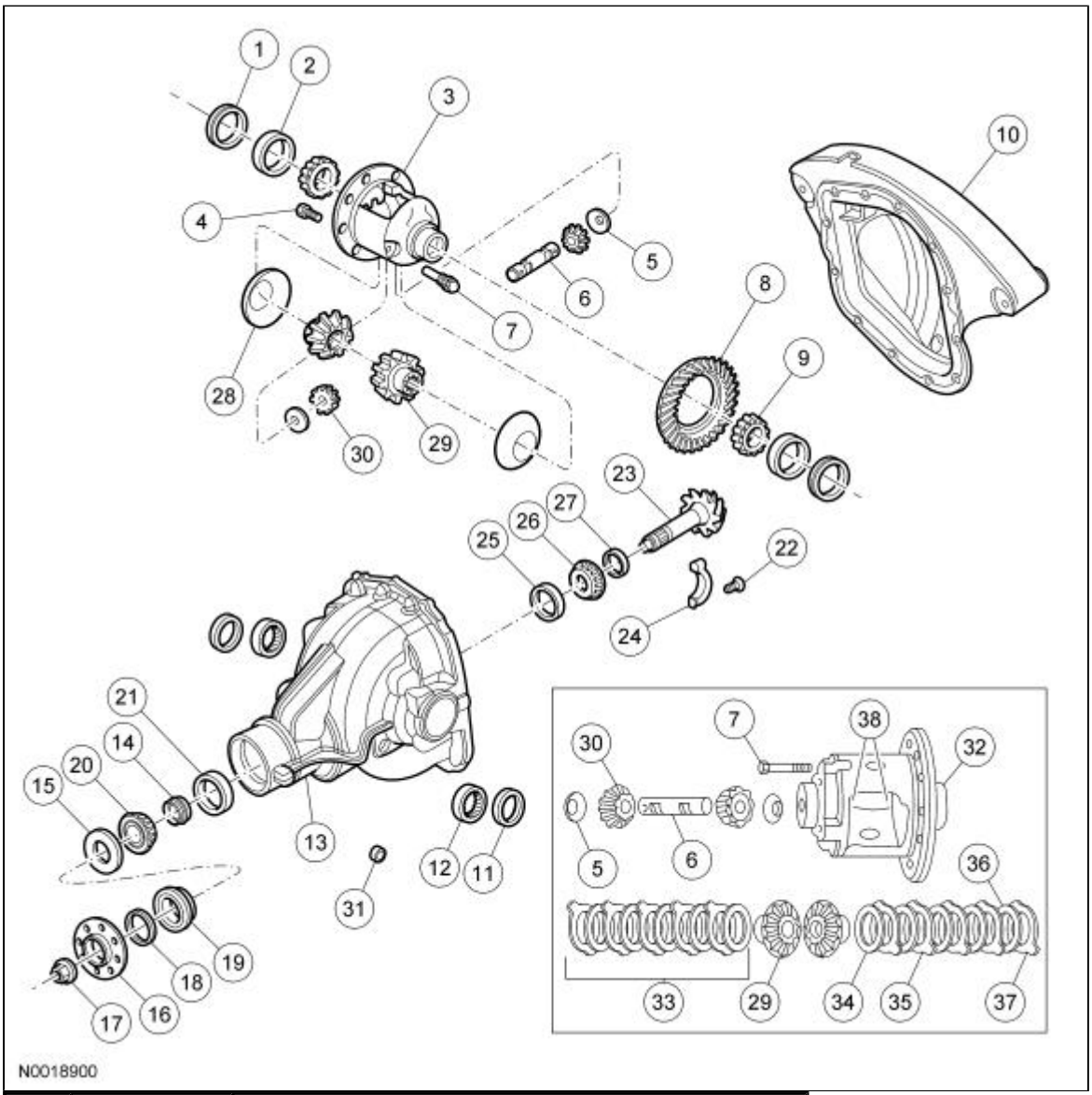
ST1678-A	205-024 (T67P-4616-A)
ST1741-A	Installer, Rear Axle Pinion Bearing Cup 205-852
ST1741-A	Installer, Rear Axle Pinion Bearing Cup 205-387 (T97T-4628-A)
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-226 (T85T-4020-AH1)
ST2468-A	Adapter for 205-S156 205-159 (T80T-4020-F42)
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-383 (T97T-4020-B)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1429-A	Adapter for 205-S156 205-160 (T80T-4020-F43)
	Puller, Bearing 205-D064 (D84L-1123-A) or equivalent

 ST1368-A	
 ST1434-A	Gauge Tube, Drive Pinion 205-377 (T97T-4020-A)
ST1367-A	Installer, Drive Pinion Bearing Cone 205-488
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
	Installer, Drive Pinion Flange 205-233 (T85T-4851-AH)
 ST2473-A	Installer, Differential Carrier Bearing 205-D044 (D81T-4221-A) or equivalent
ST1485-A	Installer, Differential Shim 205-228 (T85T-4067-AH)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-	ESA-M1C75-B

C (Canada)	
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A



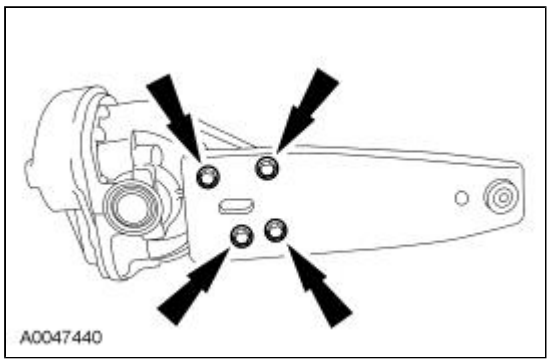
Item	Part Number	Description
1	4067	Differential bearing shim
2	4222	Differential bearing cup
3	4204	Differential case
4	4216	Ring gear bolt
5	4230	Differential pinion gear thrust washer
6	4211	Differential pinion shaft
7	4241	Differential pinion shaft lock bolt
8	—	Differential ring gear (part of 4209)

9	4221	Differential bearing
10	4033	Differential housing cover
11	4B416	Inboard CV joint stub shaft pilot bearing housing seal
12	4B413	Inboard CV joint stub shaft pilot bearing
13	4010	Differential housing
14	4662	Differential drive pinion collapsible spacer
15	4670	Drive pinion shaft oil slinger
16	4851	Pinion flange
17	389546-S100	Pinion nut
18	4859	Drive pinion oil seal deflector
19	4676	Drive pinion seal
20	4621	Drive pinion bearing
21	4616	Differential drive pinion bearing cup
22	56187-S	Differential bearing cap bolt
23	—	Drive pinion gear (part of 4209)
24	—	Differential bearing cap (part of 4010)
25	4628	Drive pinion bearing cup
26	4630	Drive pinion bearing
27	4663	Drive pinion bearing adjustment shim
28	4228	Differential side gear thrust washer
29	4236	Differential side gear
30	4215	Differential pinion gear
31	390943 S100	Fill plug
32	4026	Differential housing Traction-Lok®
33	4947	Differential clutch pack
34	—	Steel plate (part of 4947)
35	—	Friction plate (part of 4947)
36	—	Shim (part of 4947)
37	—	Belleville spring (part of 4947)
38	—	Thrust face of differential case (part of 4204)

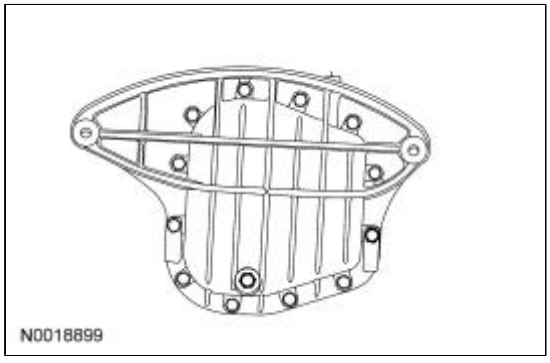
Removal

1. Remove the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

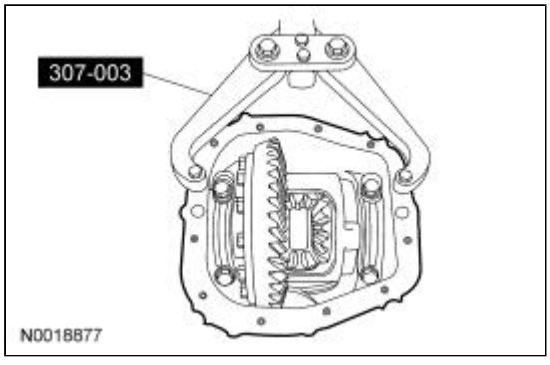
2. Remove the 4 bolts retaining the torque arm to the rear axle housing.



3. Remove the differential housing cover and drain the lubricant.

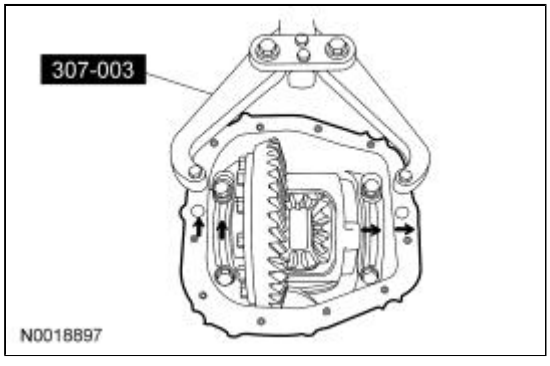


4. Using the special tools, mount the differential housing to a work bench.



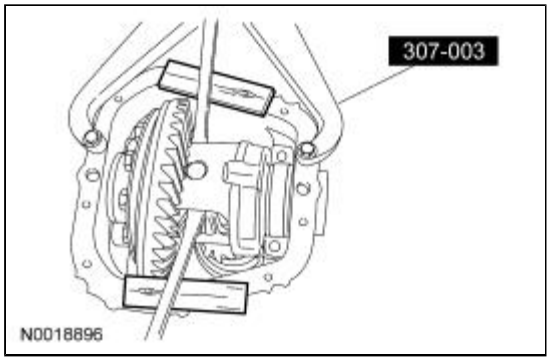
5. **CAUTION: Mark the position and location of the differential bearing caps as the arrows may not be visible. Always install the differential bearing caps in their identical locations and positions.**

   Remove the differential bearing caps.

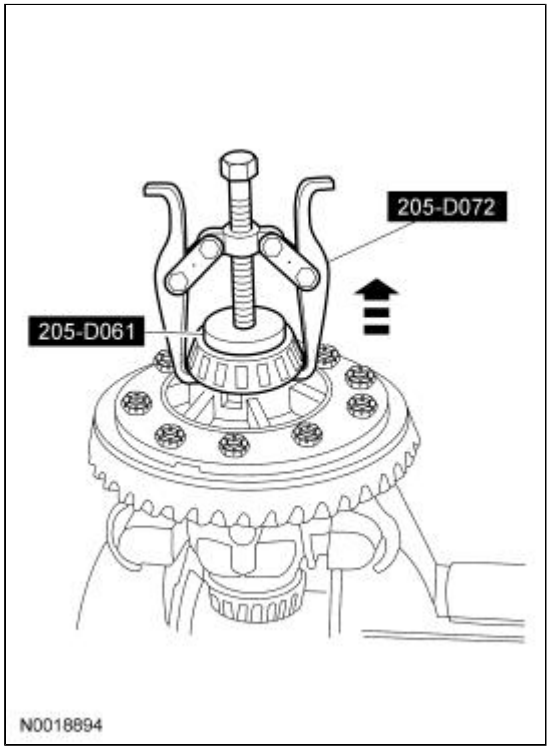


6. **CAUTION: Use wood blocks to avoid damaging the differential housing.**

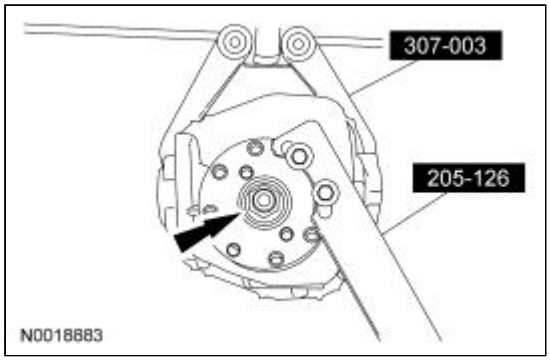
   Remove the differential assembly.
   - Position wood blocks at the top and bottom of the differential assembly.
   - Pry the differential assembly and the differential bearing shims out of the differential housing.



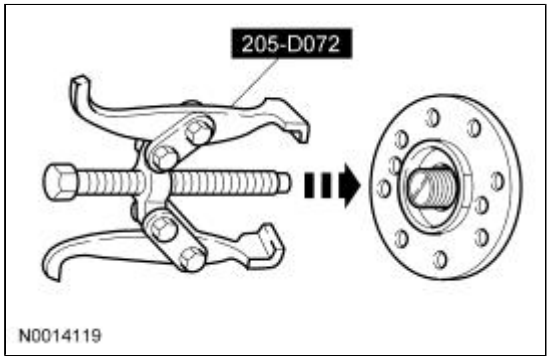
7. Using the special tools, remove the differential bearing.
   - Repeat for the other side.



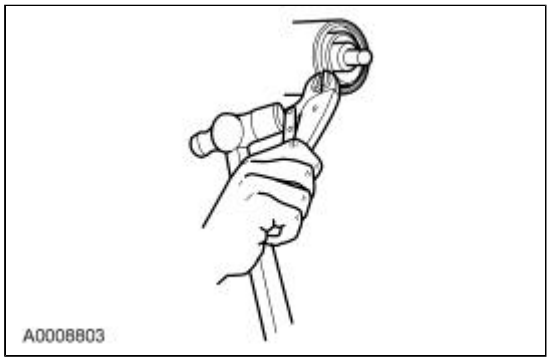
8. Using the special tool, hold the pinion flange to remove and discard the pinion nut.



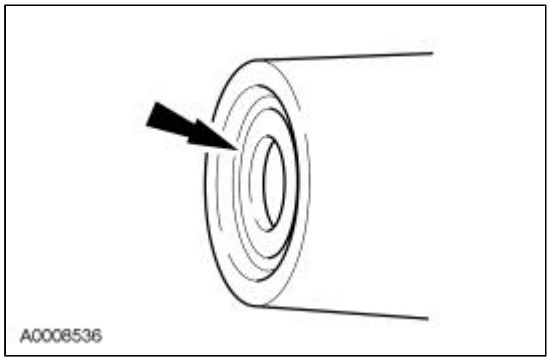
9. Using the special tool, remove the pinion flange.



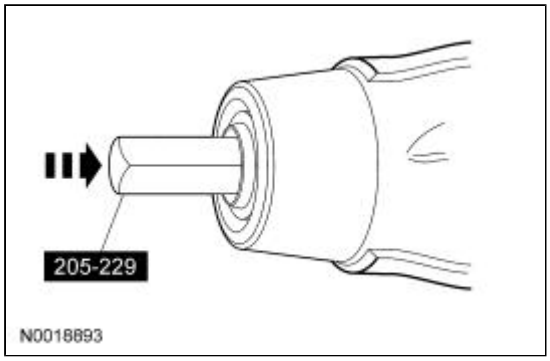
10. Use a screwdriver to force up the metal flange of the drive pinion oil seal. Install gripping pliers and strike with a hammer to remove the drive pinion oil seal.



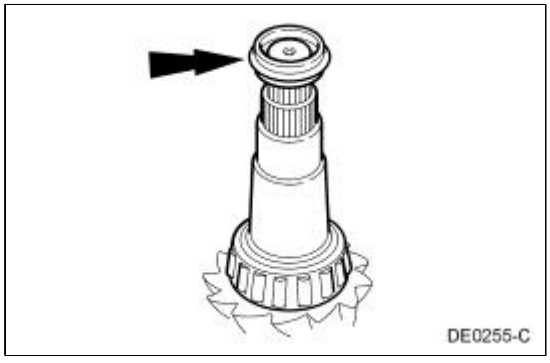
11. Remove the drive pinion oil seal deflector, drive pinion oil seal slinger and the outer pinion bearing. Discard the outer drive pinion bearing.



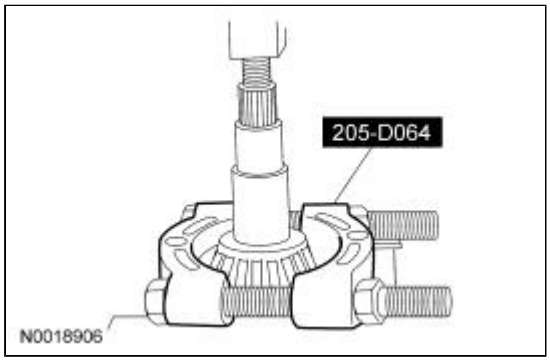
12. Using the special tool and a soft-faced hammer, remove the differential pinion gear from the differential housing.



13. Remove and discard the drive pinion collapsible spacer.

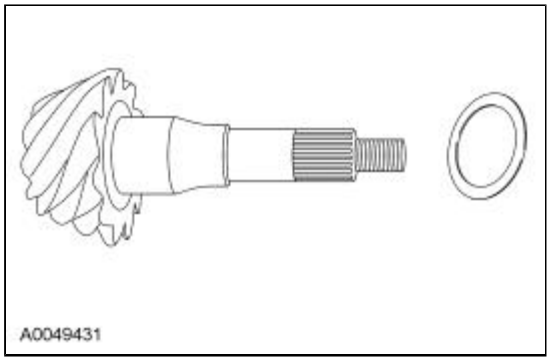


14. Using the special tools and a suitable shop press, remove and discard the inner drive pinion bearing.

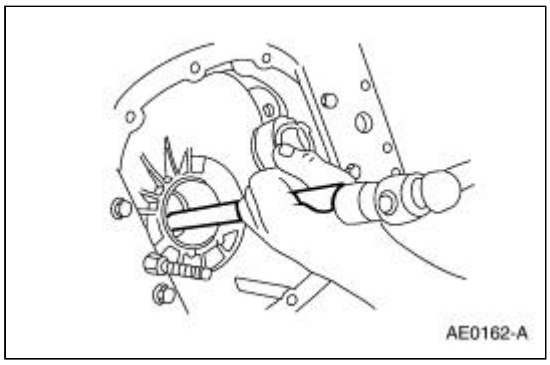


15. **NOTE:** Using a micrometer, measure the drive pinion bearing adjustment shim thickness. Use this measurement as a reference to compare to the shim gauge reading taken prior to installing the pinion bearing.

    Remove the drive pinion bearing adjustment shim.

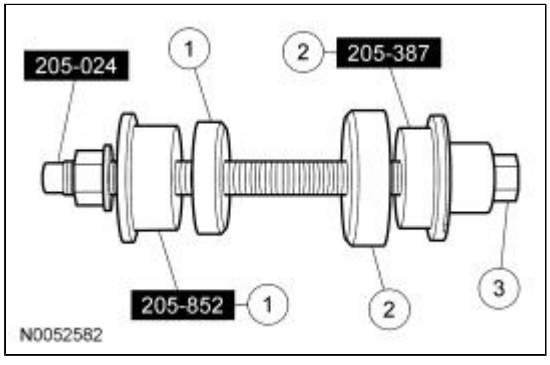


16. Using a brass drift and a hammer, remove any damaged differential drive pinion bearing cups from the differential housing. Tap alternately on each side of the cup to prevent it from cocking in the bore.

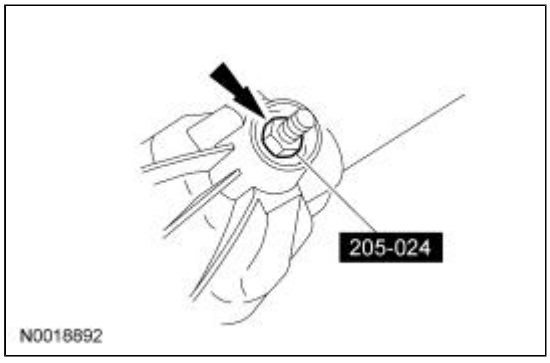


Installation

1. Position the special tools and the inner and outer drive pinion bearing cups in their respective bores.
    1. Place the special tool on the outer drive pinion bearing cup.
    2. Place the special tool on the inner drive pinion bearing cup.
    3. Install the special tool.

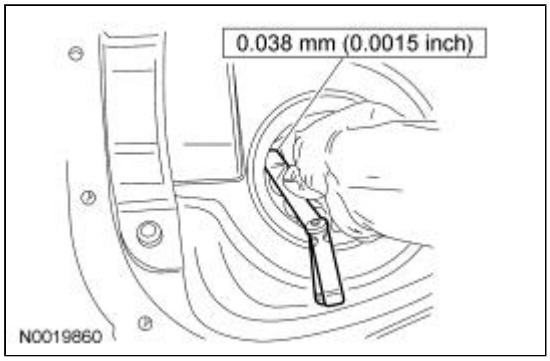


2. Tighten the special tool to fully seat the differential drive pinion bearing.



3. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

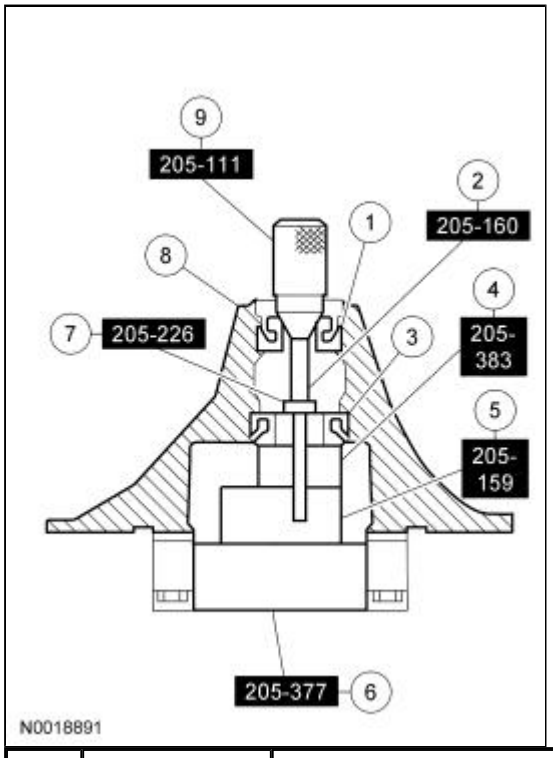
   Make sure the differential pinion bearing cups are correctly seated.



4. **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provided adequate lubricant without upsetting the drive pinion bearing preload settings.

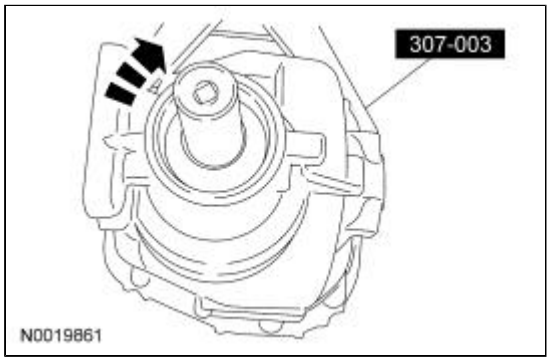
   Install the new drive pinion bearings and special tools as shown.



Item	Part Number	Description
1	4621	Outer pinion bearing
2	205-160	Adapter for 205-S127
3	4630	Inner pinion bearing
4	205-383	Depth Gauge/Aligner, Drive Pinion
5	205-159	Adapter for 205-S127
6	205-377	Drive Pinion Gauge Tube
7	205-226	Depth Gauge/Aligner, Drive Pinion
8	4010	Rear axle housing outer (front) pinion bearing
9	205-111	Adapter for 205-S127

5. **NOTE:** This step duplicates drive pinion bearing preload.

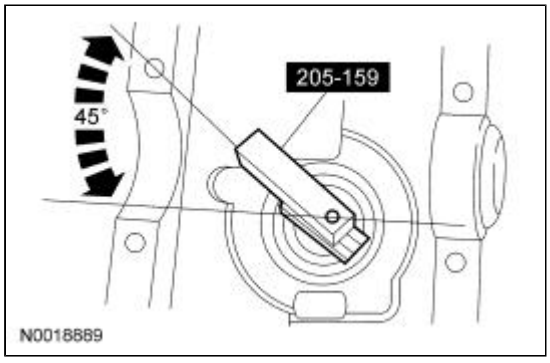
   Thread the special tool onto the screw.
   - Tighten to 2.2 Nm (20 lb-in) rotational torque.



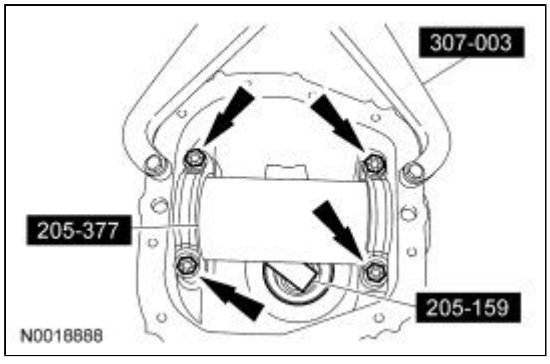
6. **CAUTION: Position the adapter so it does not contact the housing.**

   CAUTION: Offset the special tool to obtain an accurate reading.

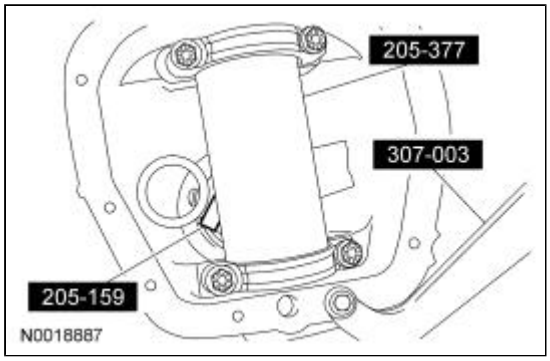
   Rotate the special tool several half turns to seat the drive pinion bearings. Position the special tool as shown.



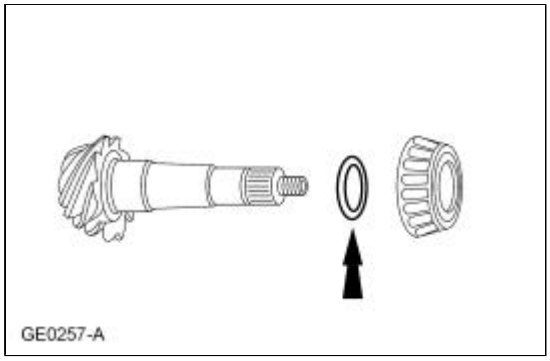
7. Install the special tool and the bearing caps.
   - Tighten to 105 Nm (77 lb-ft).



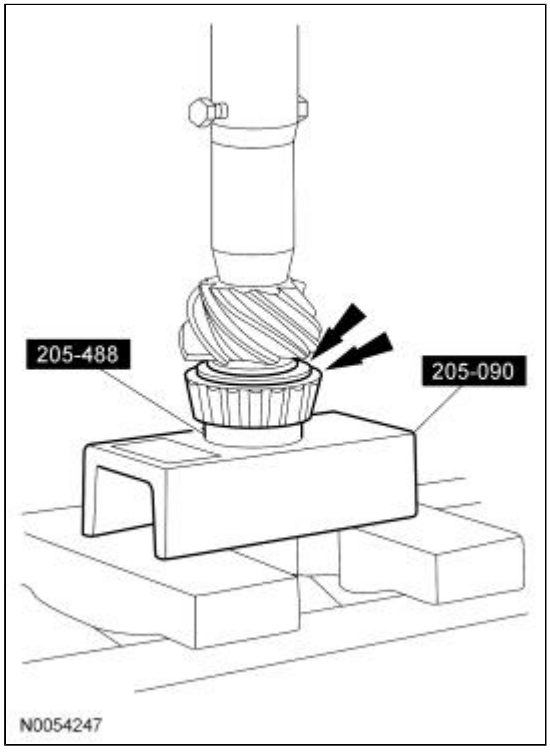
8. Use a drive pinion bearing adjustment shim as a gauge for shim selection. Check the drive pinion bearing adjustment shim thickness between the gauge block and the gauge tube. A slight drag indicates correct shim selection.



9. Position the drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.



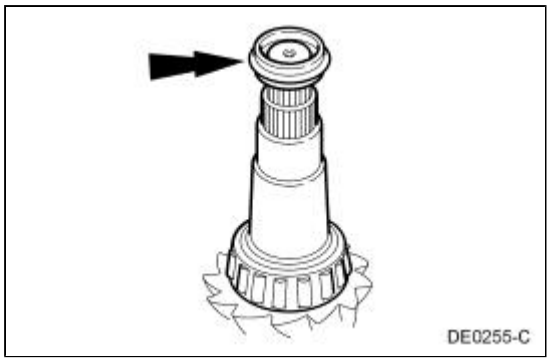
10. Using the special tools and a suitable press, firmly seat the drive pinion bearing adjustment shim and inner pinion bearing on the drive pinion gear stem.



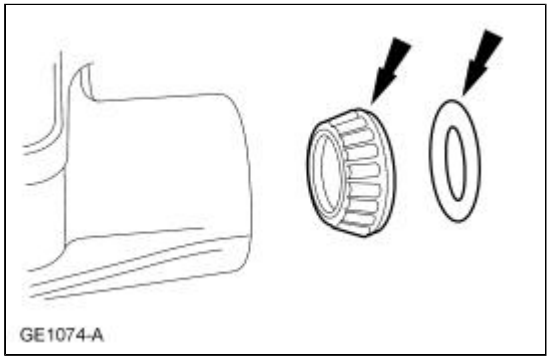
11. **CAUTION: Make sure the splines on the drive pinion gear stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.**

    Place a new differential drive pinion collapsible spacer on the drive pinion gear stem against the

pinion stem shoulder.



12. Install the outer pinion bearing and the drive pinion oil seal slinger.

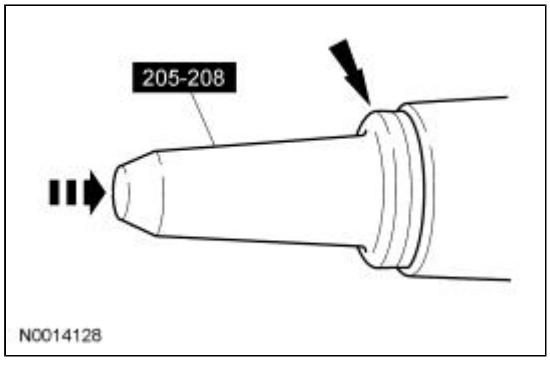


13. **CAUTION: Installation without the correct tool can result in early drive pinion seal failure.**

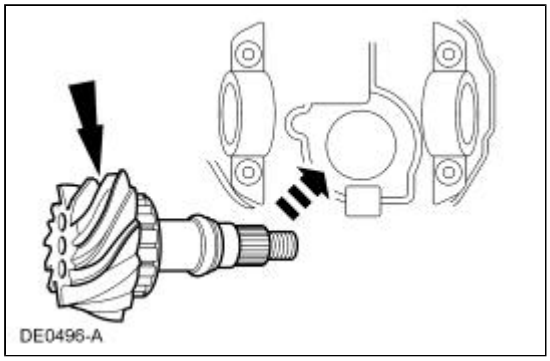
CAUTION: If the drive pinion seal becomes misaligned during installation, remove it and install a new drive pinion seal.

NOTE: Coat the drive pinion seal lips with long-life grease.

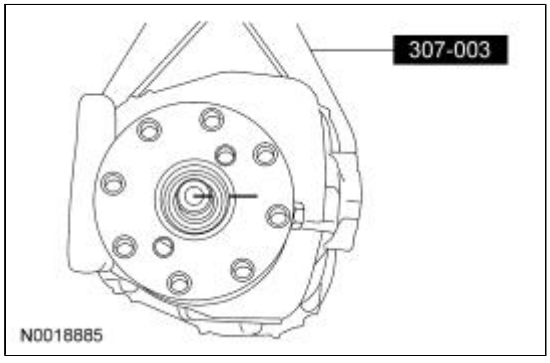
Using the special tool, install the new drive pinion seal.



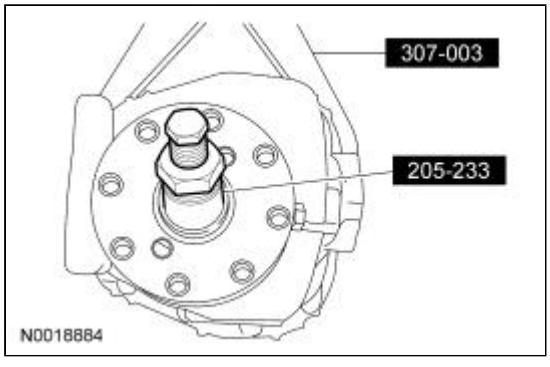
14. Install the drive pinion gear with the differential drive pinion collapsible spacer in the differential housing.



15. Align the pinion flange to the pinion index marks.



16. Using the special tool, install the pinion flange.

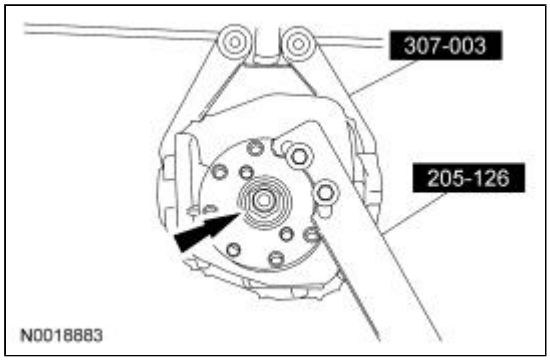


17. **CAUTION: Do not, under any circumstance, loosen the pinion nut to reduce drive pinion bearing preload. If it is necessary to reduce drive pinion bearing preload, install a new differential drive pinion collapsible spacer and pinion nut.**

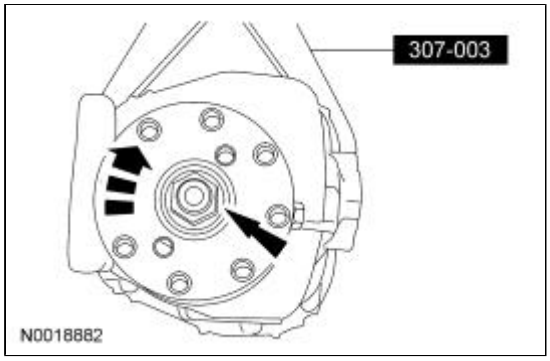
CAUTION: Remove the special tool while taking drive pinion bearing preload readings with the Nm (lb-in) torque wrench.

Use the special tool to hold the pinion flange while tightening the pinion nut.

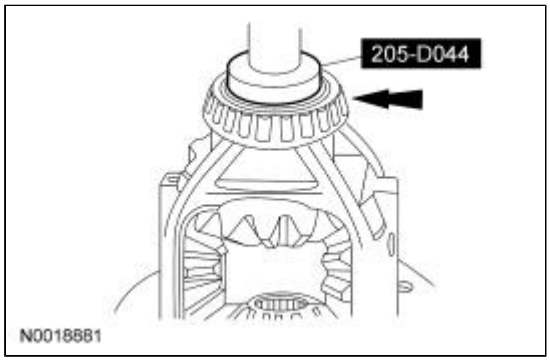
- Rotate the drive pinion gear occasionally to make sure the drive pinion bearings seat correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.



18. Tighten the pinion nut to set the drive pinion bearing preload. Refer to the torque specification for drive pinion bearings in the Specifications portion of this section.



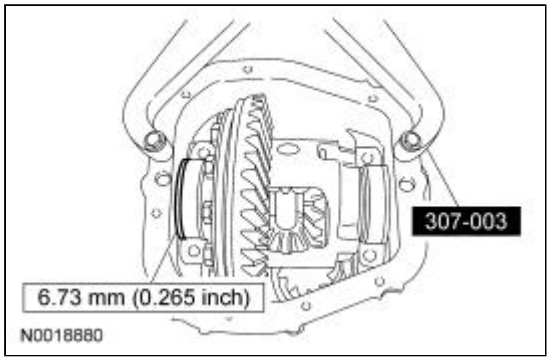
19. Press the left and right differential bearing on the differential assembly.



20. Install the differential assembly.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential assembly in place.

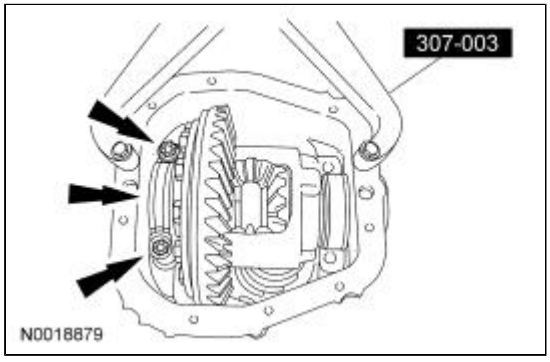
21. **NOTE:** Differential bearing shims are to be installed with the chamfer facing outboard.

    Install a differential bearing shim of the thickness shown on the LH side of the differential case.



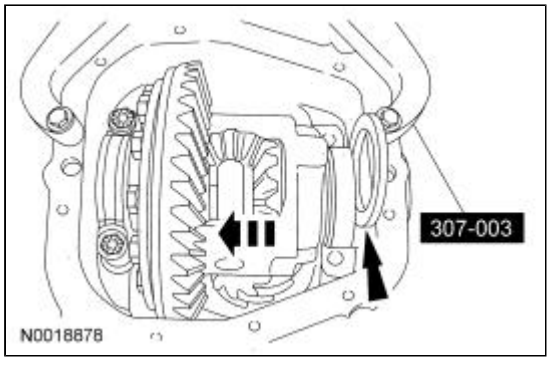
22. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install the left bearing cap and loosely install the bearing cap bolts.



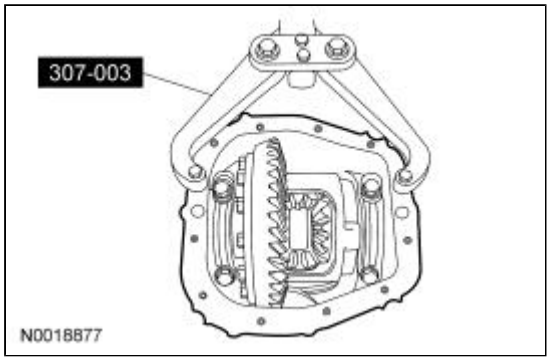
23. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

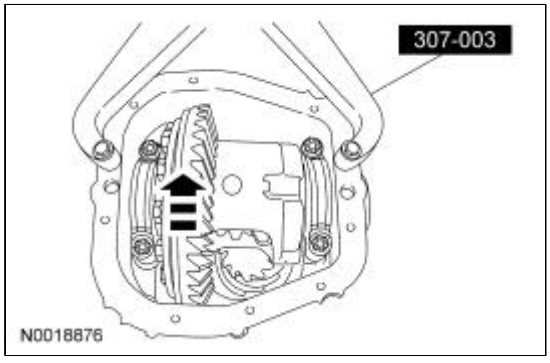


24. Install the right bearing cap and bolts.

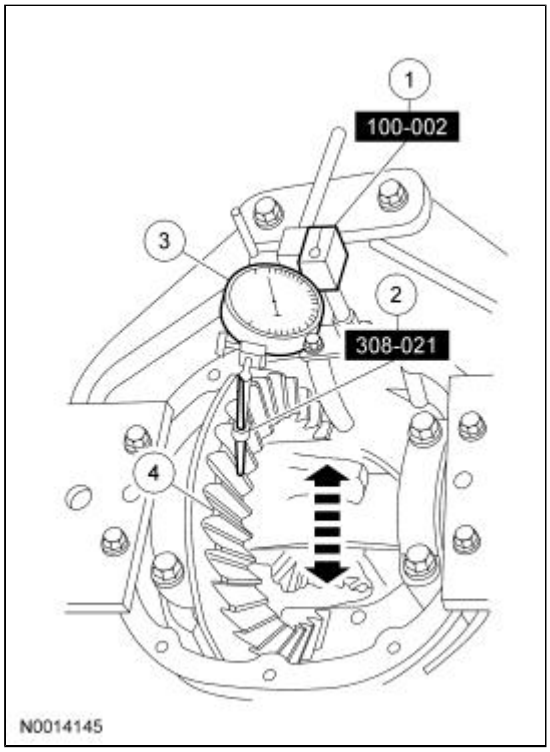
25. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



26. Rotate the differential case to make sure it turns freely.



27. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the special tool.
    2. Position the special tool tip centrally on a drive tooth.
    3. Zero the indicator.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the indicator reading. The allowable backlash is mm (0.008 in) to 0.305 mm (0.012 in).
        - To correct for a high or low backlash, proceed as follows.



28. To correct for high or low backlash, increase the thickness of one differential bearing shim and

decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

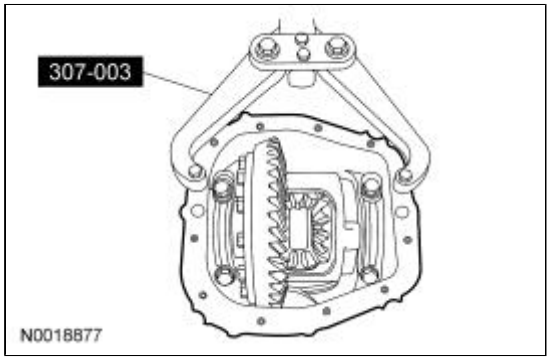
Backlash Change Required		Thickness Change Required	
mm	In	mm	In
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart — 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	In
2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035
4 — BLU	7.6454- 7.6581	0.3010- 0.3015
3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715

3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515
3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

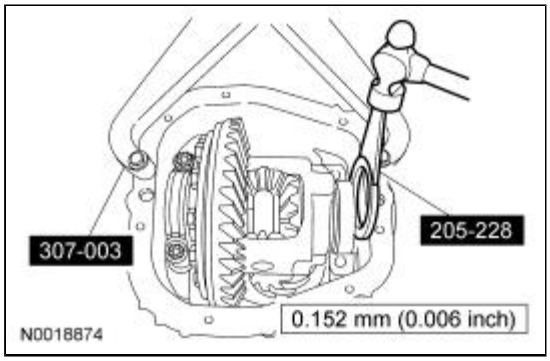
29. Remove the 4 differential bearing cap bolts.
    - Remove the differential assembly.



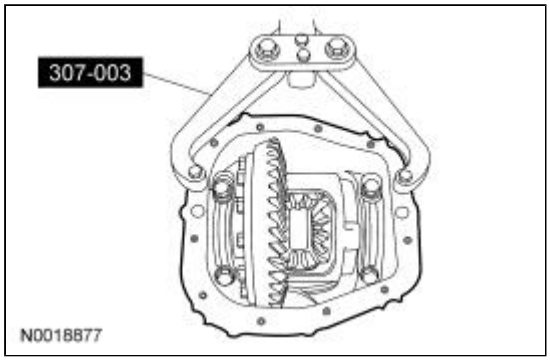
30. Measure the thickness of the selected right and left bearing shims.

31. **NOTE:** Differential bearing shims are to be installed with the chamfer facing outboard.

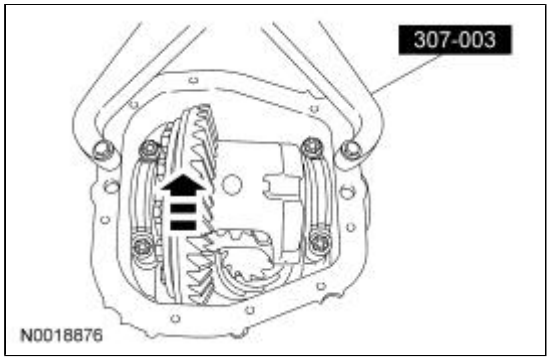
    To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.152 mm (0.006 inch).



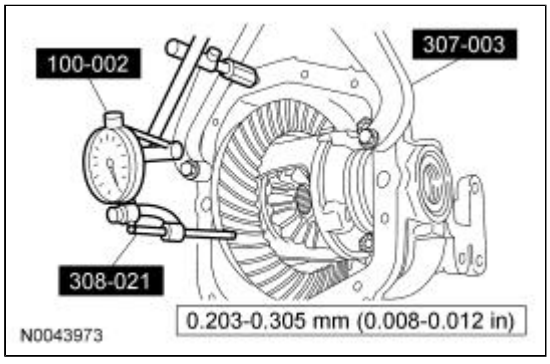
32. Install the bearing caps and bolts.
    - Tighten to 105 Nm (77 lb-ft).



33. Rotate the differential assembly several time to verify the differential bearings have seated correctly.



34. Recheck the differential ring gear backlash.



35. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

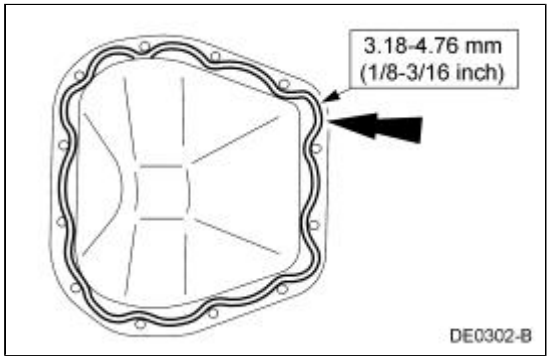
36. **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone material.

    CAUTION: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface.

- Use silicone gasket and sealant.



37. Install the differential housing cover.

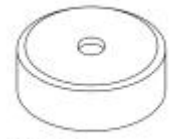
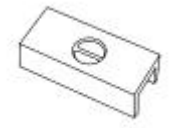
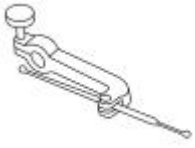
38. Fill the axle assembly with the specified lubricant.

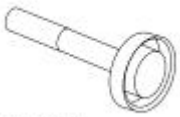
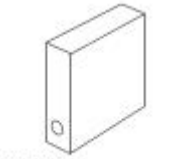
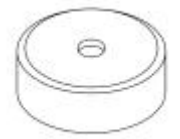
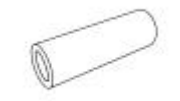
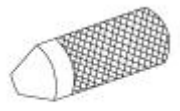
39. Install the rear axle assembly. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

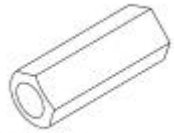
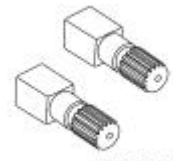
Axle

Printable View (1519 KB)

Special Tool(s)

ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-226 (T85T-4020-AH1)
 ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1724-A	Installer, Drive Pinion Flange 205-233 (T85T-4851-AH)
ST1741-A	Installer, Rear Axle Pinion Bearing Cup 205-852
	Dial Indicator Gauge with Holding Fixture

ST1214-A	100-002 (TOOL-4201-C)
 ST2473-A	Installer, Differential Carrier Bearing 205-D044 (D81T-4221-A)
 ST2468-A	Adapter for 205-S156 205-159 (T80T-4020-F42)
 ST1743-A	Depth Gauge/Aligner, Drive Pinion 205-383 (T97T-4020-B)
 ST1434-A	Gauge Tube, Drive Pinion 205-377 (T97T-4020-A)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
ST1367-A	Installer, Drive Pinion Bearing 205-488
ST1741-A	Installer, Rear Axle Pinion Bearing Installer Cup 205-387 (T97T-4628-A)
	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)

ST1678-A	
 ST1744-A	Protector, Drive Pinion Thread 205-229 (T85T-4209-AH)
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST1429-A	Adapter for 205-S156 205-160 (T80T-4020-F43)
ST1725-A	Step Plate 205-D019 (D80L-630-8) or equivalent
 ST1857-A	Gauge, Differential (Traction Lock) 205-384 (T97T-4205-A)
ST1368-A	Puller, Bearing 205-D064 (D84L-1123-A)
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
	Installer, Differential Shim 205-228 (T85T-4067-AH)

ST1485-A	
ST1749-A	Gauge, Differential (Traction Lock) 205-386 (T97T-4205-D)
ST1077-B	Rotator, Differential 205-378 (T97T-4205-C)

Material

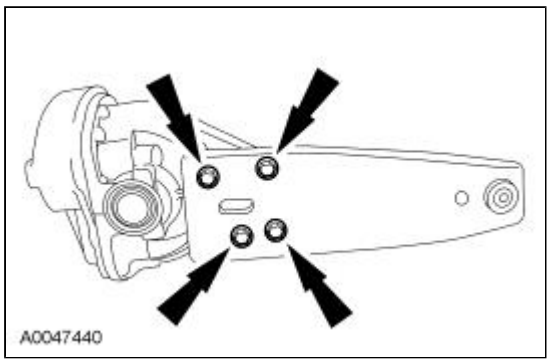
Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Ultra Silicone Sealant TA-29	—
Threadlock and Sealer TA-25	WSK-M2G351-A5

Disassembly

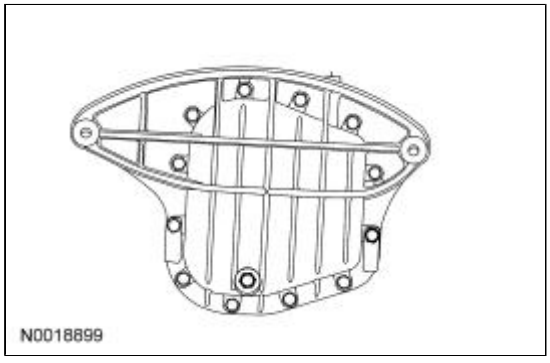
All Axles

1. Remove the axle assembly from the vehicle. For additional information, refer to Axle Assembly — Air Suspension or Axle Assembly — Coil Suspension in this section.

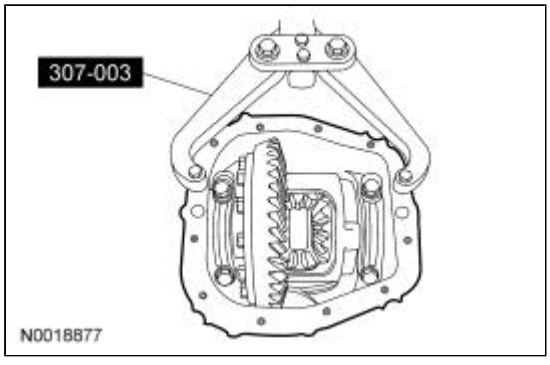
2. Remove the 4 bolts retaining the torque arm to the rear axle housing.



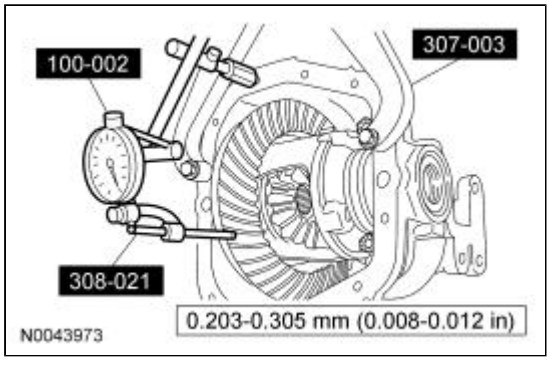
3. Drain the rear axle lubricant and remove the rear axle cover.



4. Using the special tools, mount the differential housing to a work bench.



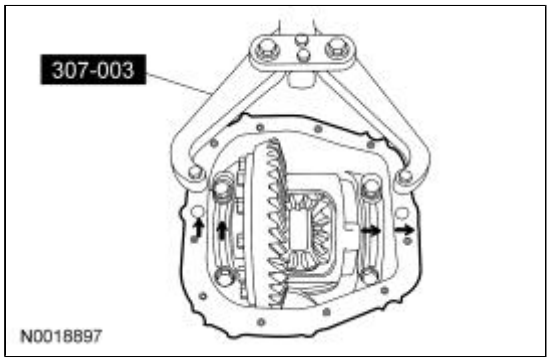
5. Using the special tool, measure and record the differential ring gear backlash between teeth in 4 equally spaced places around the ring gear.
    - Remove the dial indicator.



6. **CAUTION: Mark the position and location of the differential bearing caps as the arrows may not be visible. Always install the differential bearing caps in their identical**

location and position.

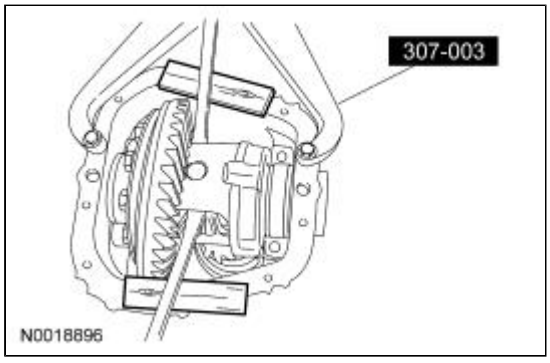
Remove the differential bearing caps.



7. **CAUTION: Use wood blocks to avoid damaging the differential housing.**

NOTE: Tag the bearing caps and shims for location as removed.

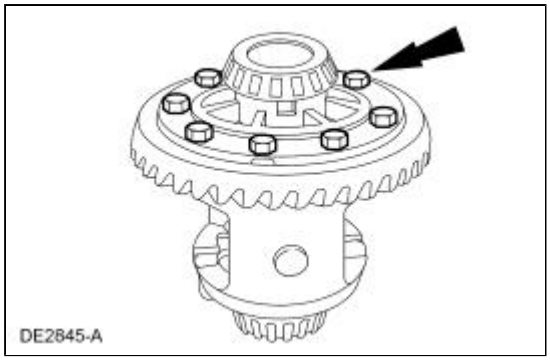
Remove the differential assembly.
1. Position wood blocks at the top and bottom of the differential case.
2. Pry the differential assembly and the differential bearing shims out of the differential housing.



Excessive differential ring gear backlash between teeth

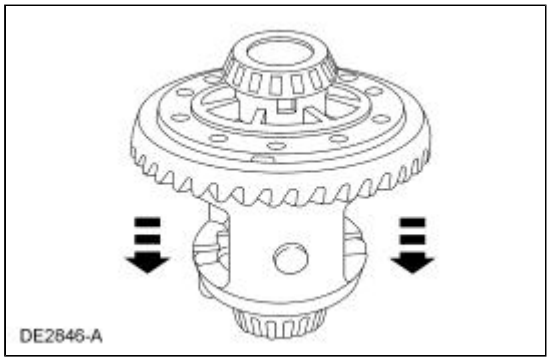
NOTE: If the differential ring gear backlash between teeth measurement, taken at the beginning of this procedure, did not exceed the specification, proceed to Final disassembly in this procedure. If the differential ring gear backlash between teeth measurement exceeds the specification, the cause may be a warped differential ring gear, a damaged differential case or loss of differential bearing preload. Verify the cause of the excessive runout.

8. Remove the ring gear bolts.



9. **CAUTION: Do not damage the bolt hole threads.**

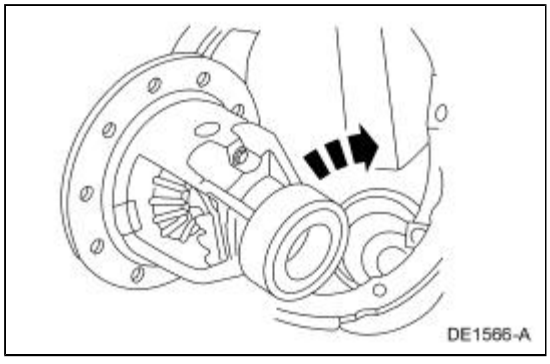
   Insert a punch in the bolt holes and drive off the differential ring gear.



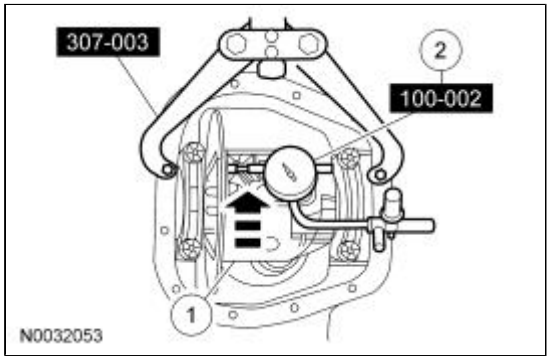
10. **NOTE:** Visually inspect the differential carrier bearings and cups for discoloration or other signs of bearing failure.

    NOTE: Install the differential bearing cups and shims in the same locations they were in before disassembly.

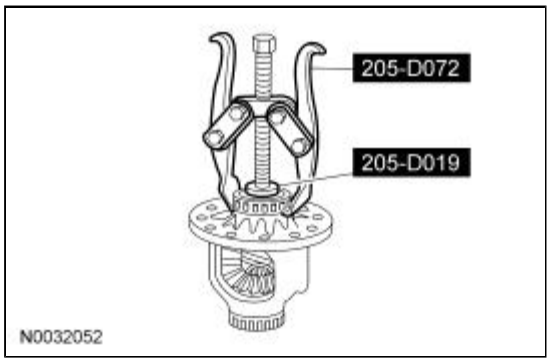
    Install the differential case. Rotate the differential case to seat the differential bearings.



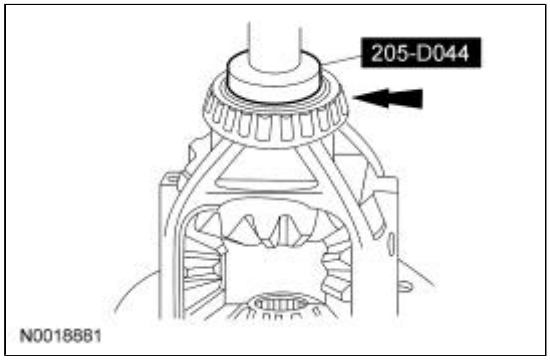
11. Using the special tool, measure the differential case flange runout.
    1. Rotate the differential case to make sure the differential bearings are seated.
    2. Position the special tool.
    - If the runout does not exceed the specification, the cause of the original excessive runout is the differential ring gear. Remove the differential case. Discard the differential ring gear and the drive pinion gear. Proceed to Final disassembly in this procedure.
    - If the runout exceeds the specification, the differential ring gear is true and the concern is due to either differential case/differential bearing damage.
        - Remove the special tool.



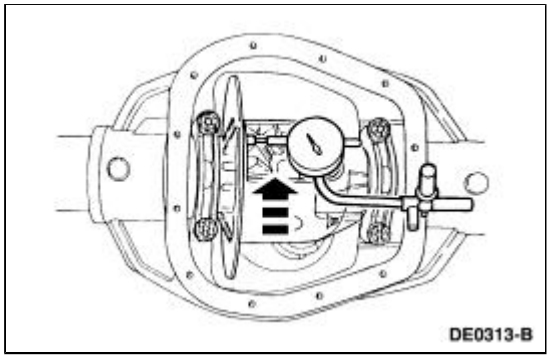
12. Remove the differential case from the rear axle housing, and remove the differential bearings using the special tools.



13. Using the special tool, install the new differential bearings on the differential case.

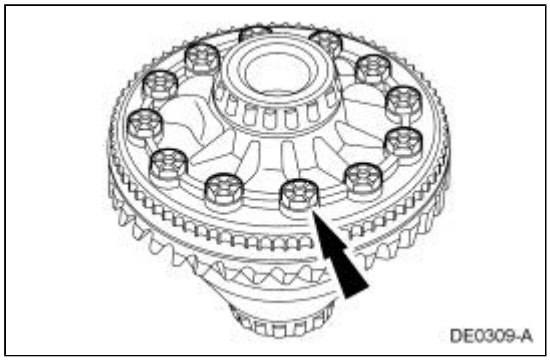


14. Measure the differential case runout without the differential ring gear.
    - Check the differential case flange runout again with the new differential bearings. If the runout is now within the specification shown, use the new differential bearings for assembly. If the runout is still excessive, the differential case is damaged and must be installed new.



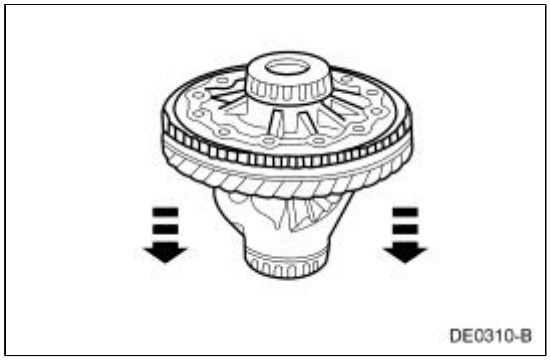
Final Disassembly, Differential Case and Ring Gear — Traction-Lok®

15. Remove the differential ring gear bolts



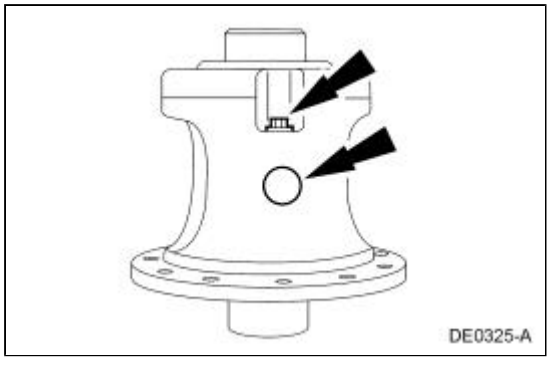
16. **CAUTION: Do not damage the ring gear bolt hole threads.**

    Insert a punch in the bolt holes and drive the differential ring gear off the differential case.

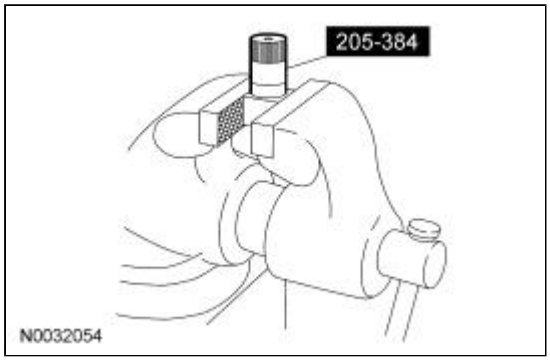


17. **NOTE:** The differential bearings do not need to be removed to overhaul the Traction-Lok® differential. If bearing removal is required, use special tool 205-D072 and special tool 205-D019 for the differential case bearings.

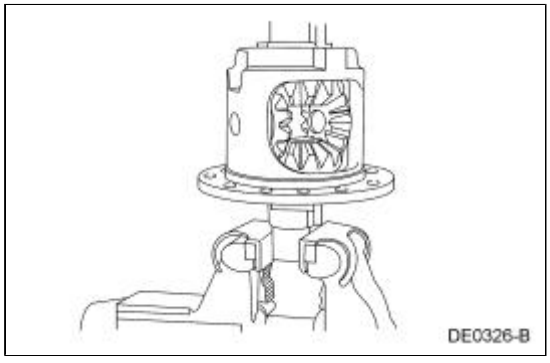
    Remove the differential pinion shaft lock bolt and remove the differential pinion shaft.



18. Install the special tool in a suitable vise.

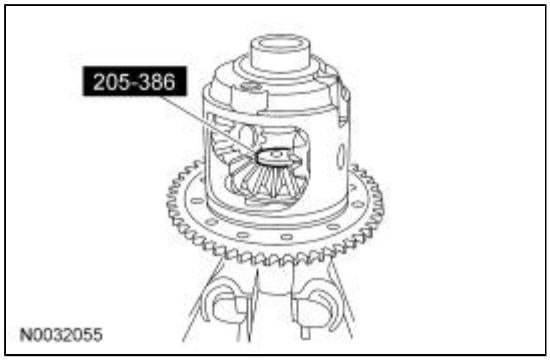


19. Install the differential case on the tool.

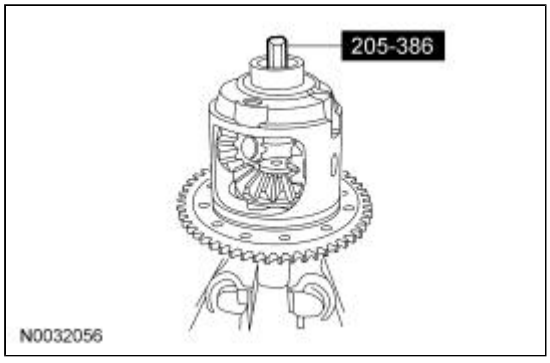


20. **NOTE:** Apply a small amount of grease to the centering hole of the special tool.

    Install the special tool in the bottom side gear bore.

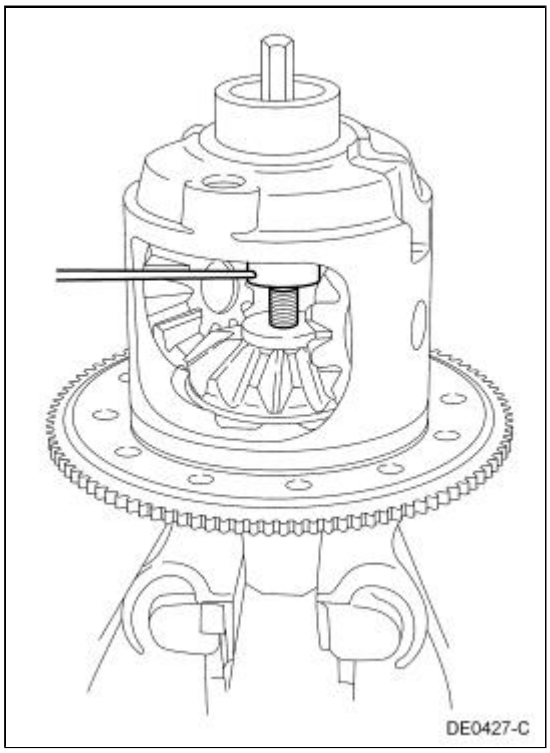


21. Install the nut in the upper differential side gear. Hold the nut in position while installing the hex screw. Tighten the hex nut until contact is made with the step plate.

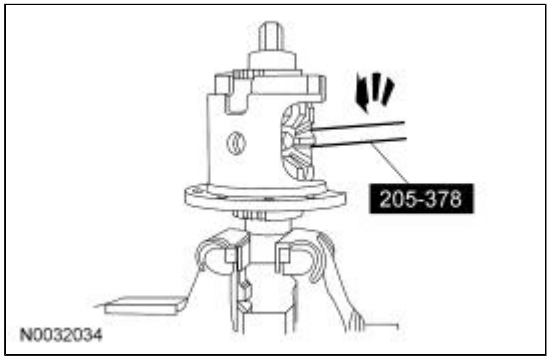


22. **NOTE:** The dowel bar is used to keep the nut from turning when the forcing screw is tightened.

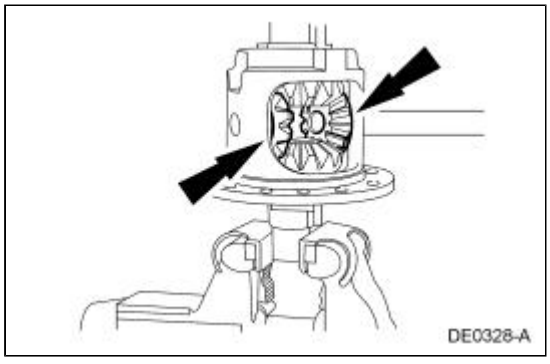
Insert a suitable dowel bar in the hole of the nut. Tighten the forcing screw to force the differential side gear away from the differential pinion gears.



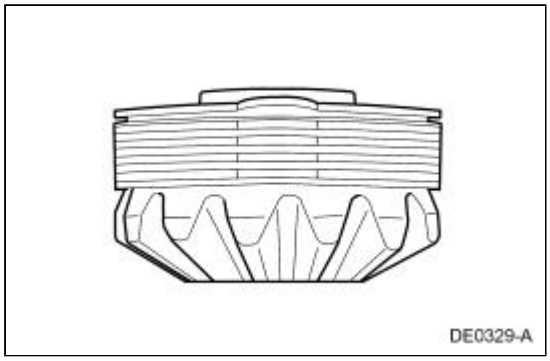
23. Insert the special tool in the pinion shaft bore and turn the differential case to move the differential pin gears and thrust washers to the differential case opening.



24. Remove the differential pinion gears and differential pinion gear thrust washers.



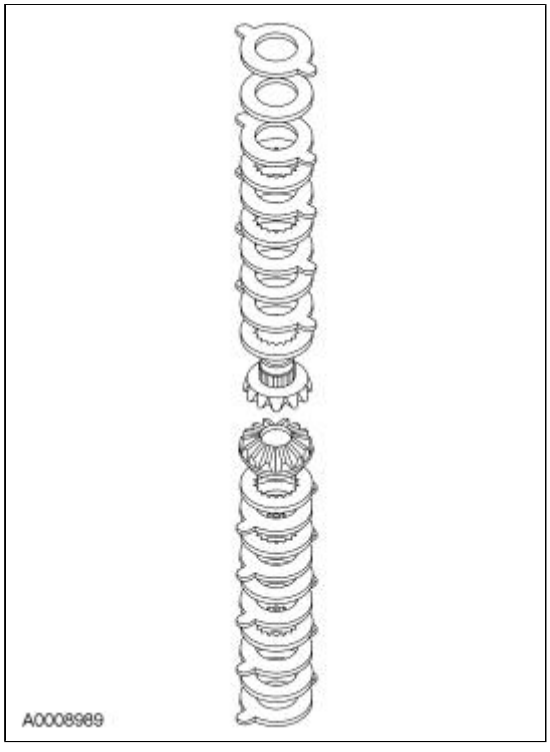
25. Remove the differential side gears and differential clutch packs. Tag the gears, clutch packs and shims for location.



26. **CAUTION: When separating the clutch plates and clutch discs, note the sequence in which they are disassembled. They must be reassembled in the same sequence.**

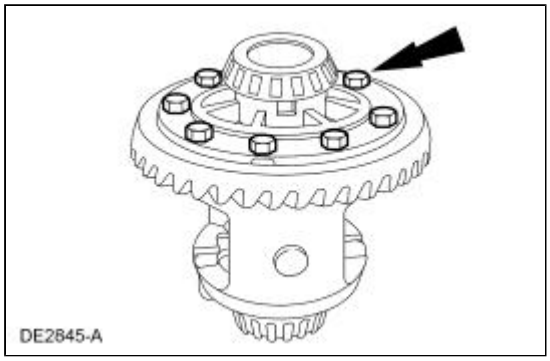
    CAUTION: Do not use acids or solvents to clean the differential clutch components. Use a clean, lint-free cloth only.

    Separate the differential clutch packs for cleaning and inspection.



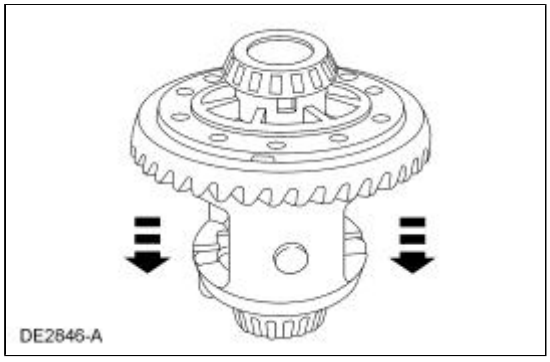
Final Disassembly, Differential Case and Ring Gear — Conventional

27. Remove the differential ring gear bolts.

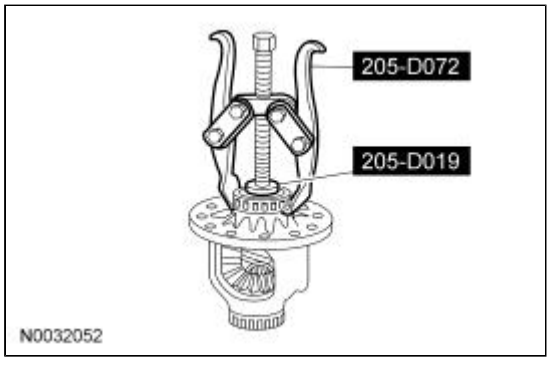


28. **CAUTION: Do not damage the ring gear bolt hole threads.**

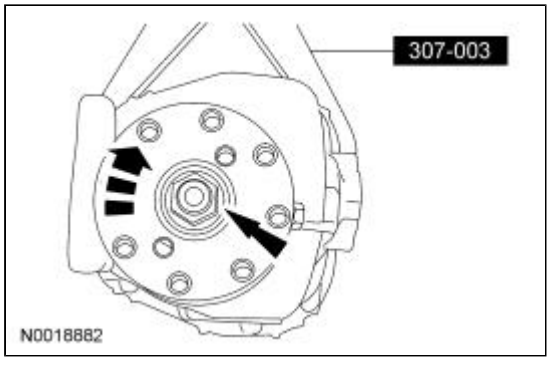
    Insert a punch in the bolt holes and drive off the differential ring gear.



29. Using the special tools, remove the differential bearing.
    - Repeat for the other side.

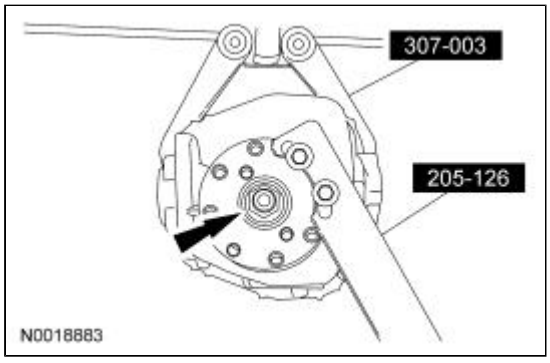


30. Record the torque necessary to maintain rotation of the drive pinion gear through several revolutions prior to removing the drive pinion flange.



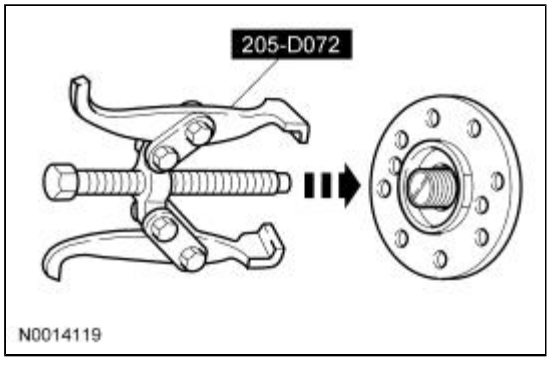
31. **CAUTION: After removing the drive pinion nut, discard it. Use a new nut for installation.**

    Using the special tool, remove the drive pinion nut.

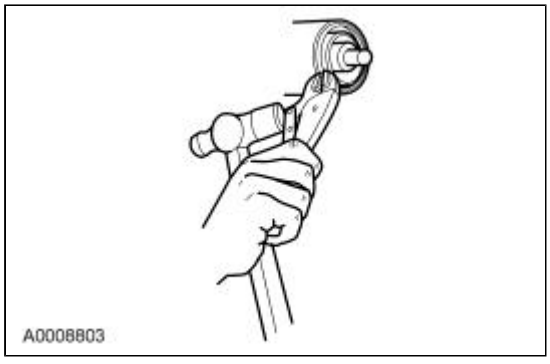


32. Index-mark the drive pinion flange and drive pinion gear stem to maintain initial balance during installation.

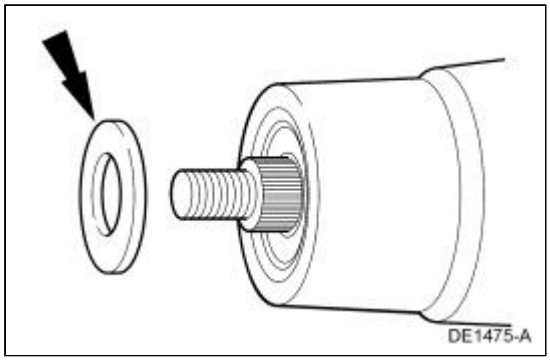
33. Using the special tool, remove the drive pinion flange.



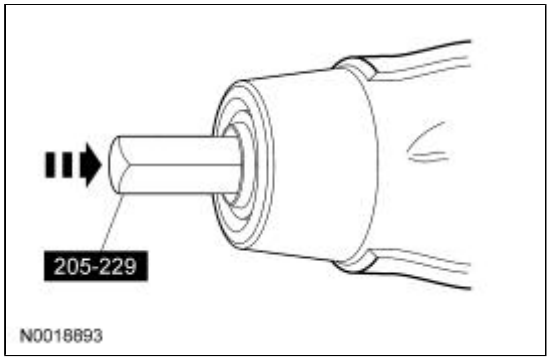
34. Force up on the metal flange of the drive pinion seal. Install gripping pliers and strike with a hammer until the pinion seal is removed.



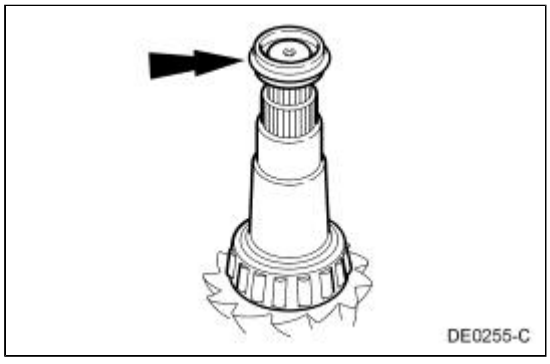
35. Remove the drive pinion shaft oil slinger.



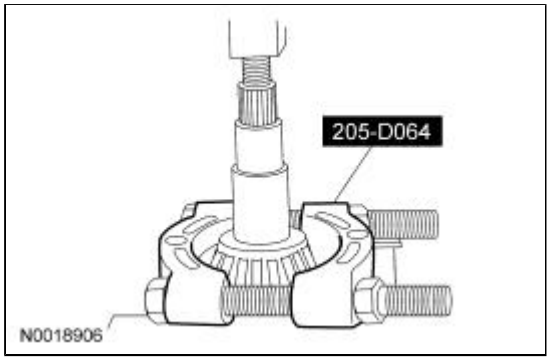
36. Using the special tool and a soft-faced hammer, drive the drive pinion gear out of the front pinion bearing and remove it through the rear of the differential housing.



37. Remove and discard the drive pinion collapsible spacer.

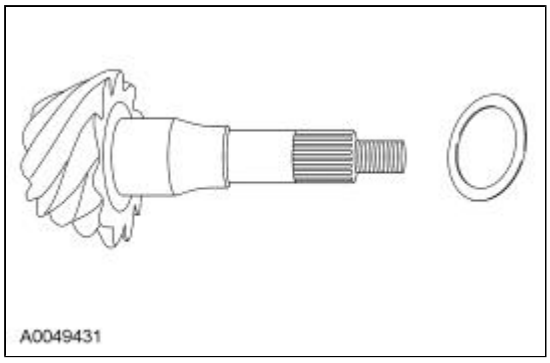


38. Using the special tool and a suitable press, remove the drive pinion bearing.



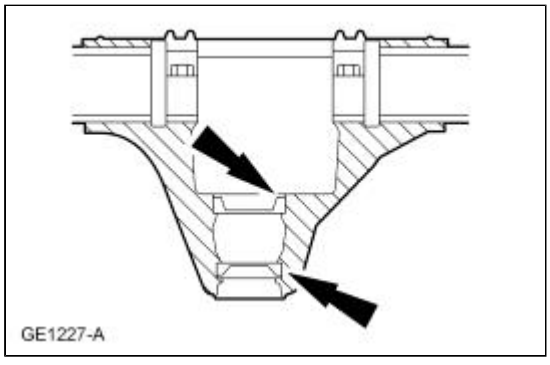
39. **NOTE:** Using a micrometer, measure the drive pinion bearing adjustment shim thickness. Use this measurement as a reference to compare to the shim gauge reading taken prior to installing the pinion bearing.

Remove the drive pinion bearing adjustment shim.



40. **NOTE:** Tap alternately on opposite sides of the cups to prevent them from cocking in the bore.

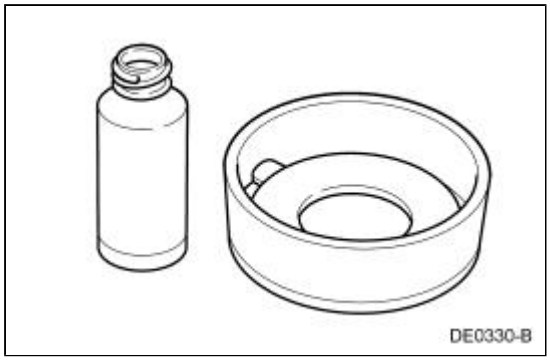
    Use a suitable brass drift to remove the differential bearing cups.



Assembly

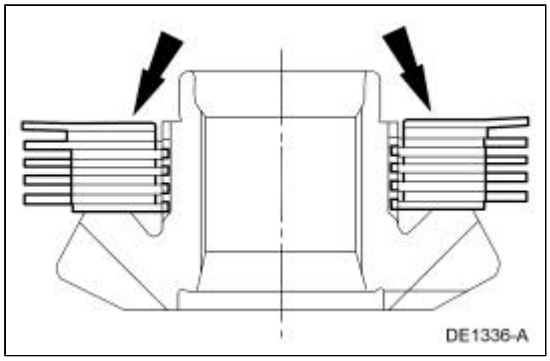
Assembly, Differential Case and Ring Gear — Traction-Lok®

1. Prelubricate each steel clutch plate and soak all friction plates with 118 ml (4 ounces) of friction modifier for at least 15 minutes.

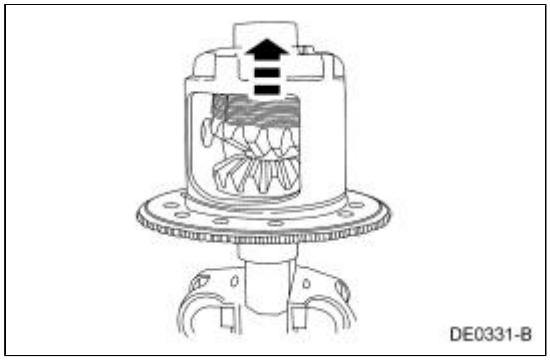


2. **NOTE:** The concave side of the Belleville spring must face up and against the thrust face of the differential case.

   Place the shim and the Belleville spring on the differential clutch pack.

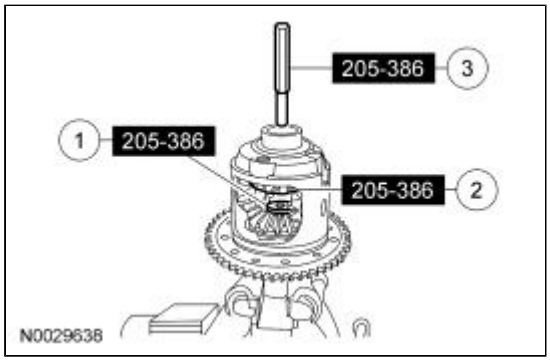


3. Insert the differential clutch packs with the shims and Belleville springs and differential side gears into the differential case.



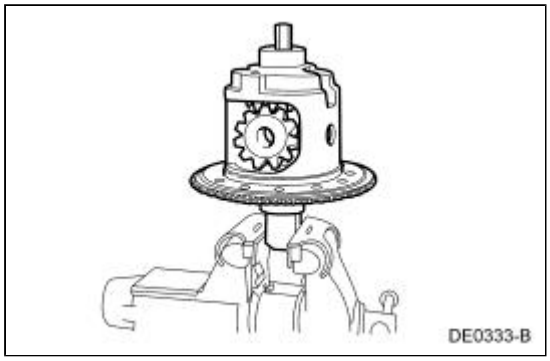
4. **NOTE:** If necessary, insert the dowel bar in the nut bore to keep the nut from turning as the hex screw is tightened.

   Assemble the special tool in the differential case.
   1. Position the special tool in the bottom side gear bore.
   2. Position the special tool in the top side gear bore and hold it in place.
   3. Install the special tool and tighten it 2 turns after it contacts the bottom step plate.



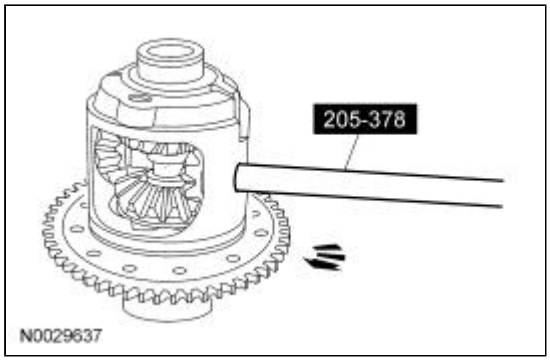
5. **NOTE:** Coat both sides of the differential pinion thrust washers with rear axle lubricant.

   Position the differential pinion gears and thrust washers in the differential case window so they mesh with the differential side gear teeth.

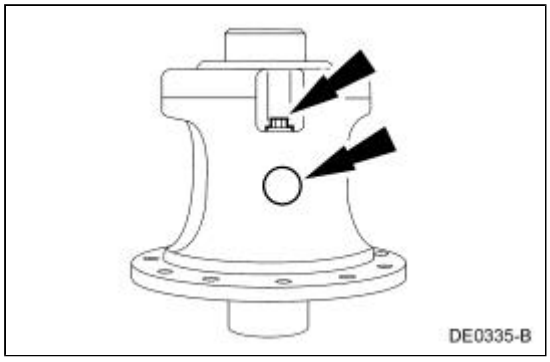


6. **NOTE:** It may be necessary to loosen or tighten the special tool forcing screw to allow the differential side gears to rotate.

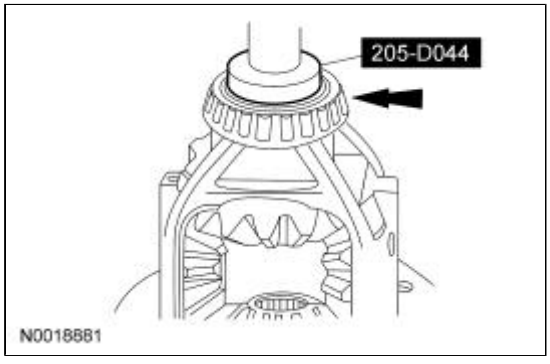
   Insert the special tool into the pinion shaft bore and turn the differential case. This will move the differential side gears and position them in the differential case. Rotate the differential case until the pinion mating shaft holes are aligned with the differential pinion gears.



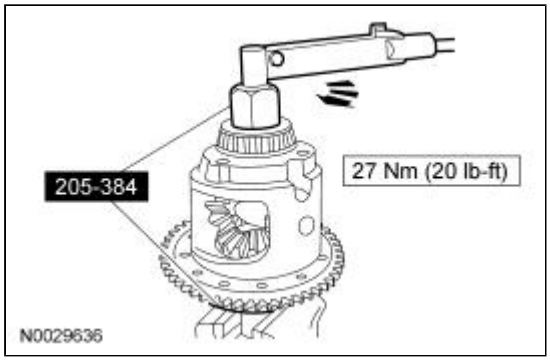
7. Loosen the special tool forcing screw and remove the special tool from the differential case. Install a new differential pinion shaft and bolt in the differential case.



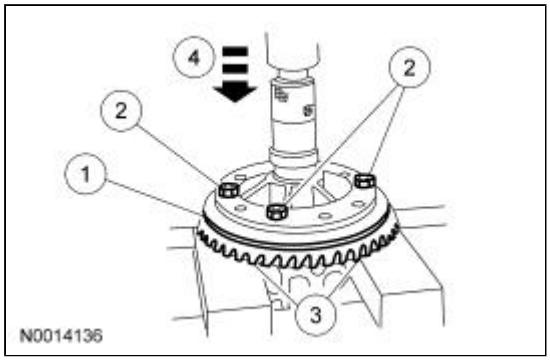
8. If removed, install new differential carrier bearings.



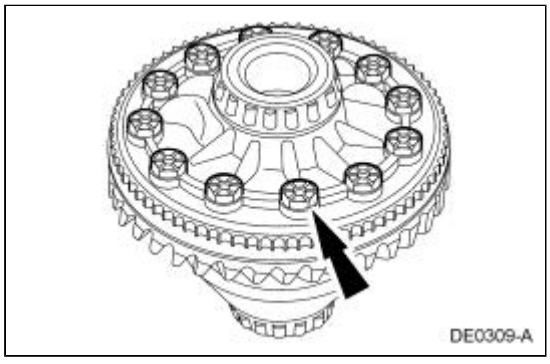
9. Using the special tools, check the torque required to rotate on differential side gear.
    - Install the special tools as shown.
    - If the original clutch plates are used, the initial breakaway torque must be within specification. The rotating torque required to turn the differential side gear with new clutch plates, may vary.



10. Install the differential ring gear.
    1. Place the differential ring gear on the differential case.
    2. Hand start 3 bolts to align the ring gear to the differential case.
    3. Place the differential case and ring gear on the press bed with the ring gear teeth facing down.
    4. Press the ring gear into place on the differential case.



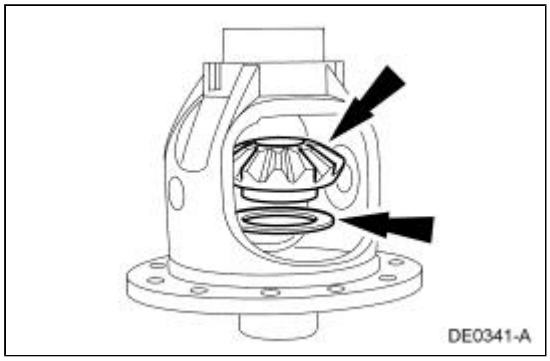
11. Install the ring gear bolts and tighten.
    - Tighten to 150 Nm (111 lb-ft).



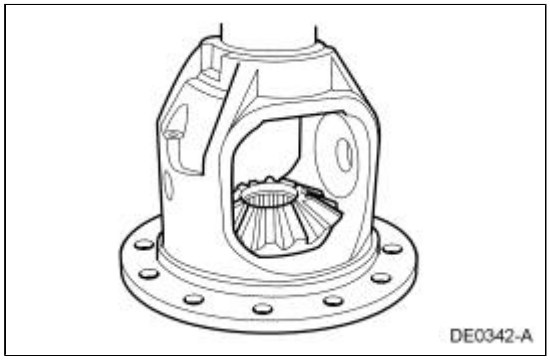
Assembly, Differential Case and Ring Gear — Conventional

12. **NOTE:** Coat the differential side gears and differential side gear thrust washers with rear axle lubricant.

    Position the differential thrust washers on the differential side gears.

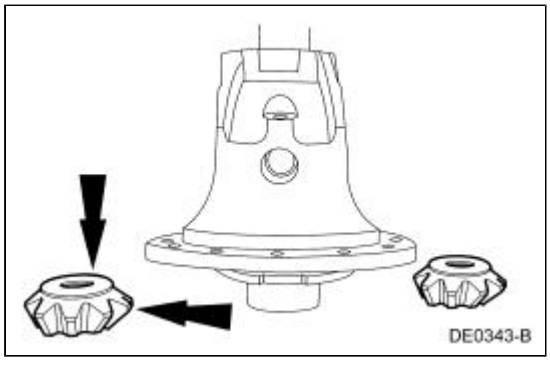


13. Position the differential side gears and thrust washers in the differential case.

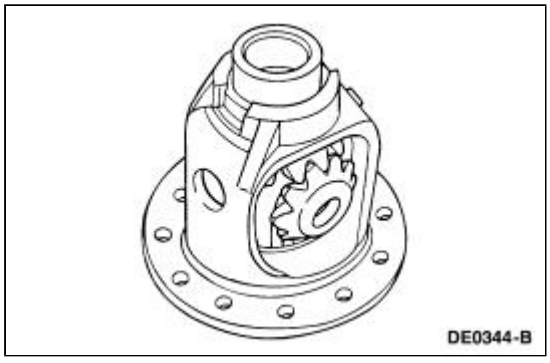


14. **NOTE:** Coat the differential pinion thrust washers and differential pinion gears with rear axle lubricant.

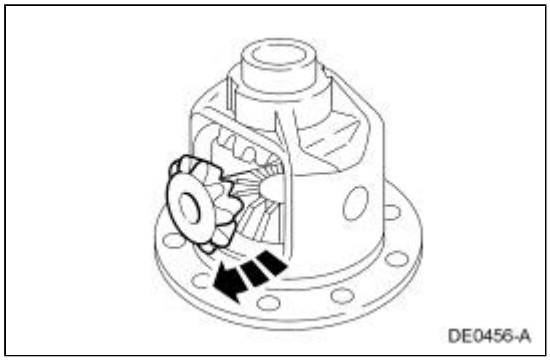
    Assemble the differential pinion thrust washers and the differential pinion gears.



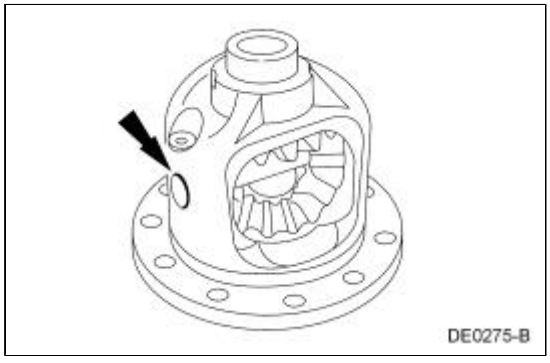
15. Engage the differential pinion gears opposite the differential side gears.



16. Rotate the differential pinion gears to align with the differential pinion shaft bore.

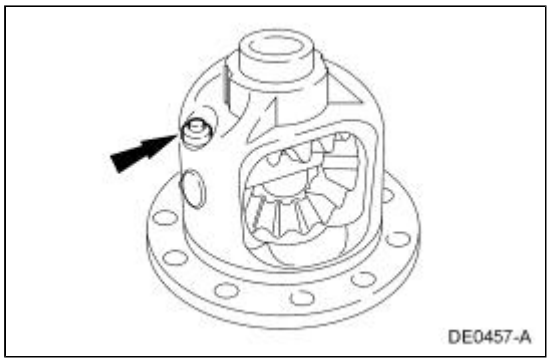


17. Insert the differential pinion shaft.

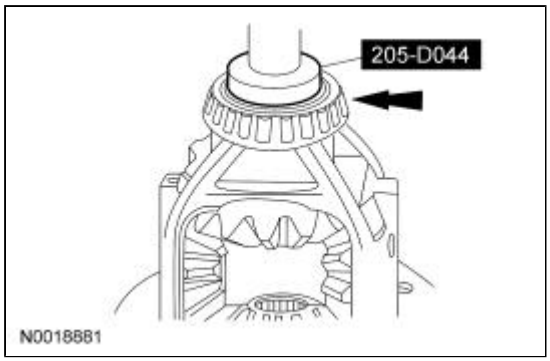


18. **NOTE:** If a new pinion shaft lock bolt is unavailable, coat the threads with sealer prior to installation.

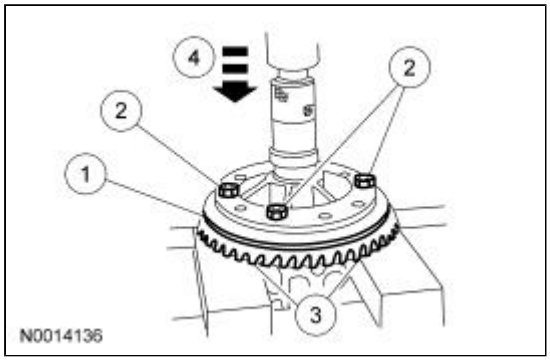
    Install a new differential shaft lock bolt.
    - Tighten to 30 Nm (22 lb-ft).



19. Using the special tool, install the differential bearings.

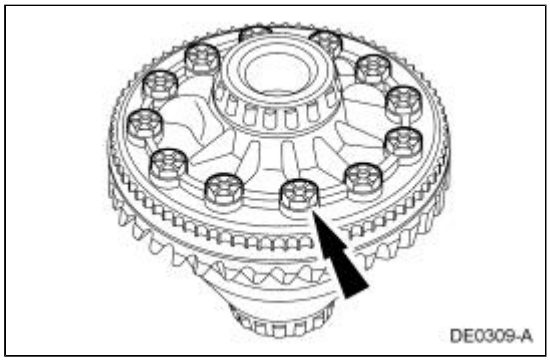


20. Install the differential ring gear.
    1. Place the differential ring gear on the differential case.
    2. Hand start 3 bolts to align the holes in the differential ring gear and the differential case.
    3. Place the differential case and the differential ring gear on the press bed with the ring gear facing down.
    4. Press the ring gear into place.



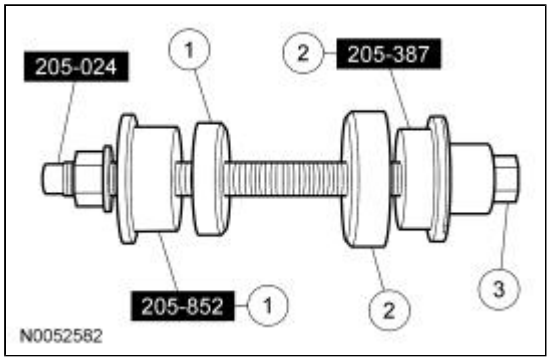
21. **NOTE:** Apply sealer to the threads of the ring gear bolts.

    Install the differential ring gear bolts and tighten.
    - Tighten to 150 Nm (111 lb-ft).

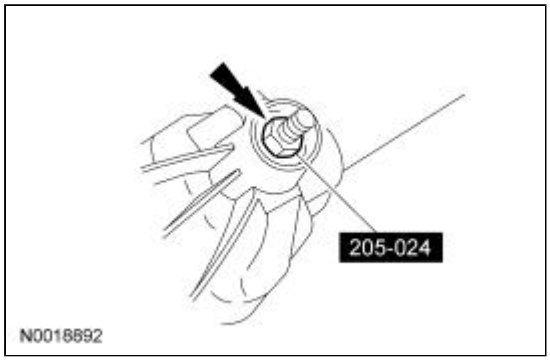


Final Assembly — All Differentials

22. Position the inner and outer bearing cups in their respective bores.
    1. After positioning the bearing cups in the bores, place the special tool on the inner bearing cup.
    2. Place the special tool on the outer bearing cup.
    3. Install the special tools.

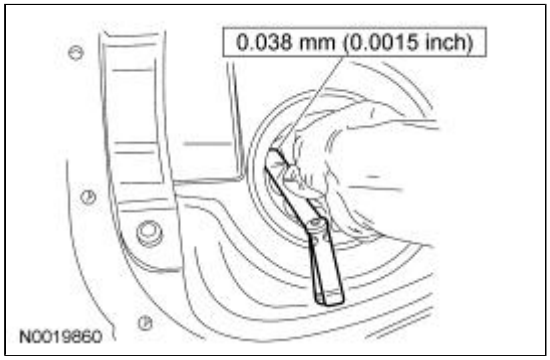


23. Tighten the special tool to seat the bearing cups in the bores.



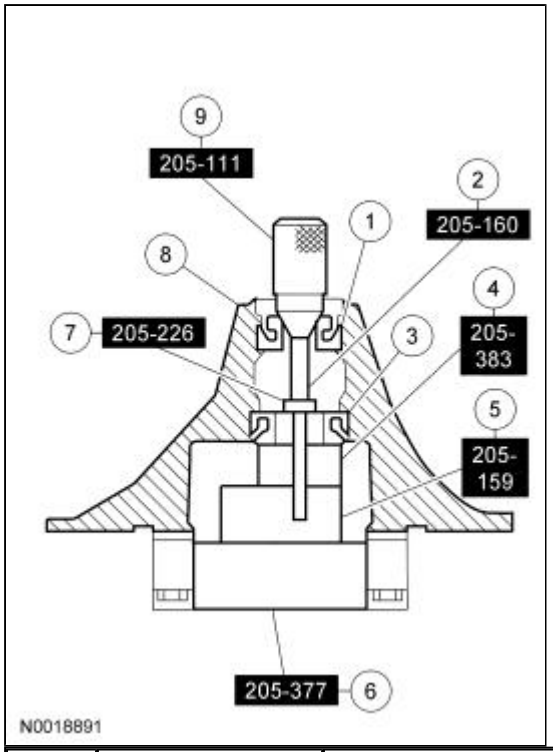
24. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

    Make sure the differential pinion bearing cups are correctly seated.



25. **NOTE:** Apply a light film of lubricant on the front and rear pinion bearings.

    Install the pinion bearings and special tools as shown.

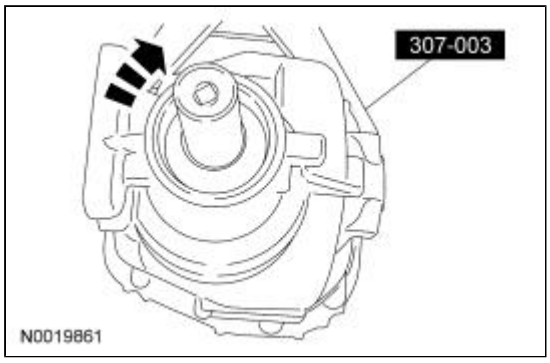


Item	Part Number	Description
1	4621	Outer pinion bearing

2	205-160	Adapter for 205-S127
3	4630	Inner pinion bearing
4	205-383	Depth Gauge/Aligner, Drive Pinion
5	205-159	Adapter for 205-S126
6	205-377	Drive Pinion Gauge Tube
7	205-226	Depth Gauge/Aligner, Drive Pinion
8	4010	Rear axle housing
9	205-111	Adapter for 205-S127

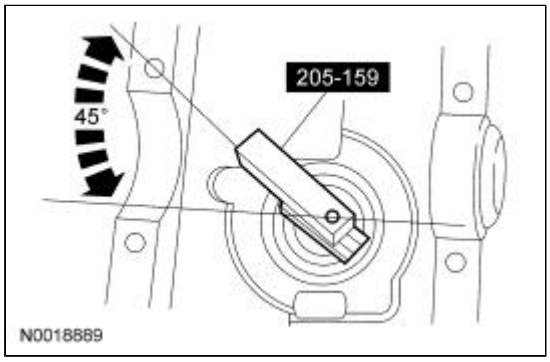
26. **NOTE:** This step duplicates pinion bearing preload.

    Thread the special tool onto the screw and tighten.
    - Tighten to 2.2 Nm (20 lb-in) rotational torque.

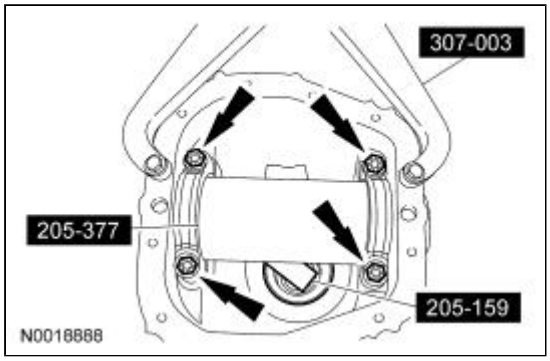


27. **NOTE:** The special tool must be offset to obtain an accurate reading.

    Position the special tool.



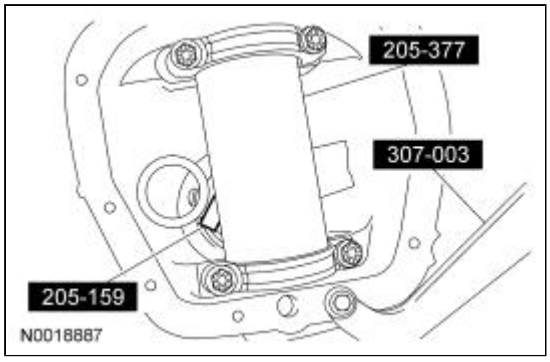
28. Install the special tool.
    - Tighten to 105 Nm (77 lb-ft).



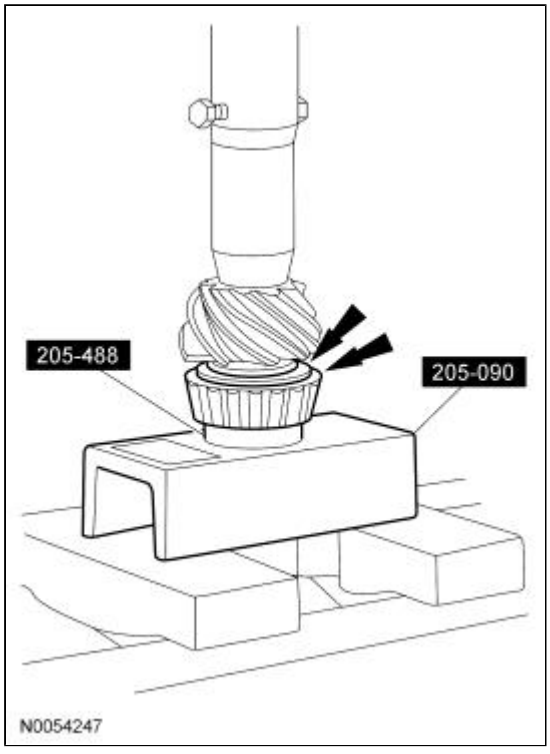
29. **NOTE:** Drive pinion bearing adjustment shims must be flat and clean.

    NOTE: A slight drag should be felt for correct shim selection. Do not attempt to force the pinion shim between the Gauge Block and the Gauge Tube. This will minimize selection of a pinion shim thicker than required, which results in a deep tooth contact in the final assembly of integral rear axle assemblies.

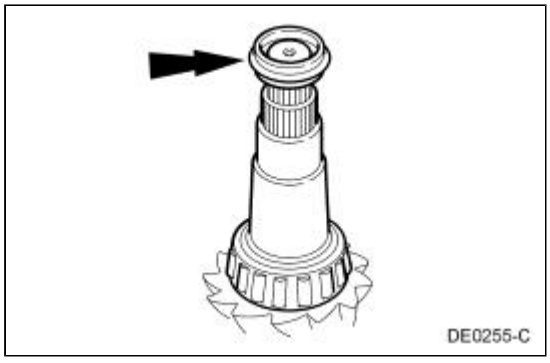
    Use a drive pinion bearing adjustment shim as a gauge for shim selection.
    - After the correct shim thickness has been determined, remove the special tools.



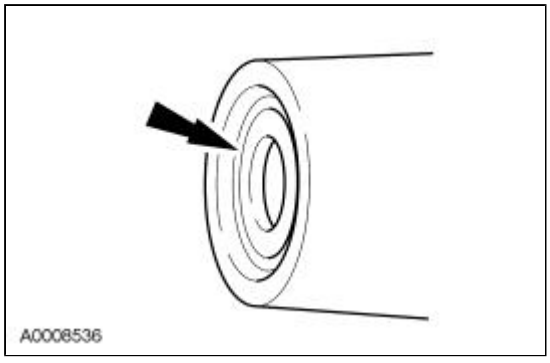
30. Using the special tools, press the inner pinion bearing and pinion shim until they are firmly seated on the pinion.



31. Place a new drive pinion collapsible spacer on the pinion shaft against the pinion stem shoulder.



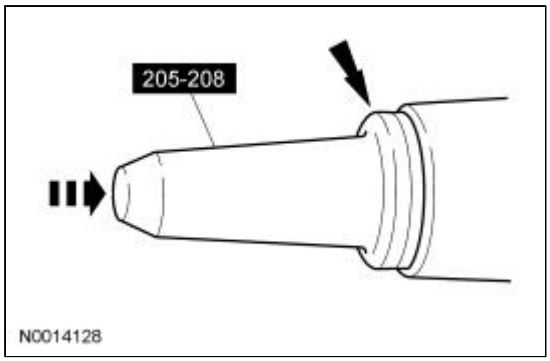
32. Install a new outer pinion bearing and rear axle drive pinion shaft oil slinger.



33. **CAUTION: Installation without the correct tool can result in early seal failure. If the rear axle drive pinion seal becomes cocked during installation, remove it and install a new one.**

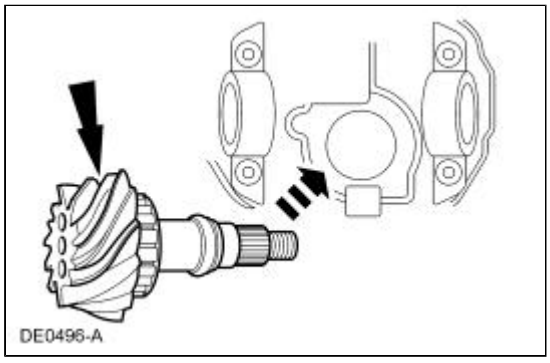
CAUTION: Coat the lips of the rear axle drive pinion seal with grease.

Place the drive pinion oil seal on the special tool and drive the seal into place.



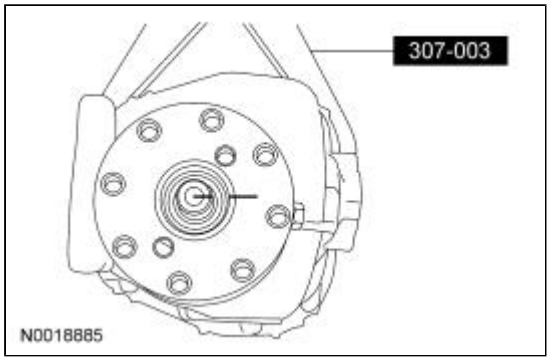
34. **NOTE:** Lubricate the pinion flange splines with rear axle lubricant.

    Install the drive pinion in the drive pinion carrier bore from inside the rear axle housing. Seat the drive pinion with a plastic hammer.

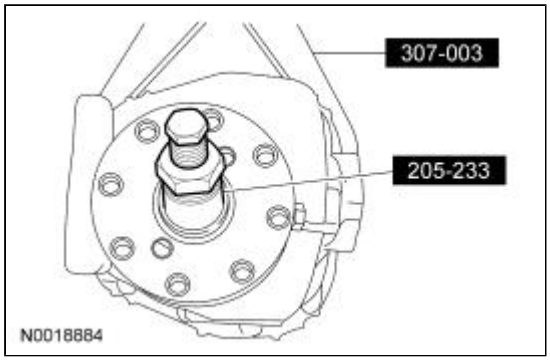


35. **NOTE:** Disregard the scribe marks if a new pinion flange is being installed.

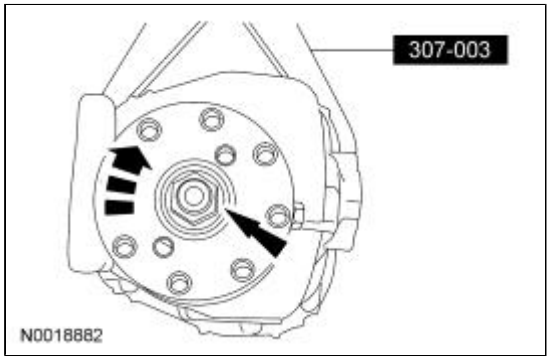
    Align the pinion flange with the drive pinion shaft.



36. With the drive pinion in the axle housing, install the pinion flange using the special tool.



37. Position the new pinion nut.

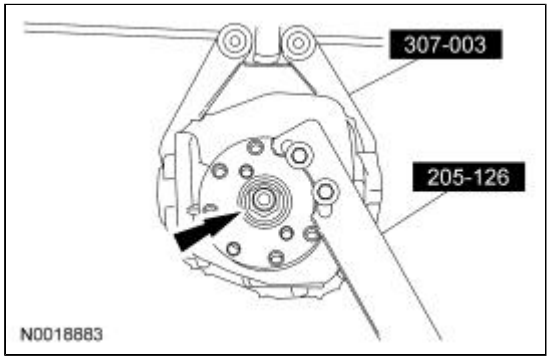


38. **CAUTION: Under no circumstances is the pinion nut to be backed off to reduce preload. If reduced preload is required, a new drive pinion collapsible spacer and pinion nut must be installed.**

CAUTION: The pinion flange holding tool must be removed before preload readings can be taken.

Using the special tool, tighten the pinion nut.

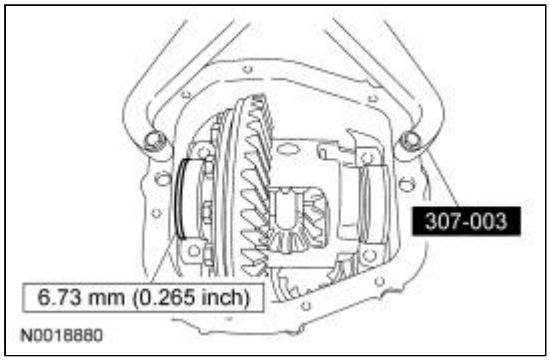
- Rotate the pinion occasionally to make sure the drive pinion bearings are seating correctly.
- Install a Nm (lb-in) torque wrench on the pinion nut.
- Rotating the pinion through several revolutions, take frequent drive pinion bearing torque preload readings until the preload reading is obtained.



39. With the pinion depth set and the pinion installed, place the differential case in the rear axle housing.

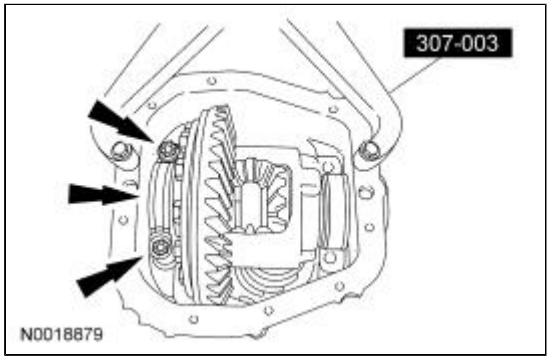
40. **NOTE:** Differential bearing shims are to be installed with the chamfer facing outboard.

Install a shim as shown on the left side.

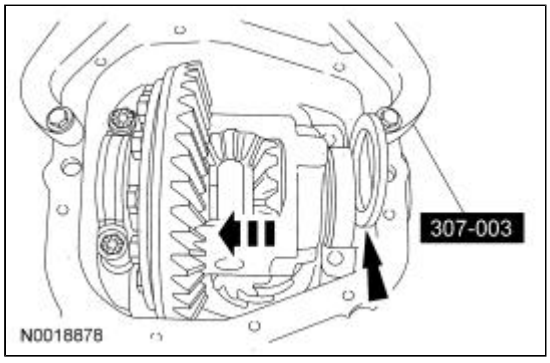


41. **NOTE:** Apply pressure toward the left side to make sure the left bearing cup is seated.

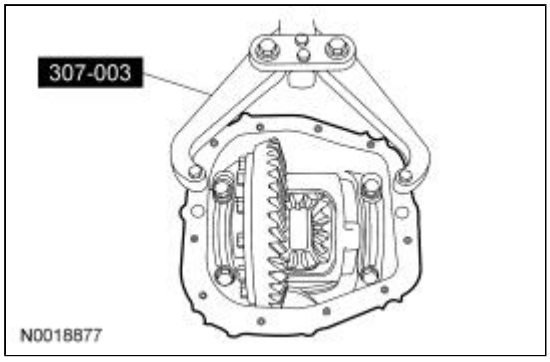
    Install the left bearing cap and loosely install the bearing cap bolts.



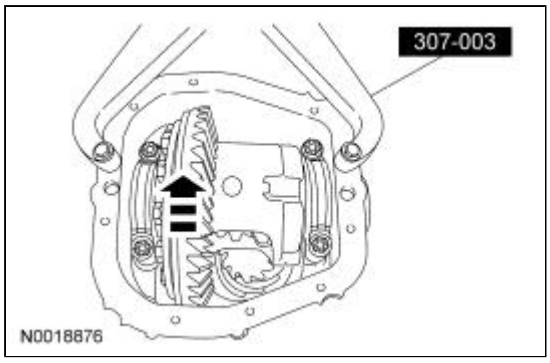
42. Install progressively larger shims on the right side until the largest shim selected can be installed by hand.



43. Install the right side bearing cap and tighten the bolts.
    - Tighten to 105 Nm (77 lb-ft).



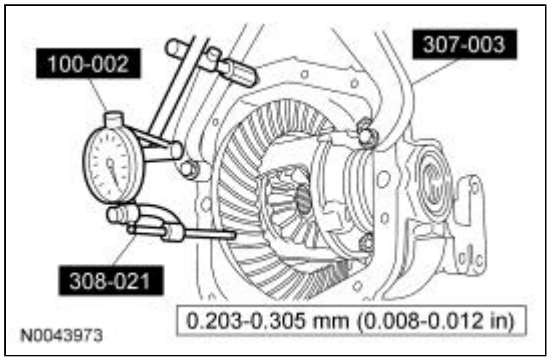
44. Rotate the differential case to make sure it rotates freely.



Measuring backlash

45. Using the special tools, measure and note the differential ring gear backlash.
    - If backlash is within the specification, refer to Backlash within specification in this procedure.
    - If a zero backlash condition occurs, refer to Zero backlash in this procedure.
    - If backlash is not within the specification, refer to Backlash not within specification in this procedure.

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020



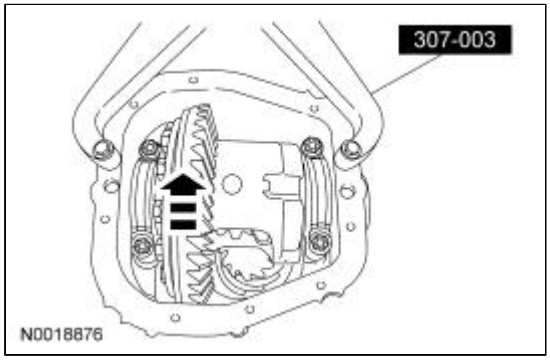
Zero backlash

46. If a zero backlash condition occurs, add 0.51 mm (0.020 inch) to the RH side and subtract 0.51 mm (0.020 inch) from the LH side to allow backlash indication. Measure the backlash. Refer to Measuring backlash in this procedure.

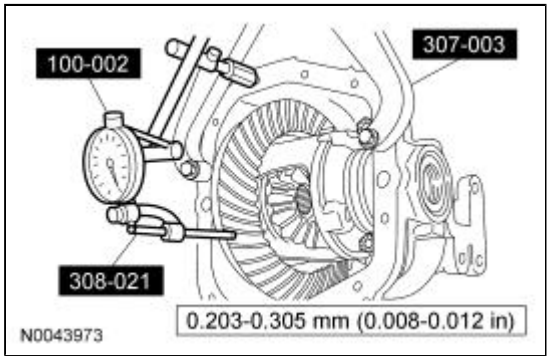
Backlash not within specification

47. To increase or decrease backlash, remove the differential bearing caps and install a thicker shim and a thinner shim accordingly.
    - If backlash is not within the specification, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount.

48. Rotate the differential assembly several times to verify that the differential bearings seated correctly.



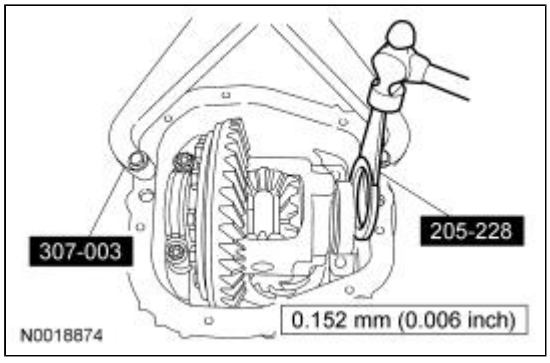
49. Using the special tools, recheck the backlash.
    - If backlash is within the specification, refer to Backlash within specification in this procedure. If backlash is not within the specification, repeat Backlash not within specification in this procedure.



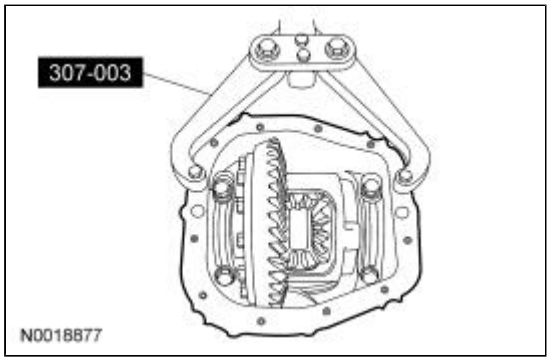
Backlash within specification

50. Remove the bolts and the differential bearing caps.

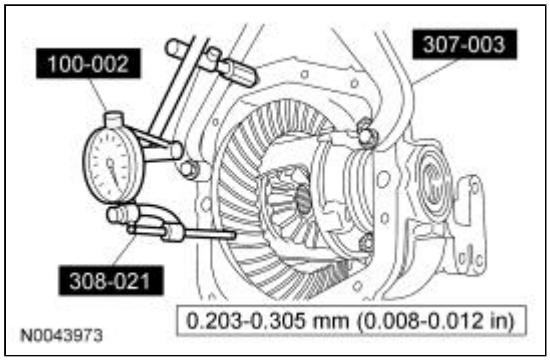
51. To establish differential bearing preload, increase both left and right differential bearing shim sizes by the specification shown.



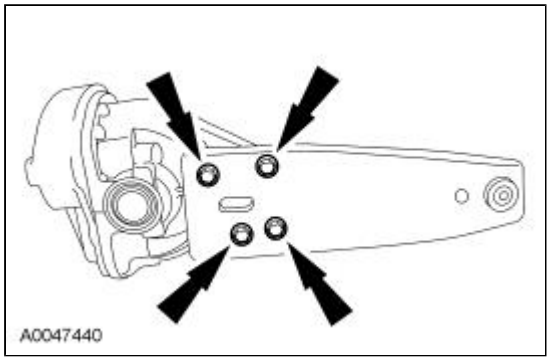
52. Install the differential bearing caps and bolts.
    - Tighten to 105 Nm (77 lb-ft).



53. Using the special tools, recheck the backlash.

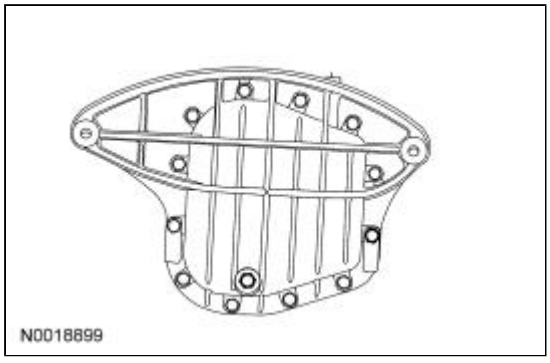


54. Remove the axle assembly from the holding fixture and install the torque arm.
    - Tighten to 205 Nm (150 lb-ft).



55. **NOTE:** The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If possible, allow 1 hour before filling with lubricant to make sure the silicone sealant has cured correctly.

    Install the differential housing cover and tighten the differential housing cover bolts.
    - Tighten to 32 Nm (24 lb-ft).



56. Fill with axle lubricant. For additional information, refer to Specifications in this section.

Printable View (81 KB)

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada) (Model 60/70 axles)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Threadlock and Sealer TA-25	WSK-M2G351-A5
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Lubricant Fill Level Checks	
Front axle	1.70L (3.6 pints)
Lubricant level	9.56 mm (0.38 in) below bottom of differential housing fill hole
Backlash Specifications	
Ring gear backlash	0.204-0.305 mm (0.008-0.012 in)
Ring gear maximum backlash between teeth	0.101mm (0.004 in)
Rotational Torque Ranges	
Pinion bearing torque preload	1.8-3.3 Nm (16-29 lb-in)
Clearance Specifications	
Maximum differential housing spread	0.762 mm (0.030 in)
Differential case maximum runout	0.076 mm (0.003 in)
Housing spreader adapter thread engagement	12.5 mm (0.500 in)

Torque Specifications

Description	Nm	lb-ft
Axle tube bolts	73	54
Crossmember bolts	90	66
Differential bearing cap bolts	105	77
Differential housing cover bolts	32	24
Differential pinion shaft lock bolt	30	22
Drain plug	25	18
Driveshaft retaining bolts	112	83
Fill plug	25	18
Halfshaft bolts	82	60
Isolator bolt and nut	150	111
Lower steering column shaft-to-steering gear bolt	30	22

Ring gear bolts	105	77

Front Drive Axle and Differential

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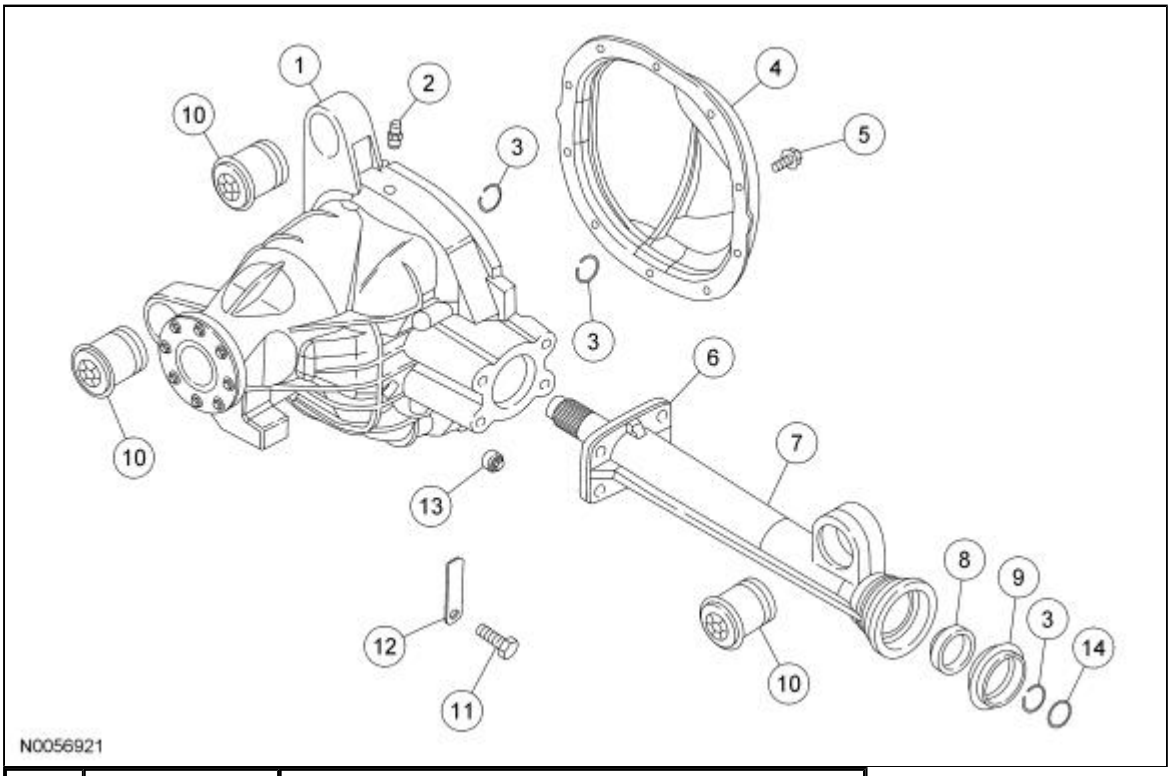
Front Axle Assembly — Disassembled View



Item	Part Number	Description
1	3C202	Differential carrier assembly
2	4338	Axle housing vent
3	4B422	Circlips
4	3N136	Differential housing cover
5	390919	Differential housing cover bolt (10 required)
6	—	Intermediate shaft
7	3B210	Axle housing tube
8	4B413	Axle shaft bearing assembly (outer)
9	4B416	Axle shaft dust seal
10	3A443	Front axle support isolators (3 required)
11	N808703	Axle housing tube bolt (4 required)
12	4121	Axle identification tag
13	373098	Fill plug
14	4369	O-ring

- The axle housing assembly consists of a cast-aluminum center section, a removable cast-aluminum axle housing tube and a differential housing cover. Both the axle housing tube and the differential housing cover use silicone sealant as a gasket.

- The hypoid-design gearset consists of an 8.8-inch ring gear and a pinion gear. Two opposed tapered roller bearings support the drive pinion in the axle housing.
- A drive pinion collapsible spacer, located on the pinion shaft, maintains pinion bearing preload. The pinion nut adjusts the preload.
- Differential bearing shims, located between the differential bearing cups and the axle housing, adjust the differential bearing preload and the ring gear backlash.
- The differential case is a 1-piece design with 2 openings to allow for assembly of the internal components and lubricant flow. Two opposed tapered roller bearings (differential bearings) support the differential case in the axle housing. Removable differential bearing caps retain the differential assembly in the axle housing.
- Inside the differential case, the differential pinion shaft supports 2 differential pinion gears. The pinion gear speed is synchronized by a differential clutch spring. The pinion gears engage the differential side gears, to which the left axle shaft and the right axle shaft are splined. The differential pinion shaft bolt retains the differential pinion shaft in the differential case.
- An embossed metal tag, bolted to the rear face of the RH axle tube, contains front axle identification information.

Front Drive Axle

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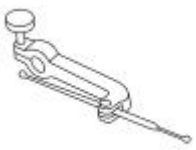
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)

Inspection and Verification

The technician should have a thorough knowledge of driveline system operation and accepted general driveline guidelines to detect any problems.

A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Certain conditions, such as road conditions and weather, will amplify normal vehicle noise.

Certain axle and driveline concern symptoms are also common to the engine, transmission, wheel bearings and tire. For this reason, be sure the cause of the concern is in the axle before repairing or installing any axle components.

The following is a guide to diagnose a driveline concern:

- Verify and document the customer concern.
- Perform a preliminary investigation.
- Road test the vehicle.
- Find the cause of the problem.
- Inspect the components.

1. Verify and document the customer concern.
    1. When was it first noticed?
    2. Did it appear suddenly or gradually?
    3. Did anything unusual occur that would coincide with it or precede it?
    4. Has the driveline system been repaired before or new components installed?
        - Check the vehicle service record. Note any repairs other than driveline, such as brakes or suspension.
    5. Are there any special conditions affecting the concern or will alter the concern? For example:
        - Road speed
        - Type of road
        - Drive mode

- Temperature
- Vehicle loaded or unloaded

6. Is the condition constant or intermittent? Can the concern be duplicated at any time?
7. Check for TSBs, SSM and OASIS messages.

2. **NOTE:** If the inspection reveals an obvious concern, repair the vehicle.

   Do a preliminary investigation. Visually inspect for obvious signs of damage.
   1. Inspect the driveshaft:
      - for build up of any foreign material.
      - for damage, such as a bent tube or missing weights.
      - U-joints, CV joints or flex couplers for wear or damage.
   2. Inspect the axle:
      - for signs of leakage at the drain or fill plug, differential seal, vent or halfshaft seals.
        - a plugged vent or vent tube will cause a leak.
      - for damage, such as cracks, bent halfshafts or dented cover.
      - for missing fasteners.
   3. Inspect other suspect components/systems:
      - inspect the suspension for broken springs, damaged shock absorbers and worn suspension bushings.
      - inspect the brake components — lines, cables and calipers.
      - inspect the tires; are they in good condition and do they match?

3. **NOTE:** A road test is necessary for any customer concern of noise or vibration.

   Road test the vehicle.
   1. During the road test, use the following driving methods to diagnose the problem. Is the concern most noticeable:
      - from a stop?
      - on shifts from REVERSE to DRIVE?
      - on turns?
        - sweeping type turn.
        - tight turn (to the stop).
      - in DRIVE?
        - accelerating the vehicle, definite throttle depression, applying engine torque.
      - in CRUISE?
        - maintain a constant speed with the throttle applied.
      - in COAST?
        - decelerating with the throttle closed.
   2. Record when the concern occurs. Write down the kph (mph) range at which the noise/vibration occurs.

4. Find the cause of the problem.
   1. Compare the inspection and road test results with the following chart.
   2. Use the following diagnostic routine chart to identify the probable cause and know what corrective actions should be taken to repair the component/vehicle and to prevent a reoccurrence.

Diagnostic Routine Chart

Condition	Action
· Fluid loss	· GO to Diagnostic Routine — Fluid Loss
· Noise louder on turns (sweeping turn)	· GO to Diagnostic Routine — Noise Louder on Turns (Sweeping)
· Axle noise (growl) [a] in tight turn	· GO to Diagnostic Routine — Noise (Growl) In Tight Turn

· Axle noise (whine) [a] in all or more than one drive mode	· GO to Diagnostic Routine — Noise (Whine) In All Or More Than One Drive Modes
· Axle noise (tick/click) [a] in all or more than one drive mode (drive, cruise, coast)	· GO to Diagnostic Routine — Noise (Tick/Click) In All Or More Than One Drive Modes
· Axle noise (howl/moan) [a] in all or more than one drive mode (drive, cruise, coast)	· GO to Diagnostic Routine — Noise (Howl/Moan) In All Or More Than One Drive Modes
· Axle noise (clunk) [a] on changes in speed or direction of power	· GO to Diagnostic Routine — Noise (Clunk) On Changes In Speed Or Direction Of Power
· Front axle will not engage/disengage	· GO to Diagnostic Routine — Front Axle Will Not Engage/Disengage
· Vibration	· For driveline vibration diagnostics, REFER to Section 100-04 .

a. Refer to Section 100-04 for a glossary of noise-related terms.

5. **NOTE:** If the conclusion of the road test points to an axle assembly section (ring and pinion or differential case) concern, carry out a visual inspection of the axle.

   Inspect the axle components.
   1. Remove the differential housing cover. Drain the axle lubricant through a white cloth. Check the fluid for:
      - any foreign material.
      - metal particles.
      - burnt odor.
   2. **NOTE:** When inspecting the axle, do not clean the components immediately. Cleaning may remove diagnostic evidence.

      Inspect the axle components.
      - Look for:
        - loose fasteners.
        - notches or visible steps or grooves created by wear.
        - pitting or cracking along gear contact lines.
        - scuffing or deformations.
        - discolorations.
        - nicks or ridges on gear teeth.
      - Clean the axle components for inspection.
        - Remove as much lubricant as possible with clean solvent. Wipe the components or blow them dry with compressed air.
      - Re-inspect for:
        - loose fasteners.
        - notches or visible steps or grooves created by wear.
        - pitting or cracking along gear contact lines.
        - scuffing or deformations.
        - discolorations.
        - nicks or ridges on gear teeth.
      - Check backlash and carry out a ring and pinion pattern test. Refer to Checking Differential Ring Gear Backlash and Checking Tooth Contact Pattern and Condition of the Ring and Pinion in this section.

Diagnostic Routines

Diagnostic Routine — Fluid Loss

Possible Component	Reference/Action
· Vent	· CLEAN the axle vent and vent hose.
· Overfilled axle	· CHECK the lubricant level for specific amount.
· Fill plug	· CLEAN the area around the plug. REMOVE the plug. APPLY pipe sealant and INSTALL the plug.
· Halfshaft oil seal	· INSTALL a new halfshaft oil seal, O-ring and circlip.
· Pinion seal	· INSTALL a new pinion seal.
· Differential housing cover	· RESEAL the differential housing cover.

Diagnostic Routine — Noise Louder on Turns (Sweeping)

Possible Component	Reference/Action
· Wheel end bearing	· CHECK the wheel end bearing for wear or damage. INSTALL a new bearing.

Diagnostic Routine — Noise (Growl) in Tight Turn, Conventional Differential

Possible Component	Reference/Action
· Differential side gears and differential pinion gears	· DISASSEMBLE the differential carrier. INSPECT the differential case assembly. INSTALL new side gears and differential pinion gears or case assembly.

Diagnostic Routine — Noise (Whine) in All or More Than One Drive Modes

Possible Component	Reference/Action
· Axle ring and pinion	· REMOVE and INSTALL a new gear set and bearings.

Diagnostic Routine — Noise (Tick/Click) in All or More Than One Drive Modes

Possible Component	Reference/Action
· Axle ring and pinion	· REMOVE and INSTALL a new ring gear, pinion and bearings.

Diagnostic Routine — Noise (Howl/Moan) in All or More Than One Drive Modes

Possible Component	Reference/Action
· Axle bearings	· INSPECT differential and pinion bearings. INSTALL new bearings.

Diagnostic Routine — Noise (Clunk) on Changes in Speed or Direction of Power

Possible	

Component	Reference/Action
· Axle and pinion system	· MEASURE total backlash. If end play and total backlash are within specification, INSTALL a new differential case assembly.
· Differential pinion shaft	· INSTALL a new differential pinion shaft and pin.
· Pinion bearings	· INSTALL new pinion and differential bearings and bearing cups.

Diagnostic Routine — Front Axle Will Not Engage/Disengage

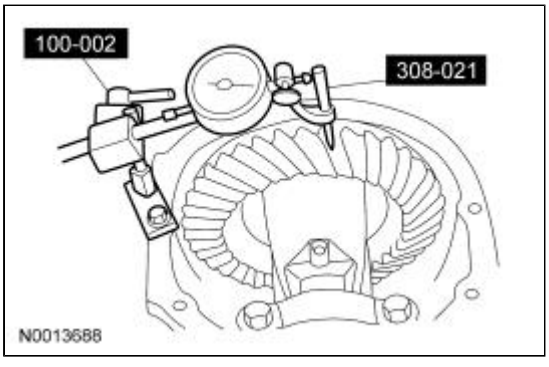
Possible Component	Reference/Action
· Mode switch Wiring Shift motor	· REFER to Section 308-07A .

Diagnostic Routine — Vibration

Possible Component	Reference/Action
· For driveline vibration, REFER to Section 100-04 .	

Checking Differential Ring Gear Backlash

1. Remove the differential housing cover.
2. Using a suitable dial indicator and the special tool, measure and record the differential ring gear backlash in 4 opposing points on the ring gear.

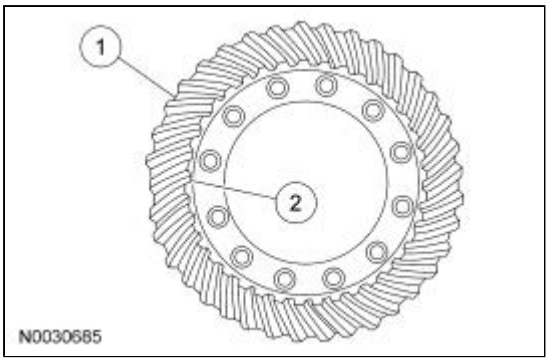


Checking Tooth Contact Pattern and Condition of the Ring and Pinion

There are 2 basic types of conditions that will produce ring and pinion noise. The first type is a howl or chuckle produced by broken, cracked, chipped, scored or forcibly damaged gear teeth and is usually quite audible over the entire speed range. The second type of ring and pinion noise pertains to the mesh pattern of the gear pattern. This gear noise can be recognized as it produces a constant pitch or whine. Ring and pinion noise tends to peak in a narrow speed range or ranges, and will tend to remain constant in pitch.

NOTE: In the following steps, the movement of the contact pattern along the length is indicated as

toward the "heel" or "toe" of the differential ring gear.



Item	Description
1	Heel
2	Toe

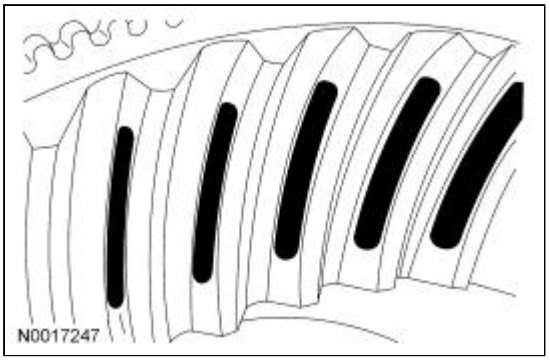
Apply a marking compound to a third of the gear teeth on the differential ring gear. Rotate the differential ring gear several complete turns in both directions until a good, clear tooth pattern is obtained. Compare the contact patterns on the ring gear teeth with the following illustrations.

Good Contact Pattern

Pattern inspection allows the technician to detect gross errors in set up prior to complete assembly of the differential assembly. Pattern contact should be within the primary area of the ring gear tooth section. Avoid narrow or hard contact with the outer perimeter of the ring gear tooth. Pattern inspection should be on the drive side of the tooth. Correct assembly of the drive pattern will result in satisfactory coast performance.

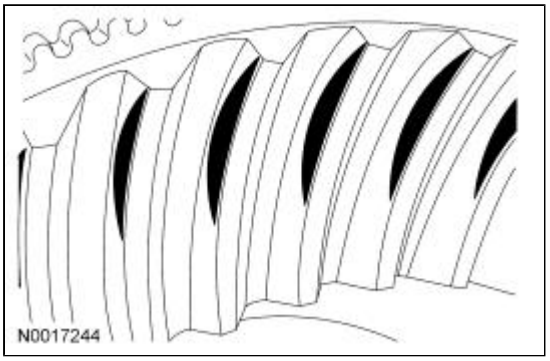
NOTE: If a gross pattern error is detected with the correct backlash, check the pinion shim selection.

Good Contact Pattern



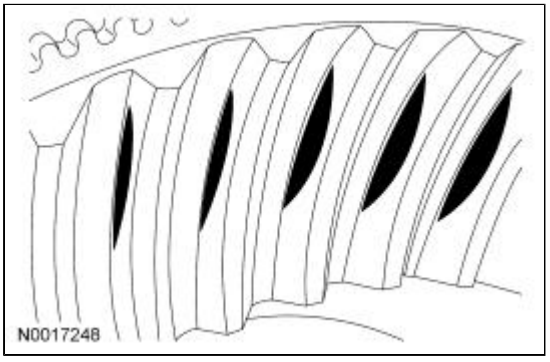
Low Contact Pattern That Is Contacting More Toward the Heel

Gross Pattern Error



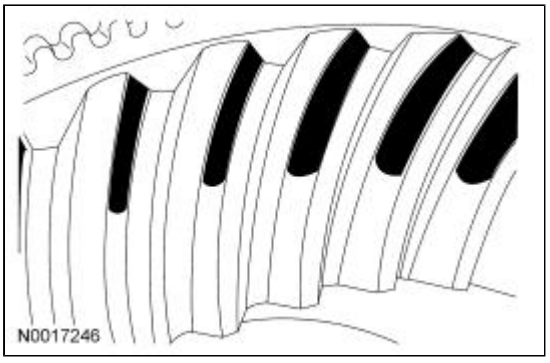
High, Thin Contact Pattern In the Center Of the Tooth

Gross Pattern Error



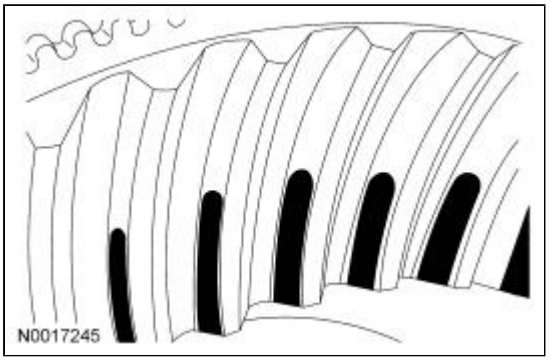
Thick Contact Pattern That Is Contacting Tooth Toward the Heel

Gross Pattern Error



Thick Contact Pattern That Is Contacting Tooth Toward the Toe

Gross Pattern Error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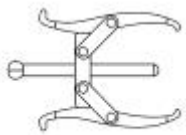
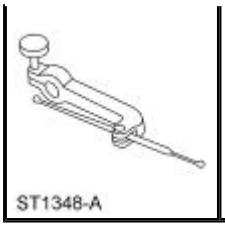
Differential Case Runout Check

Printable View (308 KB)

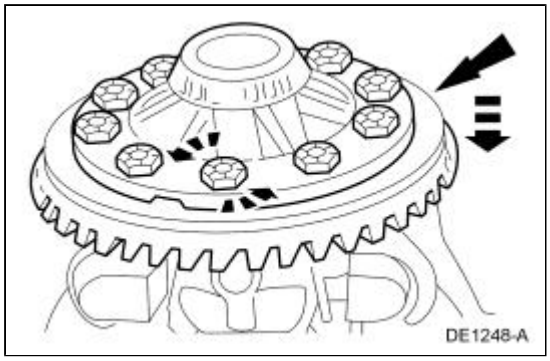
Special Tool(s)

 ST1321-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST1214-A	Dial Indicator With Holding Fixture 100-002 (TOOL-4201-C)
ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)
ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A)
ST1437-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST2043-A	Step Plate 205-D061 (D83T-4205-C2)
	Gauge, Clutch Housing 308-021 (T75L-4201-A)



1. Remove the differential carrier. For additional information, refer to Differential Carrier in this section.

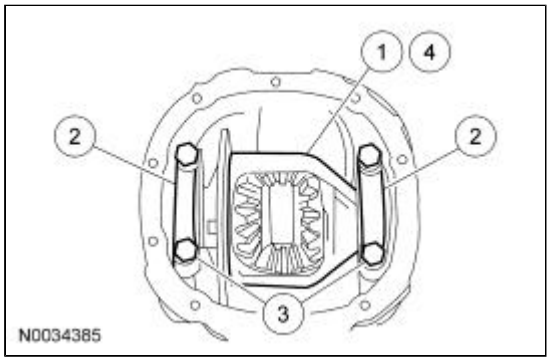
2. Remove the ring gear.
   - Remove the 10 bolts.
   - Use a drift punch to separate the ring gear from the differential case.



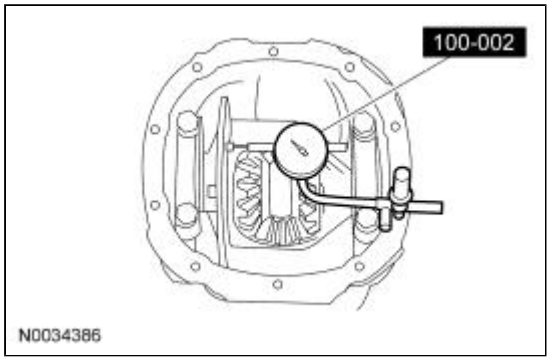
3. **NOTE:** Visually inspect the differential bearing cups and cones for discoloration indicating bearing overheating or failure.

   NOTE: It may be necessary to use the Differential Carrier Spreader to carry out this step.

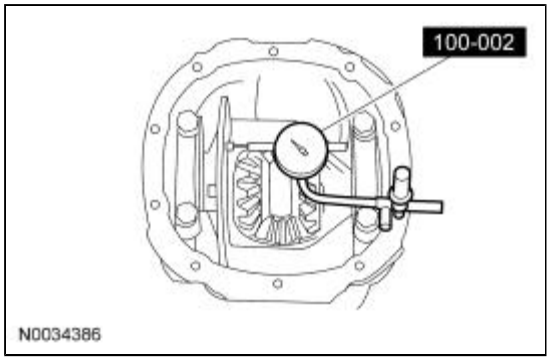
   Install the differential case with the bearing cups and all the shims in the housing.
   1. Position the differential case with the bearing cups and shims in their original location.
   2. Install the bearing caps.
   3. Install the bolts.
   4. Rotate the differential case to make sure the bearings have seated correctly.



4. Install the special tool.

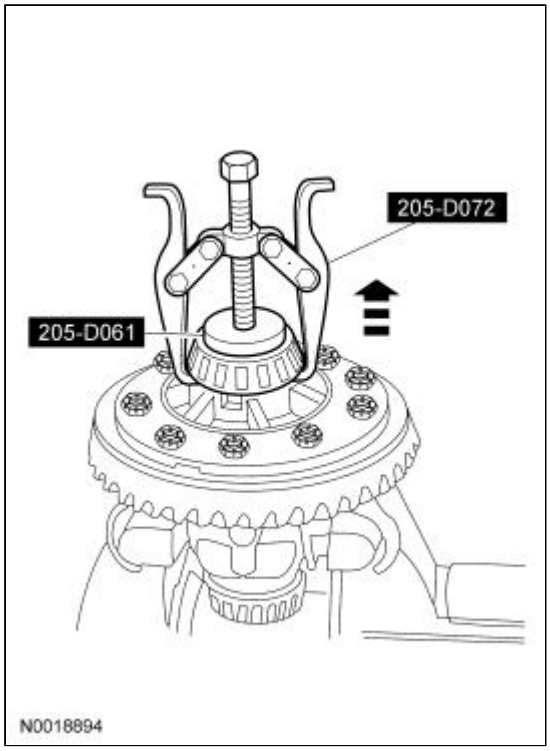


5. Rotate the differential case and check the differential case runout.
    - If the runout does not exceed the specification, install a new ring gear and pinion.
    - If runout exceeds the specification, the ring gear is true and the condition is due to differential case/differential bearing damage.
        - Inspect the differential bearings and the differential case. Always install new differential bearings when installing a new differential case, or if a bearing condition is questionable.



6. Remove the bearing caps and the differential case with the bearing cups and shims from the housing.

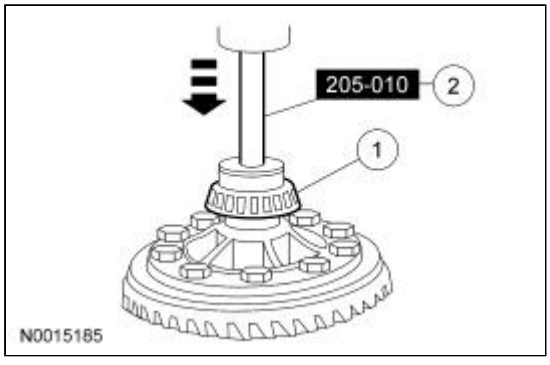
7. If necessary, using the special tools, remove the differential bearings.



8. **CAUTION: Press against the differential bearing inner cone only.**

Install the new differential bearings.

1. Position the appropriate differential bearing (RH or LH).
2. Using a suitable press and the special tool, install the differential bearing.
   - Repeat the steps for the other differential bearing.

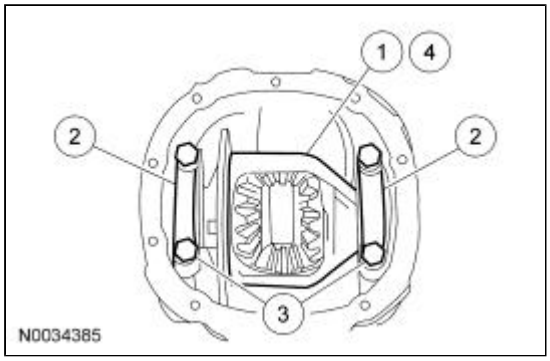


9. **NOTE:** It may be necessary to use the Differential Carrier Spreader to carry out this step.

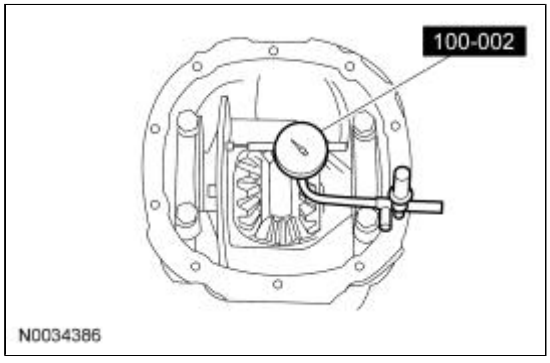
NOTE: Recheck the flange runout.

Install the differential case with the bearing cups and the shims in the housing.

1. Position the differential case with the bearing cups and shims in their original locations.
2. Install the bearing caps.
3. Install the bolts.
4. Rotate the differential case to make sure the bearings have seated correctly.

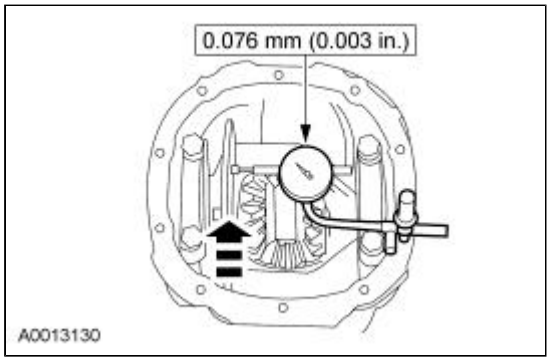


10. Install the special tool.

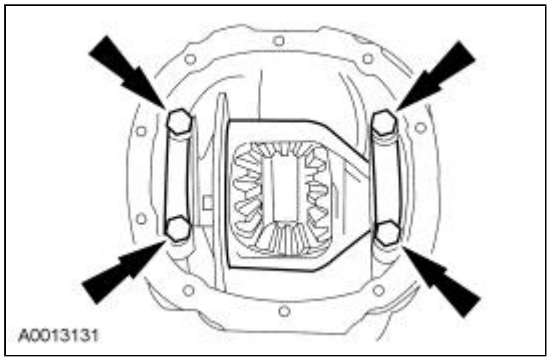


11. **NOTE:** If the runout is still excessive, install a new differential case.

    Check the runout with the new differential bearings. If the runout does not exceed the specification, use the new differential bearings for assembly.

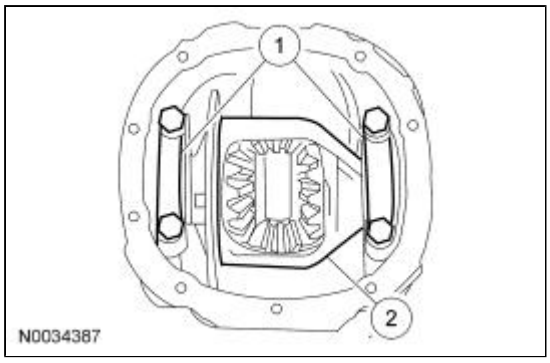


12. Remove the bolts.



13. Remove the differential case with the bearing cups and the shims from the housing.
    1. Remove the bearing caps.

2. Remove the differential case with the bearing cups and the shims from the housing.



14. Install the ring gear. For additional information, refer to Differential Ring And Pinion in this section.
15. Install the differential carrier. For additional information, refer to Differential Carrier in this section.

Drive Pinion Seal

Printable View (106 KB)

Special Tool(s)

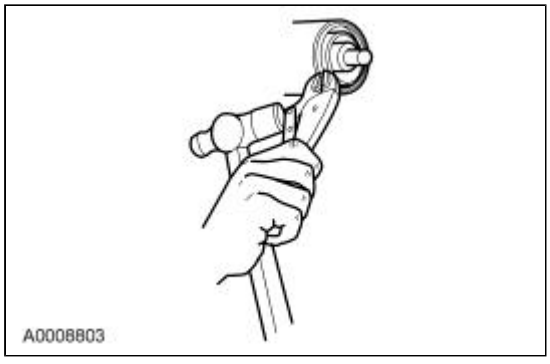
ST1358-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Removal

1. Remove the front axle universal joint flange. For additional information, refer to Universal Joint Flange in this section.

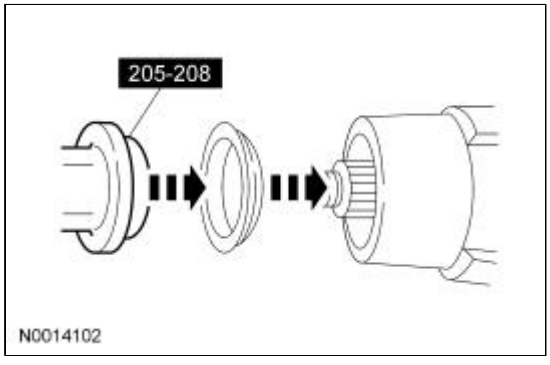
2. **CAUTION: Do not damage the front axle housing.**

   Force up on the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer to remove the pinion seal.



Installation

1. Clean the pinion seal bore and use the Drive Pinion Oil Seal Installer to install the pinion seal.

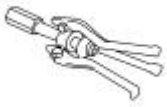
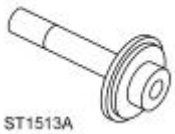


2. Install the front axle universal joint flange. For additional information, refer to Universal Joint Flange in this section.

Stub Shaft Pilot Bearing and Seal

Printable View (189 KB)

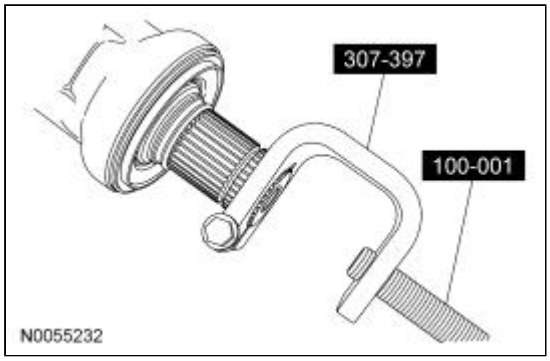
Special Tool(s)

ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
ST1326-A	Handle 205-D055 (D81L-4000-A)
ST2369-A	Installer, Wheel Speed Sensor Ring 206-034 (T88P-20202-B)
 ST1513A	Installer, Axle Shaft Oil Seal 205-123 (T78P-1177-A)
ST2891-A	Remover, Transmission Fluid Pump 307-397

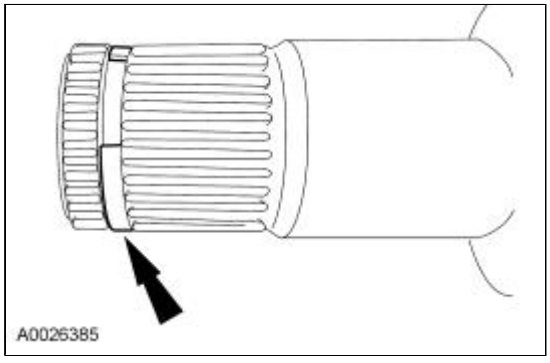
Removal

NOTE: Install a new stub shaft seal whenever a halfshaft is removed.

1. Remove the front drive halfshafts. For additional information, refer to Section 205-03 .
2. Using the special tools, remove the intermediate shaft.

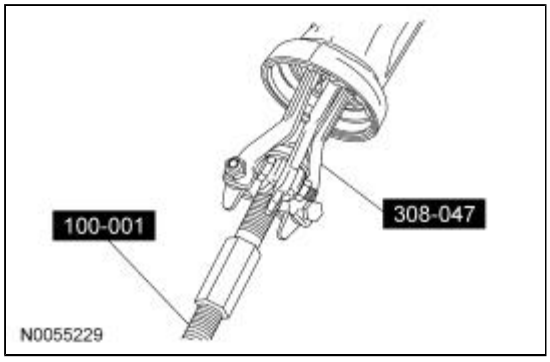


3. Remove and discard the intermediate shaft circlip and O-ring.



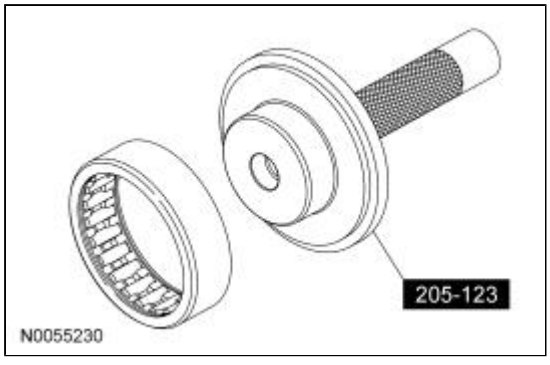
4. Using a suitable seal remover, remove and discard the stub shaft pilot bearing oil seal.

5. Using the special tools, remove and discard the stub shaft pilot bearing.

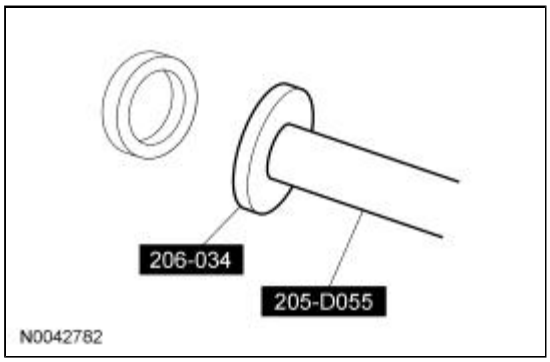


Installation

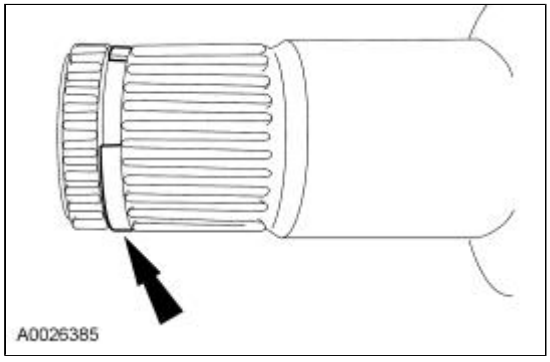
1. Position the stub shaft pilot bearing in the axle tube or differential housing bore and using the special tool, install the bearing.



2. Carefully align the stub shaft pilot bearing oil seal with the housing bore and install the stub shaft bearing oil seal flush in the housing using the special tools.



3. Install a new O-ring and new circlips on the intermediate shaft ends.



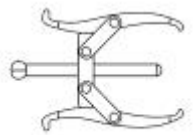
4. Insert the intermediate shaft and engage the circlip with the differential side gear.

5. Install the front drive halfshafts. For additional information, refer to Section 205-04 .

Universal Joint Flange

Printable View (275 KB)

Special Tool(s)

 ST1321-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1800-A	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)

Material

Item	Specification
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada) (Model 60/70 axles)	WSP-M2C197-A

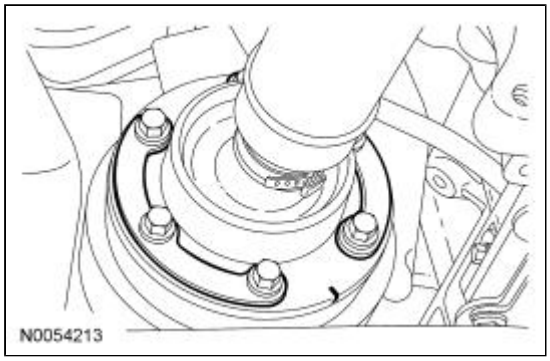
Removal

CAUTION: This operation disturbs the pinion bearing preload. Carefully reset the preload during assembly.

1. Position the vehicle on a hoist. For additional information, refer to Section 100-02 .
2. **CAUTION: Remove the front brake caliper to prevent drag during the drive pinion bearing preload adjustment.**

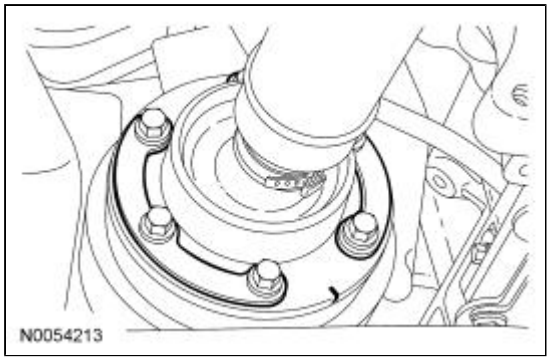
   CAUTION: Do not allow the calipers to hang from the brake hoses.

   Remove the front brake calipers. Wire the caliper aside. For additional information, refer to Section 206-03 .
3. Index-mark the front driveshaft to the axle universal joint flange.

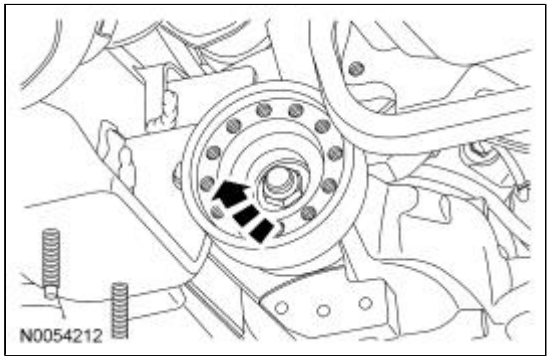


4. **CAUTION: Do not allow the driveshaft to hang unsupported.**

   Disconnect and support the front driveshaft.
   - Remove and discard the 6 bolts and 3 washers.
   - Carefully disconnect and support the front driveshaft.

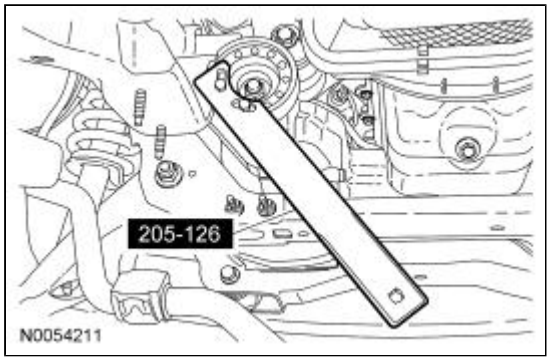


5. Using a Nm (inch/pound) torque wrench, measure the torque necessary to maintain pinion rotation. Record the measurement for reference during installation.

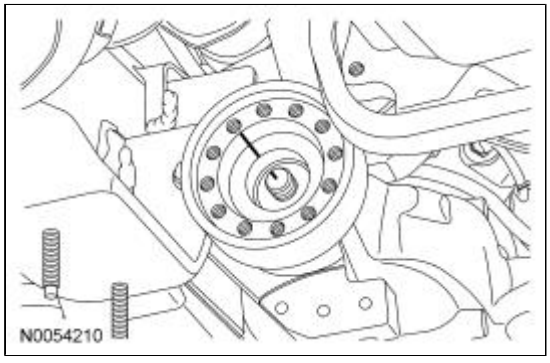


6. **CAUTION: After removing the pinion nut, discard it. Use a new pinion nut for installation.**

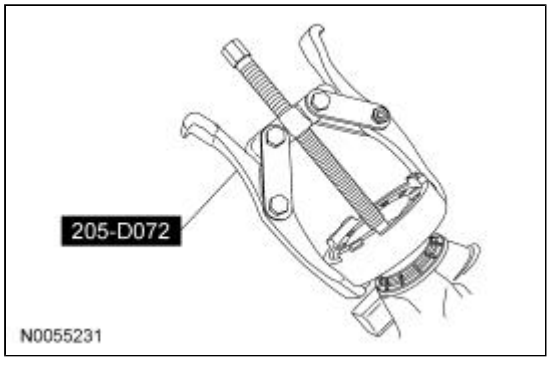
   Install the special tool and remove the pinion nut.



7. Index-mark the axle universal joint flange to the pinion stem.



8. Using the special tool, separate the axle universal joint flange from the pinion gear.



9. Remove the flange.

10. Inspect the axle universal joint flange for burrs, the nut counterbore and the seal contact surface for nicks, and the bearing cone contact area for damage. Install a new flange if necessary.

11. Check the pinion stem splines for burrs. If burrs are evident, remove them with a fine crocus cloth.

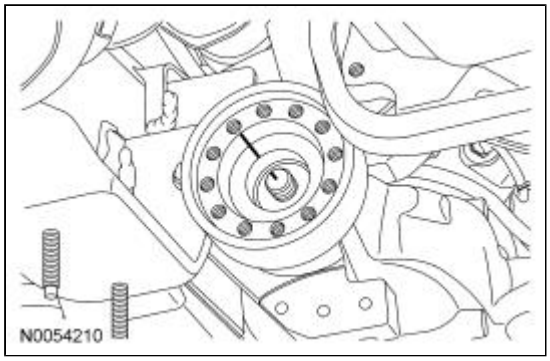
Installation

1. Lubricate the axle universal joint flange splines and the pinion seal.
   - Use front axle lubricant.

2. **CAUTION: Never install the axle universal joint flange with a hammer or power tools.**

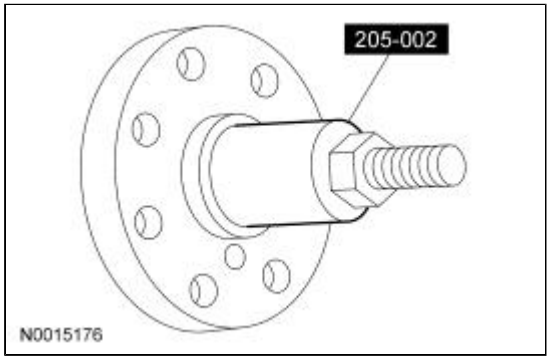
   NOTE: Disregard the scribe marks if installing a new flange.

   Align the index marks and position the axle universal joint flange on the pinion shaft.



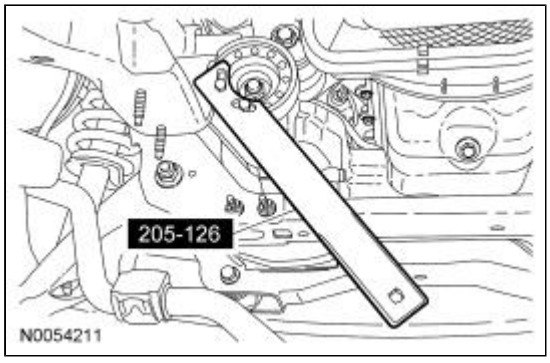
3. **NOTE:** Rotate the pinion gear occasionally to make sure the pinion bearings seat correctly.

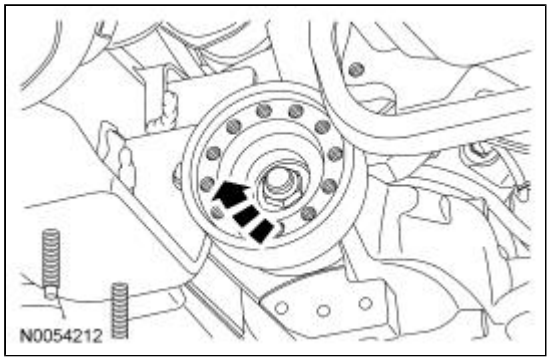
   Using the special tool, install the axle universal joint flange.



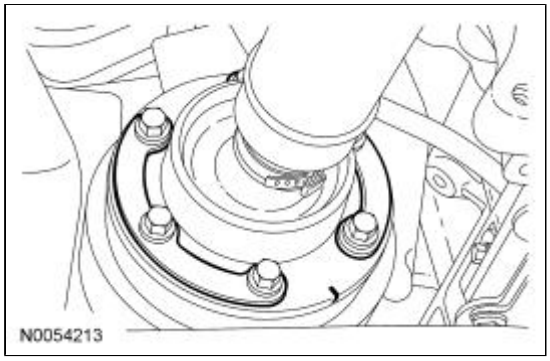
4. **CAUTION: Do not loosen the pinion nut to reduce preload under any circumstance. If it is necessary to reduce preload, install a new drive pinion collapsible spacer and pinion nut.**

   Install the special tool and tighten the pinion nut. Refer to the torque specifications for used bearings in the Specifications portion of this section.
   - Rotate the pinion gear occasionally to make sure the pinion bearings are seating correctly. Take frequent pinion bearing torque preload readings by rotating the pinion gear with a Nm (inch/pound) torque wrench.
   - If the preload recorded prior to disassembly is lower than the specification for used bearings, then tighten the pinion nut to the specification. If the preload recorded prior to disassembly is higher than the specification for used bearings, then tighten the pinion nut to the original reading as recorded.





5. Align the index marks then attach the front driveshaft. Refer to Section 205-01 for driveshaft fastener tightening specifications.



6. Inspect and, if necessary, fill the differential.
   - Use rear axle lubricant.

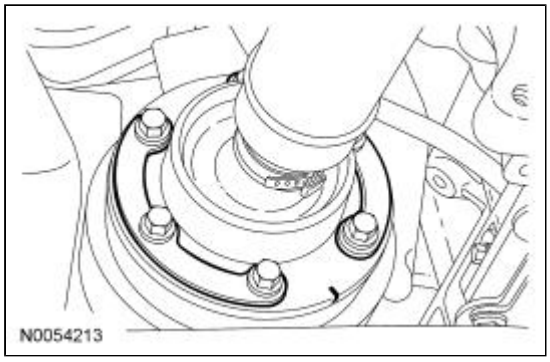
7. Lower the vehicle.

Axle Assembly

Printable View (280 KB)

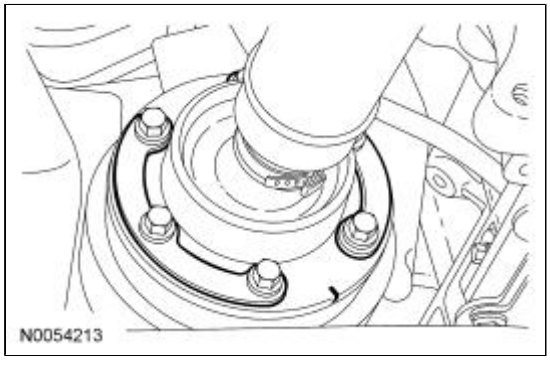
Removal

1. Position the vehicle on a hoist. For additional information, refer to Section 100-02 .
2. Index-mark the front driveshaft to the universal joint drive pinion flange.



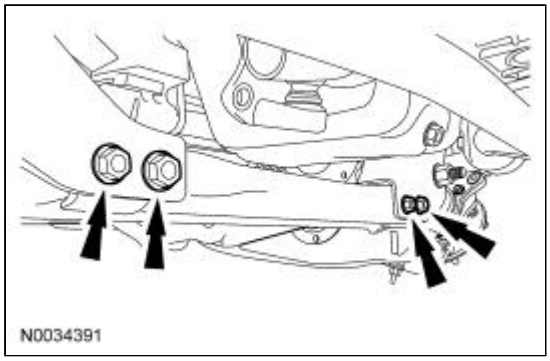
3. **CAUTION: Do not allow the driveshaft to hang unsupported.**

   Disconnect and support the front driveshaft. Discard the bolts and washers.
   - To install, tighten to 112 Nm (83 lb-ft).

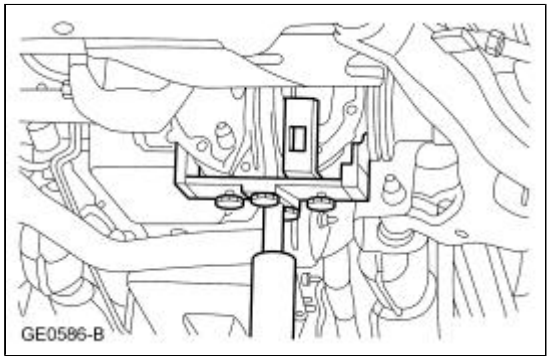


4. **CAUTION: Do not allow the halfshaft to hang unsupported.**

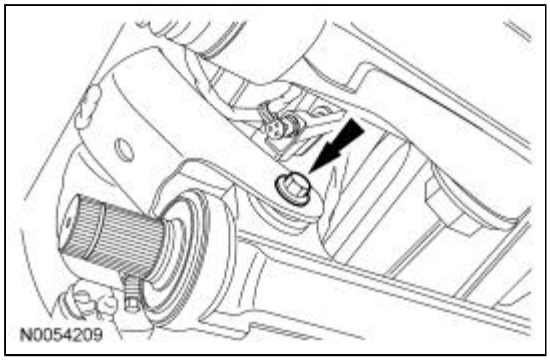
   Remove the halfshafts. Refer to Section 205-04 .
5. Remove the 4 crossmember bolts and the crossmember.
   - To install, tighten to 90 Nm (66 lb-ft).



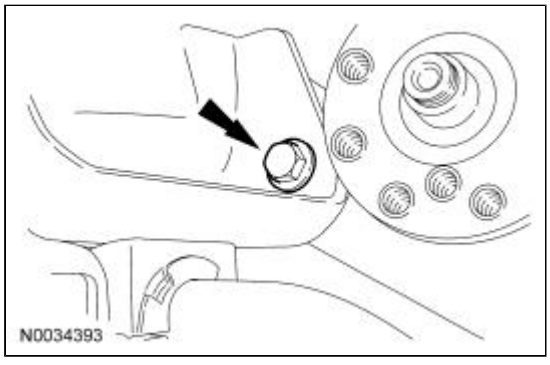
6. Use a high-lift jack to support the axle assembly.



7. Remove the axle housing tube isolator nut and bolt.
    - To install, tighten to 150 Nm (111 lb-ft).

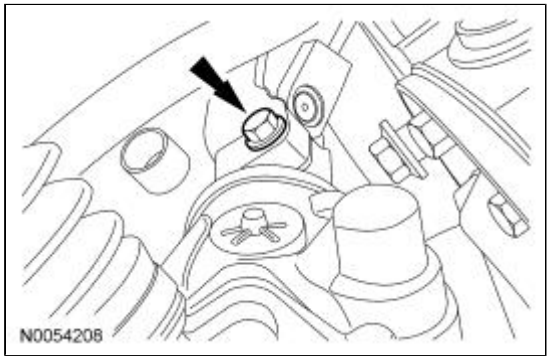


8. Remove the front mounting isolator bolt.
    - To install, tighten to 150 Nm (111 lb-ft).

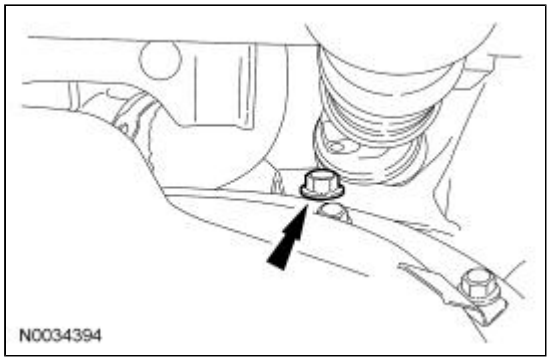


9. Remove the bolt from the lower steering shaft-to-steering gear and disconnect the coupler from the rack.

- To install, tighten to 30 Nm (22 lb-ft).



10. Remove the upper mounting insolator bolt.
    - To install, tighten to 150 Nm (111 lb-ft).



11. Carefully lower the front drive axle assembly.

12. Disconnect the vent hose from the axle vent barbed fitting.

Installation

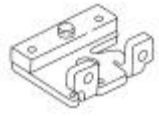
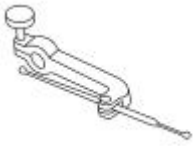
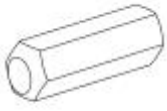
NOTE: Make sure the axle vent hose is connected.

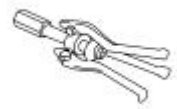
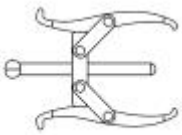
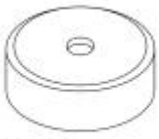
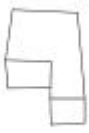
1. To install, reverse the removal procedure.

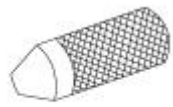
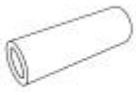
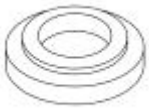
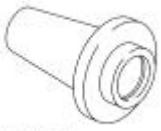
Differential Ring And Pinion

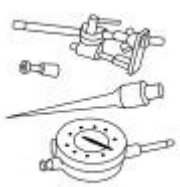
Printable View (1189 KB)

Special Tool(s)

ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A) (RH)
ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)
 ST1150-B	Adapter For Differential Housing Spreader 205-368 (T96T-4000-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1882-A	Protector, Drive Pinion Thread 205-460
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
	Remover, Bearing Cup 308-047 (T77F-1102-A)

 ST1200-A	
 ST1321-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST2043-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
ST1357-A	Installer, Differential Carrier Bearings 205-D044 (D81T-4221-A) or equivalent
ST1361-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
 ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
	Adapter for 205-S127 205-111 (T76P-4020-A11)

 ST1432-A	
 ST1433-B	Adapter for 205-S127 205-129 (T79P-4020-A18)
 ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
 ST1484-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)
 ST1800-A	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1437-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)

 ST1214-A	

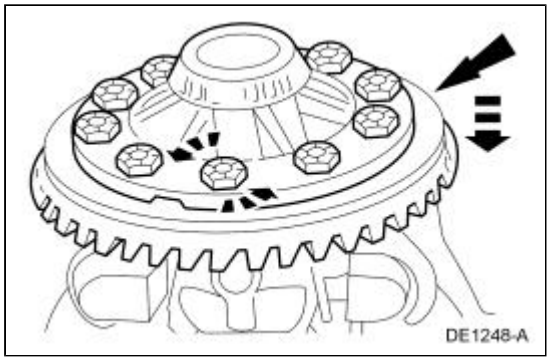
Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada); (Model 60/70 axles)	WSP-M2C197-A
Stud and Bearing Mount TA-27	WSK-M2G349-A1

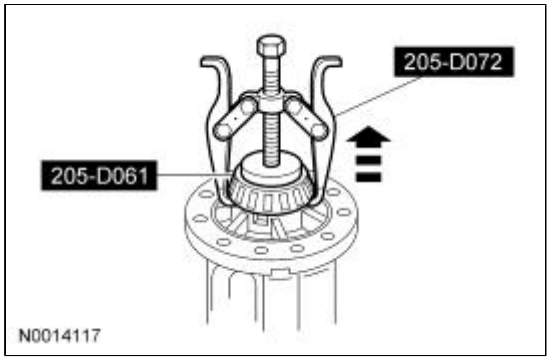
Removal

1. Remove the differential carrier. For additional information, refer to Differential Carrier in this section.

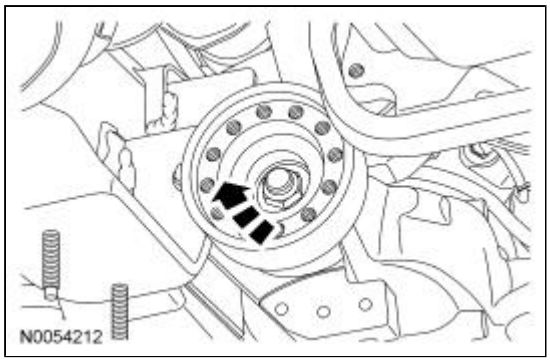
2. Remove the 10 differential ring gear bolts and the differential ring gear.
   - Use a drift punch to separate the differential ring gear from the differential case.



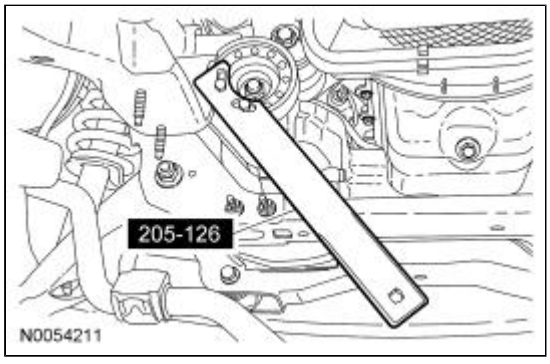
3. Using the special tools, remove the 2 differential bearings.



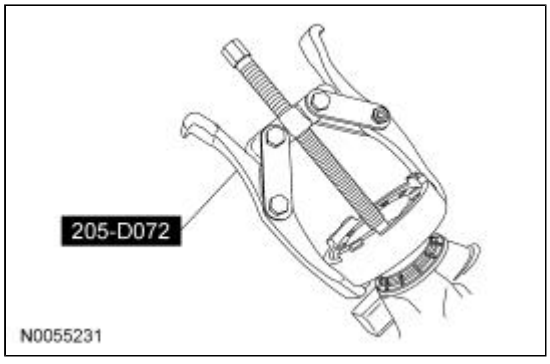
4. Index-mark the pinion flange to the drive pinion gear.



5. Install the special tool and loosen, but do not remove, the pinion nut.
    - Remove the special tool.



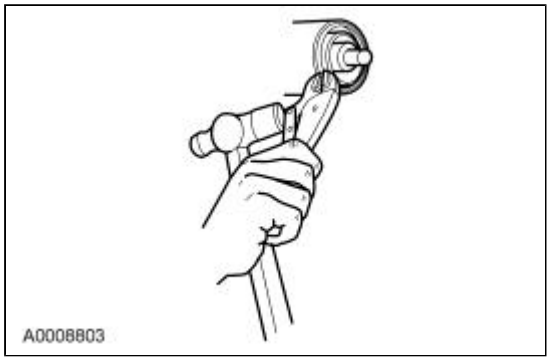
6. With the pinion nut still engaged by a few threads, use the special tool to separate the pinion flange from the drive pinion gear.



7. Remove the pinion nut and the pinion flange.

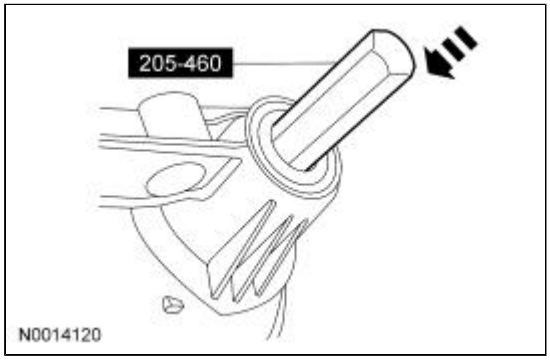
8. **CAUTION: Do not damage the axle housing while removing the drive pinion seal.**

    Remove the drive pinion seal and drive pinion oil slinger.
    - Pry up on the drive pinion seal flange. Install gripping pliers, and strike with a hammer to remove the drive pinion seal.

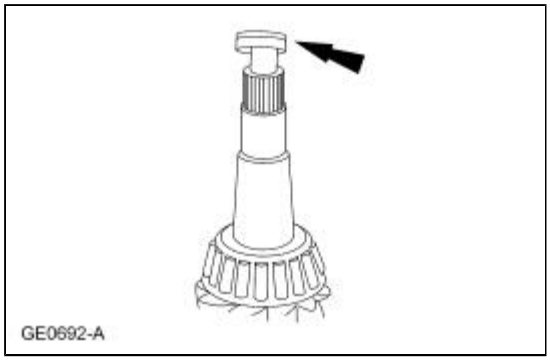


9. Remove the outer drive pinion bearing.

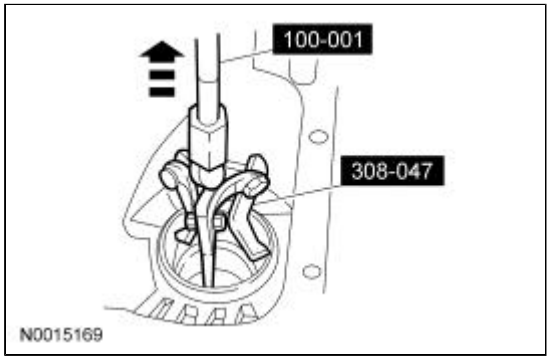
10. Using the special tool and a soft hammer, remove the drive pinion gear.



11. Remove and discard the drive pinion collapsible spacer.

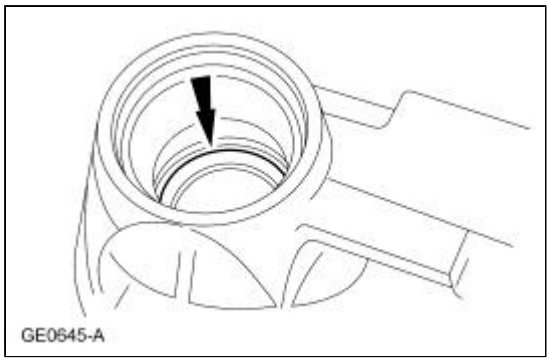


12. Using the special tools, remove the inner drive pinion bearing cup.

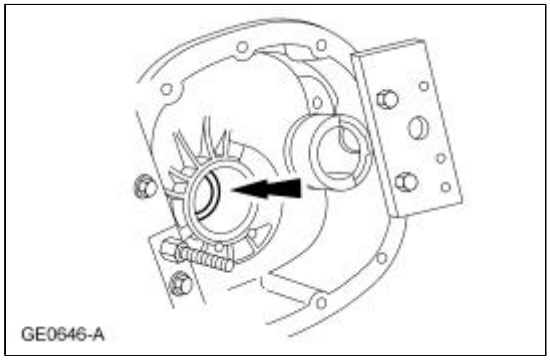


13. **NOTE:** The pinion bearing oil baffle aids in bearing lubrication. Normally, it is not necessary to remove the baffle.

If necessary, remove the pinion bearing oil baffle.



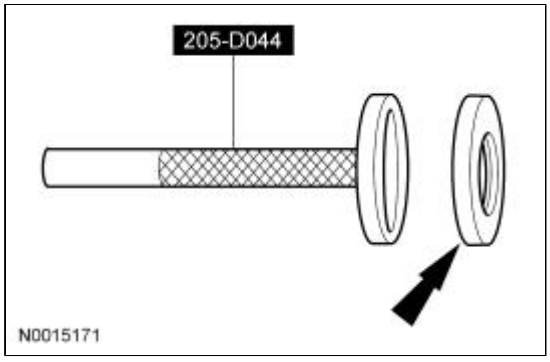
14. Remove the outer drive pinion bearing cup by tapping alternately on each side to prevent the drive pinion bearing cup from becoming misaligned.



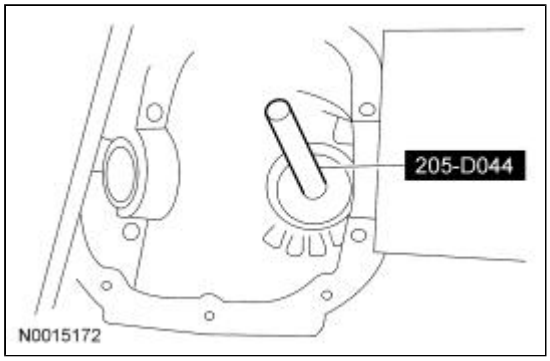
Installation

1. **CAUTION: Do not omit the drive pinion bearing oil baffle or drive pinion bearing failure can result.**

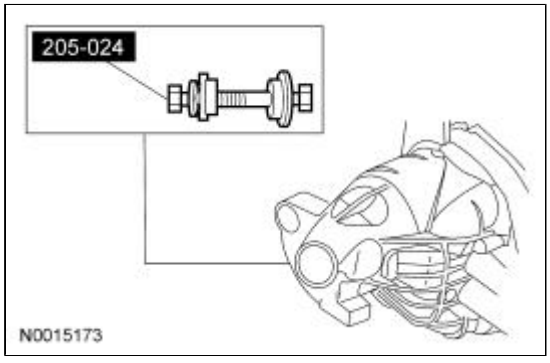
   If removed, position the drive pinion bearing oil baffle on the special tool.



2. Using the special tool, install the drive pinion bearing oil baffle.



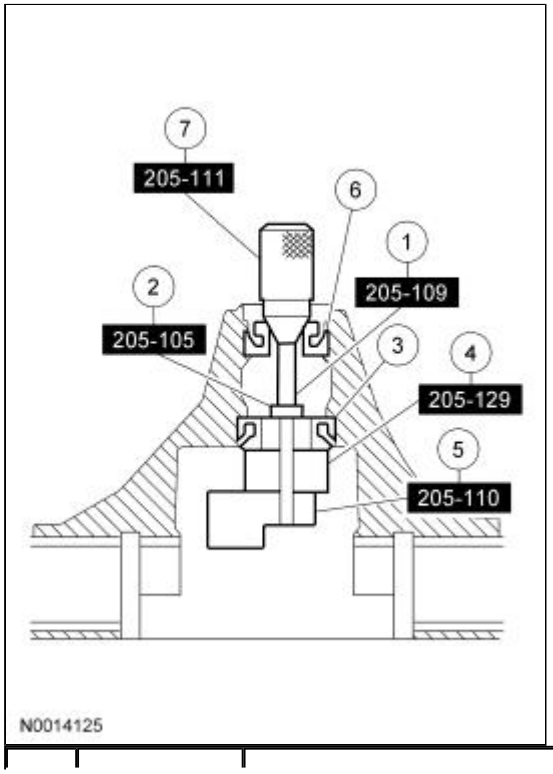
3. Using the special tool, install the drive pinion bearing cups.



4. **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

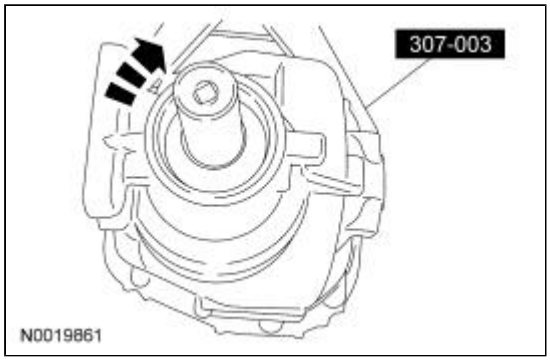
   Assemble and position the special tools.



Item	Part Number	Description
1	205-109	Adapter for 205-S127 (T76P-4020-A9)
2	205-105	Adapter for 205-S127 (1.612 inch O.D.) (T76P-4020-A3)
3	4630	Drive pinion bearing (inner)
4	205-129	Adapter for 105-S127 (1.1884 inch thick) (T79P-4020-A18)
5	205-110	Adapter for 205-S127 (1.7 inch thick) (T76P-4020-A10)
6	4621	Drive pinion bearing (outer)
7	205-111	Adapter for 205-S127 (T76P-4020-A11)

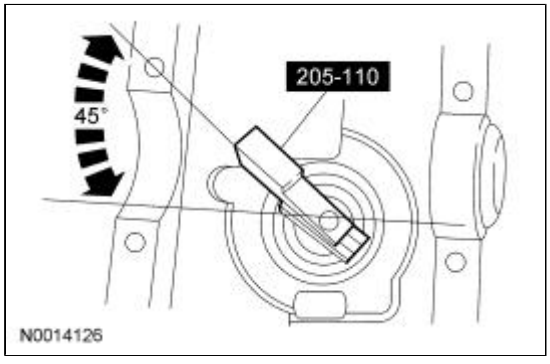
5. **NOTE:** This step duplicates final drive pinion bearing preload.

   Tighten the special tool.
   - Tighten to 2.2 Nm (20 lb-in).

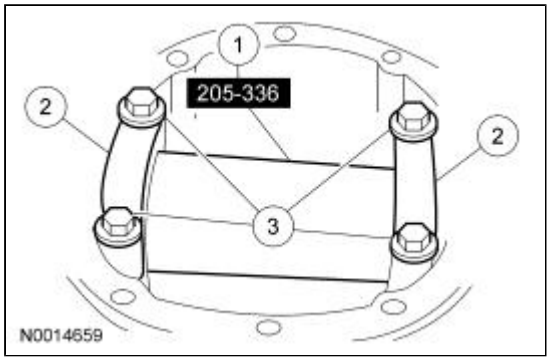


6. **NOTE:** The special tool must be offset to obtain an accurate reading.

   Rotate the special tool several half-turns to make sure of correct seating of the drive pinion bearings and position the special tool.



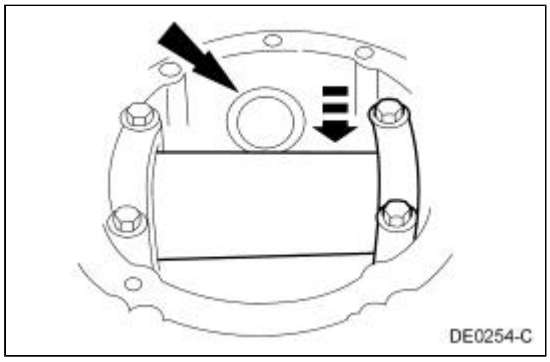
7. Install the special tool.
   1. Position the special tool.
   2. Install the differential bearing caps.
   3. Install the 4 differential bearing cap bolts.
      - Tighten to 105 Nm (77 lb-ft).



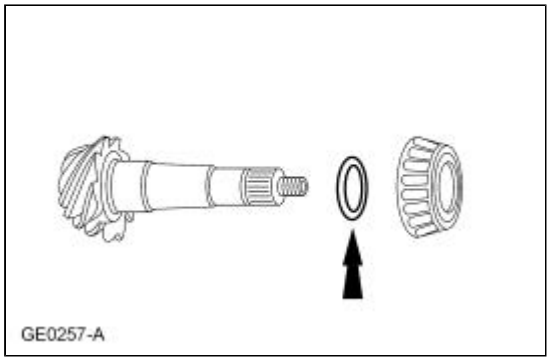
8. **NOTE:** Drive pinion bearing adjustment shims must be flat and clean.

   NOTE: A slight drag should be felt for correct drive pinion bearing adjustment shim selection. Do not attempt to force the drive pinion bearing adjustment shim between the gauge block and the gauge tube. This will minimize selection of a drive pinion bearing adjustment shim thicker than required, which results in a deep tooth contact in final assembly of integral axle assemblies.

   Use a drive pinion bearing adjustment shim as a gauge for drive pinion bearing adjustment shim selection.
   - After the correct drive pinion bearing adjustment shim thickness has been determined, remove all of the special tools.

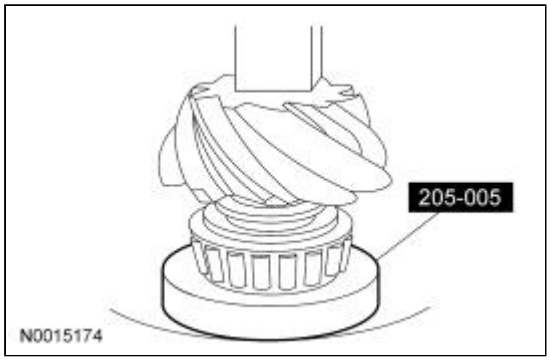


9. Position the drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.

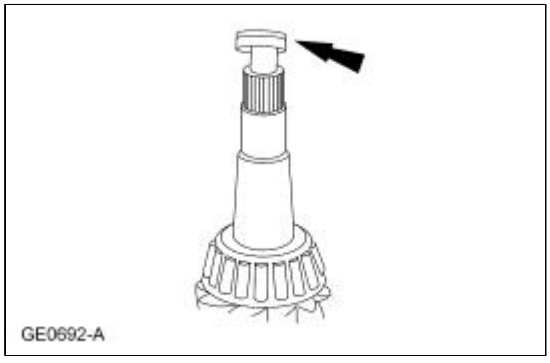


10. **NOTE:** You must use the same drive pinion bearings from the previous steps.

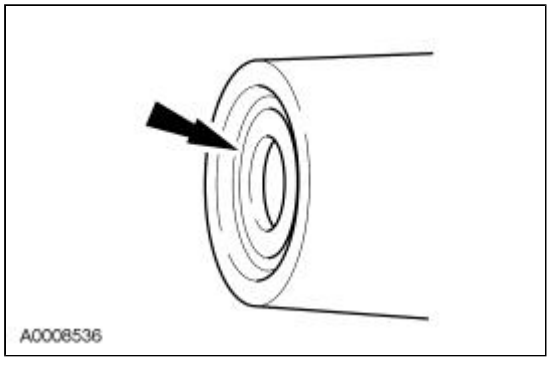
    Install the inner drive pinion bearing.
    - Place the drive pinion bearing adjustment shim on the drive pinion gear.
    - Using a suitable press and the special tool, press the inner drive pinion bearing until it is firmly seated on the pinion gear.



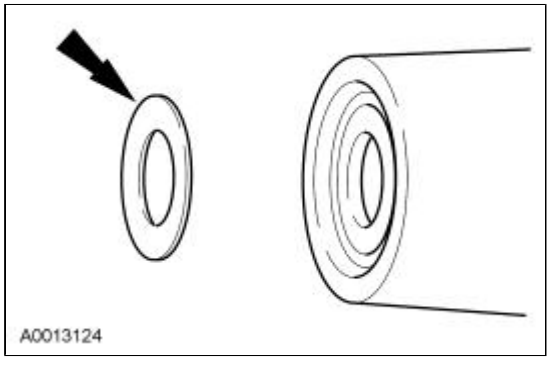
11. Place a new drive pinion collapsible spacer on the drive pinion gear.



12. Install the outer drive pinion bearing.

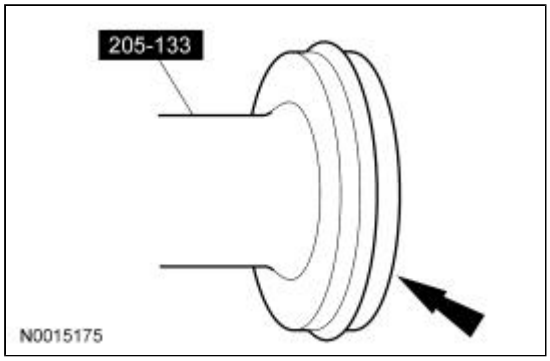


13. Install the drive pinion oil slinger.



14. **NOTE:** Coat the drive pinion seal lips with long-life grease.

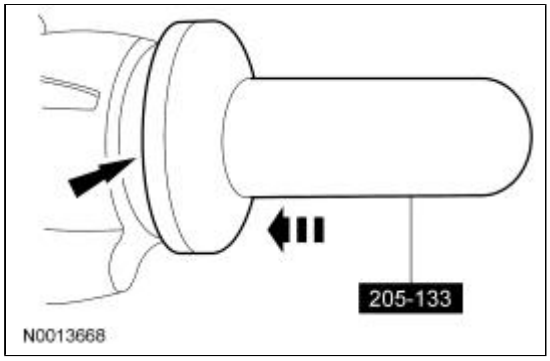
    Install the drive pinion seal on the special tool.



15. **CAUTION: Installation without the correct tool can result in early drive pinion seal failure.**

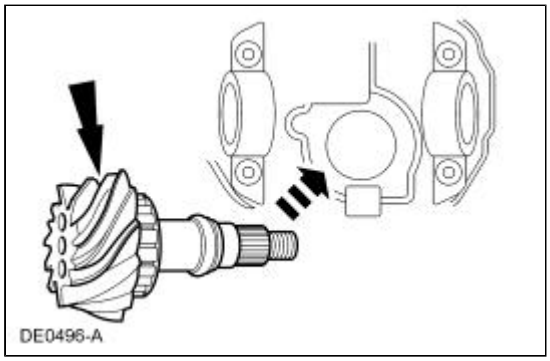
    CAUTION: If the drive pinion seal becomes misaligned during installation, remove it and install a new drive pinion seal.

    Using the special tool, install the drive pinion seal.



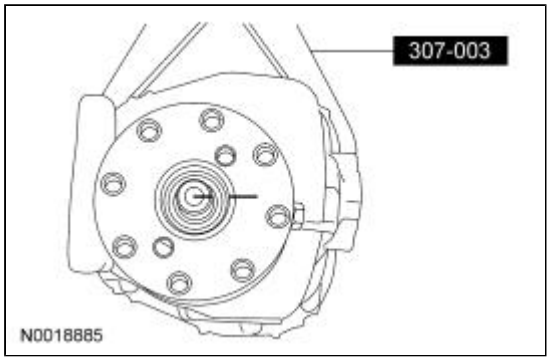
16. Lightly lubricate the drive pinion gear splines with axle lubricant.

17. Position the drive pinion gear in the axle housing.

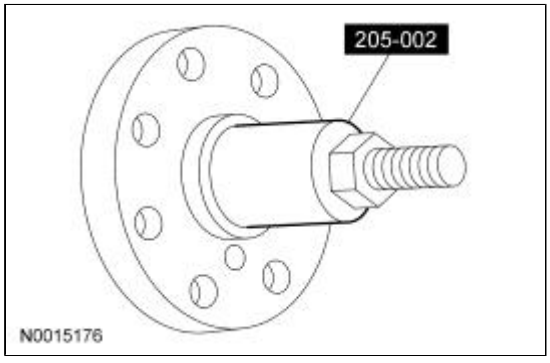


18. **CAUTION: Never install the pinion flange with a hammer or power tools.**

    Position the pinion flange.
    - Position the pinion flange on the drive pinion gear.



19. Using the special tool, install the pinion flange.

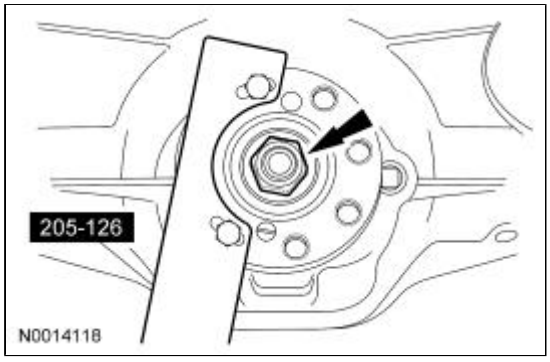


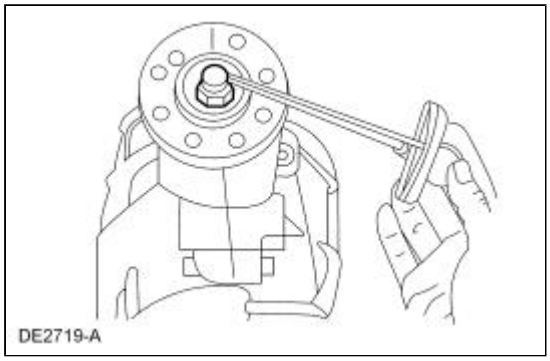
20. Apply a small amount of axle lubricant to the washer side of the new pinion nut and install the new pinion nut.

21. **CAUTION: Do not loosen the pinion nut to reduce drive pinion bearing preload under any circumstance. If it is necessary to reduce drive pinion bearing preload, install a new drive pinion collapsible spacer and pinion nut.**

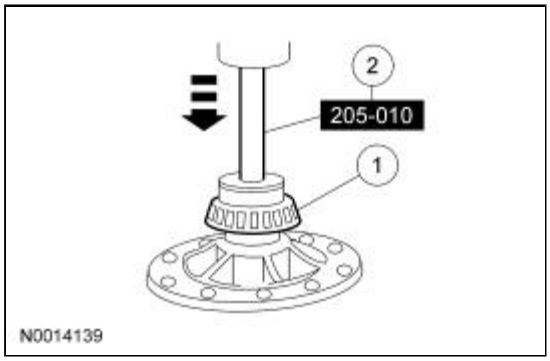
    Install the special tool and tighten the pinion nut. Refer to the torque specifications in the Specifications portion of this section.

    - Rotate the drive pinion gear occasionally to make sure the drive pinion bearings are seating correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.



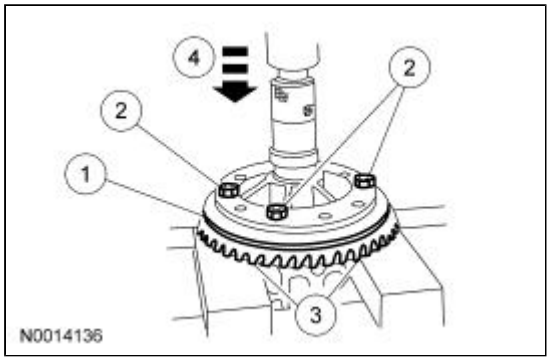


22. Press the left and right differential bearing on the differential carrier.
    1. Position the differential bearing.
    2. Using the special tool, press the differential bearing on the differential carrier.

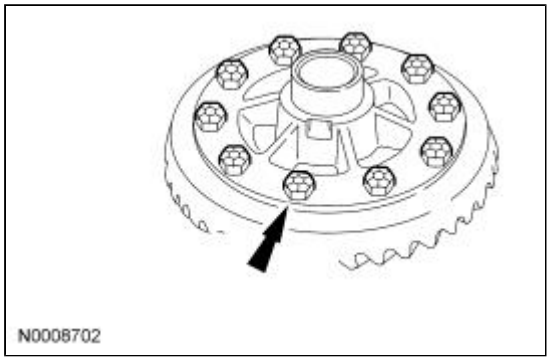


23. **NOTE:** If removed, press the speed sensor ring on with the differential ring gear.

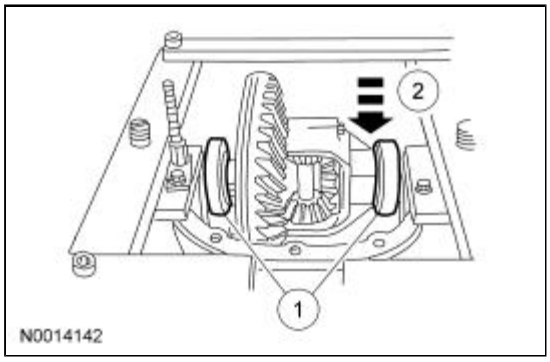
    Install the differential ring gear.
    1. Place the differential ring gear on the differential assembly.
    2. Hand-start 3 ring gear bolts to align the holes in the differential ring gear and the differential assembly.
    3. Place the differential carrier and differential ring gear onto the press bed blocks with the differential ring gear teeth facing downward.
    4. Press the differential ring gear into place.



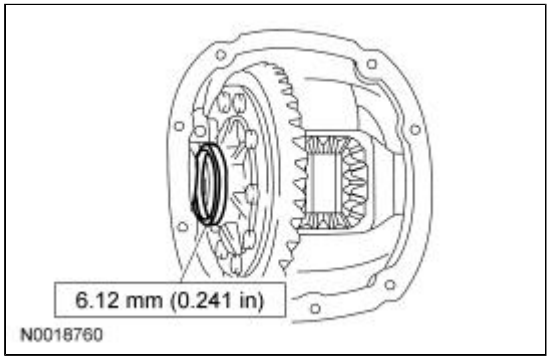
24. Install the ring gear bolts after applying sealer to the bolt threads.
    - Use stud and bearing mount.
    - Tighten to 105 Nm (77 lb-ft).



25. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place.

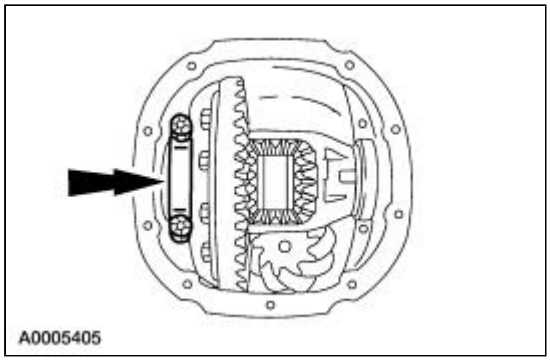


26. Install a differential bearing shim of the thickness shown on the LH side of the differential bearing.



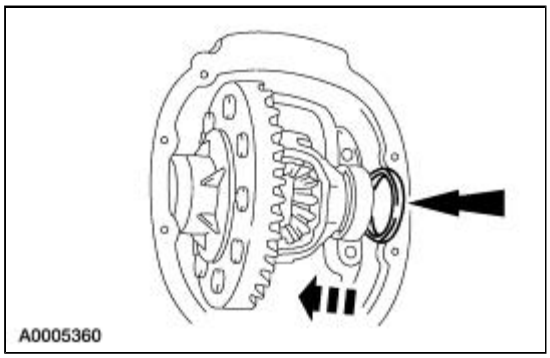
27. **NOTE:** Apply pressure toward the left side to make sure the left bearing cup is seated.

    Install the left bearing cap and loosely install the bearing cap bolts.



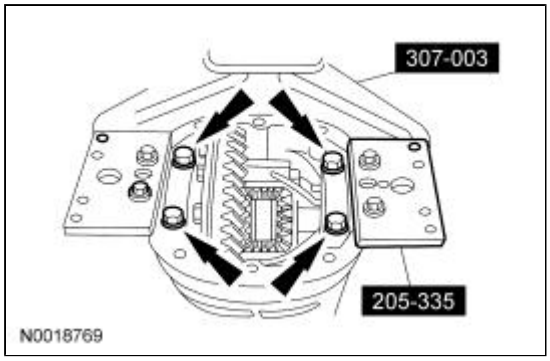
28. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

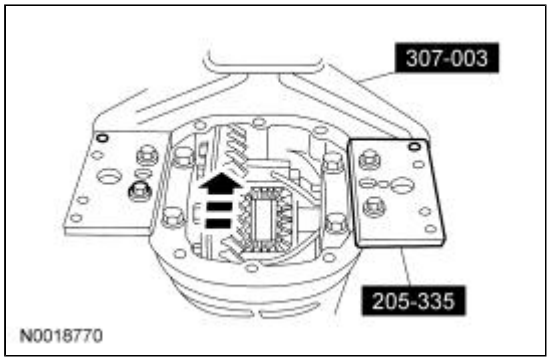


29. Install the right bearing cap and bolts.

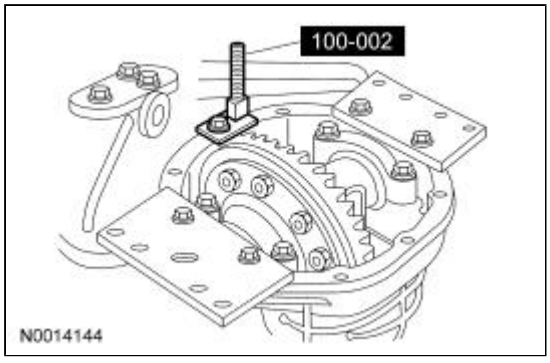
30. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



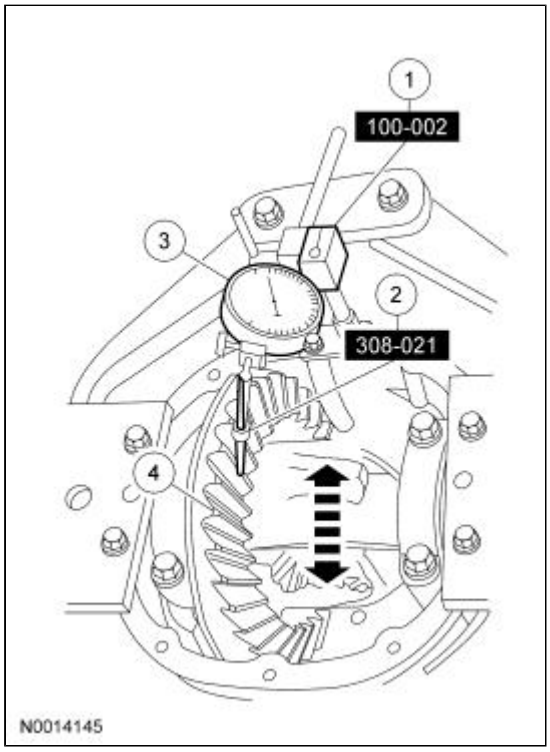
31. Rotate the differential carrier to make sure it turns freely.



32. Install the special tool at the 12 o'clock position.



33. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the special tool.
    2. Position the special tool tip centrally on a drive tooth.
    3. Zero the indicator.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the indicator reading. The allowable backlash is 0.203 mm (0.008 in) to 0.305 mm (0.012 in) and must not vary more than 0.101 mm (0.004 in) between points measured. A backlash variation of more than 0.101 mm (0.004 in) between points checked indicates gear/case runout.
        - To correct for a high or low backlash, proceed as follows.



34. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

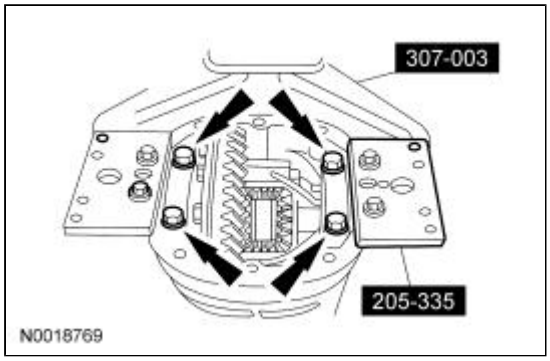
Backlash Change Required		Thickness Change Required	
mm	**Inch**	**mm**	**Inch**
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018

0.381	0.015	0.508	0.020

Differential Shim Size Chart — 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	Inch
2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035
4 — BLU	7.6454- 7.6581	0.3010- 0.3015
3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715
3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515
3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

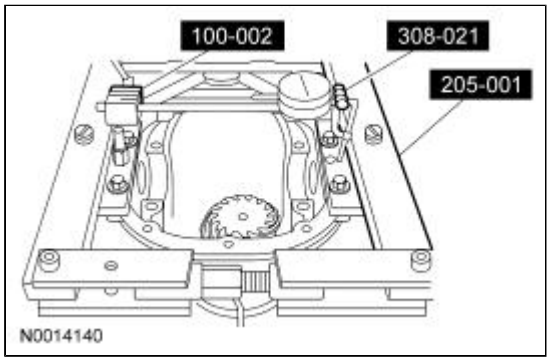
35. Remove the 4 differential bearing cap bolts.
    - Remove the differential carrier.



36. Measure the thickness of the selected right and left bearing shims.

37. To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.203 mm (0.008 in).

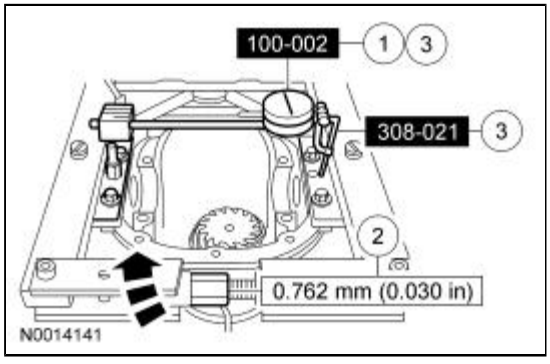
38. Install the special tools.



39. **CAUTION: Overspreading may damage the differential housing.**

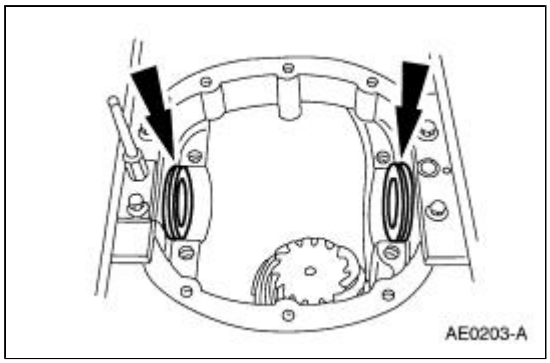
NOTE: Tighten and loosen the differential carrier spreader screw to normalize the housing spreader adapters prior to taking the final dial indicator reading.

Spread the differential housing to the specification.
1. Adjust the special tool to zero.
2. Tighten the screw until spreading the differential housing to the specification.
3. Remove the special tools.

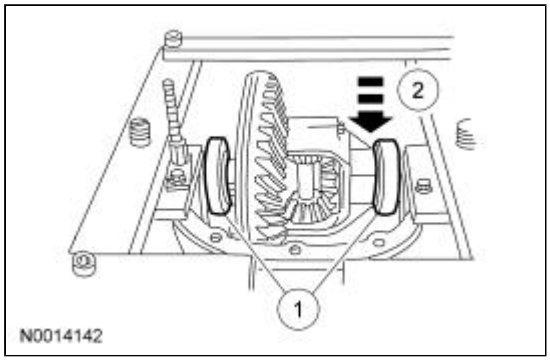


40. **CAUTION: To avoid galling the case, insert shims with a light coating of grease before installing the differential assembly. If not carried out in this order, the aluminum housing can be damaged.**

Place the differential bearing shims in the differential housing.

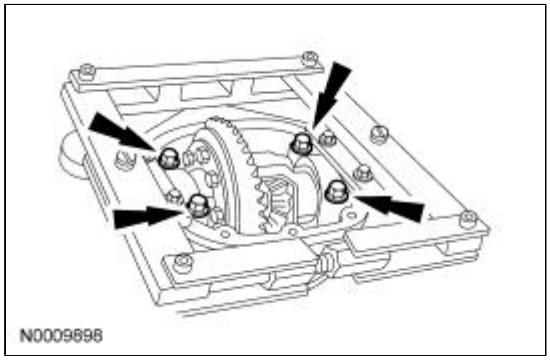


41. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place between the differential bearing shims.

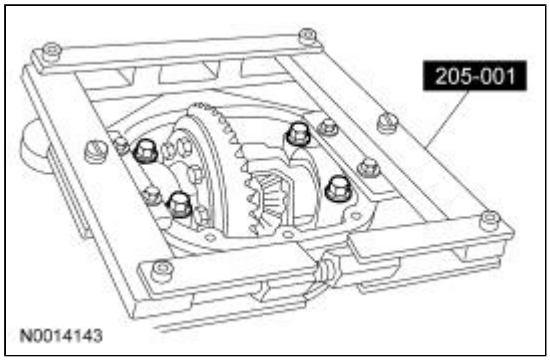


42. **NOTE:** Hand-tighten the differential bearing cap bolts prior to releasing the carrier spreader.

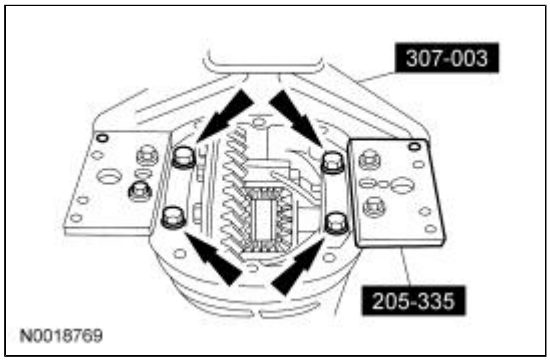
    Install the differential bearing caps and the differential bearing cap bolts in their original locations and positions.



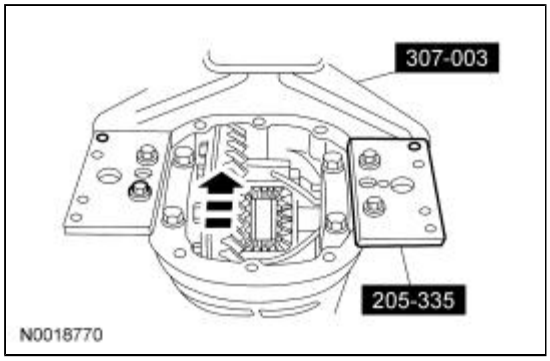
43. Loosen and remove the special tool.



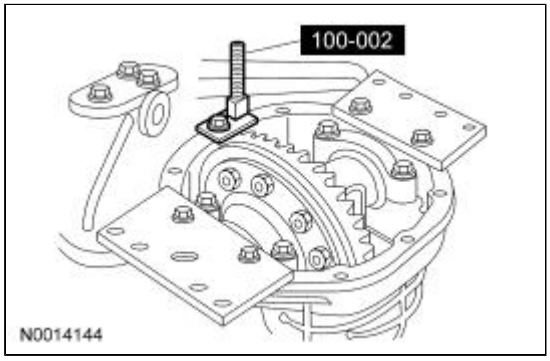
44. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



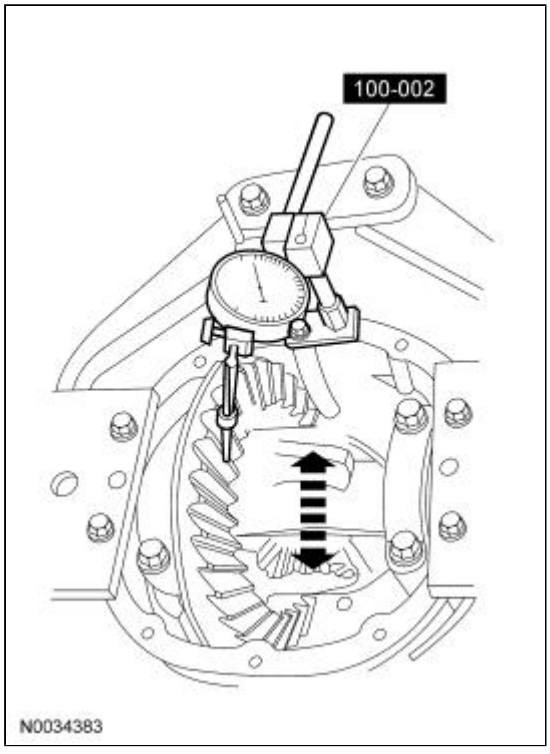
45. Rotate the differential carrier to make sure it turns freely.



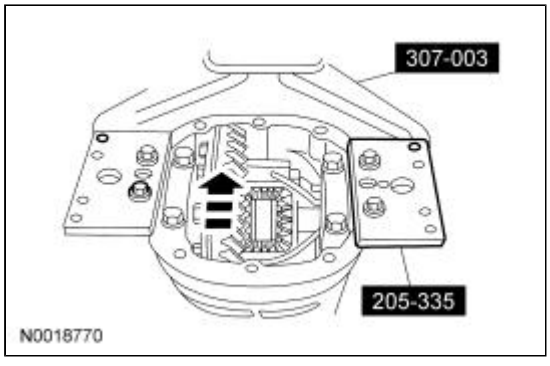
46. Install the special tool at the 12 o'clock position.



47. Using the special tools, recheck the ring gear backlash.

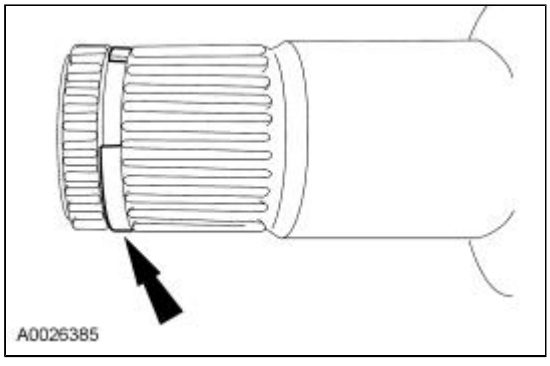


48. Apply marking compound and rotate the differential assembly 5 complete revolutions.

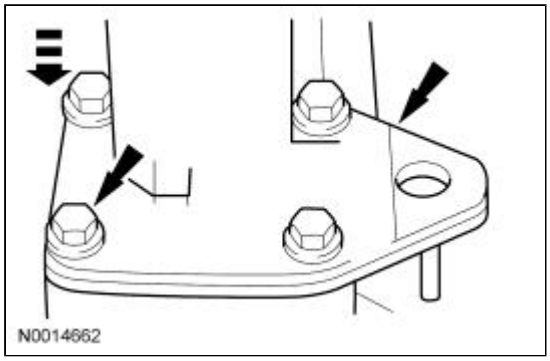


49. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

50. Install a new O-ring and new circlips on the intermediate shaft ends.



51. Install the axle housing tube.
    - Tighten to 73 Nm (54 lb-ft).



52. Install a new stub shaft seal. For additional information, refer to Stub Shaft Pilot Bearing and Seal in this section.

53. Insert the intermediate shaft and engage the circlip with the differential side gear.

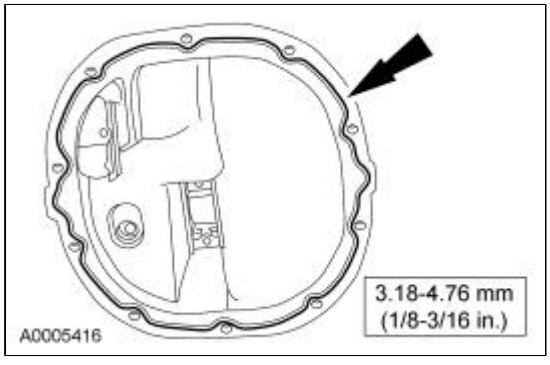
54. Remove the axle assembly from the special tool and place it on the bench.

55. **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone material.

    CAUTION: Allow the sealant to cure for 1 hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface.
    - Use silicone gasket and sealant.



56. Install the differential housing cover.

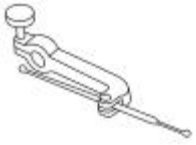
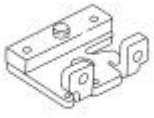
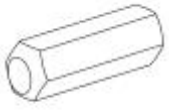
57. Fill the axle assembly with the specified amount any type of axle lubricant.

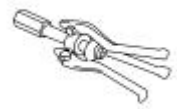
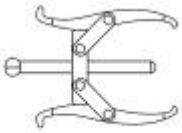
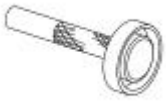
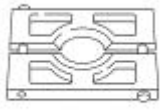
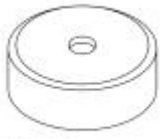
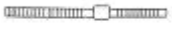
58. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

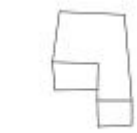
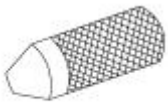
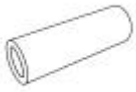
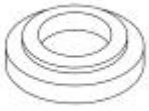
Differential Bearings

Printable View (1141 KB)

Special Tool(s)

ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A) (RH)
ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1150-B	Adapter for Differential Housing Spreader 205-368 (T96T-4000-A)
 ST1882-A	Protector, Drive Pinion Thread 205-460
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
	Remover, Bearing Cup 308-047 (T77F-1102-A)

 ST1200-A	
 ST1321-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
ST2043-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
 ST1357-A	Installer, Differential Carrier Bearings 205-D044 (D81T-4221-A) or equivalent
 ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)
ST1361-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
 ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
 ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
	Adapter for 205-S127 205-110 (T76P-4020-A10)

 ST1431-A	
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1433-B	Adapter for 205-S127 205-129 (T79P-4020-A18)
 ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
 ST1484-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)
 ST1800-A	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)

 ST1437-A	
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)

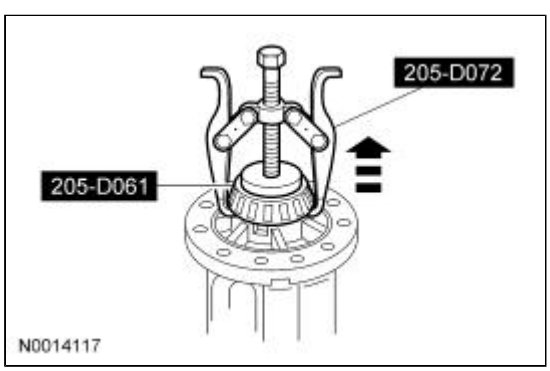
Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada); (Model 60/70 axles)	WSP-M2C197-A

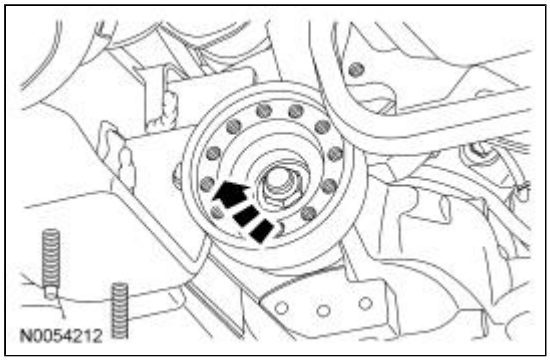
Removal

1. Remove the differential carrier. For additional information, refer to Differential Carrier in this section.

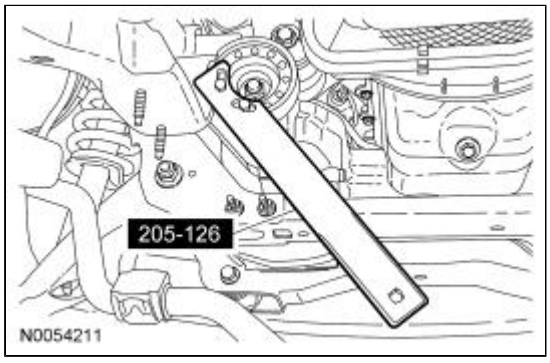
2. Using the special tools, remove the 2 differential bearings.



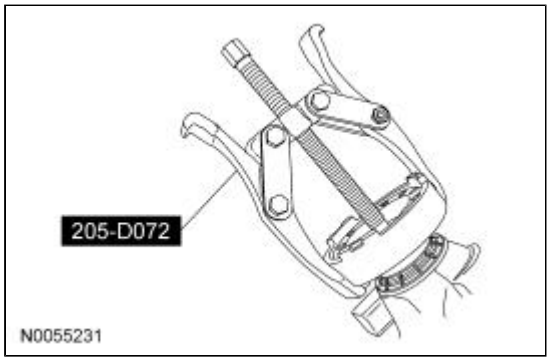
3. Index-mark the pinion flange to the drive pinion gear.



4. Install the special tool and loosen, but do not remove, the pinion nut.
    - Remove the special tool.



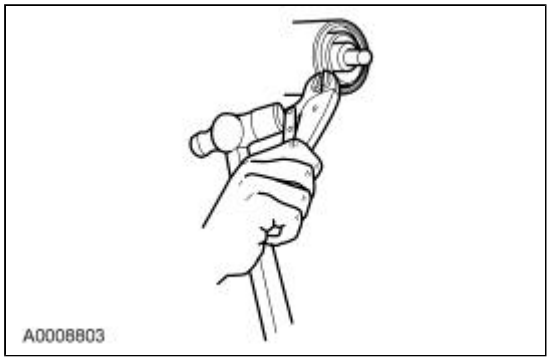
5. With the pinion nut still engaged by a few threads, use the special tool to separate the pinion flange from the drive pinion gear.



6. Remove the pinion nut and the pinion flange.

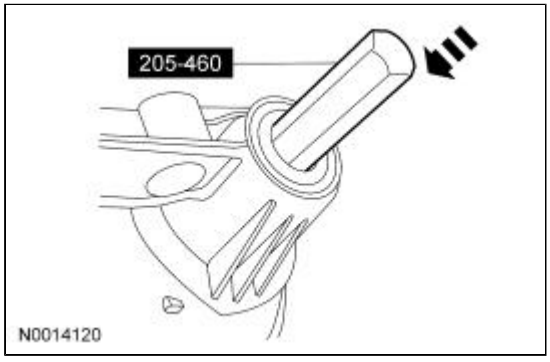
7. **CAUTION: Do not damage the axle housing while removing the drive pinion seal.**

   Remove the drive pinion seal and drive pinion oil slinger.
    - Pry up on the drive pinion seal flange. Install gripping pliers, and strike with a hammer to remove the drive pinion seal.

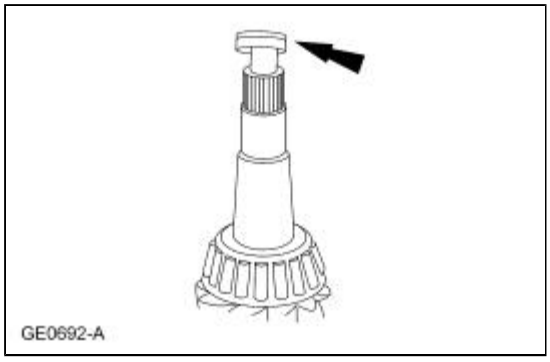


8. Remove the outer drive pinion bearing.

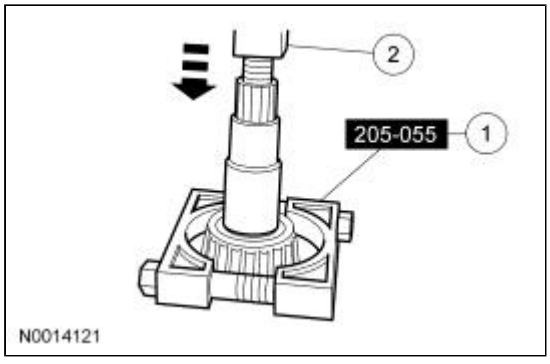
9. Using the special tool and a soft hammer, remove the drive pinion gear.



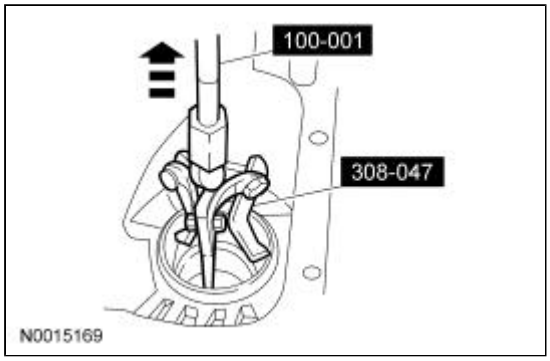
10. Remove and discard the drive pinion collapsible spacer.



11. Using the special tool and a press, remove the drive pinion inner bearing.
    1. Position the special tool under the drive pinion inner bearing.
    2. Using a press, remove the inner drive pinion bearing and shim.

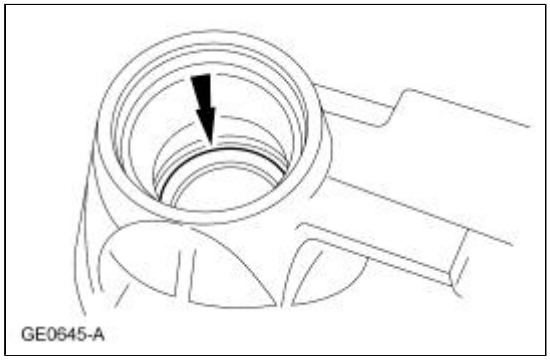


12. Using the special tools, remove the inner drive pinion bearing cup.

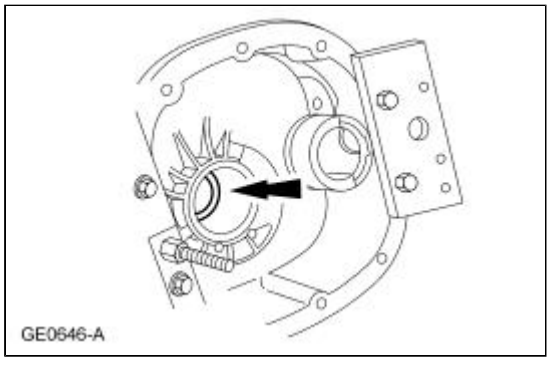


13. **NOTE:** The pinion bearing oil baffle aids in bearing lubrication. Normally, it is not necessary to remove the baffle.

    If necessary, remove the pinion bearing oil baffle.



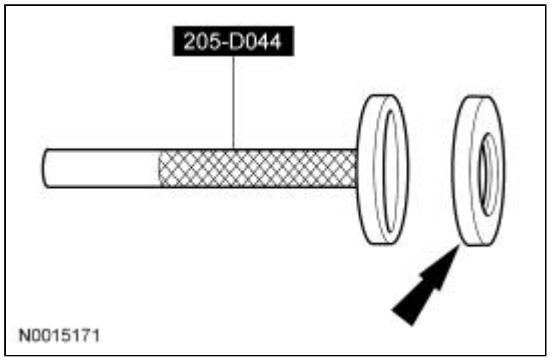
14. Remove the outer drive pinion bearing cup by tapping alternately on each side to prevent the drive pinion bearing cup from becoming misaligned.



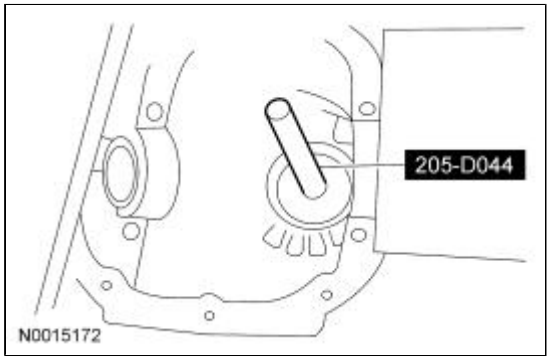
Installation

1. **CAUTION: Do not omit the drive pinion bearing oil baffle or drive pinion bearing failure can result.**

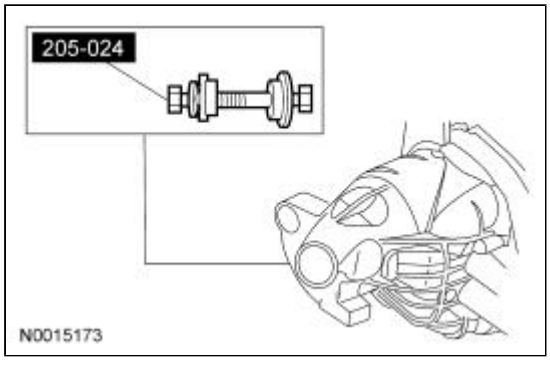
   If removed, position the drive pinion bearing oil baffle on the special tool.



2. Using the special tool, install the drive pinion bearing oil baffle.



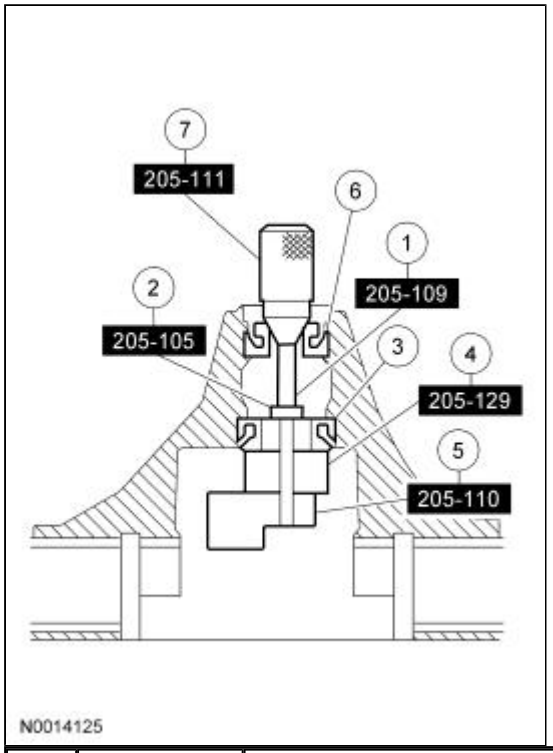
3. Using the special tool, install the drive pinion bearing cups.



4. **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

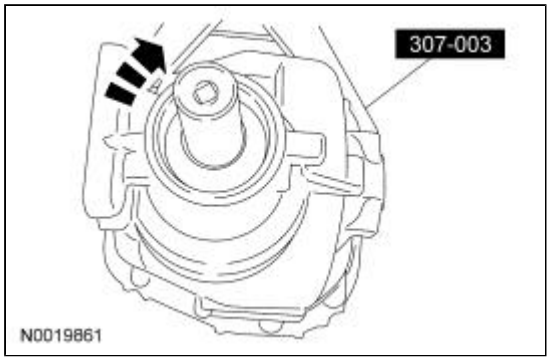
   Assemble and position the special tools.



Item	Part Number	Description
1	205-109	Adapter for 205-S127 (T76P-4020-A9)
2	205-105	Adapter for 205-S127 (1.612 inch O.D.) (T76P-4020-A3)
3	4630	Drive pinion bearing (inner)
4	205-129	Adapter for 105-S127 (1.1884 inch thick) (T79P-4020-A18)
5	205-110	Adapter for 205-S127 (1.7 inch thick) (T76P-4020-A10)
6	4621	Drive pinion bearing (outer)
7	205-111	Adapter for 205-S127 (T76P-4020-A11)

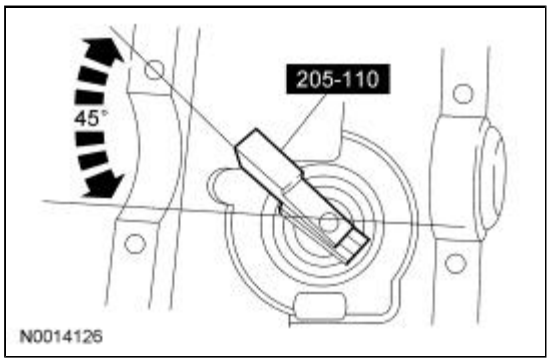
5. **NOTE:** This step duplicates final drive pinion bearing preload.

   Tighten the special tool.
   - Tighten to 2.2 Nm (20 lb-in).

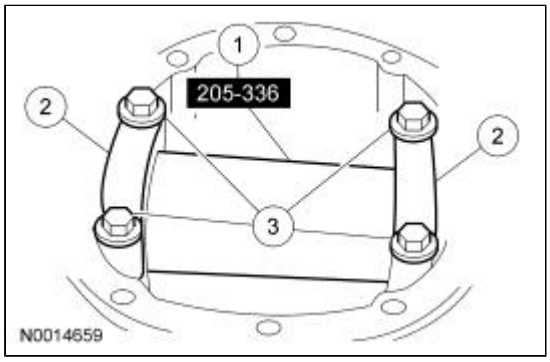


6. **NOTE:** The special tool must be offset to obtain an accurate reading.

Rotate the special tool several half-turns to make sure of correct seating of the drive pinion bearings and position the special tool.



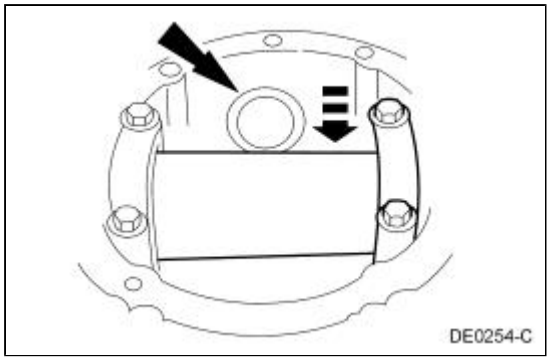
7. Install the special tool.
    1. Position the special tool.
    2. Install the differential bearing caps.
    3. Install the 4 differential bearing cap bolts.
        - Tighten to 105 Nm (77 lb-ft).



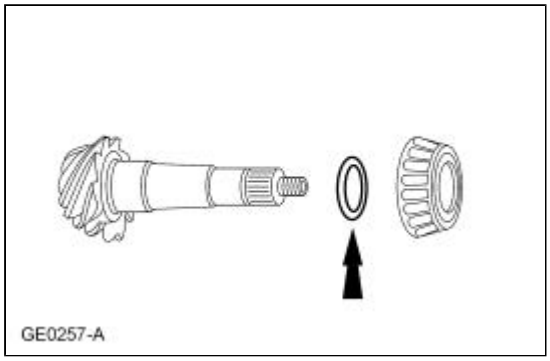
8. **NOTE:** Drive pinion bearing adjustment shims must be flat and clean.

    NOTE: A slight drag should be felt for correct drive pinion bearing adjustment shim selection. Do not attempt to force the drive pinion bearing adjustment shim between the gauge block and the gauge tube. This will minimize selection of a drive pinion bearing adjustment shim thicker than required, which results in a deep tooth contact in final assembly of integral axle assemblies.

    Use a drive pinion bearing adjustment shim as a gauge for drive pinion bearing adjustment shim selection.
    - After the correct drive pinion bearing adjustment shim thickness has been determined, remove all of the special tools.

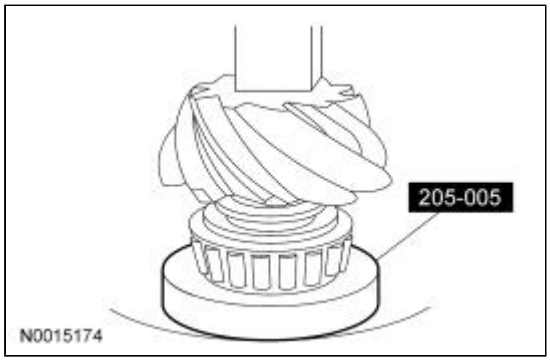


9. Position the drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.

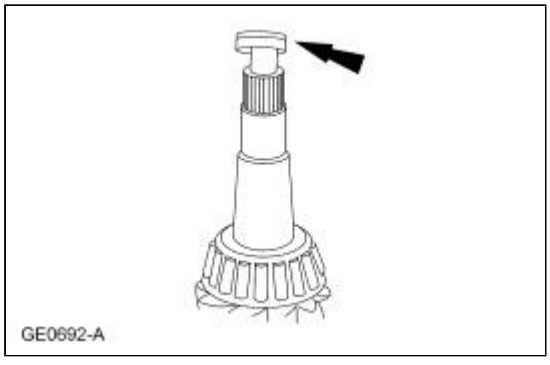


10. **NOTE:** You must use the same drive pinion bearing from the previous steps.

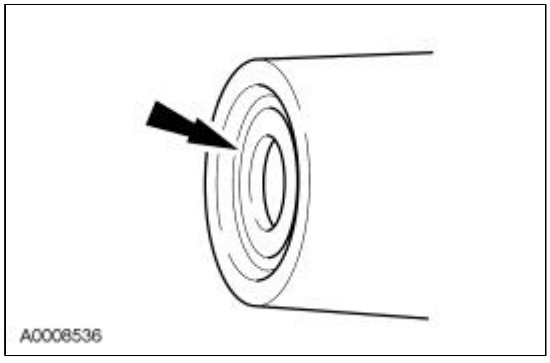
    Install the inner drive pinion bearing.
    - Place the drive pinion bearing adjustment shim on the drive pinion gear.
    - Using a suitable press and the special tool, press the inner drive pinion bearing until it is firmly seated on the pinion gear.



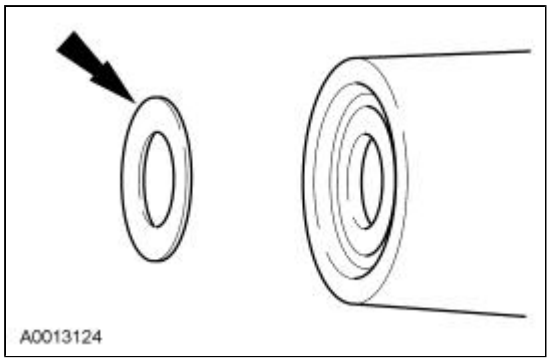
11. Place a new drive pinion collapsible spacer on the drive pinion gear.



12. Install the outer drive pinion bearing.

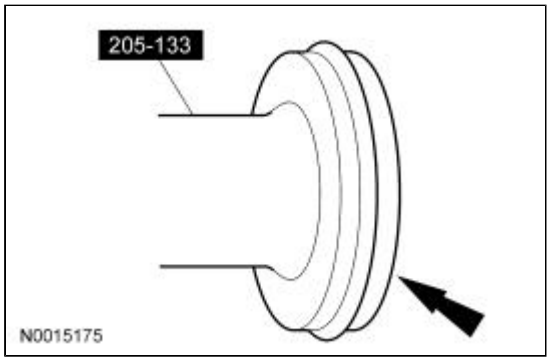


13. Install the drive pinion oil slinger.



14. **NOTE:** Coat the drive pinion seal lips with long-life grease.

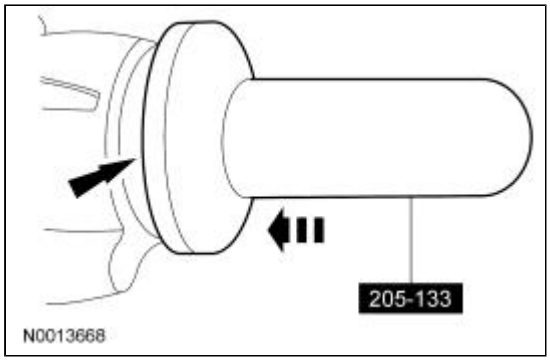
    Install the drive pinion seal on the special tool.



15. **CAUTION: Installation without the correct tool can result in early drive pinion seal failure.**

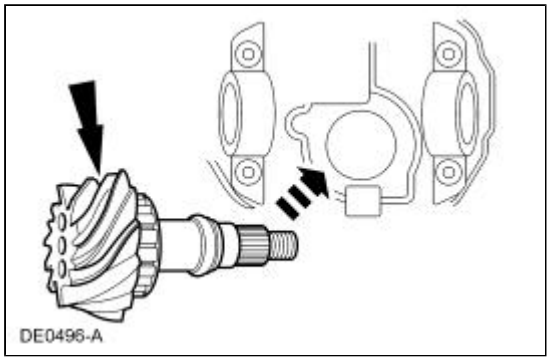
    CAUTION: If the drive pinion seal becomes misaligned during installation, remove it and install a new drive pinion seal.

    Using the special tool, install the drive pinion seal.



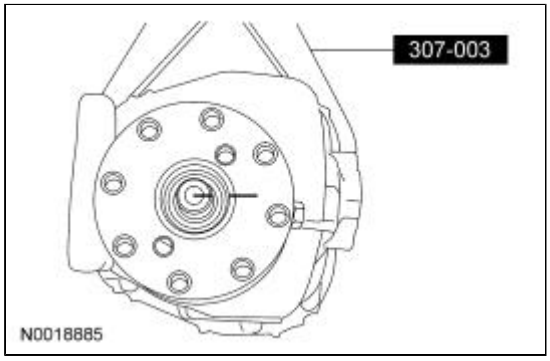
16. Lightly lubricate the drive pinion gear splines with rear axle lubricant.

17. Position the drive pinion gear in the axle housing.

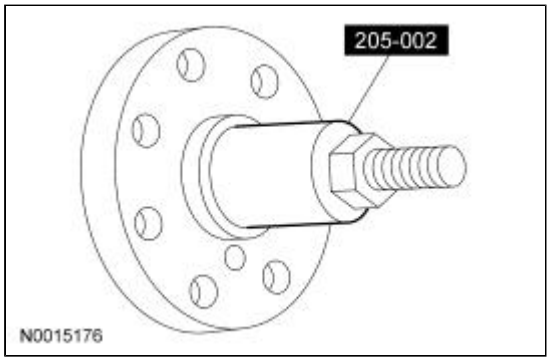


18. **CAUTION: Never install the pinion flange with a hammer or power tools.**

    Position the pinion flange.
    - Position the pinion flange on the drive pinion gear.



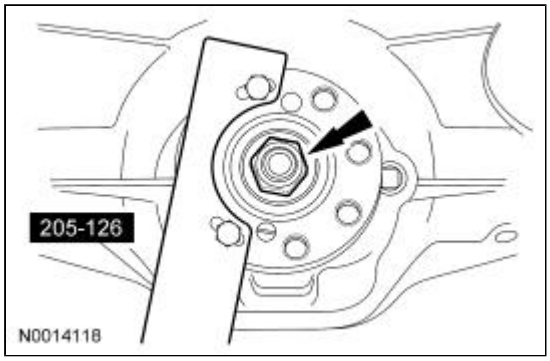
19. Using the special tool, install the pinion flange.

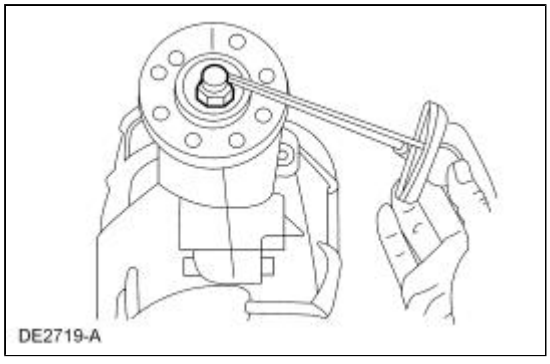


20. Apply a small amount of axle lubricant to the washer side of the new pinion nut and install the new pinion nut.

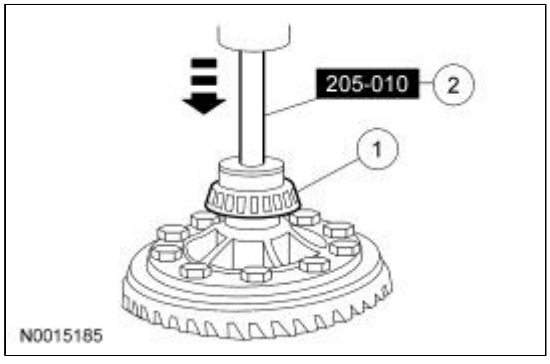
21. **CAUTION: Do not loosen the pinion nut to reduce drive pinion bearing preload under any circumstance. If it is necessary to reduce drive pinion bearing preload, install a new drive pinion collapsible spacer and pinion nut.**

    Install the special tool and tighten the pinion nut. Refer to the torque specifications in the Specifications portion of this section.
    - Rotate the drive pinion gear occasionally to make sure the drive pinion bearings are seating correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.

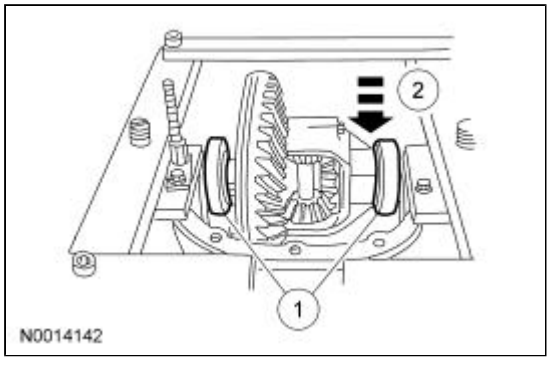




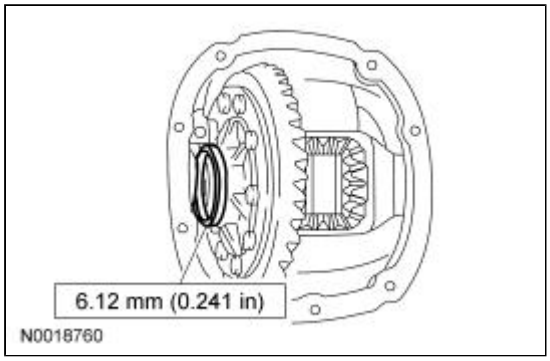
22. Press the left and right differential bearing on the differential case.
    1. Position the differential bearing.
    2. Using the special tool, press the differential bearing on the differential case.



23. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place.

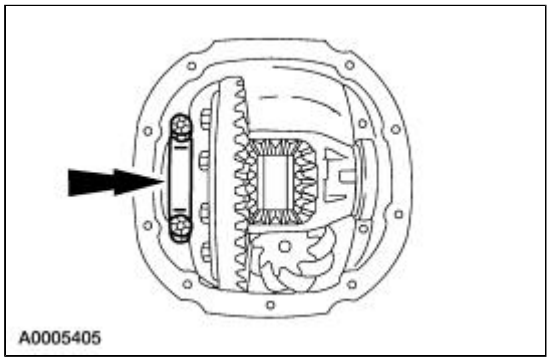


24. Install a differential bearing shim of the thickness shown on the LH side of the differential bearing.



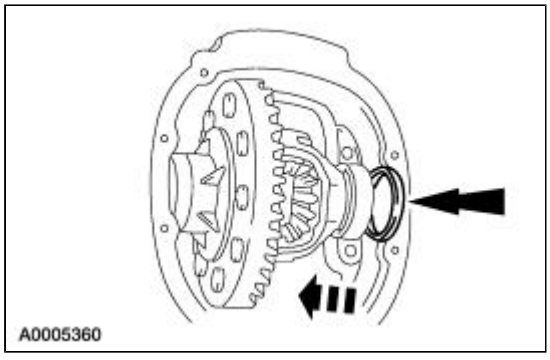
25. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install the left bearing cap and loosely install the bearing cap bolts.



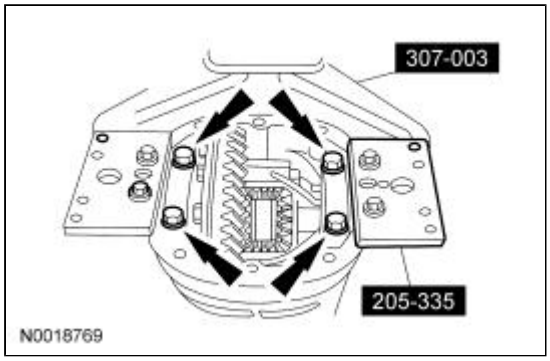
26. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

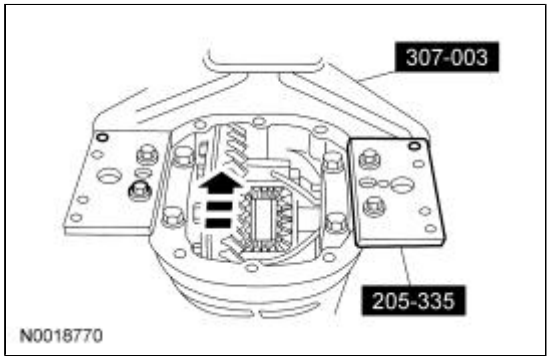


27. Install the right bearing cap and bolts.

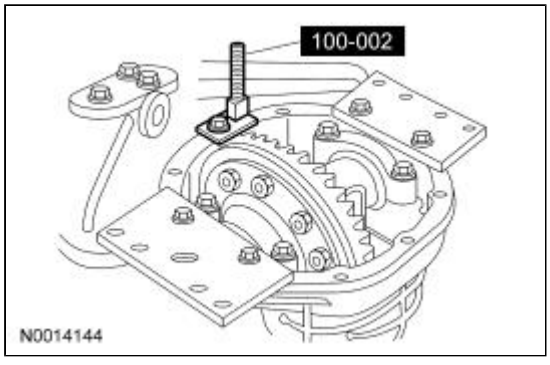
28. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



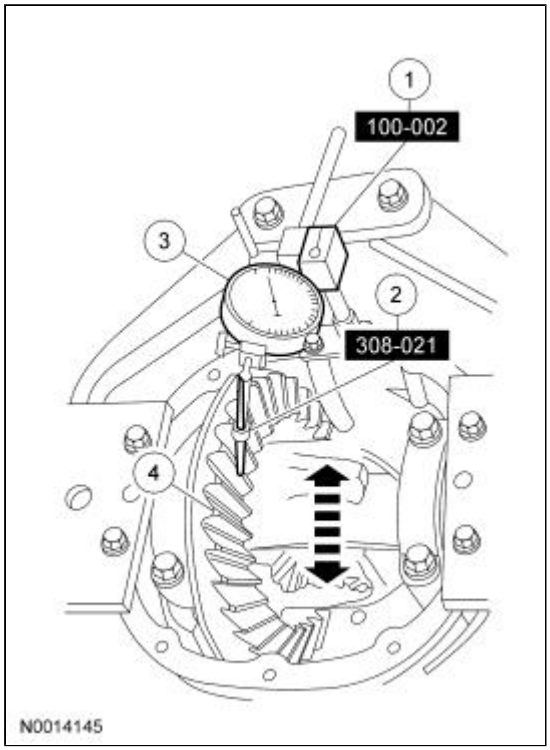
29. Rotate the differential carrier to make sure it turns freely.



30. Install the special tool at the 12 o'clock position.



31. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the special tool.
    2. Position the special tool tip centrally on a drive tooth.
    3. Zero the indicator.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the indicator reading. The allowable backlash is 0.203 mm (0.008 in) to 0.305 mm (0.012 in) and must not vary more than 0.101 mm (0.004 in) between points measured.
        - To correct for a high or low backlash, proceed as follows.



32. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

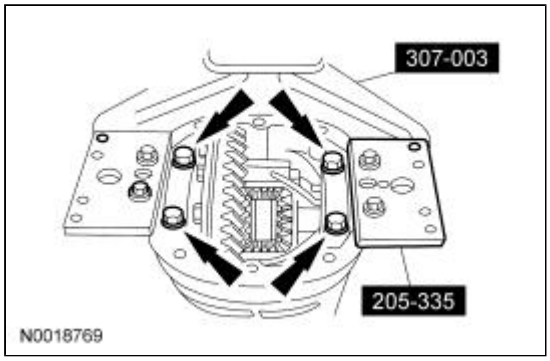
Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart — 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	Inch

2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035
4 — BLU	7.6454- 7.6581	0.3010- 0.3015
3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715
3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515
3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

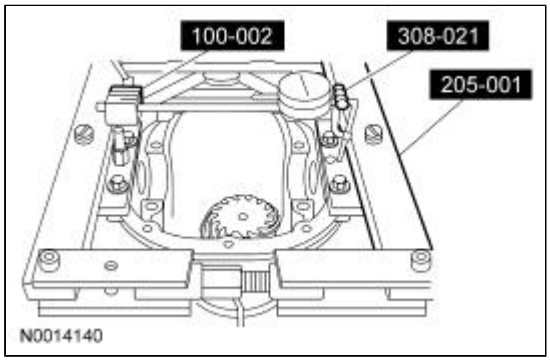
33. Remove the 4 differential bearing cap bolts.
    - Remove the differential carrier.



34. Measure the thickness of the selected right and left bearing shims.

35. To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.203 mm (0.008 in).

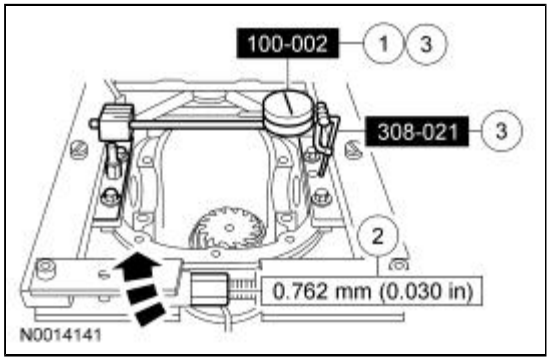
36. Install the special tools.



37. **CAUTION: Overspreading may damage the differential housing.**

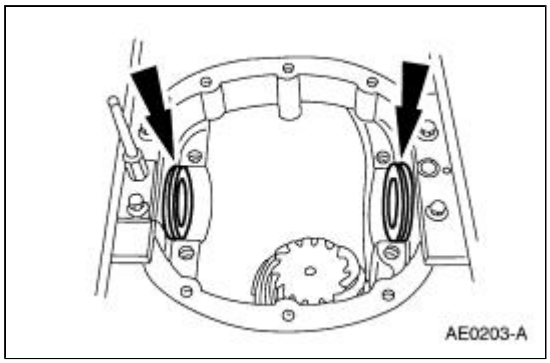
NOTE: Tighten and loosen the differential carrier spreader screw to normalize the housing spreader adapters prior to taking the final dial indicator reading.

Spread the differential housing to the specification.
1. Adjust the special tool to zero.
2. Tighten the screw until spreading the differential housing to the specification.
3. Remove the special tools.

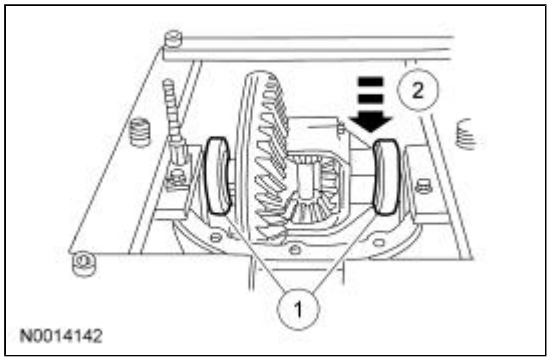


38. **CAUTION: To avoid galling the case, insert shims with a light coating of grease before installing the differential assembly. If not carried out in this order, the aluminum housing can be damaged.**

Place the differential bearing shims in the differential housing.

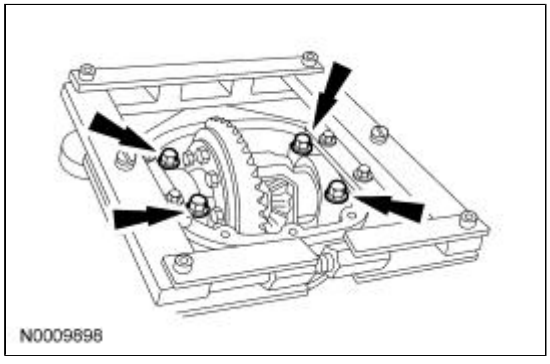


39. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place between the differential bearing shims.

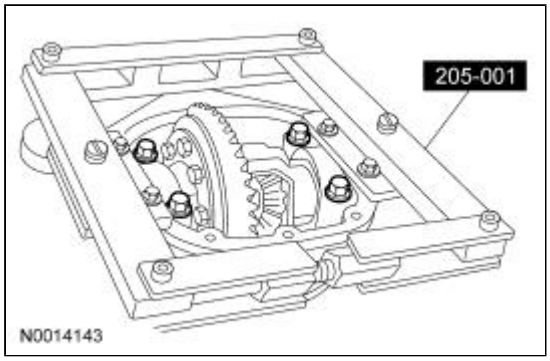


40. **NOTE:** Hand-tighten the differential bearing cap bolts prior to releasing the special tool.

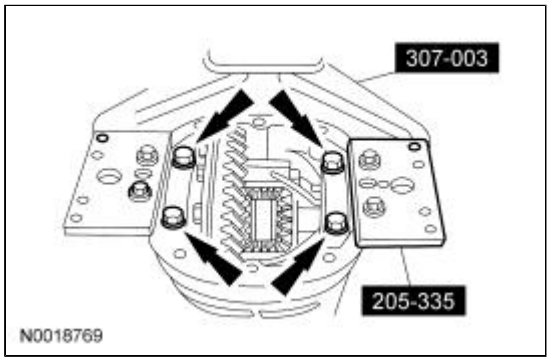
    Install the differential bearing caps and the differential bearing cap bolts in their original locations and positions.



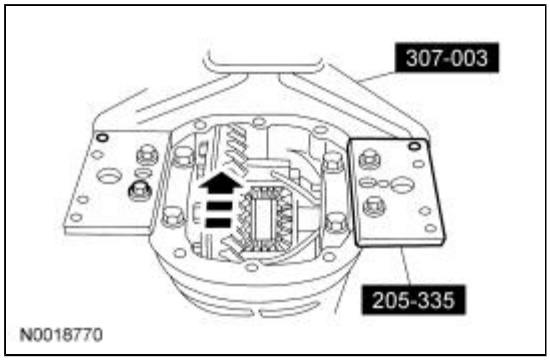
41. Loosen and remove the special tool.



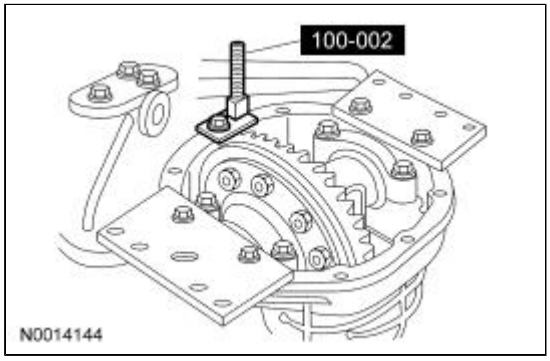
42. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



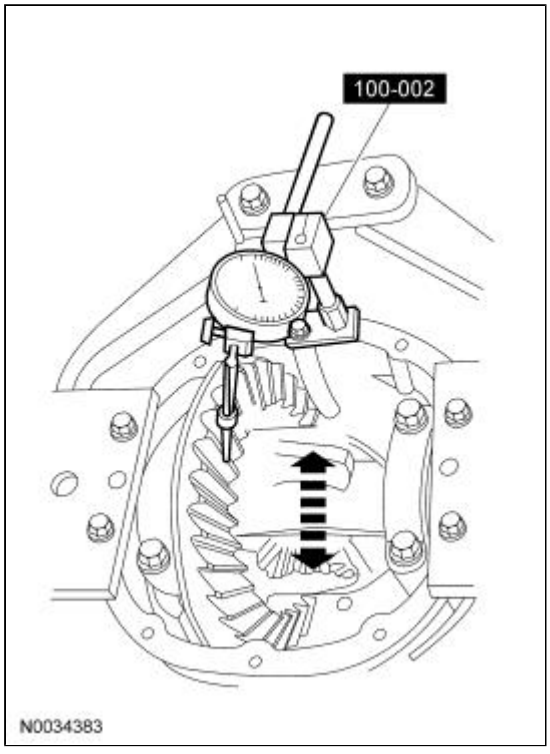
43. Rotate the differential carrier to make sure it turns freely.



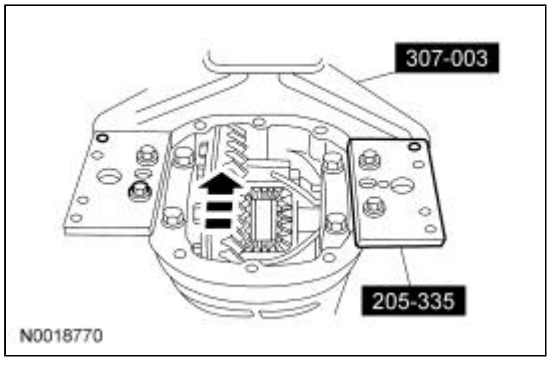
44. Install the special tool at the 12 o'clock position.



45. Using the special tools, recheck the ring gear backlash.

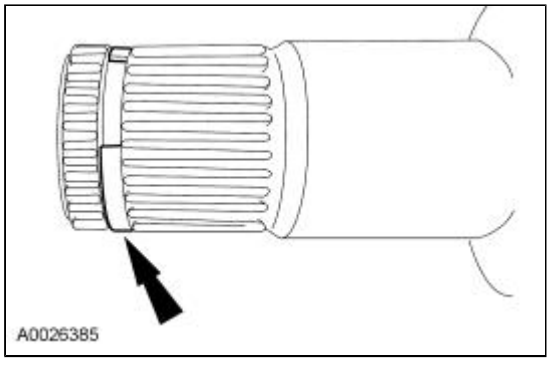


46. Apply marking compound and rotate the differential assembly 5 complete revolutions.

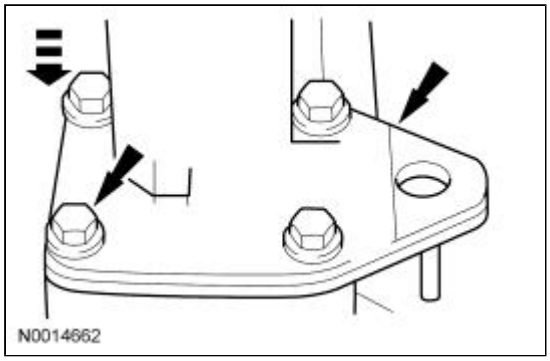


47. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

48. Install a new O-ring and new circlips on the intermediate shaft ends.



49. Install the axle housing tube.
    - Tighten to 73 Nm (54 lb-ft).



50. Install a new stub shaft seal. For additional information, refer to Stub Shaft Pilot Bearing and Seal in this section.

51. Insert the intermediate shaft and engage the circlip with the differential side gear.

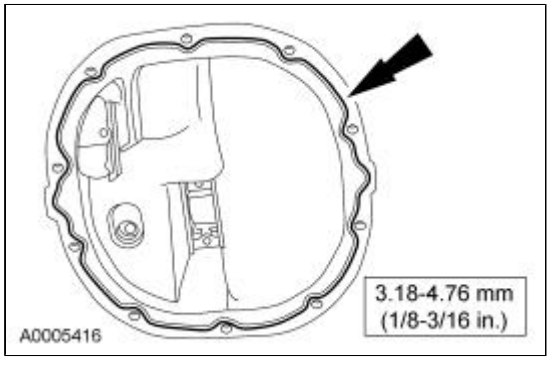
52. Remove the axle assembly from the special tool and place it on the bench.

53. **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone material.

    CAUTION: Allow the sealant to cure for 1 hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface.
    - Use silicone gasket and sealant.



54. Install the differential housing cover.

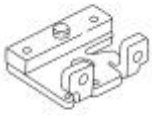
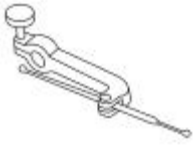
55. Fill the axle assembly with the specified type and amount of axle lubricant.

56. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

Differential Carrier

Printable View (602 KB)

Special Tool(s)

ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A) (RH)
 ST1150-B	Adapter for Differential Housing Spreader 205-368 (T96T-4000-A)
ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2891-A	Remover, Transmission Fluid Pump 307-397
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
	Dial Indicator Gauge with Holding Fixture

ST1214-A	100-002 (TOOL-4201-C)

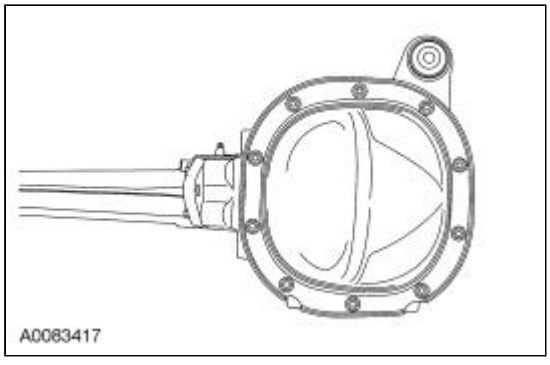
Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A

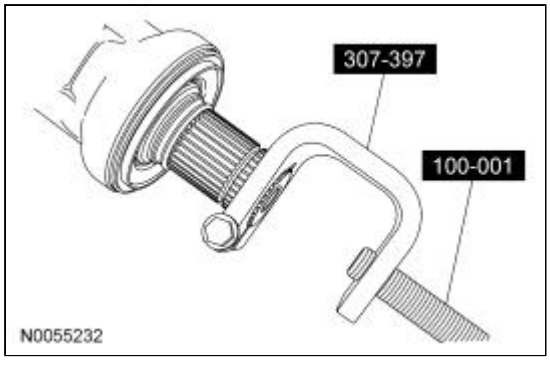
Removal

1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.

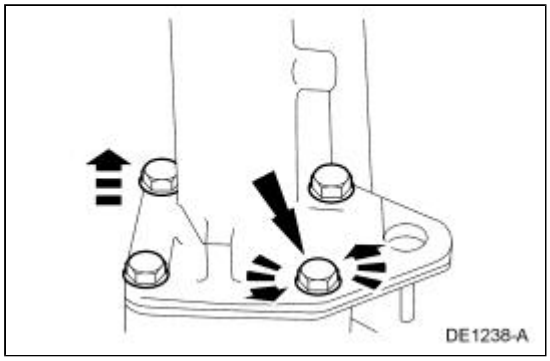
2. Remove the differential housing cover.
   - Drain the fluid.
   - Remove the 10 differential housing cover bolts.
   - Remove the differential housing cover.



3. Using the special tools, remove the intermediate shaft.

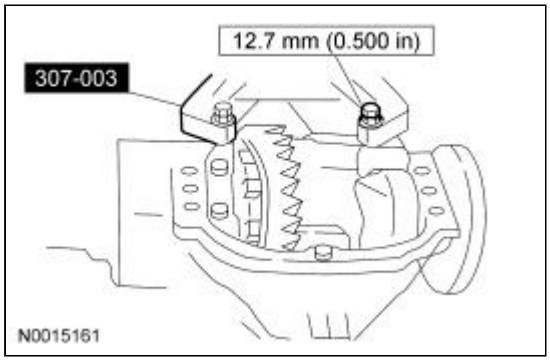


4. Remove the axle housing tube.



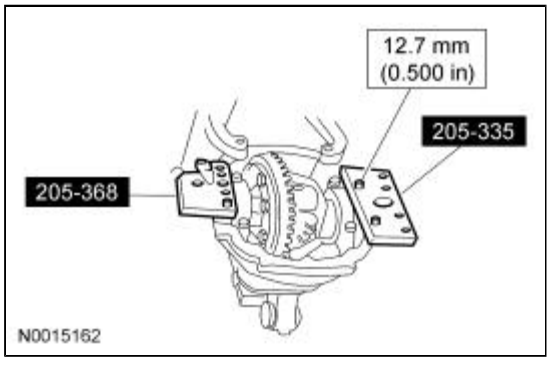
5. **CAUTION: The fixture mounting bolts must have the minimum specified thread engagement in the carrier.**

   Install the special tool.

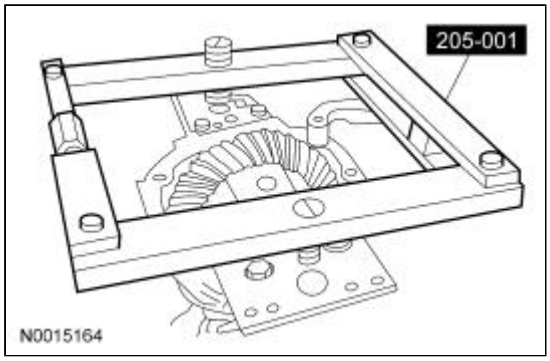


6. **CAUTION: The housing spreader adapter bolts must have the minimum specified thread engagement in the carrier.**

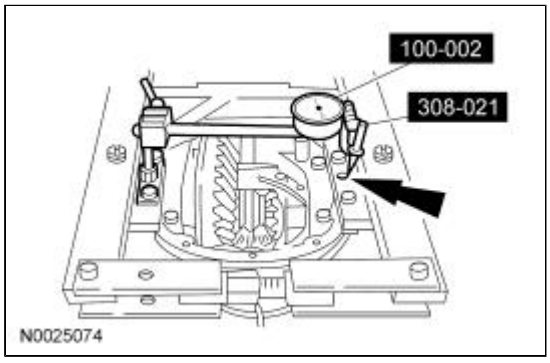
   Install the special tools.



7. Position the special tool on the spreader adapters.

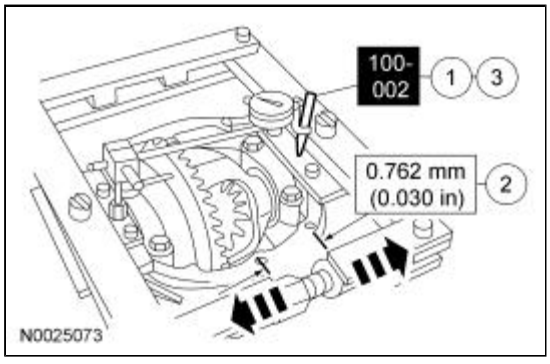


8. Install the special tools.
    - Position the adapter tip in the spreader adapter hole.



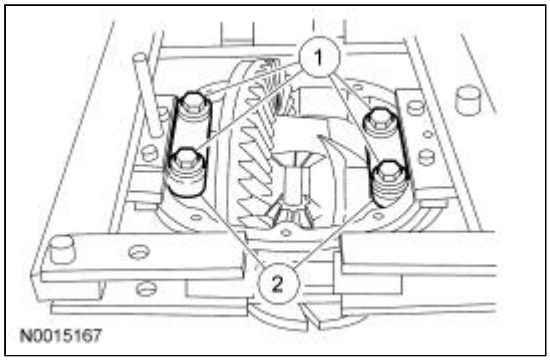
9. **CAUTION: Overspreading can damage the axle housing.**

    Spread the axle housing to the specification.
    1. Adjust the special tool to zero.
    2. Tighten the housing spreader screw to spread the axle housing to the specification.
    3. Remove the special tool.



10. **CAUTION: Mark the differential bearing caps Top or Bottom and LH or RH appropriately before removing them. Always install the differential bearing caps in their original positions.**

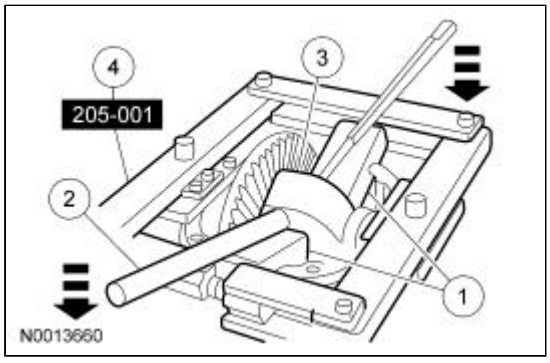
    Mark and remove the differential bearing caps.
    1. Remove the 4 differential bearing cap bolts.
    2. Remove the differential bearing caps.



11. **CAUTION: Use wood blocks to avoid axle housing damage.**

    CAUTION: Index-mark the position of the differential bearing shims. The differential bearing shims must be installed in their original locations and positions.

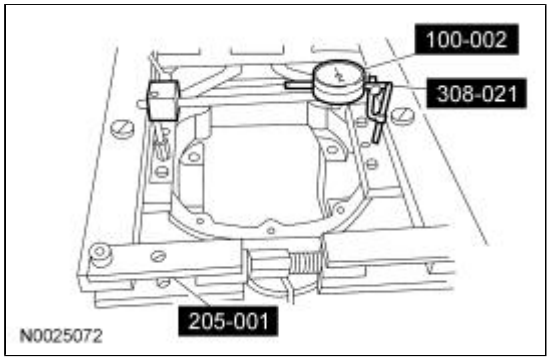
    Remove the differential carrier from the axle housing.
    1. Position the wood blocks.
    2. Position and push down on the 2 pry bars.
    3. Remove the differential carrier.
    4. Remove the special tool.



Installation

1. **NOTE:** Make sure the indicator needle is in the spreader adapter hole.

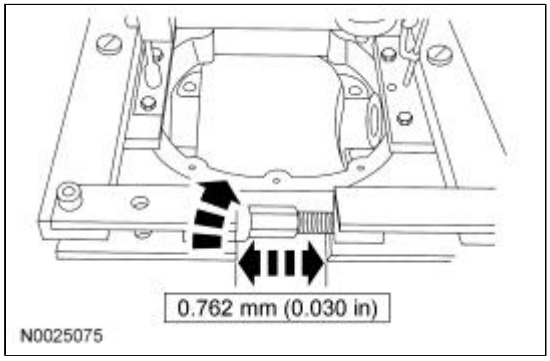
   Install the special tools.



2. **CAUTION: Overspreading can damage the axle housing.**

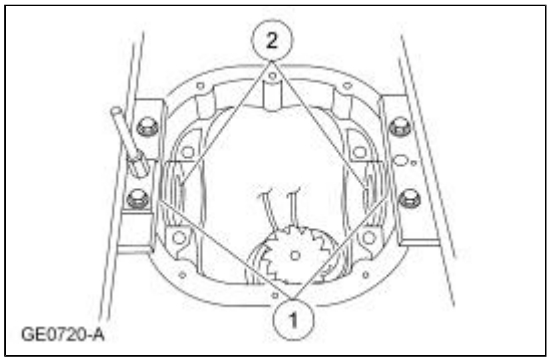
   Spread the axle housing to the specification.

- Remove the dial indicator.



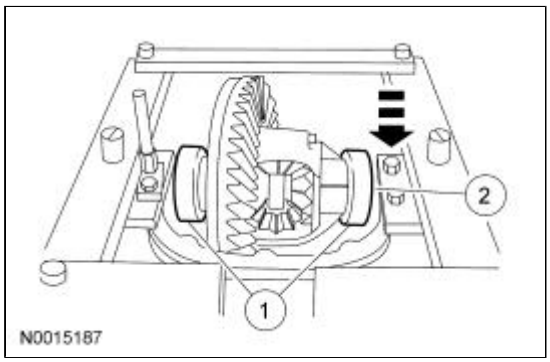
3. **CAUTION: Never attempt to drive the differential bearing shim in place. Permanent damage to the machined axle housing surfaces can occur.**

   Position the differential bearing shims.
   1. Apply a light coating of grease to one side of the differential bearing shims to help hold them in place.
   2. Position the differential bearing shims.



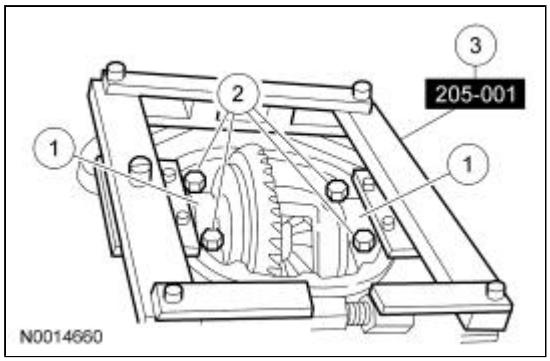
4. **NOTE:** Push the differential carrier downward to fully seat the differential bearing cups in the axle housing.

   Position the differential carrier.
   1. Position the differential bearing cups on the differential bearings.
   2. Lower the differential assembly in place between the differential bearing shims.

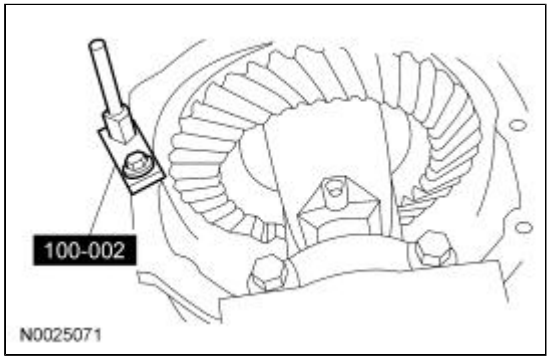


5. Install the differential bearing caps in their original positions and tighten with the housing still spread.
   1. Position the differential bearing caps.
   2. Install the 4 differential bearing cap bolts.
      - Tighten to 105 Nm (77 lb-ft).

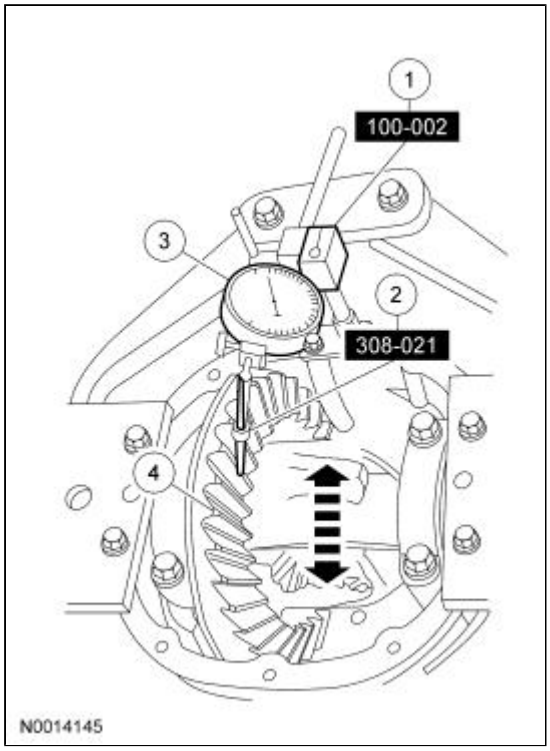
3. Remove the special tool.



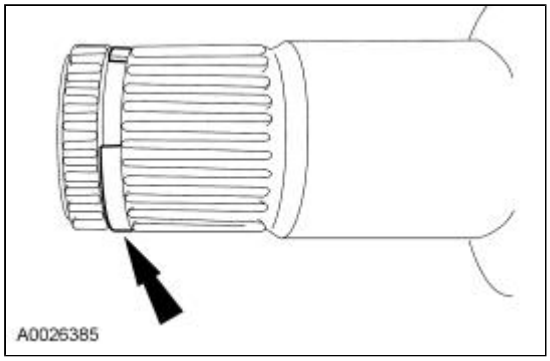
6. Install the special tool.



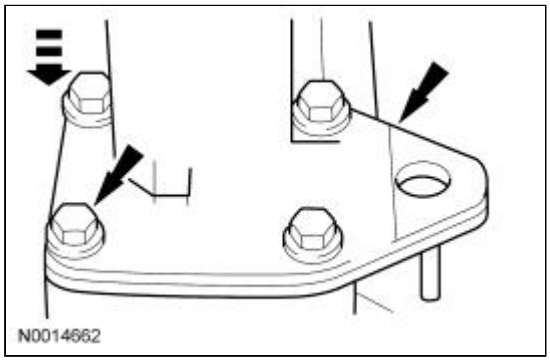
7. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the special tool.
    2. Position the special tool tip centrally on a drive tooth.
    3. Zero the indicator.
    4. Turn the differential ring gear without turning the drive pinion gear.



8. Install a new O-ring and new circlips on the intermediate shaft ends.



9. Install the axle housing tube.
    - Tighten to 73 Nm (54 lb-ft).



10. Install a new stub shaft seal. For additional information, refer to Stub Shaft Pilot Bearing and Seal in this section.

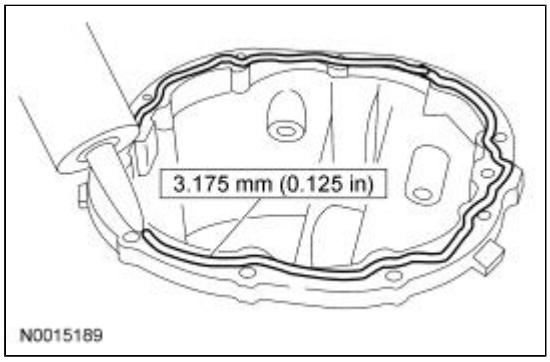
11. Insert the intermediate shaft and engage the circlip with the differential side gear.

12. Remove the axle assembly from the special tool and place it on the bench.

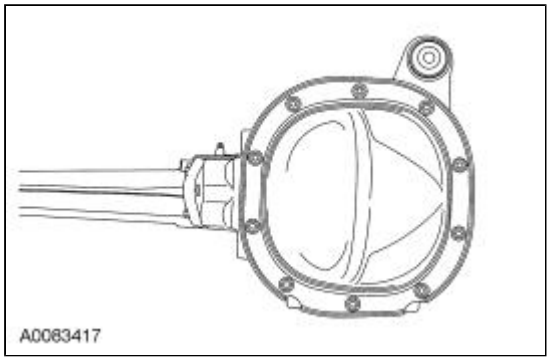
13. **CAUTION: Remove all of the silicone gasket and make sure the machined surfaces are free of oil before applying the new silicone gasket.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone gasket, or it will be necessary to remove and reapply silicone gasket. If possible, allow 1 hour before filling with lubricant to make sure the silicone gasket has cured.

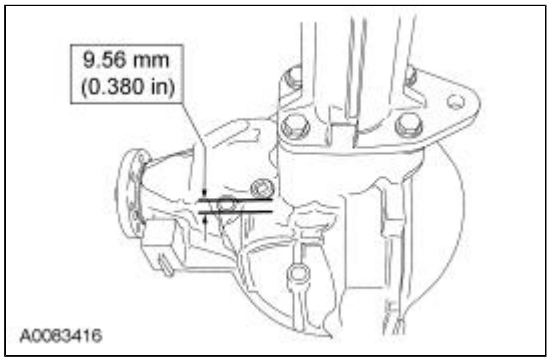
    Fill the sealing groove on the differential housing cover with silicone gasket.



14. Install the differential housing cover and the 10 differential housing cover bolts.
    - Tighten to 32 Nm (24 lb-ft).



15. Fill the axle housing with axle lubricant and install the fill plug.
    - Tighten to 25 Nm (18 lb-ft).



16. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

Axle Carrier Bushing

Printable View (227 KB)

Special Tool(s)

ST1159-A	Remover, Front Axle Mounting Bushing Cup 205-371 (T96T-5638-E)
ST1464-A	Remover/Installer, Front Differential Housing Bushing 205-527/1
ST2265-A	Installer, Wheel Hub Dust Seal 205-289 (T89P-1249-A)
ST2587-A	Remover, Front Differential Housing Bushing 204-186 (T95T-5638-AH)
ST1155-A	Remover, Front Axle Mounting Bushing 205-376 (T96T-5638-K)
ST2586-A	Installer, Front Differential Mounting Bushing 204-187 (T95T-5638-AH)
ST1162-A	Installer Front Axle Mounting Bushing Drawbolt 205-374 (T96T-5638-H)

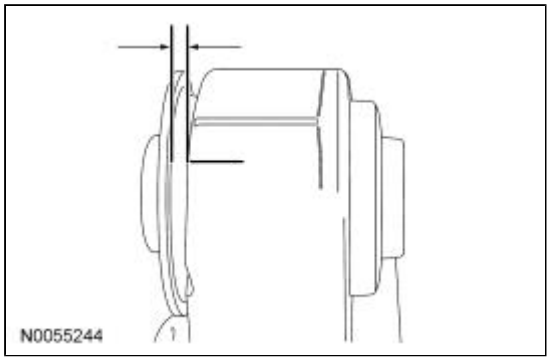
Removal

All bushings

1. **NOTE:** It is not necessary to remove the axle assembly from the jack.

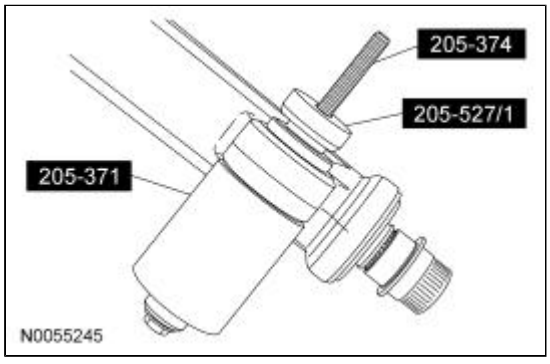
   Remove the front drive axle assembly. For additional information, refer to Axle Assembly in this section.

2. Measure and record the width of the gap between the bushing front lip and the housing. Mark the housing at the point where the measurement was taken.



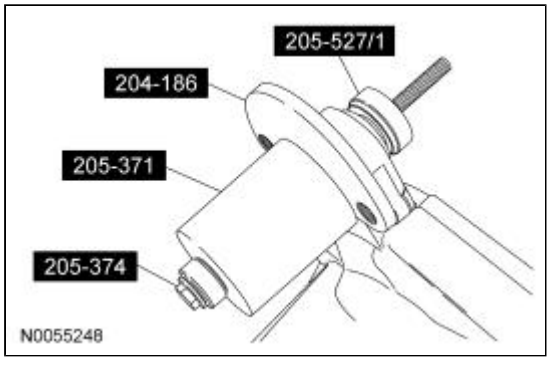
Axle tube bushing

3. Position the special tools as shown. Turn in the drawbar to remove the bushing.



Rear housing bushing

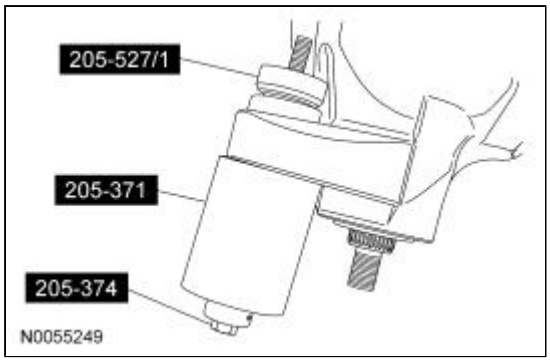
4. Position the special tools as shown. Turn in the drawbar to remove the bushing.



Front housing bushing

5. Remove the universal joint flange. For additional information, refer to Universal Joint Flange in this section.

6. Position the special tools as shown. Turn in the drawbar to remove the bushing.



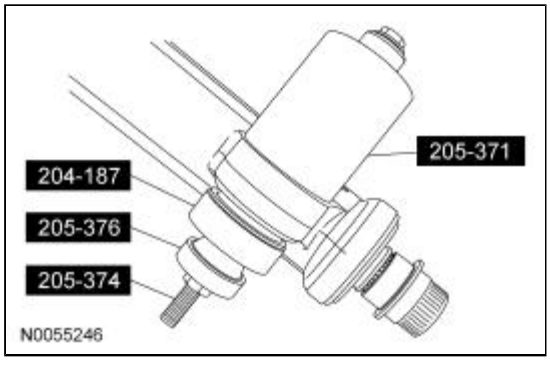
All bushings

7. Inspect the bushing bores for wear or damage.

Installation

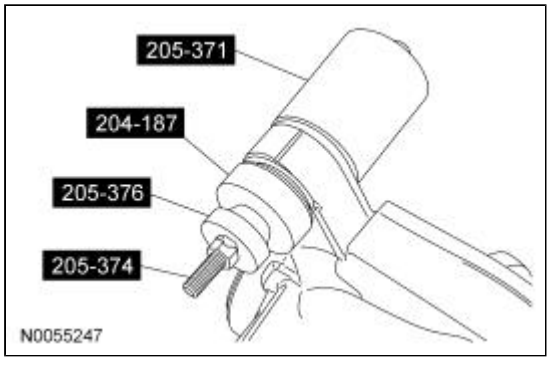
Axle tube bushing

1. Position the bushing and the special tools as shown. Draw the bushing into the bushing bore to the same depth and point measured before removal.



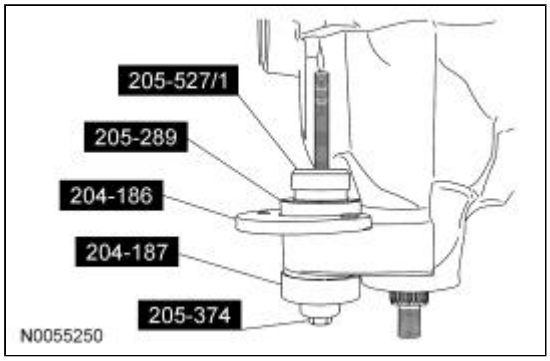
Rear housing bushing

2. Position the bushing and the special tools as shown. Draw the bushing into the bushing bore to the same depth and point measured before removal.



Front housing bushing

3. Position the bushing and the special tools as shown. Draw the bushing into the bushing bore to the same depth and point measured before removal.



4. Install the universal joint flange. For additional information, refer to Universal Joint Flange in this section.

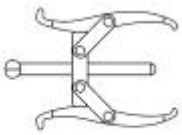
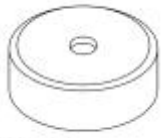
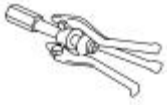
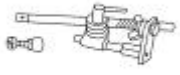
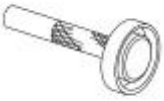
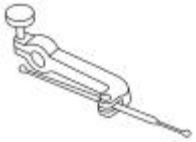
All bushings

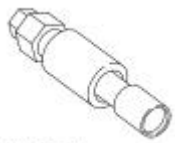
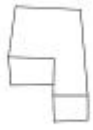
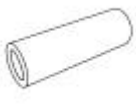
5. Install the front drive axle assembly. For additional information, refer to Axle Assembly in this section.

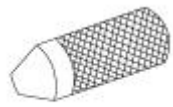
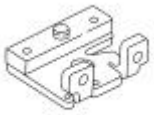
Axle

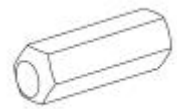
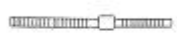
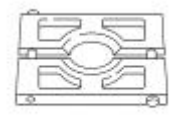
Printable View (1497 KB)

Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1321-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1182-A	Dial Indicator Gauge Brackets 100-D004 (D78P-4201-F) or equivalent
 ST1357-A	Installer, Differential Carrier Bearings 205-D044 (D81T-4221-A) or equivalent
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
	Holding Fixture, Drive Pinion Flange

ST1257-A	205-126 (T78P-4851-A)
 ST1800-A	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)
ST1183-A	Dial Indicator 100-D005 (D78P-4201-G) or equivalent
ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E) or equivalent
ST1437-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
ST1433-B	Adapter for 205-S127 205-129 (T79P-4020-A18)
 ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
	Adapter for 205-S127 205-111 (T76P-4020-A11)

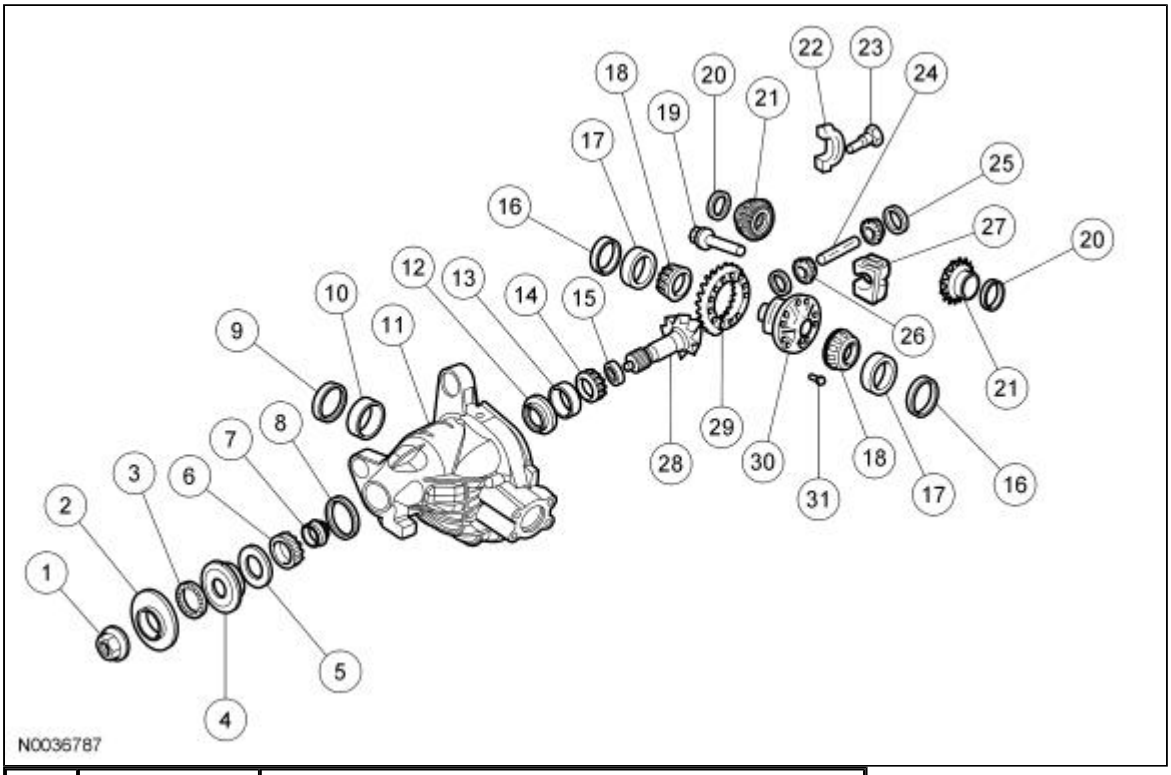
 ST1432-A	
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1150-B	Adapter for Differential Housing Spreader 205-368 (T96T-4000-A)
ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A) (RH)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST1484-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1361-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
ST1258-A	Depth Gauge, Drive Pinion 205-S127 (T79P-4020-A)
	Protector, Drive Pinion Thread 205-460

 ST1882-A	
ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)
 ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
ST2418-A	Remover, Front Pump 307-553
ST2043-A	Step Plate 205-D061 (D83T-4205-C2)
 ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada); (Model 60/70 axles)	WSP-M2C197-A

Front Differential — Disassembled View



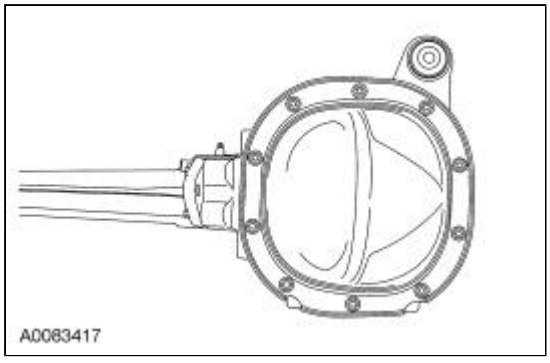
Item	Part Number	Description
1	389546	Drive pinion nut
2	4858	Drive pinion universal joint flange
3	4859	Drive pinion oil seal deflector
4	3N134	Drive pinion seal
5	386989	Drive pinion oil slinger
6	4621	Drive pinion bearing (outer)
7	4662	Drive pinion collapsible spacer
8	4616	Drive pinion bearing cup (outer)
9	4B416	Halfshaft inner dust seal
10	4B413	Halfshaft bearing assembly
11	3A412	Differential carrier
12	4631	Drive pinion bearing oil baffle
13	4628	Drive pinion bearing cup (inner)
14	4630	Drive pinion bearing (inner)
15	4663	Drive pinion bearing adjustment shim
16	4A451	Differential bearing shims (2 required)
17	4221	Differential bearing cups (2 required)
18	4221	Differential bearings (2 required)
19	387426	Differential pinion shaft bolt
20	386984	Differential side gear thrust washers (2 required)
21	4236	Differential side gears (2 required)
22	4224	Differential bearing cap (2 required)
23	391583	Differential bearing cap bolt (4 required)
24	4211	Differential pinion shaft

25	4230	Differential pinion thrust washer (2 required)
26	4215	Differential pinion gear (2 required)
27	4214	Differential clutch spring
28	3N175	Drive pinion gear
29	3A397	Differential ring gear
30	4205	Differential case
31	388056	Differential ring gear bolt (10 required)

Disassembly

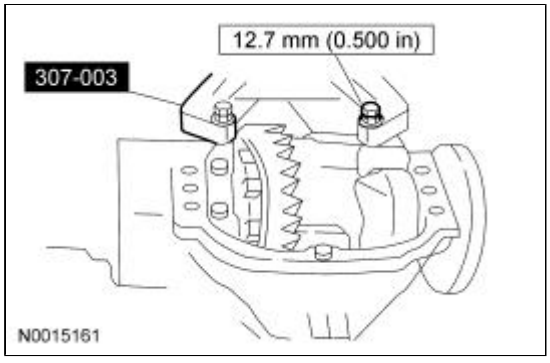
1. Remove the front drive axle assembly. For additional information, refer to Axle Assembly in this section.

2. Remove the differential housing cover.
   - Drain the fluid.
   - Remove the bolts.
   - Remove the differential housing cover.

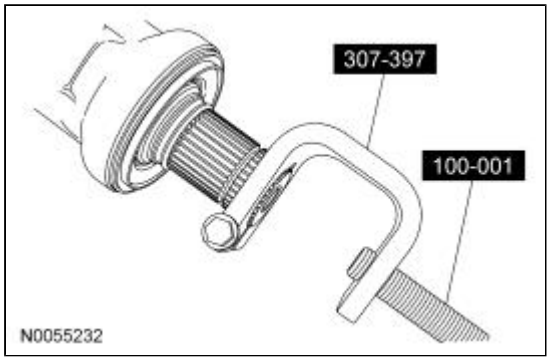


3. **CAUTION: The fixture mounting bolts must have the minimum specified thread engagement in the carrier.**

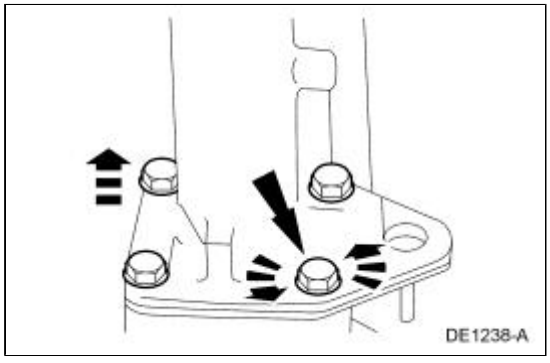
   Install the special tool.



4. Using the special tools, remove the intermediate shaft.

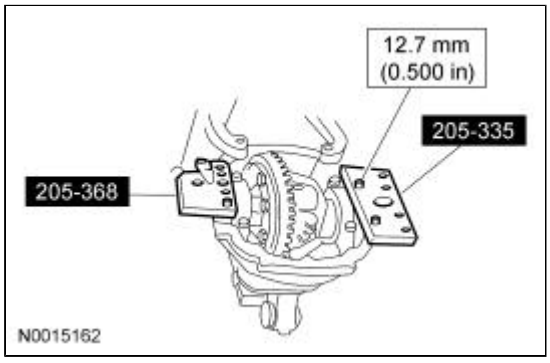


5. Remove the axle housing tube.

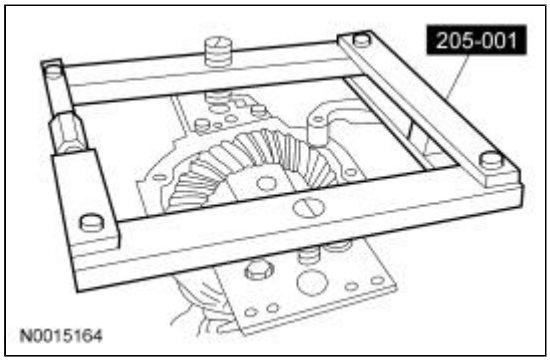


6. **CAUTION: The housing spreader adapter bolts must have the minimum specified thread engagement in the carrier.**

   Install the special tools.

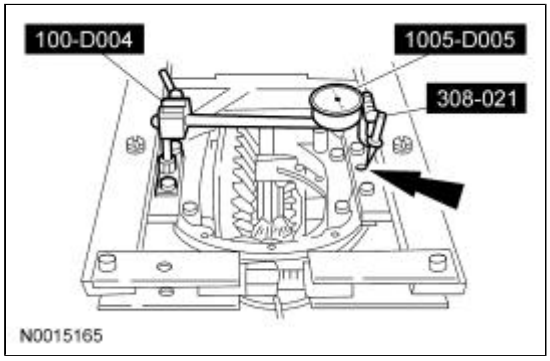


7. Position the special tool on the spreader adapters.



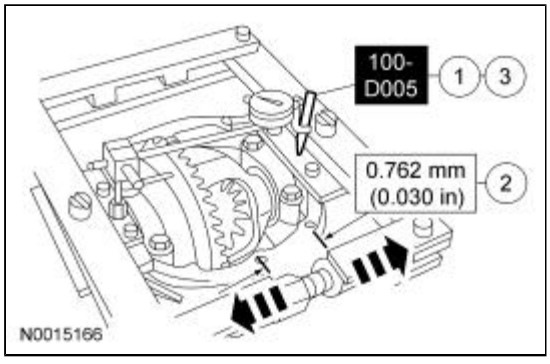
8. Install the special tools.

- Position the adapter tip in the spreader adapter hole.



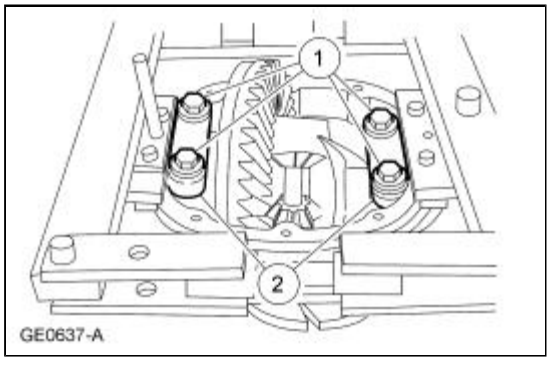
9. **CAUTION: Overspreading can damage the axle housing.**

Spread the axle housing to the specification.
1. Adjust the special tool to zero.
2. Tighten the housing spreader screw to spread the axle housing to the specification.
3. Remove the special tool.



10. **CAUTION: Mark the differential bearing caps Top or Bottom and LH or RH appropriately before removing them. Always install the bearing caps in their original place and position.**

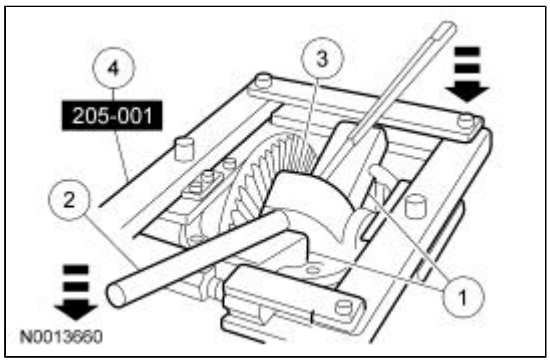
Mark and remove the differential bearing caps.
1. Remove the bolts.
2. Remove the differential bearing caps.



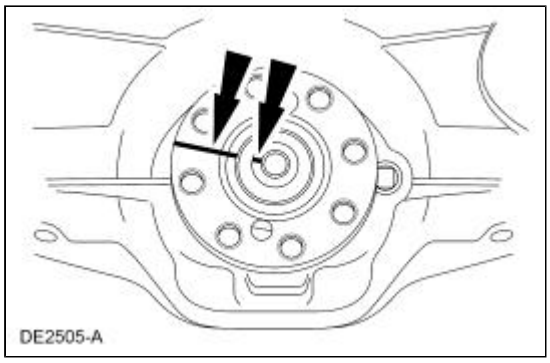
11. **CAUTION: Use wood blocks to avoid axle housing damage.**

Remove the differential assembly from the axle housing.

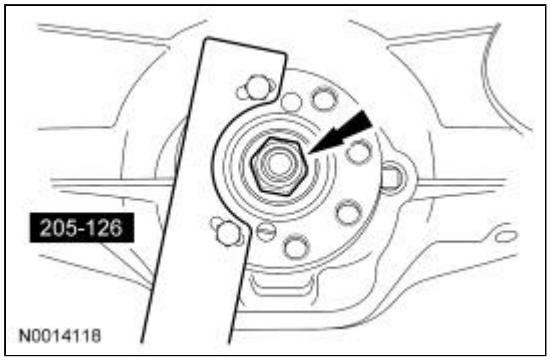
1. Position the wood blocks.
2. Position and push down on the 2 pry bars.
3. Remove the differential assembly.
4. Remove the special tool.



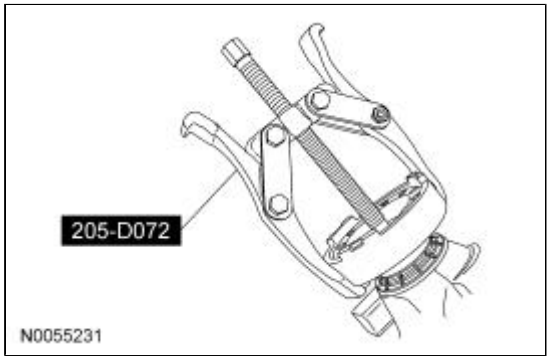
12. Index-mark the axle universal joint flange to the pinion stem.



13. Install the special tool and loosen, but do not remove, the pinion nut.

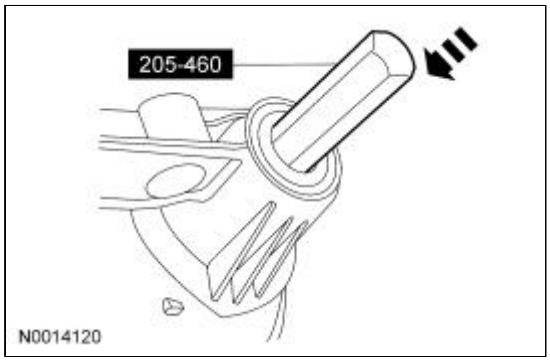


14. With the pinion nut still engaged by a few threads, use the special tool to separate the axle universal joint flange from the pinion gear.

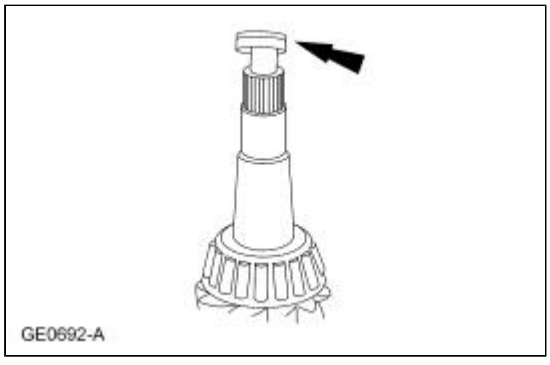


15. Remove the nut and the flange.

16. Using the special tool and a soft hammer, remove the pinion gear.

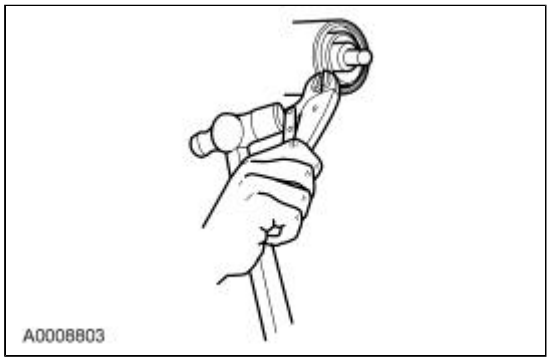


17. Discard the drive pinion collapsible spacer.



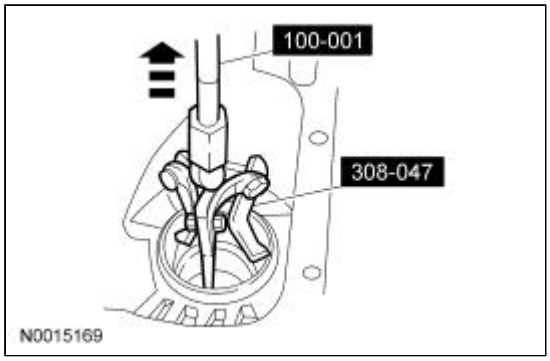
18. **CAUTION: Do not damage the carrier housing while removing the pinion seal.**

    Remove the pinion seal and slinger.
    - Pry up on the seal flange. Install gripping pliers, and strike with a hammer to remove the seal.



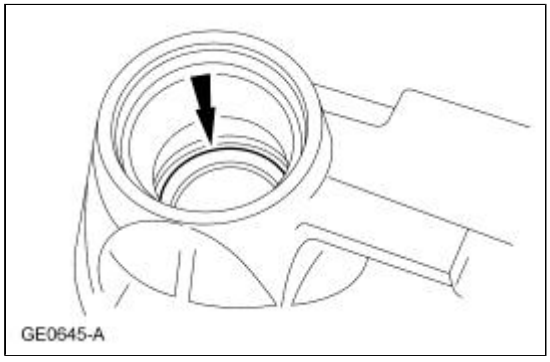
19. Remove the outer pinion bearing.

20. Using the special tools, remove the inner pinion bearing cup.

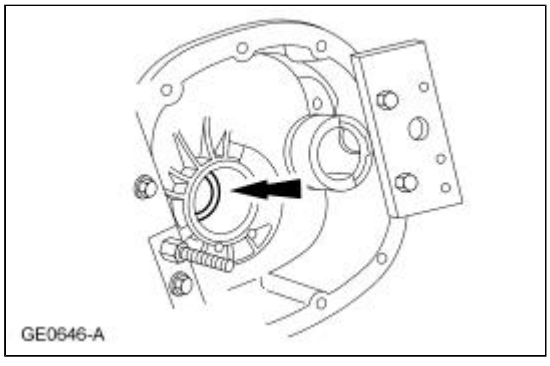


21. **NOTE:** The pinion bearing oil baffle aids in bearing lubrication. Normally, it is not necessary to remove the baffle.

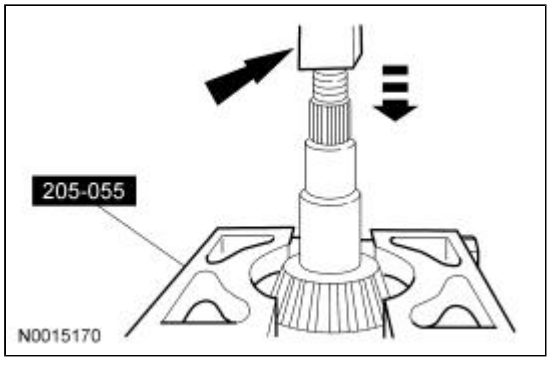
    If necessary, remove the pinion bearing oil baffle.



22. Remove the outer pinion bearing cup by tapping alternately on each side to prevent the cup from cocking.



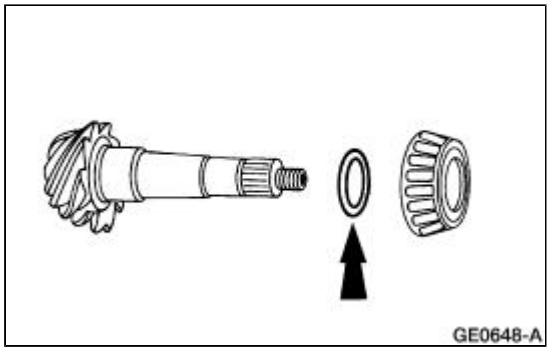
23. Using the special tool and a suitable press, remove the pinion bearing.



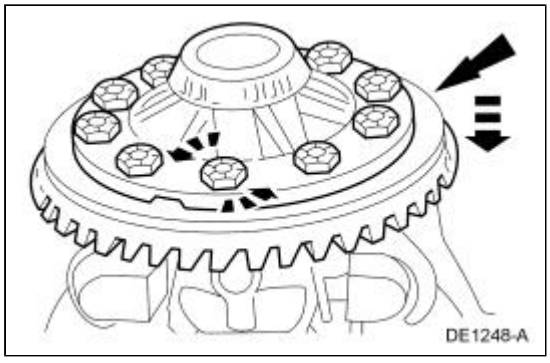
24. **NOTE:** A drive pinion bearing adjustment shim sits under the pinion bearing. Use a micrometer to

measure the shim thickness. Record the measurement for comparison to the shim gauge reading taken prior to installing the pinion bearing.

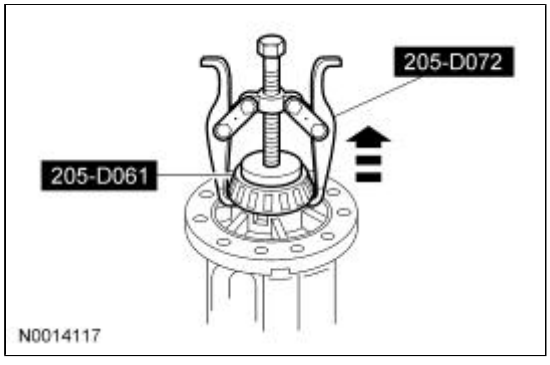
Remove and measure the drive pinion bearing adjustment shim.



25. Remove the 10 bolts and the ring gear.
    - Use a drift punch to separate the ring gear from the differential case.



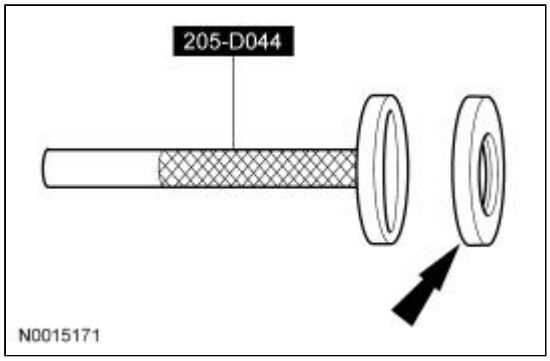
26. Using the special tools, remove the differential bearings.



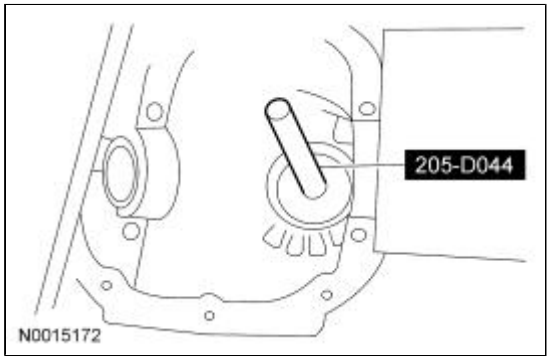
Assembly

1. **CAUTION: Do not omit the pinion bearing oil baffle; bearing failure can result.**

   If removed, position the baffle on the special tool.



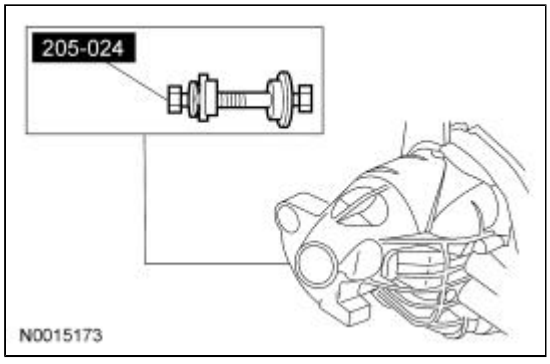
2. Using the special tool, install the baffle.



3. **NOTE:** Always install new pinion bearings when installing new pinion bearing cups.

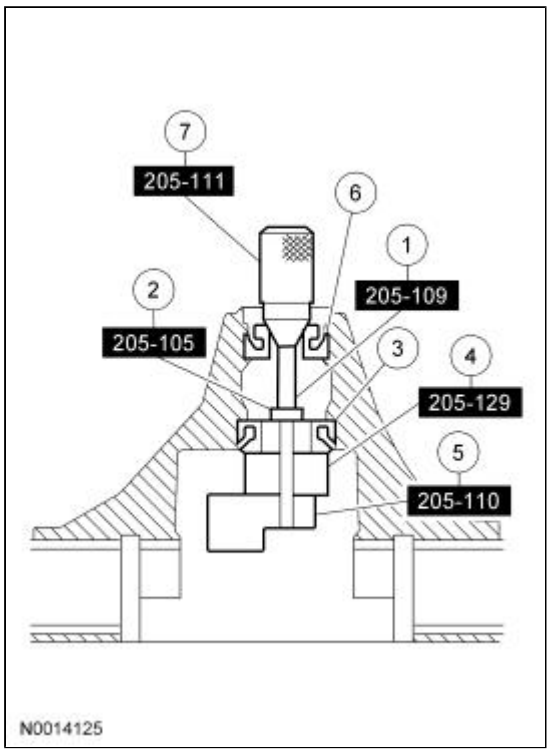
   Lightly oil the new pinion bearing cups and pinion bearings with front axle lubricant.

4. Using the special tool, install the bearing cups.



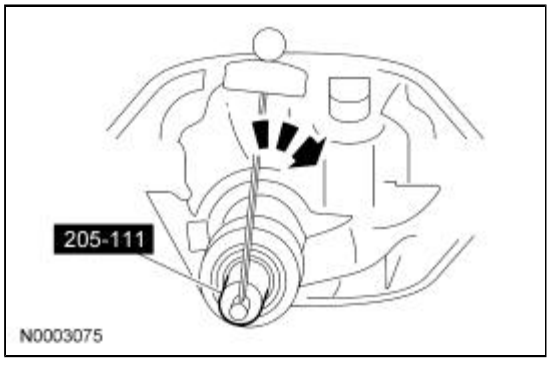
5. **NOTE:** You must use the pinion bearings assembled in this procedure step at final assembly.

   Assemble and position the special tools and the pinion bearings in the carrier housing.
   1. Position the screw adapter.
   2. Position the aligning adapter.
   3. Position the pinion bearing.
   4. Position the gauge disc adapter.
   5. Position the gauge block adapter.
   6. Position the pinion bearing.
   7. Thread on the handle adapter.



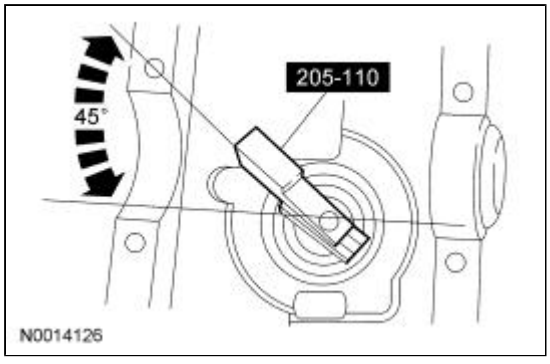
6. **NOTE:** This step duplicates final pinion bearing preload.

   Tighten the special tool to simulate bearing preload.
   - Tighten to 2.2 Nm (20 lb-in).

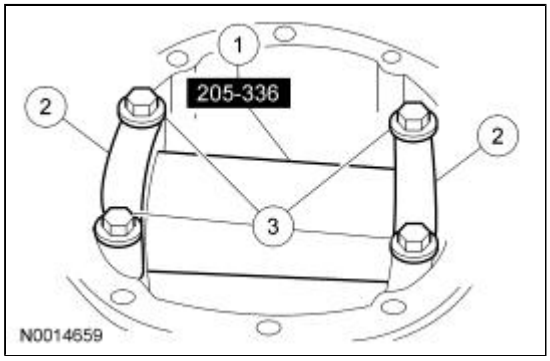


7. **NOTE:** Offset the gauge block adapter to obtain an accurate reading.

   Rotate the gauge block adapter several half-turns to make sure the pinion bearings seat correctly, and position the gauge block adapter.



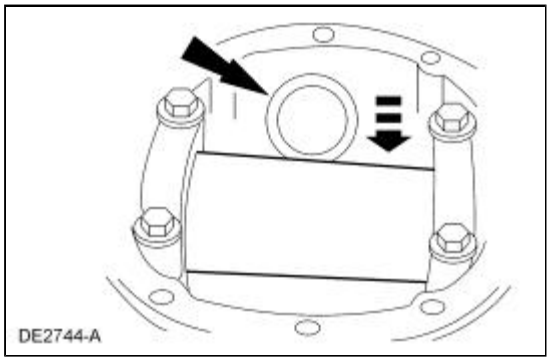
8. Install the special tool.
    1. Position the special tool.
    2. Install the differential bearing caps.
    3. Install the bolts.
        - Tighten to 105 Nm (77 lb-ft).



9. **NOTE:** Use only flat, clean drive pinion bearing adjustment shims.

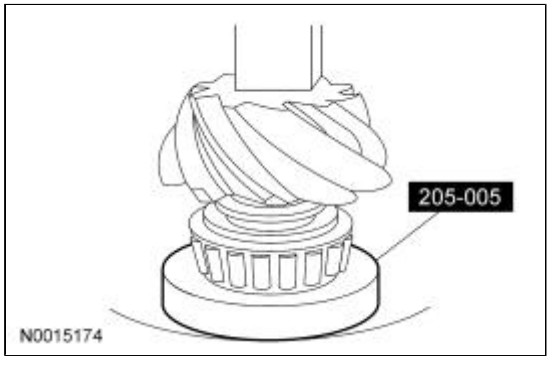
    NOTE: Do not attempt to force the shim between the gauge block adapter and the gauge tube adapter. A slight drag indicates correct shim selection.

    Use a drive pinion bearing adjustment shim as a gauge for shim selection.
    - Check the adjustment shim thickness between the gauge block adapter and the gauge tube adapter.
    - After determining the correct shim thickness, remove the special tools.

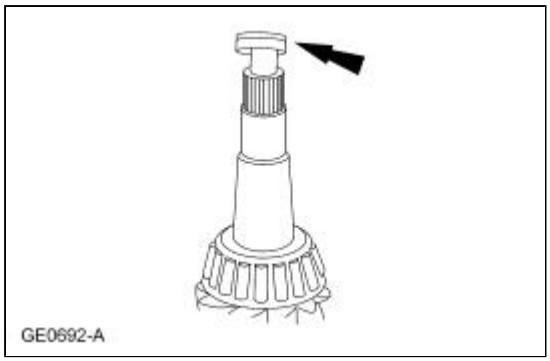


10. **NOTE:** You must use the same pinion bearings from the previous steps.

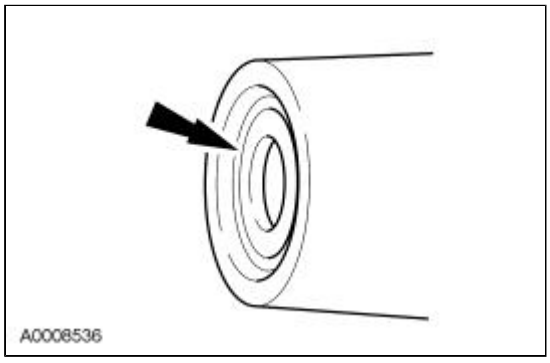
    Install the pinion bearing.
    - Place the drive pinion bearing adjustment shim on the pinion gear.
    - Using a suitable press and the special tool, press the pinion bearing until it is firmly seated on the pinion gear.



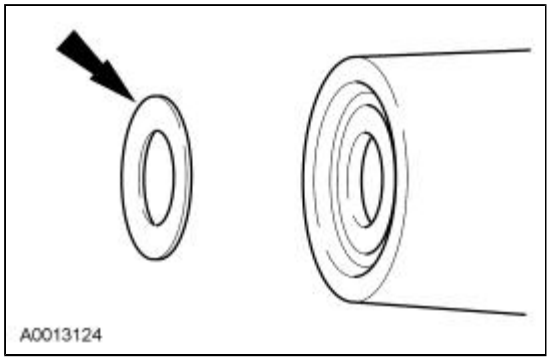
11. Place a new drive pinion collapsible spacer on the pinion stem.



12. Install the outer pinion bearing.

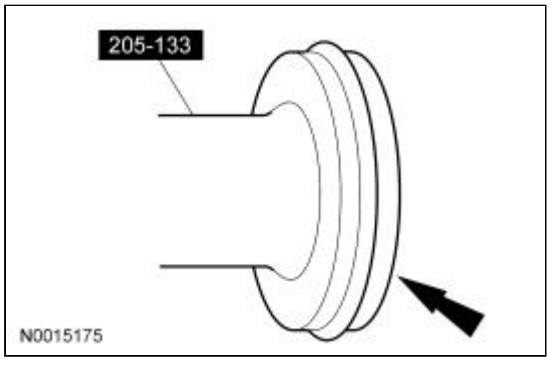


13. Install the slinger.

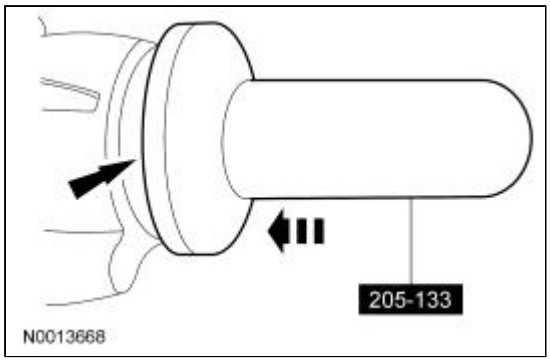


14. **NOTE:** Coat the lips of the pinion seal with front axle lubricant.

    Place the pinion seal on the special tool.

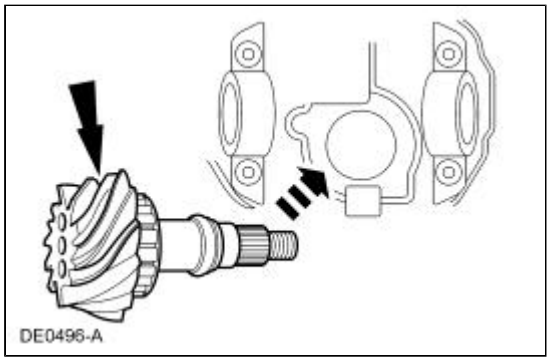


15. Place the special tool and seal in the pinion seal bore and drive the seal into place.



16. Lightly lubricate the pinion gear splines with front axle lubricant.

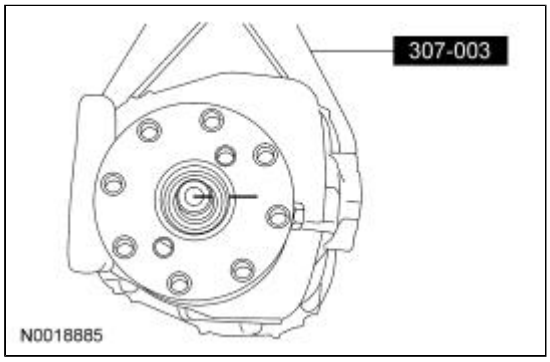
17. Position the drive pinion in the housing.



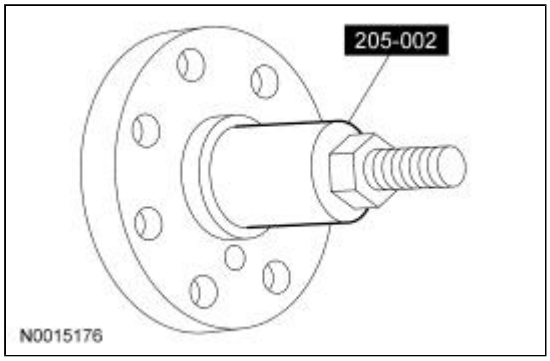
18. **CAUTION: Never install the drive pinion universal joint flange with a hammer or power tools.**

    NOTE: Disregard the scribe marks if installing a new flange.

    Align the index marks and position the universal joint flange on the drive pinion.



19. Using the special tool, install the drive pinion universal joint flange.

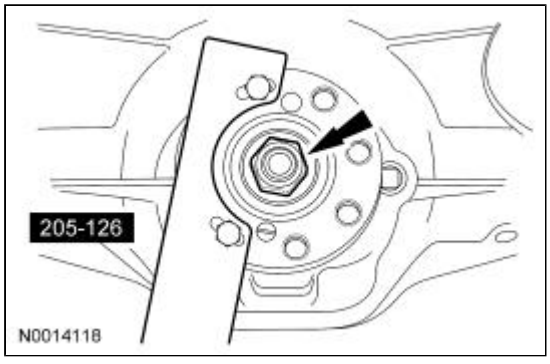


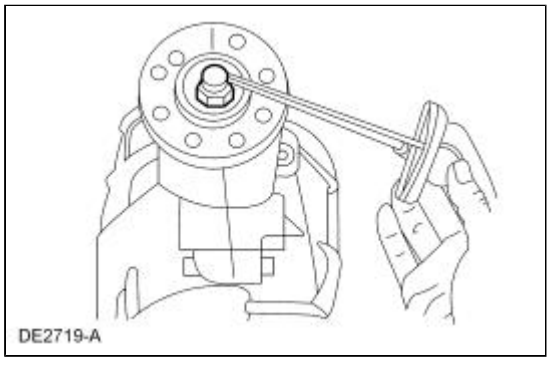
20. Apply a small amount of lubricant to the washer side of the new pinion nut, and install the nut.

21. **CAUTION: Do not loosen the pinion nut to reduce preload under any circumstance. If it is necessary to reduce preload, install a new drive pinion collapsible spacer and pinion nut.**

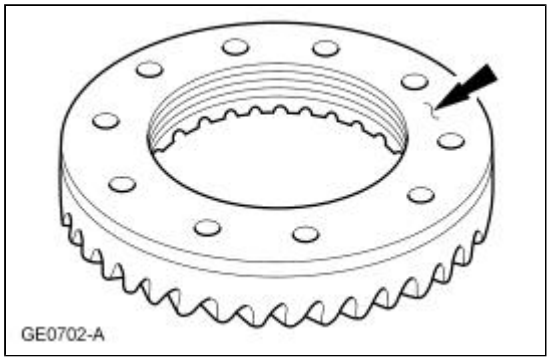
    Install the special tool, and tighten the pinion nut. Refer to the torque specifications in the Specifications portion of this section.

    - Rotate the pinion gear occasionally to make sure the pinion bearings are seating correctly. Take frequent pinion bearing torque preload readings by rotating the pinion gear with a Nm (inch-pound) torque wrench.

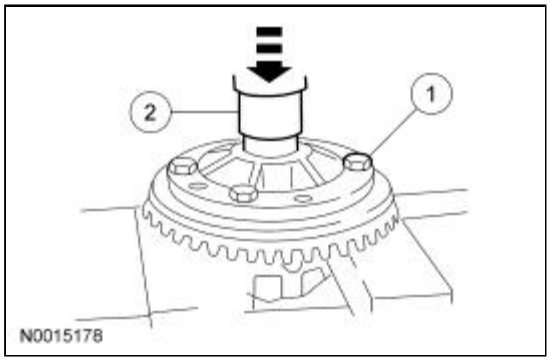




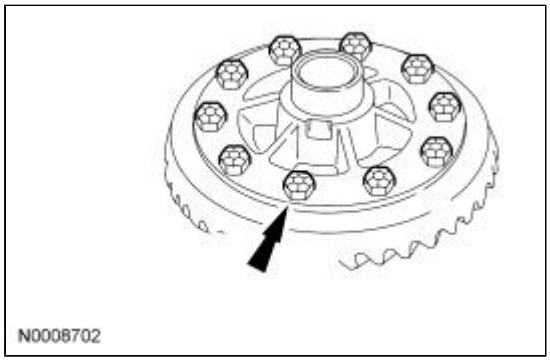
22. Use a fine flat file to remove any burrs or nicks from the ring gear mounting surface.



23. Install the ring gear.
    1. Position 3 bolts to align the holes in the ring gear and the differential case.
    2. Using a suitable press, install the ring gear.

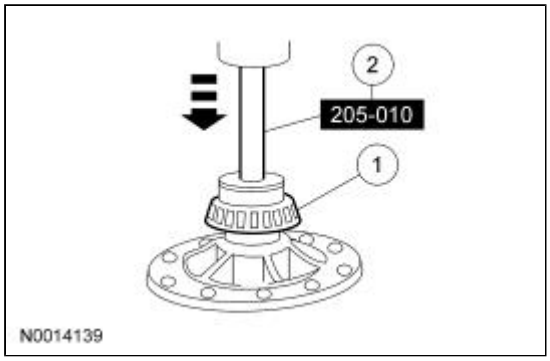


24. Install the remaining bolts.
    - Tighten to 105 Nm (77 lb-ft).

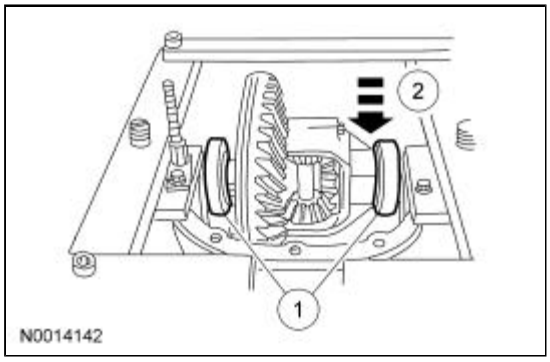


25. **CAUTION: Press against the bearing inner core only.**

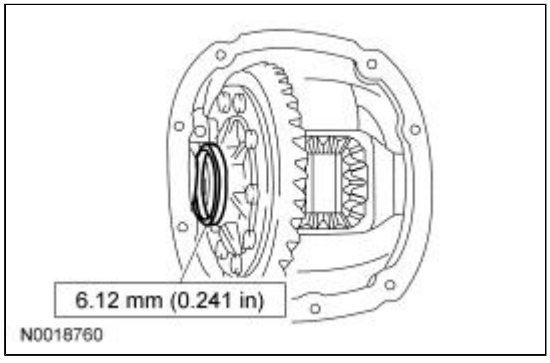
Using a suitable press and the special tool, install the differential bearings.
1. Position the appropriate differential bearing (RH or LH).
2. Using a suitable press and the special tool, install the differential bearing.
   - Repeat the procedure for the other differential bearing.



26. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place.

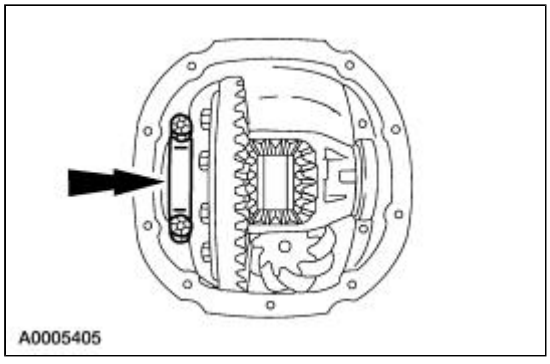


27. Install a differential bearing shim of the thickness shown on the LH side of the differential bearing.



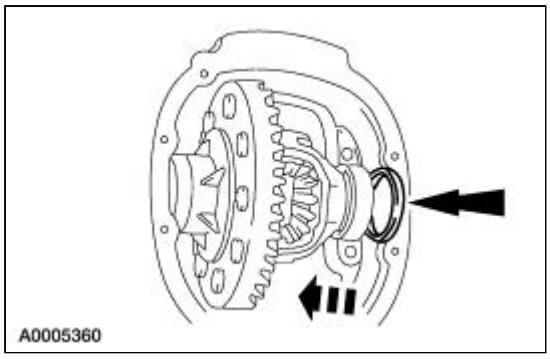
28. **NOTE:** Apply pressure to the left side to make sure the left bearing cup is seated.

    Install the left bearing cap and loosely install the bearing cap bolts.



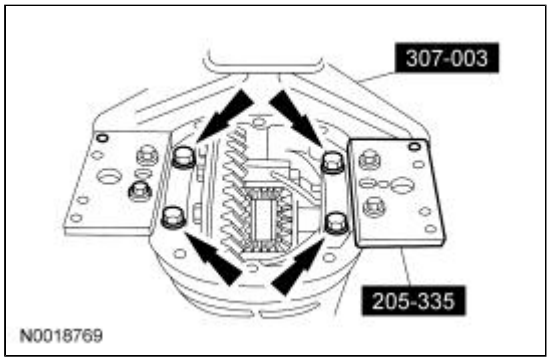
29. Install progressively thicker differential bearing shims on the right side until the thickest differential

bearing shim can be inserted by hand.

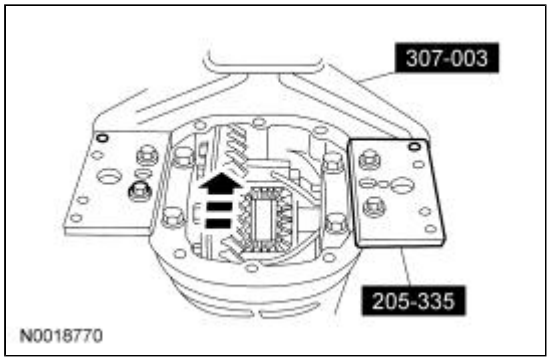


30. Install the right bearing cap and bolts.

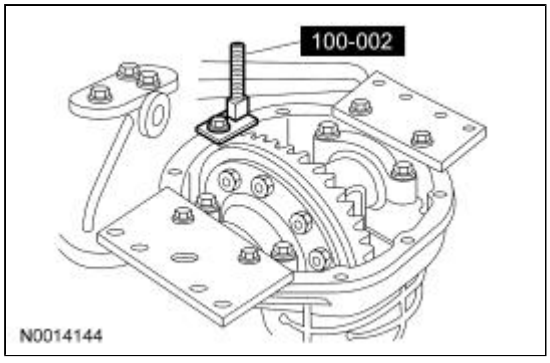
31. Tighten the 4 differential bearing cap bolts.
    - Tighten to 105 Nm (77 lb-ft).



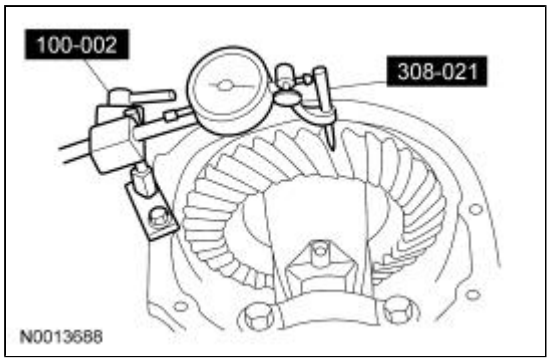
32. Rotate the differential carrier to make sure it turns freely.



33. Install the special tool.

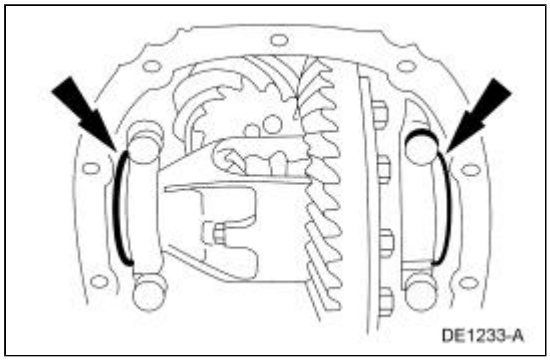


34. Measure the ring gear backlash at 4 places to obtain a consistent reading.

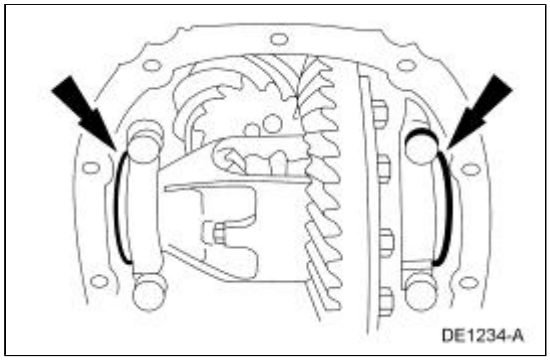


35. **NOTE:** If the backlash is not within the specifications, correct it by increasing the thickness of one differential bearing shim and decreasing the thickness on the other differential bearing shim by the same amount.

    To increase the backlash, install a thicker differential bearing shim and a thinner differential bearing shim as shown.



36. To decrease the backlash, install a thicker differential bearing shim and a thinner differential bearing shim as shown.



37. Select the appropriate shim by the thickness or the stripe color.

Backlash Change Required		Thickness Change Required	
mm	**Inch**	**mm**	**Inch**
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008

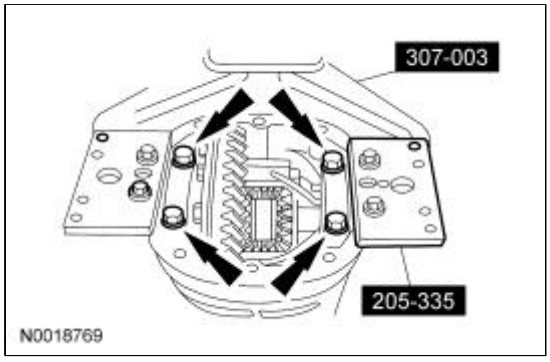
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart

Stripes/Color	mm	Inch
2 — C-COAL	7.7978-7.8105	0.3070-0.3075
1 — C-COAL		
5 — BLU	7.7470-7.7597	0.3050-0.3055
4 — BLU		
3 — BLU	7.6962-7.7089	0.3030-0.3035
2 — BLU		
1 — BLU	7.6454-7.6581	0.3010-0.3015
5 — PINK		
4 — PINK	7.5946-7.6073	0.2990-0.2995
3 — PINK		
2 — PINK	7.5458-7.5565	0.2970-0.2975
1 — PINK		
5 — GRN	7.4930-7.5050	0.2950-0.2955
4 — GRN		
3 — GRN	7.4422-7.4549	0.2930-0.2935
2 — GRN		
1 — GRN	7.3914-7.4041	0.2910-0.2915
5 — WH		
4 — WH	7.3406-7.3533	0.2890-0.2895
3 — WH		
2 — WH	7.2898-7.3025	0.2870-0.2875
1 — WH		
5 — YEL	7.2390-7.2517	0.2850-0.2855
4 — YEL		
3 — YEL	7.1882-7.2009	0.2830-0.2835
2 — YEL		
1 — YEL	7.1374-7.1501	0.2810-0.2815
5 — ORNG		
4 — ORNG	7.0866-7.0993	0.2790-0.2795
3 — ORNG		
2 — ORNG	7.0358-7.0485	0.2770-0.2775
1 — ORNG		
2 — RED	6.9850-6.9977	0.2750-0.2755
1 — RED		
	6.9342-6.9469	0.2730-0.2735
	6.8834-6.8961	0.2710-0.2715
	6.8326-6.8453	0.2690-0.2695
	6.7818-6.7945	0.2670-0.2675
	6.7310-6.7437	0.2650-0.2655
	6.6802-6.6929	0.2630-0.2635
	6.6294-6.6421	0.2610-0.2615

	6.5786-6.5913	0.2590-0.2595
	6.5278-6.5405	0.2570-0.2575
	6.4770-6.4897	0.2550-0.2555
	6.4262-6.4389	0.2530-0.2535
	6.3754-6.3881	0.2510-0.2515
	6.3246-6.3373	0.2490-0.2495
	6.2738-6.2865	0.2470-0.2475
	6.2223-6.2357	0.2450-0.2455
	6.1722-6.1849	0.2430-0.2335
	6.1214-6.1341	0.2410-0.2415

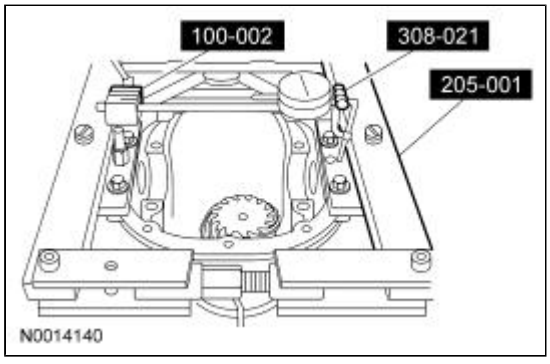
38. Remove the 4 differential bearing cap bolts.
    - Remove the differential carrier.



39. Measure the thickness of the selected right and left bearing shims.

40. To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.203 mm (0.008 in).

41. Install the special tools.

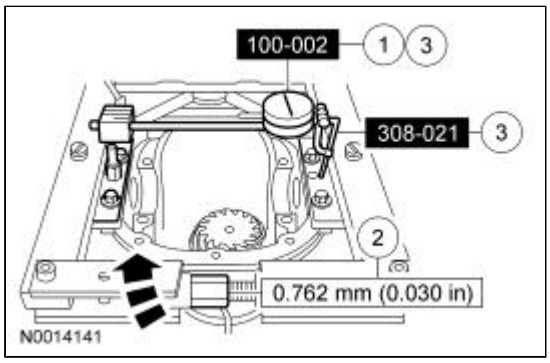


42. **CAUTION: Overspreading may damage the differential housing.**

    NOTE: Tighten and loosen the differential carrier spreader adapters to normalize the housing adapters prior to taking the final dial indicator reading.

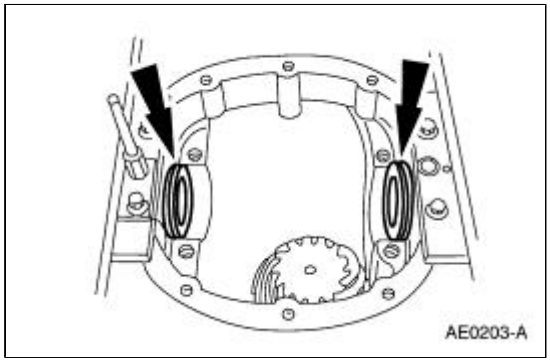
Spread the differential housing to the specification.

1. Adjust the special tool to zero.
2. Tighten the screw until spreading the differential housing to the specifications.
3. Remove the special tools.

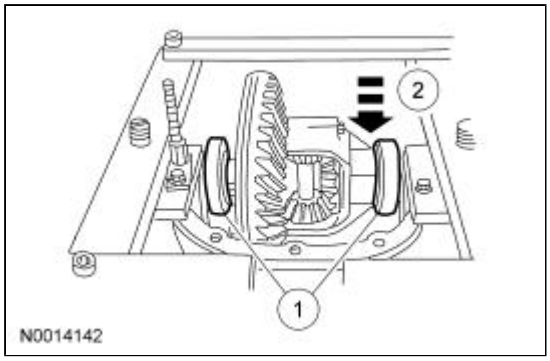


43. **CAUTION: To avoid galling the case, insert the shims with a light coating of grease before installing the differential carrier.**

    Place the differential bearing shims in the differential housing.

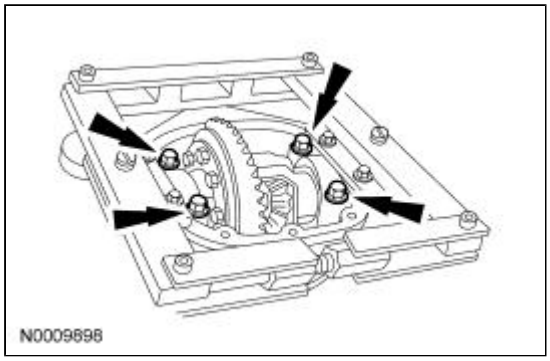


44. Install the differential carrier.
    1. Position the differential bearing cups on the differential bearings.
    2. Lower the differential carrier in place between the differential bearing shims.

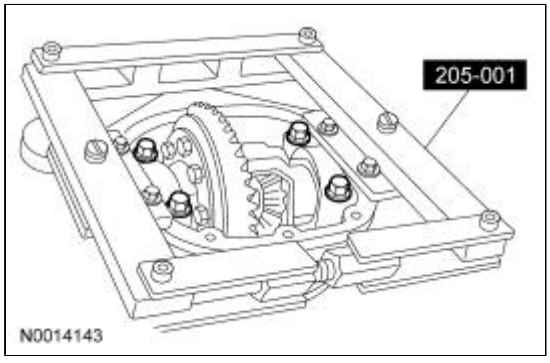


45. **NOTE:** Hand-tighten the differential bearing cap bolts prior to releasing the special tool.

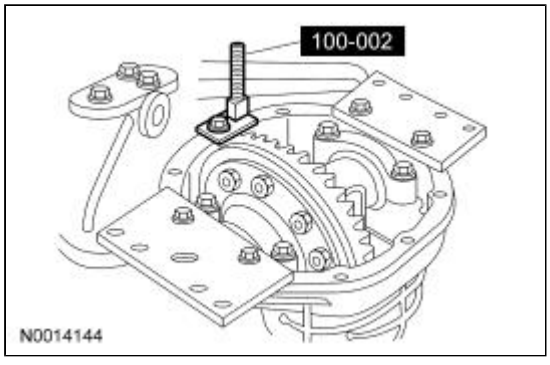
    Install the differential bearing caps and bolts in their original location.



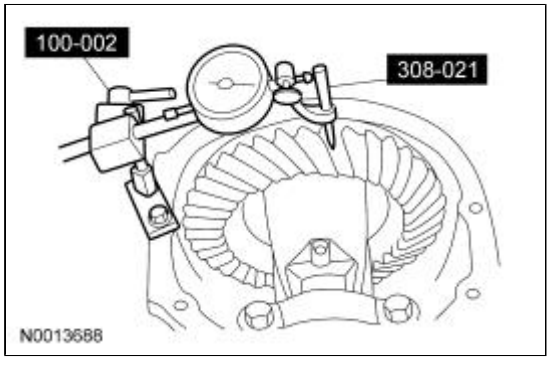
46. Loosen and remove the special tool.



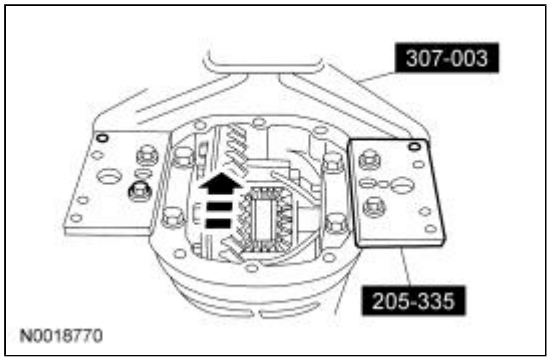
47. Install the special tool at the 12 o'clock position.



48. Using the special tools, recheck the ring gear backlash.



49. Apply marking compound and rotate the differential assembly 5 complete revolutions.



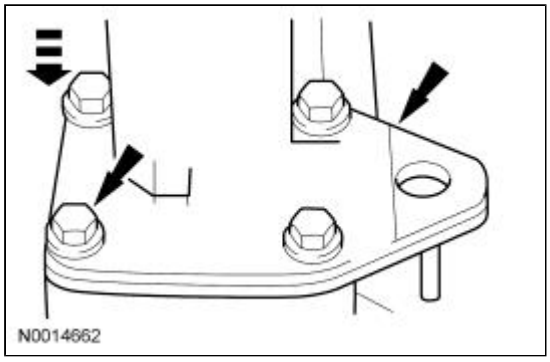
50. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

51. **CAUTION: Remove all of the old liquid gasket, and make sure the machined surfaces are free of oil before applying the new silicone rubber.**

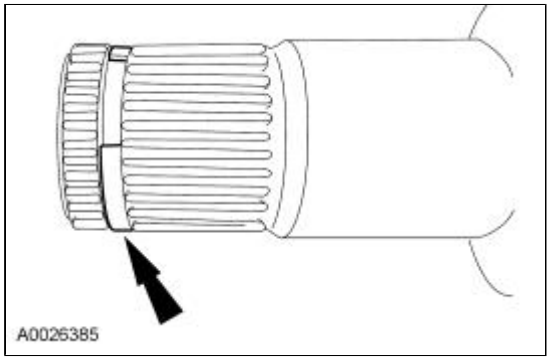
    CAUTION: Install the axle housing tube within 15 minutes of applying the silicone or it will be necessary to remove and reapply new sealant. If possible, allow one hour before filling with lubricant to make sure the silicone sealant has cured.

    CAUTION: Do not allow any silicone rubber to squeeze inside during assembly.

    Assemble the axle housing tube.
    - Align the bolt holes and position the axle tube.
    - Position the axle identification tag.
    - Install the bolts.
        - Tighten to 73 Nm (54 lb-ft).



52. Install a new O-ring and new circlips on the intermediate shaft ends.



53. Install a new stub shaft seal. For additional information, refer to Stub Shaft Pilot Bearing and Seal in this section.

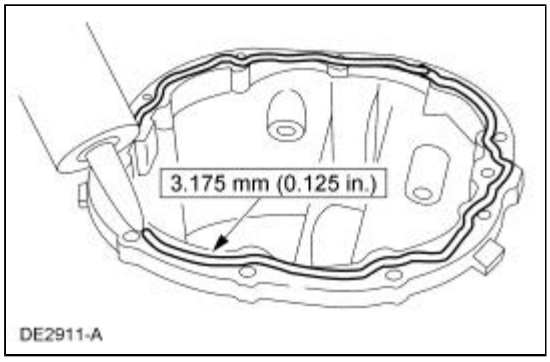
54. Insert the intermediate shaft and engage the circlip with the side gears.

55. Remove the axle assembly from the Holding Fixture and place it on the bench.

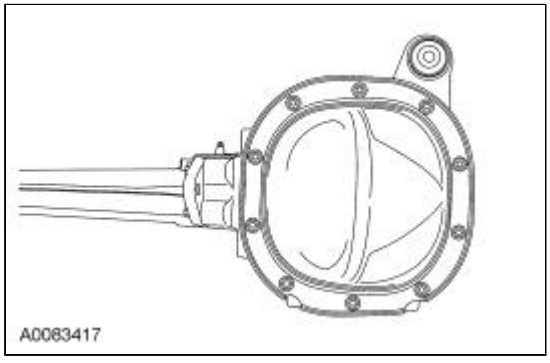
56. **CAUTION: Remove all of the old liquid gasket, and make sure the machined surfaces are free of oil before applying the new silicone rubber.**

    CAUTION: Install the differential housing cover within 15 minutes of applying the silicone, or it will be necessary to remove and reapply new sealant. If possible, allow one hour before filling with lubricant to make sure the silicone sealant has cured.

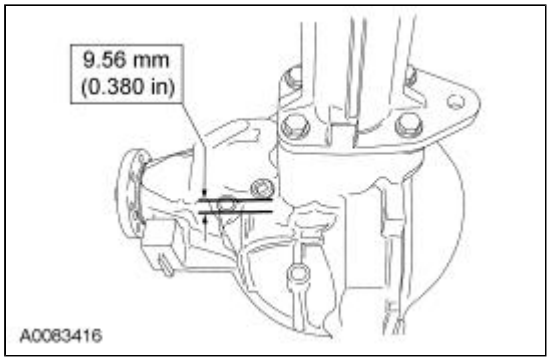
    Fill the sealing groove on the differential housing cover with silicone gasket and sealant.



57. Install the differential housing cover and the 10 cover bolts.
    - Tighten to 32 Nm (24 lb-ft).



58. Fill the differential carrier housing, and install the fill plug.
    - Use rear axle lubricant.



59. Install the front drive axle assembly. For additional information, refer to Axle Assembly in this section.

Differential Case

Printable View (382 KB)

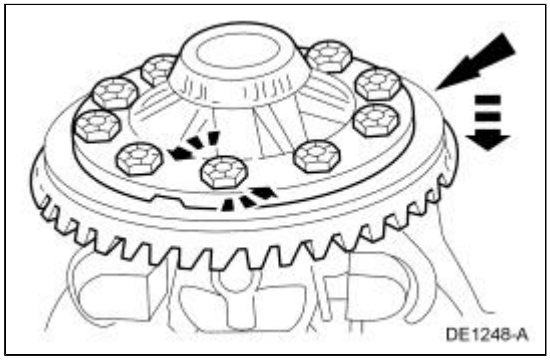
Material

Item	Specification
Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-IL (Canada); (Model 60/70 axles)	WSP-M2C197-A
Threadlock and Sealer TA-25	WSK-M2G351-A5

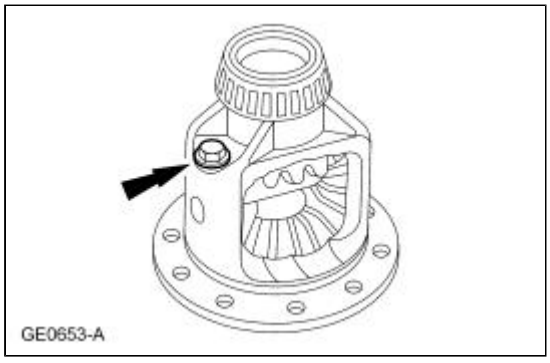
Disassembly

1. Remove the differential carrier. For additional information, refer to Differential Carrier in this section.

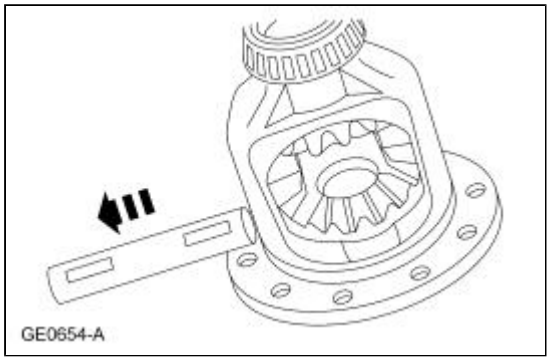
2. Remove the ring gear.
   - Remove the 10 bolts.
   - Use a drift punch to separate the ring gear from the differential case.



3. Remove the differential pinion shaft bolt.

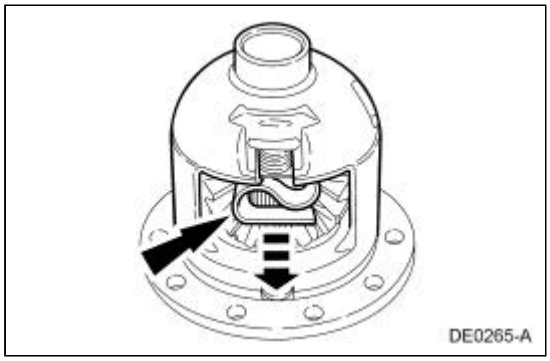


4. Remove the differential pinion shaft.

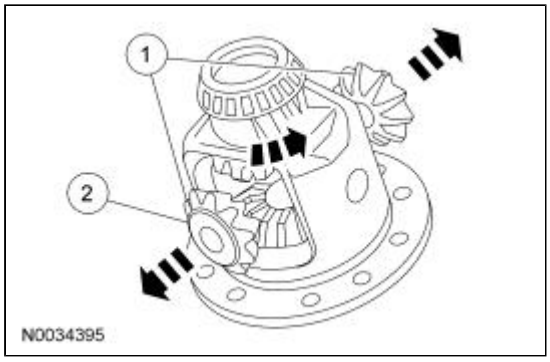


5. **WARNING: Due to the spring tension, use care when removing the differential clutch spring. Failure to follow these instructions may result in personal injury.**

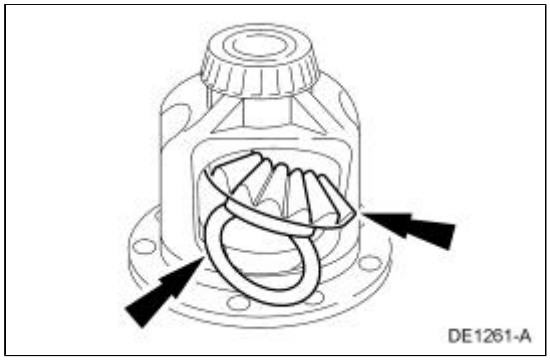
   Remove the differential clutch spring.



6. Remove the differential pinion thrust washers and the differential pinion gears.
   1. Rotate the differential pinion gears to the differential case window, and remove them.
   2. Separate the thrust washers from the gears.



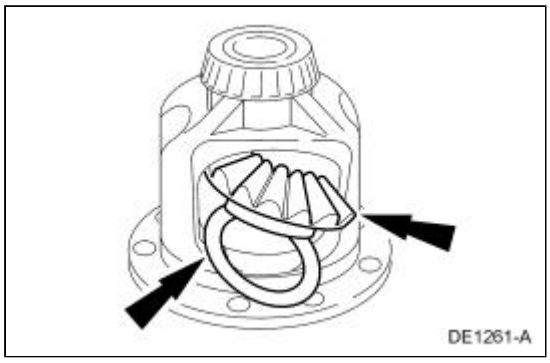
7. Remove the differential side gears and the differential side gear thrust washers.



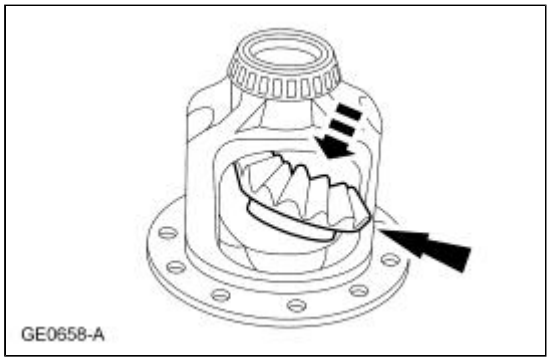
Assembly

1. Lubricate the differential side gear thrust washers and the differential side gear journals with axle lubricant.

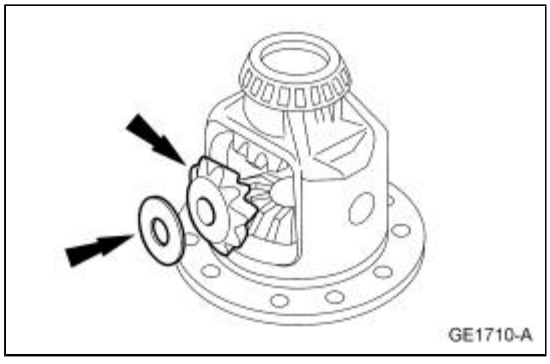
2. Position the differential side gear thrust washers on the differential side gears.



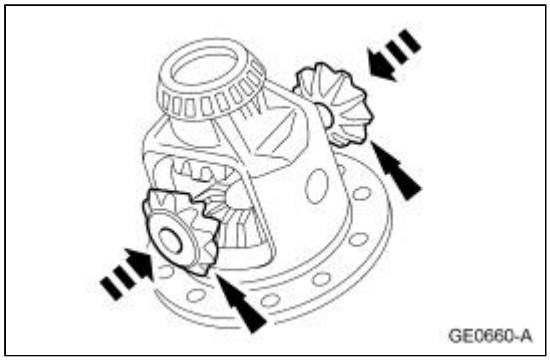
3. Position the differential side gears.



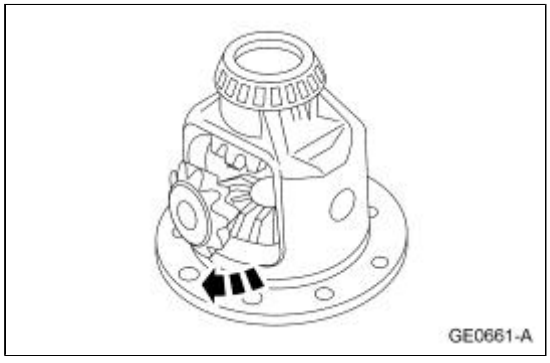
4. Lubricate the differential pinion thrust washers and the differential pinion gears with axle lubricant and assemble them.



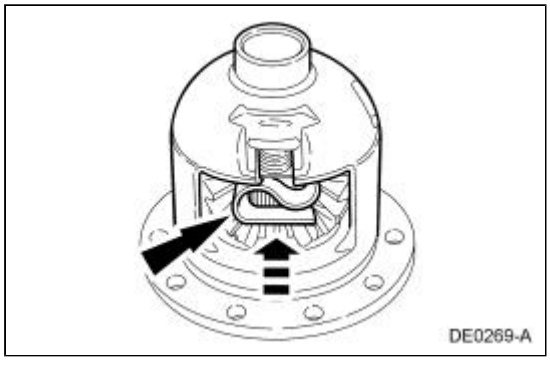
5. Engage the differential pinion gears opposite the differential side gears.



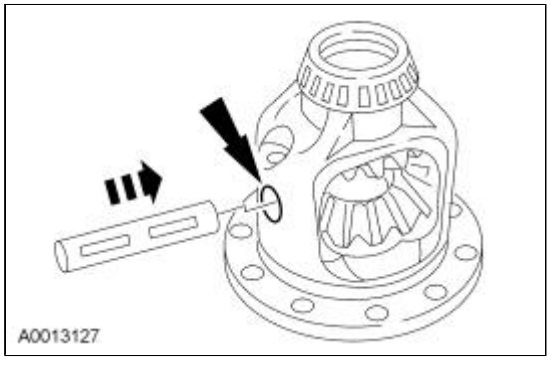
6. Rotate the differential pinion gears to align with the differential pinion shaft bore.



7. Using a soft-faced hammer, install the differential clutch spring.

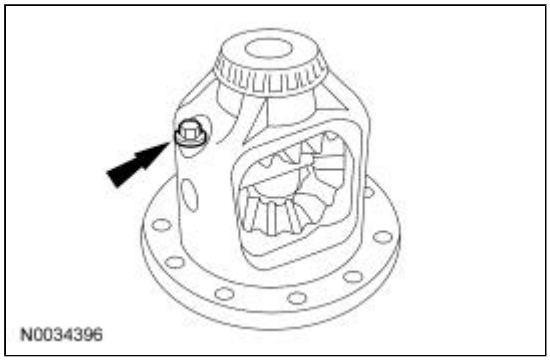


8. Insert the differential pinion shaft.



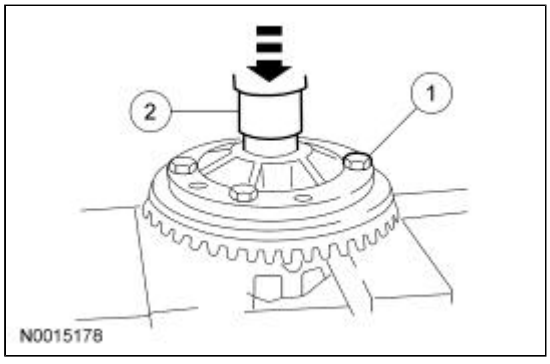
9. **NOTE:** If a new pinion shaft bolt is unavailable, coat the threads with sealer.

   Install a new differential pinion shaft bolt.
   - Tighten to 30 Nm (22 lb-ft).

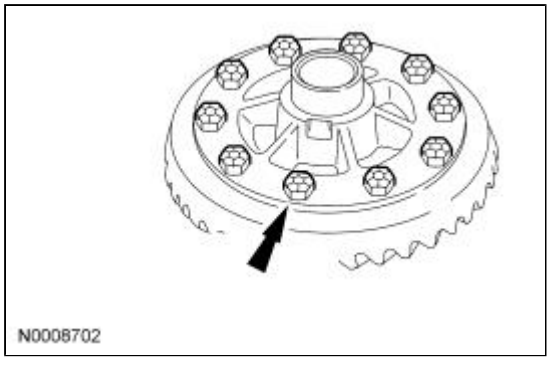


10. **CAUTION: Do not press on the bearing.**

    Install the ring gear.
    1. Position 3 bolts to align the holes in the ring gear and the differential case.
    2. Using a suitable press, install the ring gear.



11. Install the remaining bolts.
    - Tighten to 105 Nm (77 lb-ft).



12. Install the differential carrier. For additional information, refer to Differential Carrier in this section.

Printable View (63 KB)

General Specifications

Item	Specification
Right halfshaft assembled length	411.85 mm (16.21 in)
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1
Left halfshaft assembled length	406.45 mm (16.00 in)

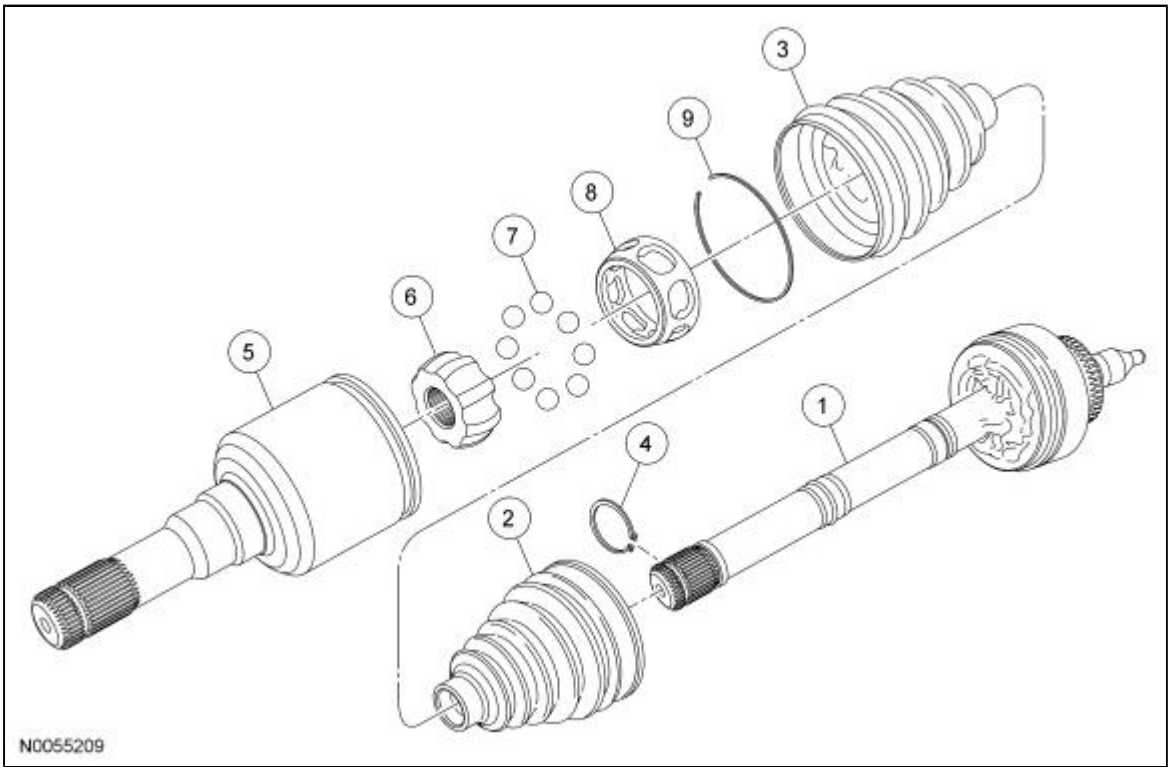
Torque Specifications

Description	Nm	lb-ft
Axle nut	27	20
Front disc brake caliper-to-anchor plate bolt	32	24
IWE disconnect-to-steering knuckle nut	12	9
Knuckle-to-upper control arm nut	150	111
Tie-rod end to knuckle nut	150	111

Front Drive Halfshafts

Printable View (157 KB)

Front Wheel Halfshaft and Joint, Disassembled View



Item	Description
1	Outboard constant velocity (CV) joint and interconnecting shaft assembly
2	Outboard boot
3	Inboard boot
4	Snap ring
5	Inboard CV joint housing
6	Inner race
7	Ball (8 required)
8	Ball cage
9	Retaining ring

New halfshaft components are available as follows:

- A repair kit includes the boots, clamps, snap ring, retaining ring and grease.
- A new inboard constant velocity (CV) joint (plunge-type).
- A new outboard CV joint and interconnecting shaft assembly includes the outboard front wheel halfshaft joint (fixed-type), boot and clamps.
- A new integrated wheel end disconnect assembly.

Front Drive Halfshafts

Printable View (62 KB)

Refer to Section 205-00 .

Halfshaft

Printable View (311 KB)

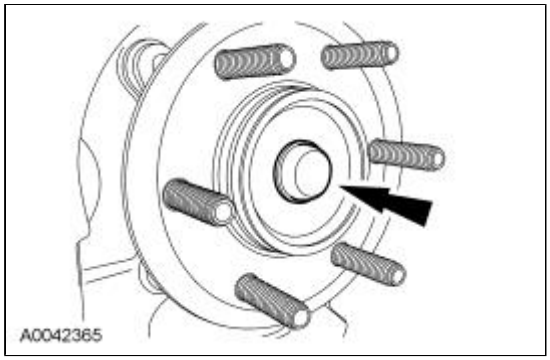
Special Tool(s)

ST1185-A	Slide Hammer 100-001 T50T-100-A
ST2934-A	Halfshaft Remover 205-832

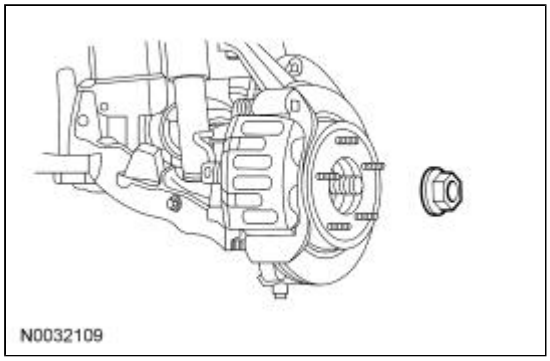
Removal and Installation

CAUTION: Whenever a halfshaft is removed, a new circlip and stub shaft pilot bearing seal must be installed.

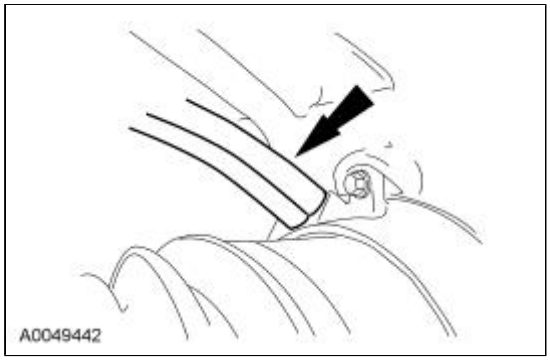
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disable the air suspension system. For additional information, refer to Section 204-05 .
3. Remove the dust cap.



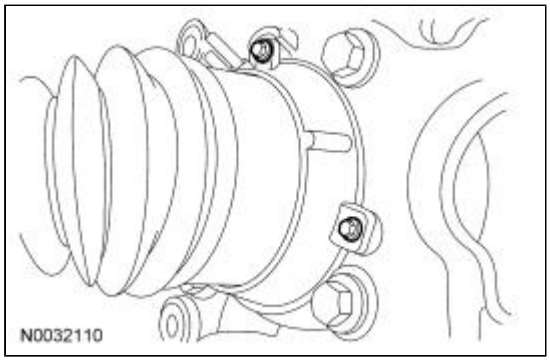
4. Remove and discard the axle nut.
   - To install, tighten to 27 Nm (20 lb-ft).



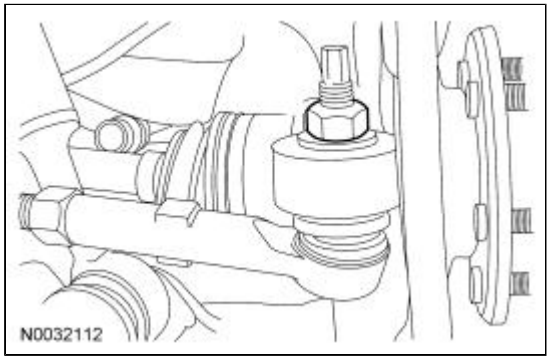
5. Remove the vacuum/vent line at the vacuum/vent port of the integrated wheel end (IWE) disconnect.



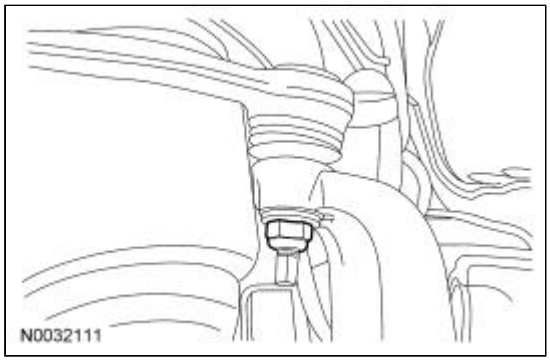
6. Remove the 3 IWE retaining bolts to the steering knuckle.
    - To install, tighten to 12 Nm (9 lb-ft).



7. Remove the tie-rod end nut.
    - Disconnect the tie-rod end from the steering knuckle.
    - Discard the tie-rod end nut.
    - To install, tighten to 150 Nm (111 lb-ft).



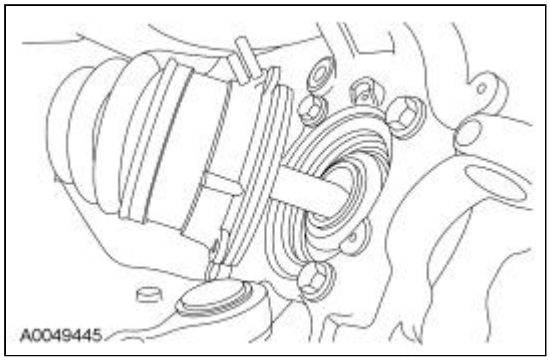
8. Remove the upper ball joint nut.
    - Disconnect the upper ball joint from the steering knuckle.
    - Discard the upper ball joint nut.
    - To install, tighten to 150 Nm (111 lb-ft).



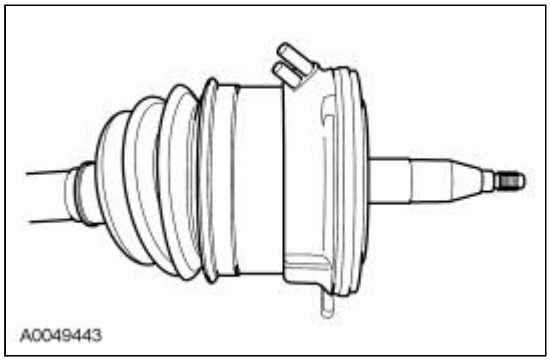
9. **CAUTION: Do not damage the hub seal.**

    NOTE: Allow the steering knuckle to swing outboard while keeping the constant velocity (CV) shaft pushed inboard.

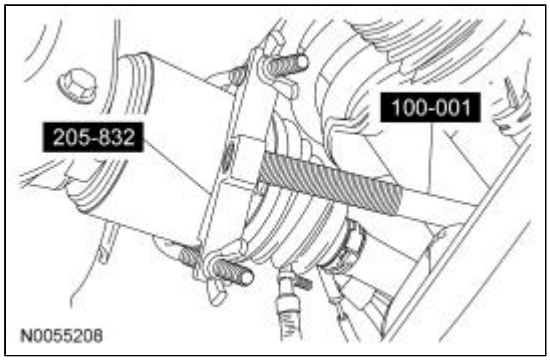
    Once clearance is available, remove the CV shaft joint outboard end and IWE disconnect from the steering knuckle hub bearing.



10. Remove the IWE disconnect from the outboard CV joint housing.



11. Using the special tools, remove the halfshaft from the differential and the intermediate shaft.



12. Remove and discard the circlip and the stub shaft seal. For additional information, refer to Section 205-03 .

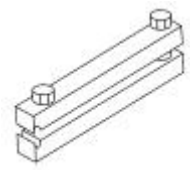
13. **CAUTION: Verify the spline engagement by checking for spline lash before installing the halfshaft nut.**

    To install, reverse the removal procedure.
    - Install a new axle nut, tie-rod end nut and an upper ball joint nut.

Halfshaft

Printable View (497 KB)

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)

Material

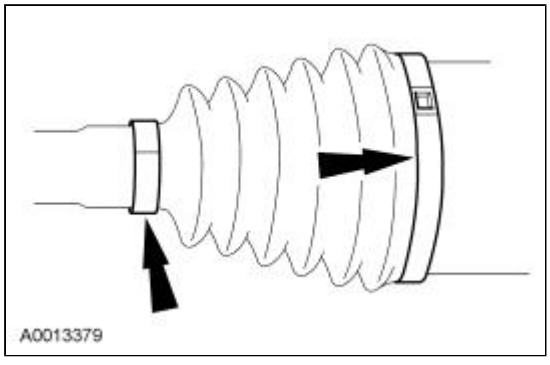
Item	Specification
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1

Disassembly

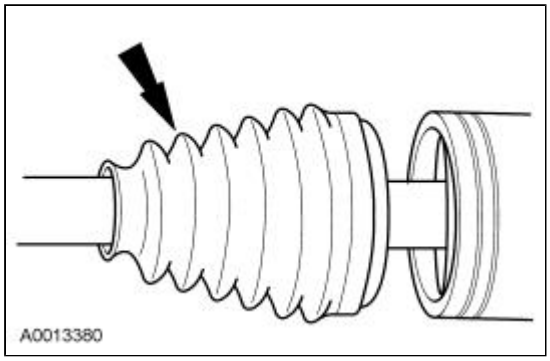
1. Remove the halfshaft from the vehicle. For additional information, refer to Halfshaft in the Removal and Installation portion of this section.

2. **CAUTION: Do not damage the boot.**

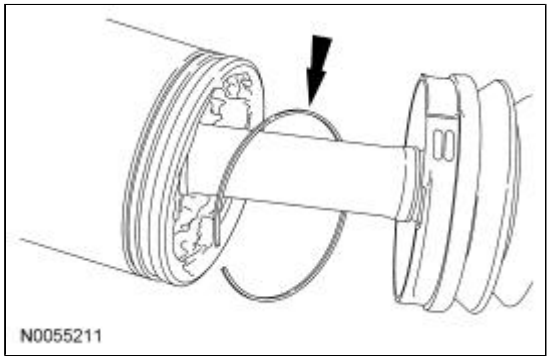
   Remove the boot clamps.



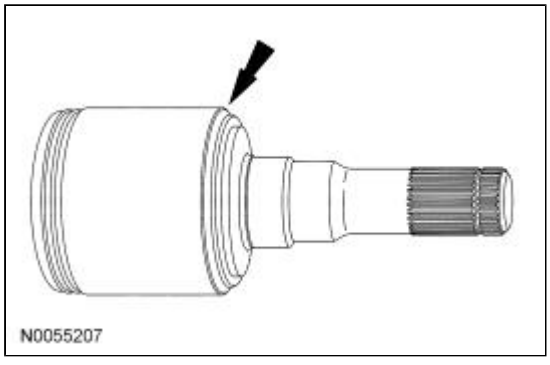
3. Separate the boot from the inboard constant velocity (CV) joint housing.



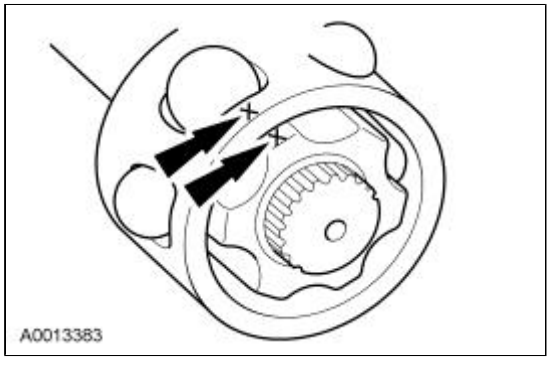
4. Remove the retaining ring.



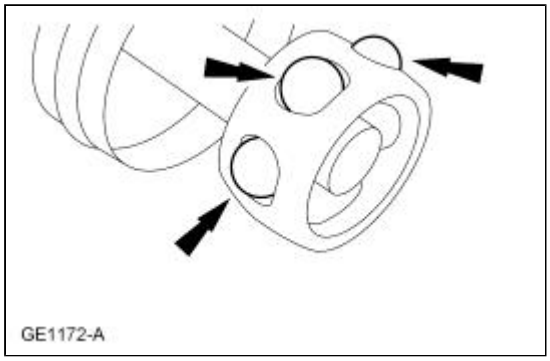
5. Remove the inboard CV joint housing.



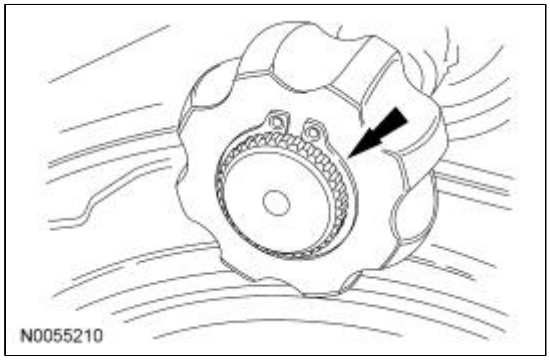
6. Index-mark the inner race and ball cage.



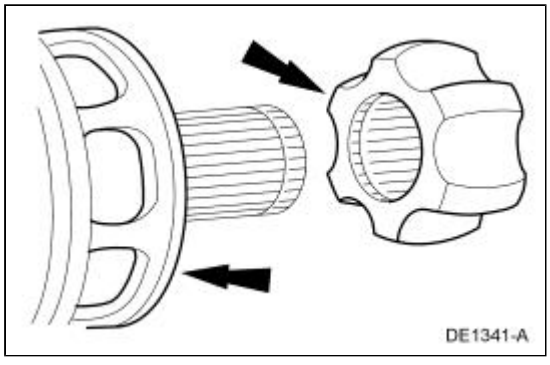
7. Remove the 6 balls.



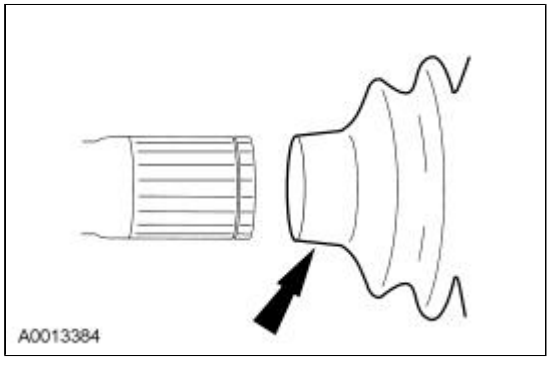
8. Remove the snap ring.



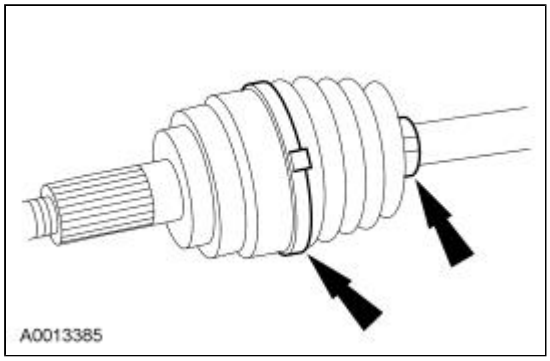
9. Remove the inner race and the ball cage.



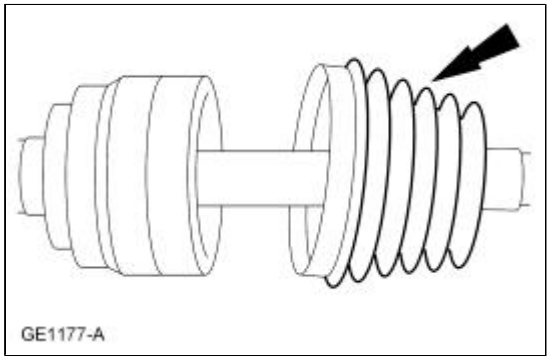
10. Remove the inboard boot.



11. Remove the boot clamps.



12. Remove the outboard boot.

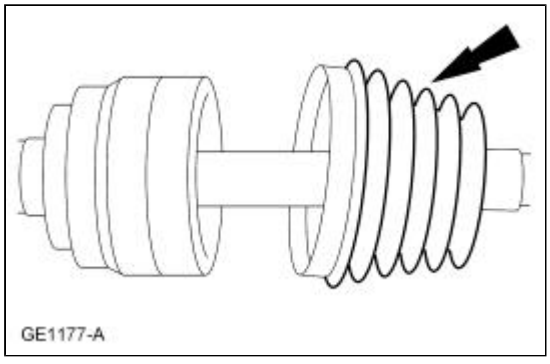


13. **NOTE:** If the grease is contaminated, clean and inspect the joint for wear. Install a new outboard CV joint and interconnecting shaft assembly if worn/damaged.

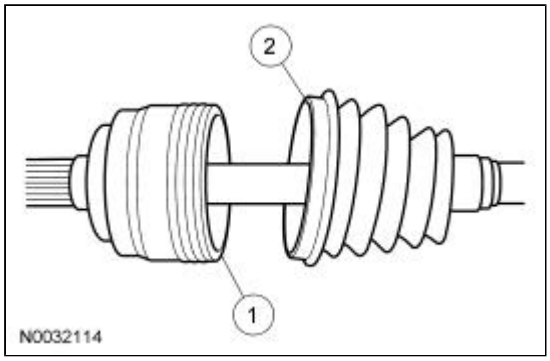
    Check the grease for contamination.

Assembly

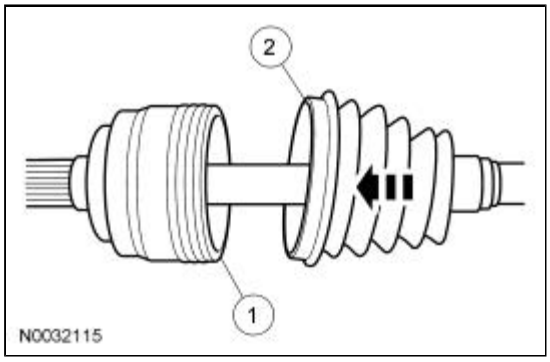
1. Position the outboard boot on the shaft.



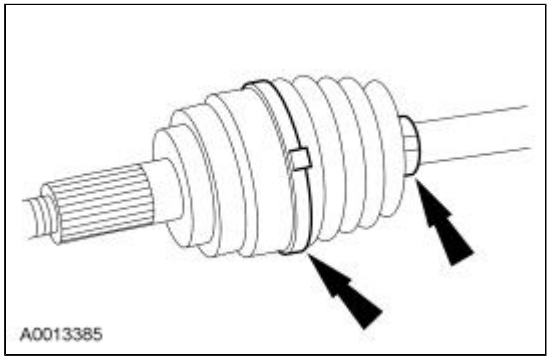
2. Pack the outboard CV joint with 165 grams (5.82 ounces) of grease.
    1. Use CV joint grease or equivalent provided in the boot kit.
    2. Spread any remaining grease from the kit evenly inside the boot.



3. Install the outboard boot.
    1. Clean the boot mounting surface.
    2. Seat the boot in the joint boot groove.

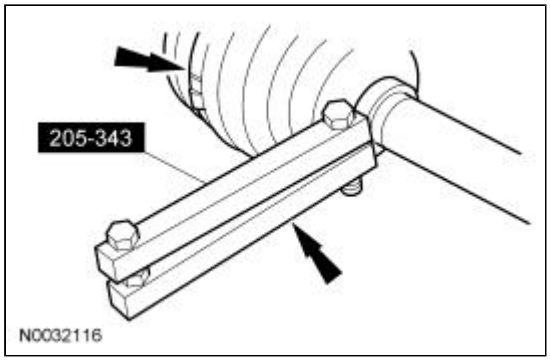


4. Position the boot clamps.

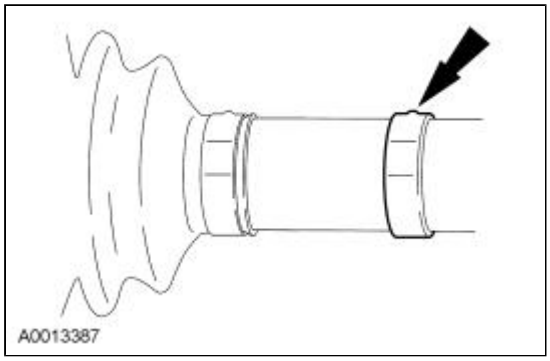


5. **NOTE:** Tighten the through-bolt until the tool is in the closed position.

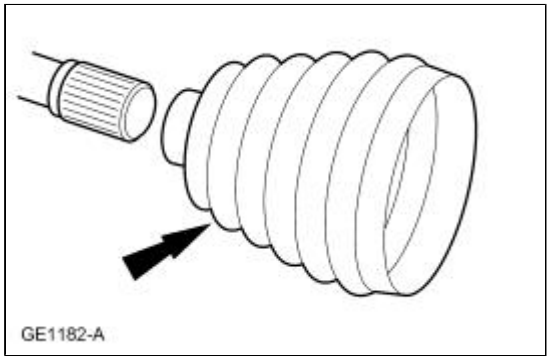
    Using the special tool, install the 2 boot clamps.



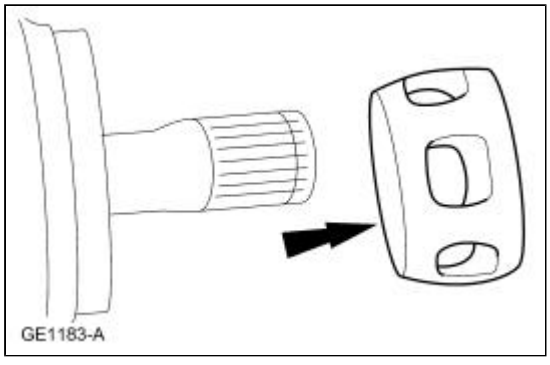
6. Position the boot clamp on the shaft.



7. Position the inboard boot on the shaft.

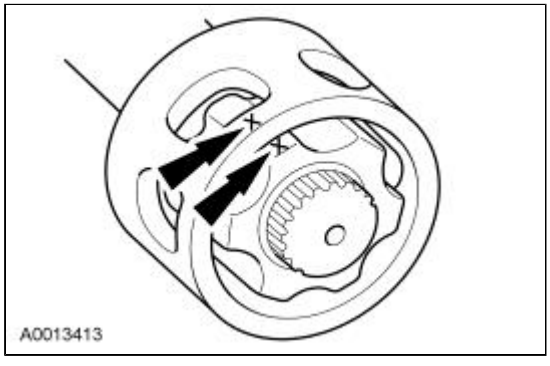


8. Position the ball cage on the shaft with the tapered end facing the boot.

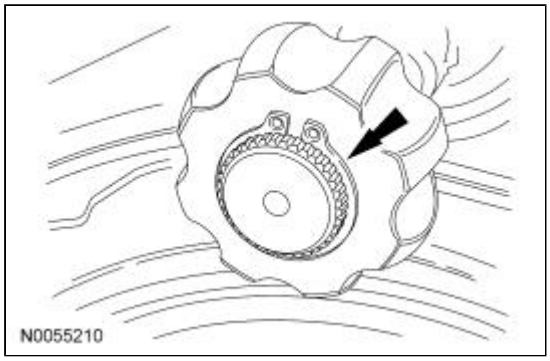


9. **NOTE:** Align the index marks.

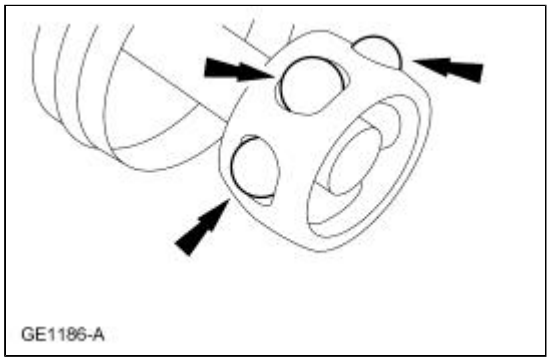
   Position the inner race on the shaft with the counterbored end facing the boot.



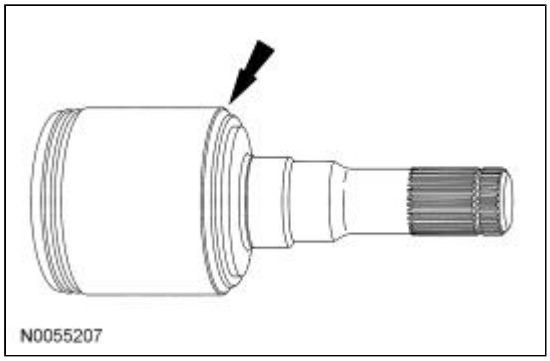
10. Install the snap ring.



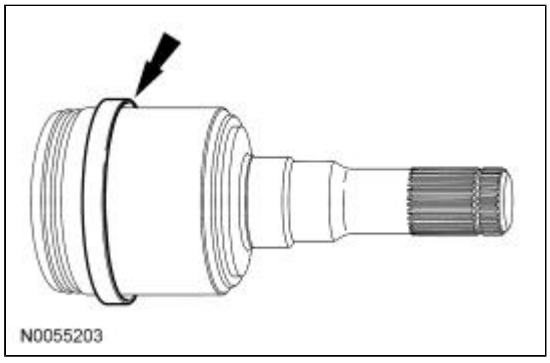
11. Lubricate and position the 6 balls.
    - Use CV joint grease or equivalent provided in the boot kit.



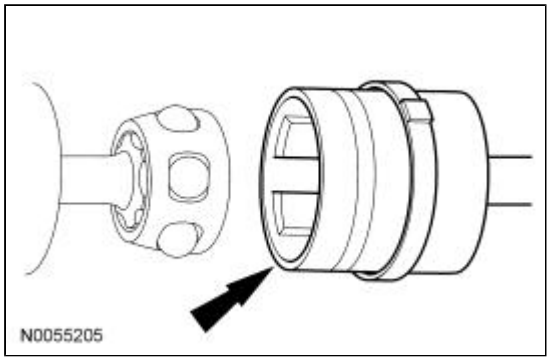
12. Fill the inboard CV joint housing with 235 grams (8.29 ounces) of grease.
    - Use CV joint grease or equivalent provided in the boot kit.



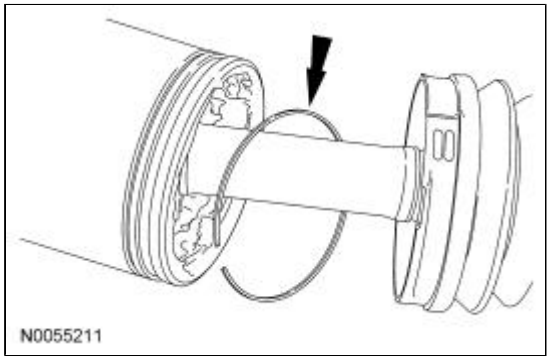
13. Position the boot clamp on the inboard CV joint housing.



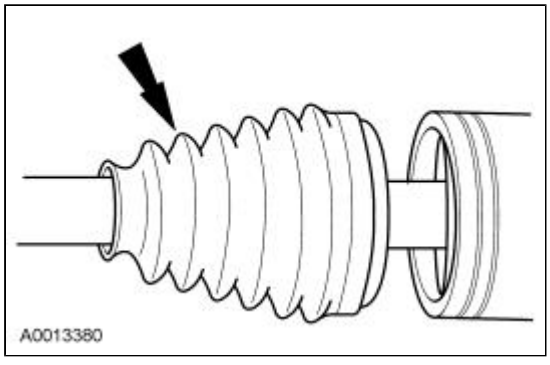
14. Position the inboard CV joint housing on the ball and race assembly.



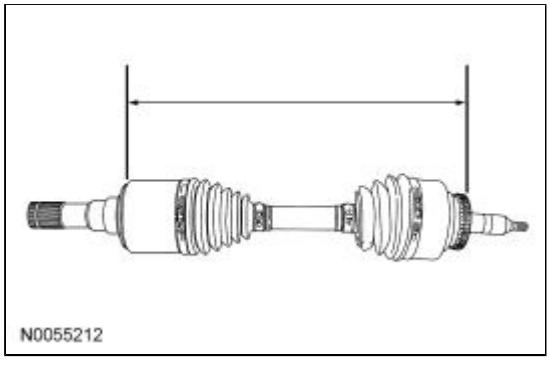
15. Install the retaining ring.



16. Remove any excess grease from the mating surface. Seat the boot in the joint boot groove.

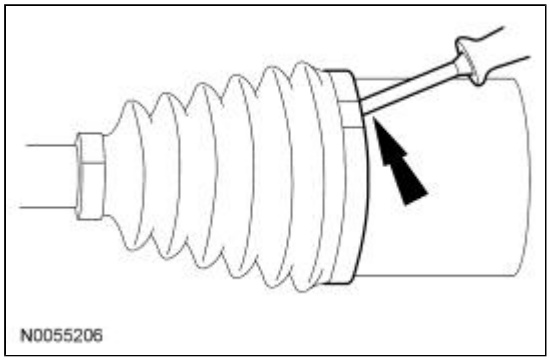


17. Set the halfshaft assembled length to specification. For additional information, refer to Specifications in this section.



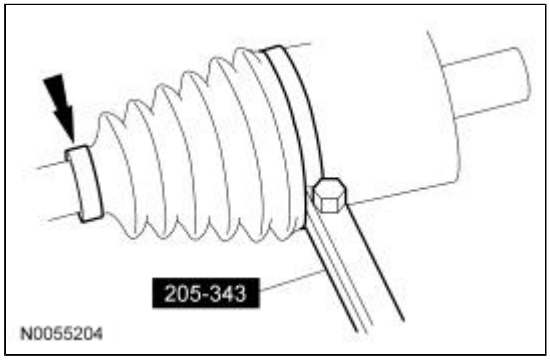
18. **CAUTION: Do not damage the boot.**

    Insert a dull screwdriver blade under the boot to release the pressure.



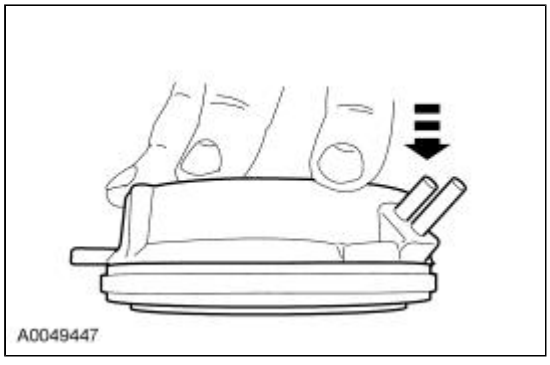
19. **NOTE:** Tighten the through-bolt until the tool is in the closed position.

    Using the special tool, install the 2 boot clamps.

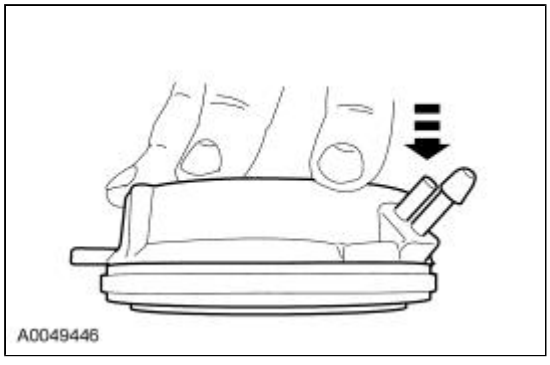


20. **NOTE:** Maintain a clean work surface.

    Compress the integrated wheel end (IWE) disconnect on the bench to collapse the vacuum chamber.

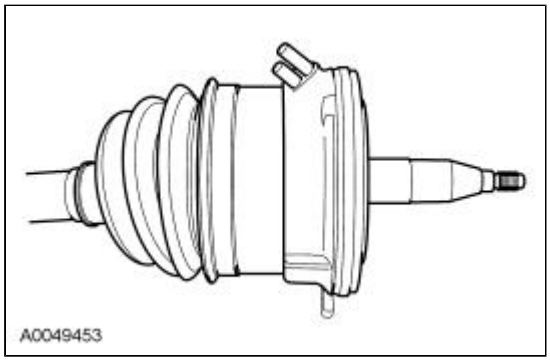


21. While the IWE disconnect is collapsed, install a vacuum cap on the vacuum port.



22. **CAUTION: Do not install the integrated wheel end disconnect in the knuckle. It must be installed on the outer constant velocity joint housing.**

    Install the IWE disconnect on the outer CV joint housing.



23. **CAUTION: Verify the spline engagement by checking for spline lash before installing the halfshaft nut.**

    Install the halfshaft in the vehicle. For additional information, refer to Halfshaft in the Removal and Installation portion of this section.

Printable View (63 KB)

General Specifications

Item	Specification
Halfshaft assembled length, LH	952.3 mm (37.49 in)
Halfshaft assembled length, RH	910.8 mm (35.86 in)

Torque Specifications

Description	Nm	lb-ft
Knuckle to lower control arm bolt	400	295
Rear axle wheel hub retainer	345	254
Toe-link nut	55	41

Materials

Item	Specification
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1

Rear Drive Halfshafts

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- The RH and LH halfshafts are different lengths, with the LH halfshaft being the longer of the 2.
- Inboard and outboard CV joints connect to a splined shaft.
- An axle circlip retains the splined inboard CV joint to the differential side gear. Install a new axle circlip every time the halfshaft is removed from the vehicle.
- A rear axle wheel hub retainer secures the side shaft assembly (interconnecting shaft and outboard CV joint) to the rear hub. Install a new rear axle wheel hub retainer every time you remove the halfshaft from the vehicle.

Halfshaft Handling

CAUTION: Never pick up or hold the halfshaft by the inboard or outboard CV joint only.

NOTE: Only the inner CV joints are removable for installation of new CV boots and clamps. The boots and clamps are the only serviced parts of the halfshaft assembly.

Handle all halfshaft components carefully during removal and installation procedures.

- The halfshaft assemblies are not repairable. Install new assemblies if worn/damaged.
- To separate the halfshaft from the rear hub, press the outboard CV joint from the rear hub.
- To separate the halfshaft from the differential, apply a load to the back face of the inboard CV joint assembly to overcome the axle circlip.
- Do not over-angle the CV joints.
- Install new differential stub shaft seals whenever the halfshafts are removed. For additional information, refer to Section 205-02 .
- Damage will occur to an assembled inboard CV joint if it is over-plunged outward from the joint housing.
- Never use a hammer to remove or install the halfshafts.
- Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft.
- Do not allow the boots to contact sharp edges or hot exhaust components.
- Handle the halfshaft by the interconnecting shaft only to avoid pull-apart and potential damage to the CV joints.
- Do not drop assembled halfshafts. The impact can cut the boots from the inside without evidence of external damage.

Wheel and Tire Balancing, Rear

WARNING: Do not balance the rear wheels and tires while mounted on the vehicle. For additional information, refer to Section 204-04 .

Hoisting

CAUTION: Use a frame-contact hoist only. Vehicle or component damage can result if other types of hoists are used. For additional information, refer to Section 100-02 .

Never raise the vehicle using the halfshafts as lift points.

Undercoating and Rustproofing

During undercoating and rustproofing procedures, protect the boots from the coating materials. Foreign materials on the rubber boots will cause extreme advanced wear.

Rear Drive Halfshafts

Printable View (62 KB)

Refer to Section 205-00 .

Halfshaft

Printable View (266 KB)

Special Tool(s)

ST2666-A	Remover, Halfshaft 205-529
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)

Removal and Installation

NOTE: This procedure applies to both rear halfshaft assemblies.

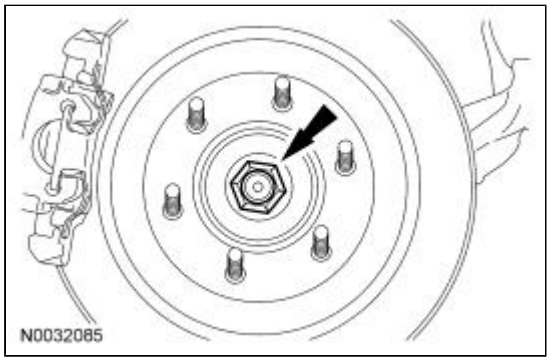
1. **CAUTION: Do not loosen the rear axle wheel hub retainer until after the wheel and tire assembly is removed from the vehicle. Wheel bearing damage will occur if the wheel bearing is unloaded with the weight of the vehicle applied.**

   With the vehicle in NEUTRAL, raise and support the vehicle. For additional information, refer to Section 100-02 .

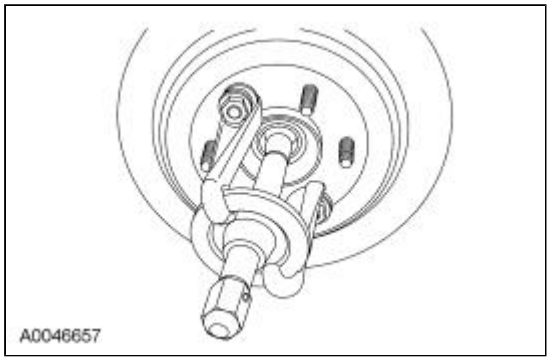
2. Remove the rear wheel and tire assembly. For additional information, refer to Section 204-04 .

3. **NOTE:** Have an assistant press the brake pedal to keep the axle from rotating.

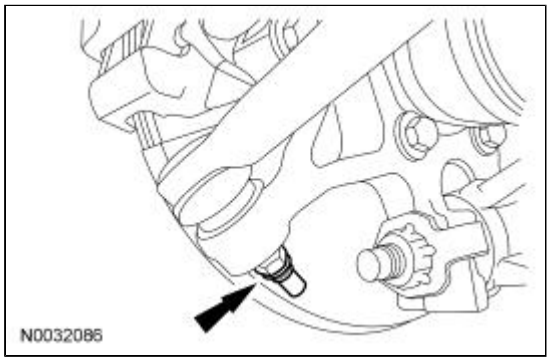
   Remove and discard the rear axle wheel hub retainer and the washer.
   - To install, tighten to 345 Nm (254 lb-ft).



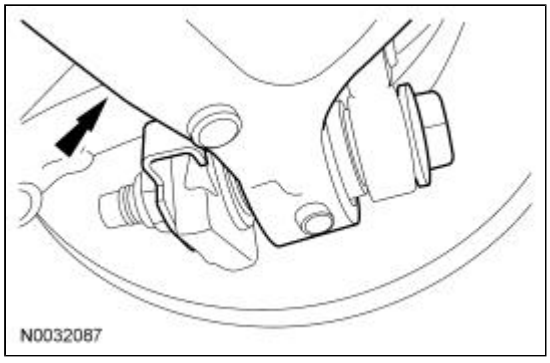
4. Using a suitable hub puller, separate the halfshaft from the knuckle.



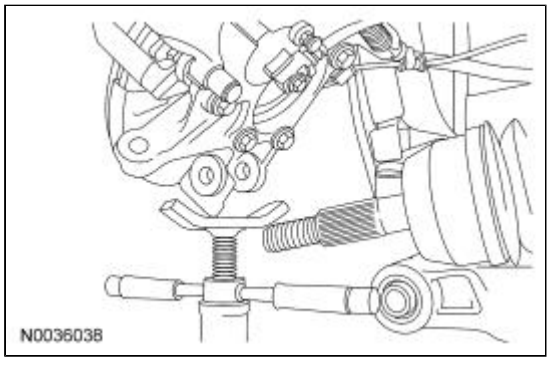
5. Disconnect the toe link from the rear knuckle.
    - To install, tighten to 55 Nm (41 lb-ft).



6. Remove the bolt retaining the knuckle to the lower control arm.
    - To install, tighten to 400 Nm (295 lb-ft).



7. Pivot the rear knuckle on the upper control arm bolts and support the knuckle in a raised position.

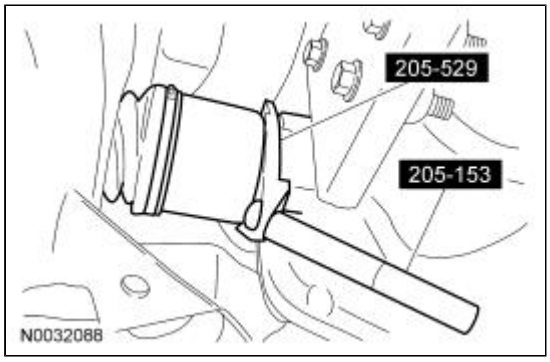


8. **CAUTION: Do not damage the axle shaft oil seal or the machined sealing surface on the inboard CV joint housing.**

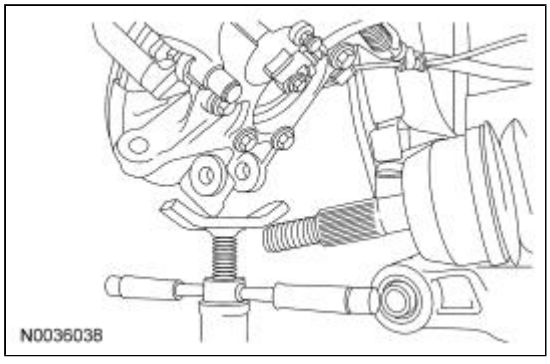
CAUTION: Do not allow the splines on inboard CV joint housing to touch the axle shaft oil seal.

NOTE: A circlip retains the inboard CV joint housing to the differential side gear in the axle.

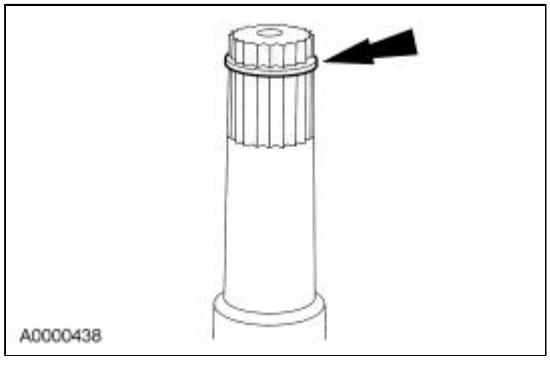
Using the special tool, disengage the inboard CV joint housing from the differential side gear.



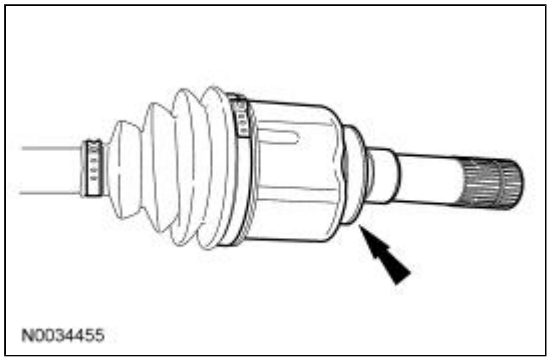
9. Remove the halfshaft assembly from the vehicle.



10. Remove and discard the halfshaft retainer circlip.



11. Remove and discard the halfshaft excluder seal, if equipped.
    - Do not install a new excluder seal.



12. **CAUTION: Always install a new differential stub shaft seal. For additional information, refer to Section 205-02 .**

    CAUTION: Always install the halfshaft with a new retainer circlip and a new rear axle wheel hub retainer.

    CAUTION: Never use power tools to tighten the rear axle wheel hub retainer.

    To install, reverse the removal procedure.

Halfshaft Joint

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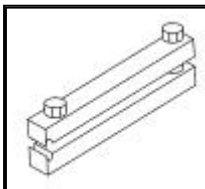
Special Tool(s)

 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)
ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)

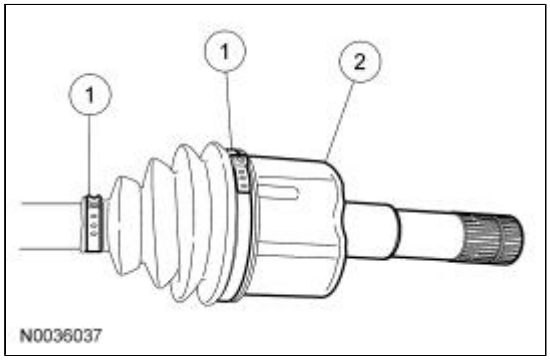
Material

Item	Specification
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1

Disassembly

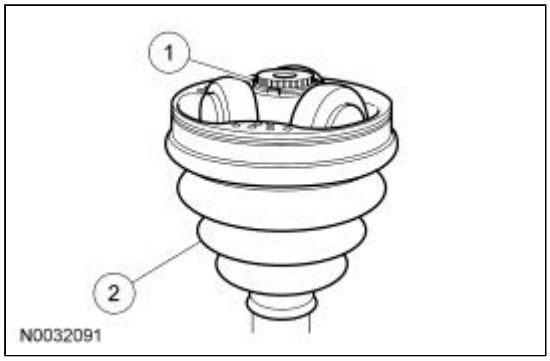
1. Remove the halfshaft assembly from the vehicle. For additional information, refer to Halfshaft in this section.

2. For the inboard CV joint, carry out the following:
   1. Remove and discard the boot clamps.
      - Use diagonal cutters to cut the clamp.
   2. Remove the inboard CV joint housing.

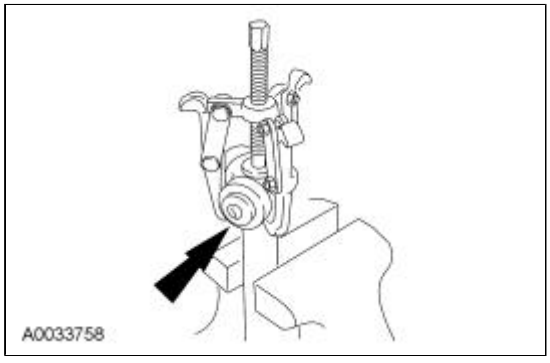


3. **NOTE:** Install the halfshaft in a soft-jaw vise.

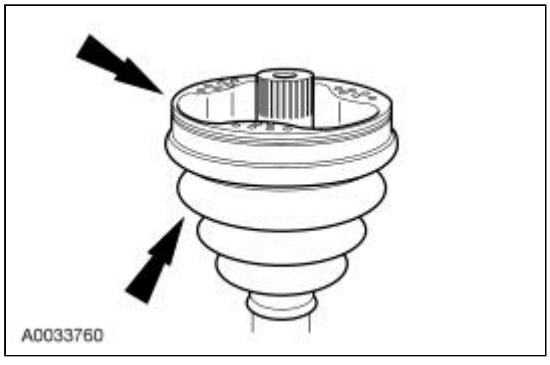
   For the inboard CV joint, carry out the following:
   1. Remove and discard the retainer circlip.
   2. Slide the boot away from the CV joint.



4. Using a suitable 3-jaw puller, remove the CV joint.

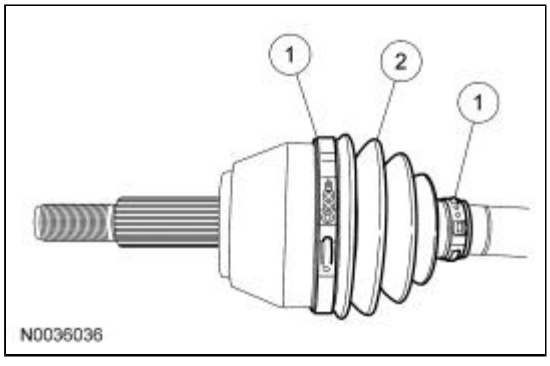


5. Remove and discard the tri-lobe insert and the boot.



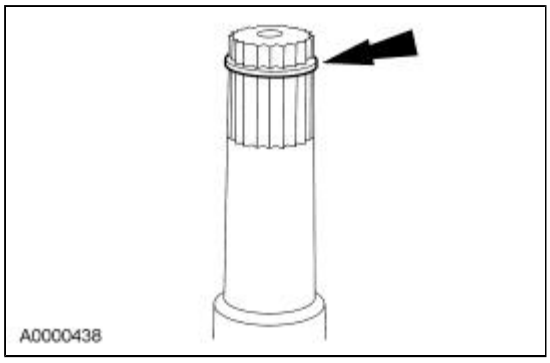
6. **NOTE:** The outboard CV joint is not removable from the halfshaft. The boot must be removed or installed from the inboard CV joint side of the shaft.

   For the outboard CV joint, carry out the following:
   1. Remove and discard the boot clamps.
   2. Remove and discard the boot.



7. Inspect the grease, packed in the inboard CV joint and the outboard CV joint, for contamination. Rub some of the grease from each joint between 2 fingers. Any gritty feeling indicates contamination. Wash all of the grease from the inboard CV joint, the inboard CV joint housing, the outboard CV joint and the interconnecting shaft. Thoroughly dry all of the components and inspect them for wear or damage. Discard the assembly, if necessary. Only proceed as follows if not discarding the assembly.

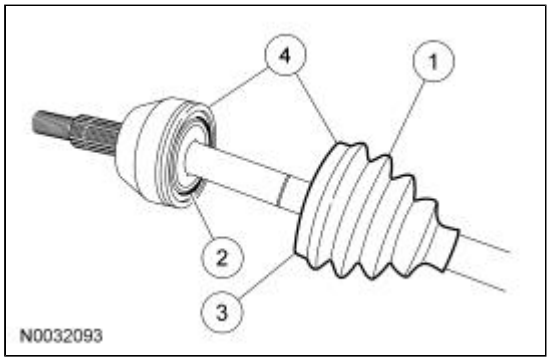
8. On the inboard end, remove and discard the retainer circlip.



Assembly

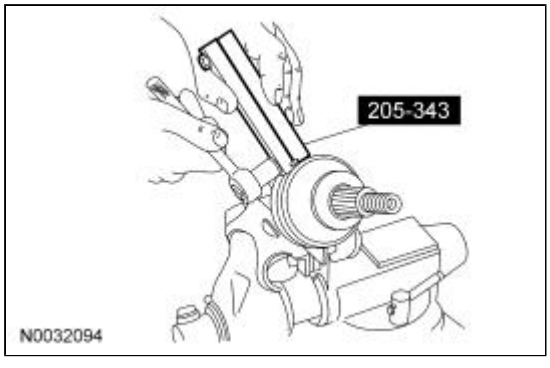
1. **NOTE:** Clean any excess grease from the boot mounting surfaces before installing the boot.

   For the outboard CV joint, carry out the following:
   1. Slide the boot on the interconnecting shaft.
   2. Pack the outboard CV joint with 275 grams (9.7 ounces) of grease.
   3. Spread any remaining grease evenly inside the boot.
   4. Install the boot by seating it in the groove in the CV joint housing.



2. **NOTE:** Tighten the through-bolt until the special tool is in the closed position.

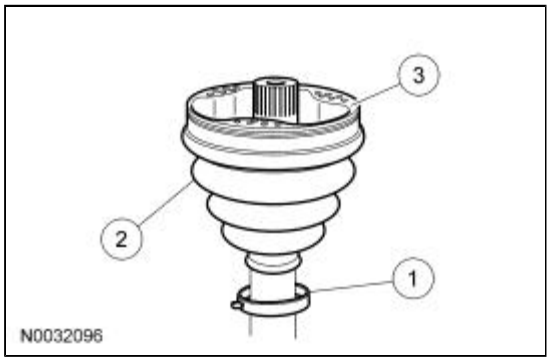
   Using the special tool, install both boot clamps.



3. **NOTE:** Install the halfshaft in a soft-jaw vise.

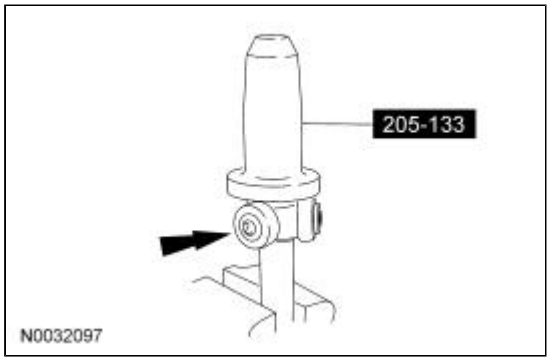
   NOTE: The lip on the end of the tri-lobe insert must seat against the end of the boot.

   For the inboard CV joint, carry out the following:
   1. Position the clamp on the interconnecting shaft.
   2. Position the boot on the interconnecting shaft.
   3. Install the tri-lobe insert.

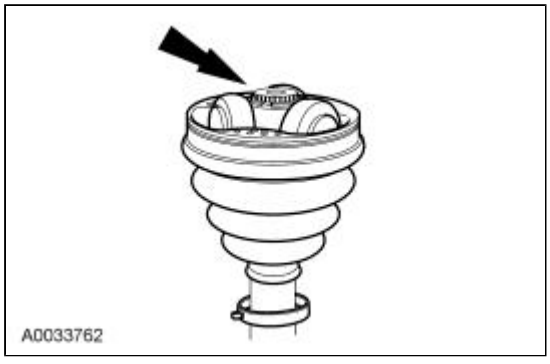


4. **NOTE:** One side of the inboard CV joint has a chamfer cut in the edge of joint at the inner diameter near the splines. Install the inboard CV joint so that the chamfer faces the outboard end of the halfshaft.

   Install the CV joint.

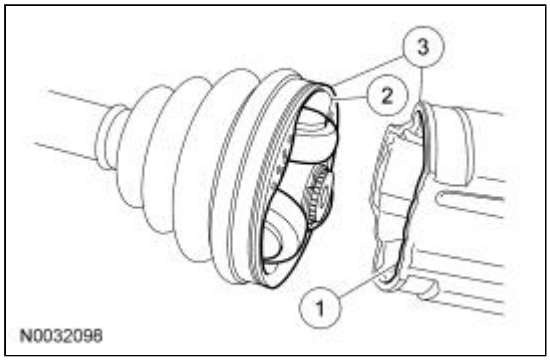


5. Install the retainer circlip.

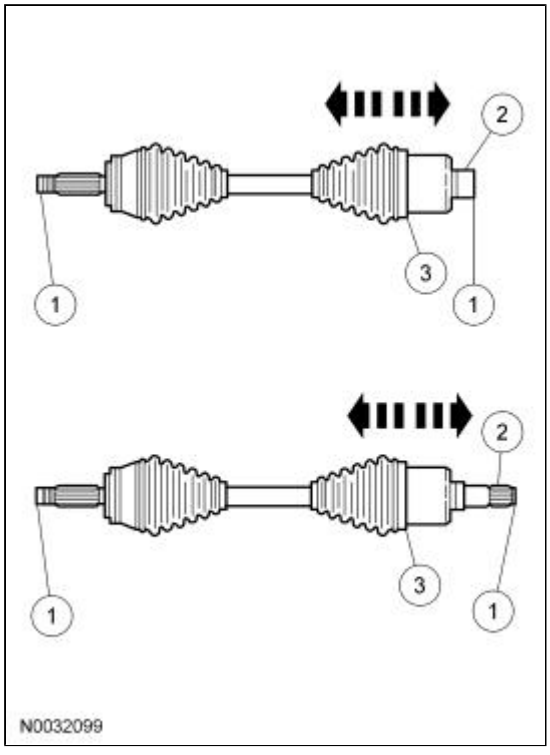


6. **NOTE:** Clean any excess grease from the boot mounting surfaces before installing the boot.

   For the inboard CV joint, carry out the following:
   1. Pack the inboard CV joint housing with 325 grams (11.5 ounces) of grease.
   2. Spread any remaining grease evenly inside the boot and on the CV joint.
   3. Install the inboard CV joint housing, seating the boot in the groove in the housing.

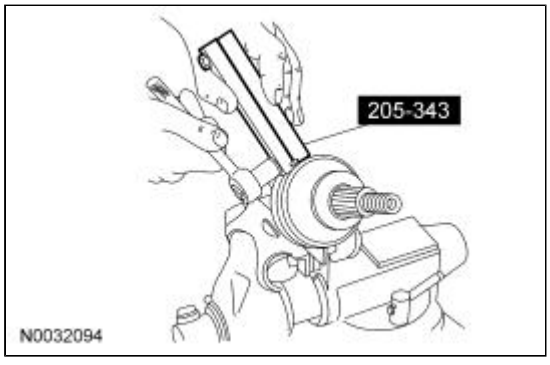


7. Set the halfshaft assembled length to specification. For additional information, refer to Specifications in this section.
    1. Measure the entire assembly length.
    2. Push in or pull out on the inner joint as necessary to adjust the halfshaft assembled length to specification.
    3. Hold the inner joint to prevent the assembled length from changing, and insert a small flat-blade screwdriver between the boot and the joint to equalize the pressure.



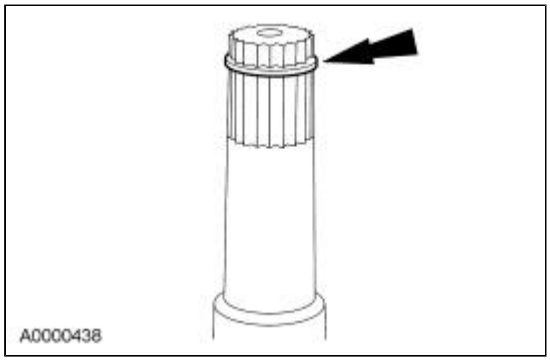
8. **NOTE:** Tighten the through-bolt until the special tool is in the closed position.

    Using the special tool, install both boot clamps.



9. **CAUTION: Do not overexpand or twist the circlip during installation.**

   Install a new retainer circlip.



10. Install the halfshaft assembly in the vehicle. For additional information, refer to Halfshaft in this section.

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General Specifications

Item	Specification
Brake Pads	
Minimum brake pad thickness	2.0 mm (0.079 in)
Maximum brake pad thickness variation (pad-to-pad)	2.0 mm (0.079 in)
Maximum brake pad taper wear (in any direction)	3.0 mm (0.118 in)
Brake Disc	
Minimum front brake disc thickness	27.0 mm (1.06 in)
Minimum rear brake disc thickness	19.0 mm (0.74 in)
Minimum thickness to machine front brake disc	28.3 mm (1.11 in)
Minimum thickness to machine rear brake disc	19.6 mm (0.77 in)
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Torque Specifications

Description	Nm	lb-ft
Front disc brake caliper bleeder screw	16	12
Front master cylinder brake tube fitting	25	18
Rear disc brake caliper bleeder screw	16	12
Rear master cylinder brake tube fitting	25	18

Brake System

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The brake system consists of:

- a vacuum-assisted power braking system.
- a front-to-rear split hydraulic system.
- front brakes utilize a dual piston brake caliper and disc brake system.
- rear brakes utilize a single piston brake caliper and disc brake system.
- parking brake system is a mechanical system that activates a shoe-and-drum system within the brake disc.
- four-wheel anti-lock brake system (4WABS) is standard equipment.

Brake System

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Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Principles of Operation

Hydraulic Brake System

Applying the brake pedal uses lever action to push a rod into the brake booster, which through the use of vacuum, boosts the force of the rod and then transmits this force into the master cylinder. This produces hydraulic pressure in the master cylinder. On vehicles not equipped with anti-lock brake systems (ABS), the hydraulic pressure is transmitted by brake fluid through the brake tubes to the individual brake calipers. On vehicles equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the ABS hydraulic control unit (HCU), which then distributes that pressure to the individual brake calipers. The brake calipers use hydraulic pressure to apply the pads. The application of the brake pads will cause the rotation of the wheels to slow or stop depending on how much brake pressure is applied. The parking brakes carry out the same function except that they are mechanically actuated by a cable that connects only to the rear brakes.

Programming Adjustable Pedal Positions

An adjustable pedal position can be stored at any time.

Programming adjustable pedal positions can be accomplished by doing the following:

- An adjustable pedal position can be stored at any time. To store the adjustable pedal position to memory, the driver must move the pedals to the preferred position using the adjustable pedal switch. The driver must then depress the memory SET switch. Within 5 seconds, the driver must select a memory position. Memory No. 1 is selected by depressing the 1 switch. Memory No. 2 is selected by depressing the 2 switch.
- If no memory switch input is received within the 5 second time limit, the operation is aborted. If one of the following inputs is received during the 5 second programming limit, the operation will also be aborted:
  - Adjustable pedal switch
  - Power driver seat switch
  - Power outside rearview mirrors switch
  - Memory SET switch

To program the remote keyless entry (RKE) transmitter, refer to Section 501-14 .

Recalling a Stored Adjustable Pedal Position

Once the driver has stored a preferred adjustable pedal position, the driver can recall the setting by depressing the corresponding memory switch or by using a programmed remote transmitter. Recalling a stored adjustable pedal position can be accomplished by doing the following:

- The driver can recall a preferred adjustable pedal position by depressing one or both of the memory recall switches. Pressing memory switch 1 will initiate a recall of the adjustable pedal position stored in memory No. 1. Pressing memory switch 2 will initiate a recall of the adjustable pedal position stored in memory No. 2. Pressing both memory No. 1 and memory No. 2, will initiate a recall of the adjustable pedal position stored in memory No. 3.
- A remote transmitter can be used to recall previously set memory positions. The remote transmitters are manufactured with an assigned personality number (1, 2 or 3) and are so designated on the back of the remote transmitter case. The remote transmitter assigned with personality 1 is capable of only recalling memory position 1. Similarly, the remote transmitters assigned with personalities 2 and 3, can only recall memory positions 2 and 3, respectively.
- Memory recall occurs when the unlock switch is pressed on the remote transmitters. A second press of the unlock switch, which unlocks the passenger doors, does not initiate a memory recall.
- A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.

Inspection and Verification

WARNING: Use of any brake fluid other than the approved DOT 3 will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled

onto a painted or plastic surface, immediately wash it with water.

NOTE: Always check the fluid level in the brake master cylinder reservoir before carrying out the test procedures. If the fluid level is not at the correct level, clean the reservoir cap before removing, then add clean, specified brake fluid.

NOTE: Prior to carrying out any diagnosis, make sure the red brake warning indicator is functional. Refer to Section 413-01 .

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal. The brake warning indicator in the instrument cluster and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but will not correct the cause of the trouble. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Inspect all hoses and connections. All unused vacuum connectors should be capped. Make sure hoses and their connections are correctly secured and in good condition with no holes, soft or collapsed areas.

Road Test

The technician should have a thorough knowledge of the brake system operation and accepted general braking guidelines in order to detect any problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

Brake Pads

NOTE: It is not required to install new brake pads if friction material properties are within guidelines. It is also not required to install new brake pads when the brake discs are machined.

- Remove the brake pads. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
- Inspect and measure the thickness of the brake pad friction material.
    - Install new brake pads if the thickness of the friction material is less than 2 mm (0.079 in). Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
    - Compare all 4 front or rear pads for uneven wear. Install new brake pads if the thickness of the friction material varies from pad to pad by more than 2 mm (0.07 in). Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
    - Install new brake pads if there are missing chunks or cracks in the lining through to the backing plate. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
    - If the friction material thickness varies by more than 3 mm (0.11 in) in any direction (taper wear), verify the caliper guide pins are functioning correctly. Refer to Brake Caliper Guide Pins in this section.

Brake Discs

CAUTION: Using an impact tool without a torque socket will lead to unevenly tightened lug nuts. This causes brake disc on-vehicle lateral runout and brake roughness.

NOTE: It is generally not required to install new brake discs to address noise issues.

- Remove the brake disc. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
- Inspect the brake discs and measure the brake disc thickness in a minimum of 4 places around the circumference of the brake disc. Record the measurements.
  - Install new brake discs if any thickness measurement is less than the minimum specification. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
  - Install new brake discs if cracked. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
  - Machine the brake discs if the diagnosis has revealed vibration in the steering wheel, seat or pedal while braking. Heavily scored brake discs, similar to that caused by pads worn down to the backing plate, should also be machined. In order to machine, discs must be above the minimum thickness to machine specification. Refer to Specifications and Brake Disc Machining in this section.

Brake Caliper

Inspect the brake calipers:

- for brake fluid leaks. Refer to Brake System Leak Check in this section.
- boots and seals for tears or cracks.
- caliper piston for binding and corrosion.
- guide pins for correct operation. Refer to Brake Caliper Guide Pins in this section.

Brake Caliper Guide Pins

CAUTION: Do not use power tools for caliper guide pin bore cleaning.

The guide pins should slide with a reasonable amount of hand force. If the brake pads show taper wear or the guide pins are difficult to move, then carry out the following steps.

NOTE: If a guide pin kit is not available, install a new caliper assembly.

- Disassemble the guide pins. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
- Use a wire brush, rolled-up sandpaper or emery cloth to remove all corrosion and foreign material from the caliper guide pin bores. Clean remaining foreign material from the bores with brake parts cleaner and compressed air.
- Install new brake pads if the lining is not within specifications. Refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
- Assemble the caliper guide pins using new caliper seals, boots and guide pins. Use an ample amount of grease to lubricate the bores and guide pins.

Brake Hoses and Tubes

CAUTION: Never use copper tubing. It is subject to fatigue, cracking and corrosion, which

could result in brake tube failure.

- Double-wall steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong, leakproof connections. When bending tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.
- If a section of the brake tube is damaged, the entire section must be installed new with a tube of the same type, size, shape and length.
- When installing the hydraulic brake tubing, hoses or connectors, tighten all connections to specifications. After installation, bleed the brake system. Refer to Brake System Bleeding in this section.
- The wet appearance on the outer cover of rubber brake hoses is called "sweating". This is a normal condition for neoprene rayon braid hose and is not a sign of leakage or cause to install a new hose.

Install a new brake hose if the hose shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle components.

Non-Pressure Leaks

NOTE: The wet appearance on the outer cover of rubber brake hoses is called "sweating". This is a normal condition for neoprene rayon braid hose. The sweating condition is not evidence of a brake fluid leak and will not result in a loss of pressure in the system.

The only part of the brake system that could have a brake fluid loss that does not appear when the system is under pressure is the brake master cylinder reservoir under the following conditions:

- Missing or poorly-fitted brake master cylinder filler cap
- Punctured or otherwise damaged brake master cylinder reservoir
- Missing or damaged brake master cylinder filler cap gasket
- Missing, damaged or poorly-fitted sealing grommets between the brake master cylinder and the brake master cylinder reservoir

The brake master cylinder reservoir grommets are not repairable and must be installed new as part of a new brake master cylinder reservoir.

Brake Master Cylinder — Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of service.

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will fall during brake application and rise during release. The net fluid level (such as after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: Fluid level will decrease with pad wear.

Brake Master Cylinder — Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. GO to Symptom Chart for abnormal condition diagnosis.

Brake Booster

Inspect the brake booster for the following:

- Excessive corrosion or damage
- Vacuum connections for leakage
- Vacuum hoses for kinks or leakage
- Brake booster check valve for correct operation

Changes in the brake pedal feel or travel are indicators that something could be wrong in the brake system. GO to Symptom Chart for abnormal condition diagnosis.

Parking Brake

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Check for any damaged cables and install new components as necessary. Check the rear brake adjustment or carry out the brake system diagnosis. Refer to Section 206-05 .

Visual Inspection Chart

Mechanical	Electrical
• Brake master cylinder • Brake caliper piston • Brake discs • Wheel bearings • Brake pads • Power brake booster • Brake pedal linkage • Booster vacuum hose • Tires • Foreign material	• Parking brake switch • Damaged or corroded wiring harness • Brake master cylinder fluid level switch

For low or spongy brake pedal concerns:

- check the system for leaks and repair as necessary.
- check and, if necessary, refill the brake master cylinder reservoir.
- bleed the brake system and retest the brake pedal feel.

For a slow or incomplete brake pedal return concern:

- inspect for binding, damage, correct installation or interference at the brake pedal.
- check the power brake booster for binding, damage and correct installation.

Adjustable Pedals Without Memory Feature

1. Verify the customer concern by operating the adjustable pedals.

2. Visually inspect for obvious signs of mechanical or electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Adjustable pedals • Adjustable pedal cable • Adjustable pedal motor • Foreign material	• Electrical connectors • Wiring harnesses • Smart junction box (SJB) fuse 20 (15A) • Adjustable pedal switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, GO to Symptom Chart .

Adjustable Pedals With Memory Feature

1. Verify the customer concern by operating the adjustable pedals.

NOTE: If the adjustable pedals are not installed on the vehicle, when a self-test is carried out, the driver seat module (DSM) will set pedal codes.

2. Visually inspect for obvious signs of mechanical or electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Adjustable pedals • Adjustable pedal cable • Adjustable pedal motor • Remote transmitter • Foreign material	• Electrical connectors • Wiring harnesses • Battery junction box (BJB) fuse 45 (30A) • Smart junction box (SJB) fuse 2 (15A) • Adjustable pedal switch • Memory SET switch • DSM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module

(PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.

9. If the DTCs retrieved are related to the concern, go to the Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart

Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B1342	ECU is Defective	DSM	REFER to Section 419-10 .
B1529	Memory Set Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1533	Memory 1 Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1537	Memory 2 Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1663	Seat Driver Front Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1664	Seat Driver Rear Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1665	Seat Driver Forward/Backward Motor Stalled	DSM	REFER to Section 501-10 .
B1667	Mirror Driver Up/Down Motor Stalled	DSM	REFER to Section 501-09 .
B1668	Mirror Driver Right/Left Motor Stalled	DSM	REFER to Section 501-09 .
B1669	Mirror Passenger Up/Down Motor Stalled	DSM	REFER to Section 501-09 .
B1670	Mirror Passenger Right/Left Motor Stalled	DSM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DSM	REFER to Section 414-00 .
B1697	Mirror Driver/Passenger Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	REFER to Section

			501-10 .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1735	Mirror Driver Vertical Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1739	Mirror Driver Horizontal Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1743	Mirror Passenger Vertical Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1747	Mirror Passenger Horizontal Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1751	Park/Neutral Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1950	Seat Rear Up/Down Potentiometer Feedback Circuit Failure	DSM	REFER to Section 501-10 .
B1952	Seat Rear Up/Down Potentiometer Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1954	Seat Front Up/Down Potentiometer Feedback Circuit Failure	DSM	REFER to Section 501-10 .
B1956	Seat Front Up/Down Potentiometer Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1962	Seat Horizontal Forward/Rearward Potentiometer Feedback Circuit Failure	DSM	REFER to Section 501-10 .
B1964	Seat Horizontal Forward/Rearward Potentiometer Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1987	Pedal Forward/Rearward Motor Stalled	DSM	Go To Pinpoint Test B .
B1988	Pedal Position Forward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test B .
B1989	Pedal Position Rearward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test B .
B1990	Pedal Forward/Rearward Potentiometer Feedback Circuit Failure	DSM	Go To Pinpoint Test C .
B1991	Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Battery	DSM	Go To Pinpoint Test C .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver seat module (DSM)	• Fuse • Circuitry • DSM	• REFER to Section 418-00 to diagnose the no communication problem.

• The red brake warning indicator is always on	• Brake fluid level	• INSPECT the system for leaks, REPAIR as necessary. FILL the brake fluid reservoir to the MAX line.
	• Parking brake switch/circuitry • Instrument cluster	• REFER to Section 413-01 .
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test in this section.
	• Parking brake component(s)	• REPAIR or INSTALL new component(s) as necessary. REFER to Section 206-05 .
• Red brake warning indicator inoperative	• Circuitry • Bulb	• REFER to Section 413-01 .
• The brakes pull or drift	• Tire air pressure	• CHECK the tires for uneven or excessive wear and correct inflation.
	• Brake pads • Brake components	• CHECK the brake pads for uneven taper or excessive wear. REPAIR as necessary. • CHECK the brake discs and the hubs for damage. REPAIR as necessary.
	• Suspension component • Wheel alignment	• CHECK wheel alignment. REFER to Section 204-00 .
• Brake pedal goes down fast	• Brake fluid level	• INSPECT the system for leaks, REPAIR as necessary. FILL the brake fluid reservoir to the MAX line. BLEED the system. REFER to Brake System Bleeding in this section.
	• Air in system	• INSPECT the system for leaks, REPAIR as necessary. BLEED the system. REFER to Brake System Bleeding in this section.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test in this section.
• The brake pedal eases down slowly	• Air in system	• INSPECT the system for leaks, REPAIR as necessary. BLEED the system. REFER to Brake System Bleeding in this section.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test in this

		section.
• Brake lockup under light brake pedal force	• Brake pads	• CHECK the brake pads for uneven taper or excessive wear. REPAIR as necessary.
	• Brake component	• CHECK the brake components for correct operation. REPAIR as necessary.
	• Parking brake component	• REPAIR or INSTALL new components as necessary. REFER to Section 206-05 .
	• Anti-lock brake control system	• CHECK the anti-lock brake control system. REFER to Section 206-09 .
• Excessive/erratic brake pedal travel	• Leak in hydraulic system • Air in system • Disc brake caliper	• INSPECT the system for leaks, REPAIR as necessary. BLEED the system. REFER to Brake System Bleeding in this section.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test in this section.
	• Brake pads	• CHECK the brake pads for excessive wear.
	• Brake pedal	• CHECK the brake pedal for binding or obstructions. REPAIR as necessary.
• Brakes drag	• Parking brake component	• REPAIR or INSTALL new components as necessary. REFER to Section 206-05 .
	• Brake caliper guide pins	• REPAIR or INSTALL new caliper guide pins, seals and boots. REFER to Brake Caliper Guide Pins in this section.
	• Disc brake caliper	• REPAIR or INSTALL new brake calipers as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
	• Brake booster	• CARRY OUT the Brake Booster Component Test in this section.
	• Brake master cylinder	• CARRY OUT the Brake Master Cylinder Component Test in this section.
• Excessive brake pedal effort	• Brake booster	• CARRY OUT the Brake Booster Cylinder Component Test in this section.
	• Brake booster check valve	• CARRY OUT the Check Valve Component Test in

		this section.
	• Brake booster manifold vacuum hose	• REROUTE, REPAIR or INSTALL new components as necessary.
• Rattling noise	• Caliper mounting bolts loose	• CHECK the caliper bolts. TIGHTEN to specifications. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
	• Damaged or worn caliper guide pins or retainers	• CHECK the caliper guide pins and retainers for lubrication and correct operation. LUBRICATE or INSTALL new components as necessary. REFER to Brake Caliper Guide Pins in this section.
	• Missing or damaged anti-rattle clips or springs	• CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
	• Loose brake disc shield	• TIGHTEN the brake disc shield bolts to specification. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
• Clicking noise — with brakes applied with anti-lock brake system (ABS)	• ABS hydraulic control unit	• Acceptable condition.
• Squealing noise — occurs on first (morning) brake application	• Brake pads	• Acceptable condition. Caused by humidity and low brake pad temperature.
• Squealing noise — a continuous squeal	• Brake pads or linings worn below minimum thickness	• INSPECT brake pads for excessive wear, taper wear or uneven wear. VERIFY brake pads are within minimum specifications. REFER to Brake Pads in this section.
• Squealing noise — an intermittent squeal brought on by cold, heat, water, mud or snow	• Brake pads	• Acceptable condition.
• Groaning noise — occurs at low speeds with brake lightly applied (creeping)	• Brake pads	• Acceptable condition.
• Grinding noise — continuous	• Brake pads or linings worn	• INSPECT the brake pads, brake discs and attaching

	below minimum thickness	hardware for damage. VERIFY brake pads are within minimum specifications. REFER to Brake Pads in this section.
• Moaning noise	• Brake linings contaminated with grease or oil	• INSPECT the brake pads for contamination. REPAIR or INSTALL new components as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
• Brake pedal application feels abnormal	• Power brake booster input shaft	• CHECK the orientation of the power brake booster input shaft; the offset (if present) must be downward. If incorrect, CORRECT as necessary.
• Adjustable brake pedal does not operate correctly — using the adjustable pedal switch (system without memory feature)	• Obstruction(s) • Adjustable pedal motor • Adjustable pedal cable • Adjustable pedal switch	• Go To Pinpoint Test A .
• Adjustable brake pedal does not operate correctly — using the adjustable pedal switch (system with memory feature)	• Fuse • Circuitry • Adjustable pedal switch • Adjustable pedal motor • DSM	• Go To Pinpoint Test B .
• Adjustable brake pedal does not operate correctly — using the memory SET switch	• Fuse • Circuitry • Memory set switch • Adjustable pedal motor • DSM	• If the seats and mirrors are also inoperative using the memory set switch, REFER to Section 501-10 . • If the only the adjustable pedals are inoperative using the memory set switch, Go To Pinpoint Test C .
• Adjustable brake pedal does not operate correctly — using the remote transmitter	• Fuse • Circuitry • Remote transmitter • Adjustable pedal motor • DSM	• If the seats and mirrors are also inoperative using the memory set switch, REFER to Section 501-10 . • If the only the adjustable pedals are inoperative using the memory set switch, Go To Pinpoint Test C .
• Vibration when the brakes are applied	• Uneven brake pad wear • Brake disc pad transfer • Brake disc • Suspension components	• COMPLETE the brake system inspection described in Inspection and Verification in this section. • Go To Pinpoint Test D .
• Brake vibration/shudder	• Brake caliper	• INSPECT the brake caliper

— occurs when the brake pedal is released	guide pins • Brake drag	guide pins for correct operation. REFER to Brake Caliper Guide Pins in this section. • INSPECT the brake pads for premature wear. REPAIR or INSTALL a new caliper as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

Pinpoint Tests

Pinpoint Test A: Adjustable Brake Pedal Does Not Operate Correctly — Using the Adjustable Pedal Switch (System Without Memory Feature)

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

The adjustable pedal switch receives fused battery voltage from smart junction box (SJB) fuse 20 (15A) along circuit SBP20 (GN/RD).

When the adjustable pedal switch is pressed in the rearward position, the voltage is sent to the adjustable pedal motor along circuit CPP01 (WH/OG), the voltage returns to the switch along circuit CPP02 (BN) and is grounded through the switch along circuit GD138 (BK/WH).

When the adjustable pedal switch is pressed in the forward position, the voltage is sent to the adjustable pedal motor along circuit CPP02 (BN), the voltage returns to the switch along circuit CPP01 (WH/OG) and is grounded through the switch along circuit GD138 (BK/WH).

Possible Causes

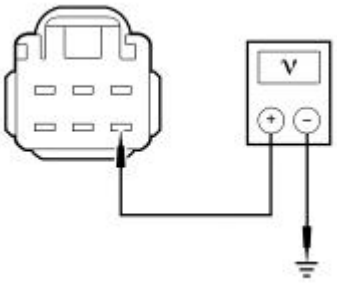
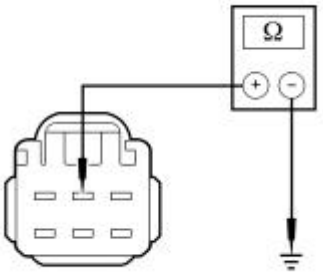
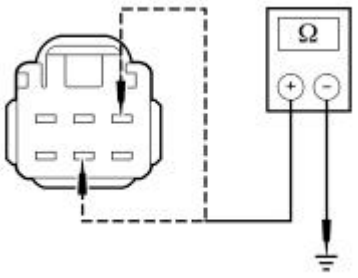
- Fuse
- Circuit open
- Circuit shorted
- Foreign material
- Adjustable pedal cable
- Adjustable pedal switch
- Adjustable pedal motor
- Adjustable brake pedal assembly
- Adjustable accelerator pedal assembly

PINPOINT TEST A: ADJUSTABLE BRAKE PEDAL DOES NOT OPERATE CORRECTLY — SYSTEM WITHOUT MEMORY (SYSTEM WITHOUT MEMORY FEATURE)

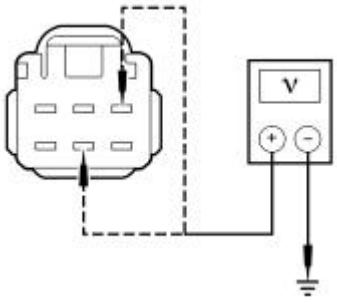
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
A1 CHECK THE ADJUSTABLE PEDAL MOTOR INSTALLATION	

• Check adjustable pedal motor for correct installation. • **Is the motor installation OK?**	**Yes** GO to A2 . **No** CORRECT the adjustable pedal motor installation. TEST the system for normal operation.
A2 CHECK THE ADJUSTABLE ACCELERATOR PEDAL SYSTEM	
• Disconnect the adjustable brake pedal cable from the adjustable accelerator pedal motor. • Operate the adjustable pedal control switch. • **Does the adjustable brake pedal operate now?**	**Yes** REPAIR the adjustable accelerator pedal system. REFER to Section 310-02 . TEST the system for normal operation. **No** GO to A3 .
A3 INSPECT FOR FOREIGN MATERIAL	
• Inspect the adjustable brake pedal assembly for foreign material causing a binding condition. • **Was any foreign material found?**	**Yes** REMOVE the foreign material. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK THE CABLE	
• Dismount the adjustable pedal motor. • Inspect the ends of the brake pedal motor cable for wear or damage. • **Are the cable ends OK?**	**Yes** GO to A5 . **No** INSTALL a new brake pedal motor cable. TEST the system for normal operation.
A5 TEST THE ADJUSTABLE PEDAL SWITCH	
• Key in OFF position. • Disconnect: Adjustable Pedal Switch C2089. • Carry out the adjustable pedal switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Does the adjustable pedal switch pass the component test?**	**Yes** GO to A6 . **No** INSTALL a new adjustable pedal switch. TEST the system for normal operation.
A6 CHECK CIRCUIT SBP20 (GN/RD) FOR VOLTAGE	
• Measure the voltage between adjustable pedal switch C2089-6, circuit SBP20 (GN/RD), harness side and ground.	**Yes** GO to A7 . **No** VERIFY SJB fuse 20 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

 N0055804 • **Is the voltage greater than 10 volts?**	
A7 CHECK CIRCUIT GD133 (BK/WH) FOR AN OPEN	
• Measure the resistance between adjustable pedal switch C2089-2, circuit GD133 (BK/WH), harness side and ground.  N0055805 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit GD133 (BK/WH). TEST the system for normal operation. **No** GO to A8 .
A8 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR AN OPEN	
• Disconnect: Adjustable Pedal Motor C2003. • Measure the resistance between: ▪ adjustable pedal switch C2089-5, circuit CPP01 (WH/OG), harness side and adjustable pedal motor C2003-2, circuit CPP01 (WH/OG), harness side. ▪ adjustable pedal switch C2089-1, circuit CPP02 (BN), harness side and adjustable pedal motor C2003-1, CPP02 (BN), harness side. • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the affected circuit (s) for an open. TEST the system for normal operation. **No** GO to A9 .
A9 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between ground and: ▪ adjustable pedal switch C2089-5, circuit CPP01 (WH/OG), harness side. ▪ adjustable pedal switch C2089-1, circuit CPP02 (BN), harness side.  N0055806	**Yes** REPAIR the affected circuit (s). TEST the system for normal operation. **No** GO to A10 .

• **Are the resistances less than 5 ohms?**	
A10 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR A SHORT TO VOLTAGE	

• Key in ON position.
• Measure the voltage between ground and:
  ■ adjustable pedal switch C2089-5, circuit CPP01 (WH/OG), harness side.
  ■ adjustable pedal switch C2089-1, circuit CPP02 (BN), harness side.
 
 	
N0055807
• **Is voltage present?**
	Yes
	REPAIR the affected circuit (s) for a short to voltage. TEST the system for normal operation.
	
	No
	INSTALL a new brake pedal assembly. TEST the system for normal operation.

Pinpoint Test B: Adjustable Brake Pedal Does Not Operate Correctly — Using the Adjustable Pedal Switch (System With Memory Feature); DTCs B1987, B1988 and B1989 — Pedal Forward/Rearward Motor Stalled, Pedal Position Forward Switch Circuit Short to Battery and Pedal Position Rearward Switch Circuit Short to Battery

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

To move the pedal rearward, the adjustable pedal switch provides a ground path for the driver seat module (DSM) along circuit CPP10 (BN/BU), through the adjustable pedal switch and finally along circuit GD133 (BK). The DSM then provides voltage to the adjustable pedal motor along circuit CPP01 (WH/OG), through the adjustable pedal motor and back into the DSM along circuit CPP02 (BN).

To move the pedal forward, the adjustable pedal switch provides a ground path for the DSM along circuit CPP09 (VT/OG), through the adjustable pedal switch and finally along circuit GD133 (BK). The DSM then provides voltage to the adjustable pedal motor along circuit CPP02 (BN), through the adjustable pedal motor and back into the DSM along circuit CPP01 (WH/OG).

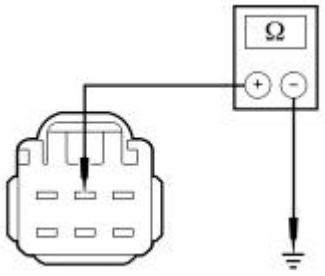
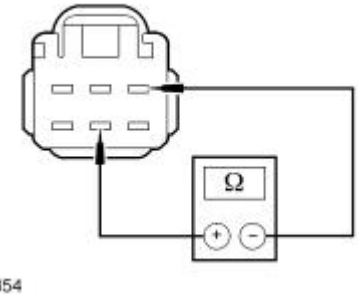
Possible Causes

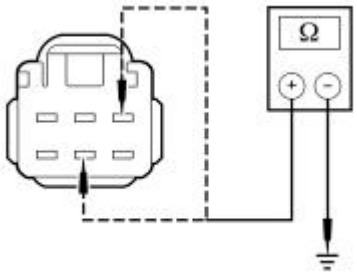
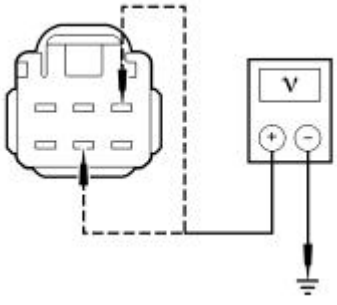
- Circuit open
- Circuit shorted
- Adjustable pedal switch
- DSM

PINPOINT TEST B: ADJUSTABLE BRAKE PEDAL DOES NOT OPERATE CORRECTLY — USING THE ADJUSTABLE PEDAL SWITCH (SYSTEM WITH MEMORY FEATURE); DTCs B1987, B1988 AND B1989 — PEDAL FORWARD/REARWARD MOTOR STALLED, PEDAL POSITION FORWARD SWITCH CIRCUIT SHORT TO BATTERY AND PEDAL POSITION REARWARD SWITCH CIRCUIT SHORT TO BATTERY

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring

terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
B1 CHECK DSM FOR CORRECT ADJUSTABLE PEDAL SWITCH PID INPUTS	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Monitor the DSM adjustable pedal switch PID inputs while activating the adjustable pedal switch. • **Does the DSM adjustable pedal switch PID value agree with the adjustable pedal switch position within one second of releasing the switch?**	**Yes** Go To Pinpoint Test C . **No** GO to B2 .
B2 CHECK THE ADJUSTABLE PEDAL SWITCH	
• Key in OFF position. • Disconnect: Adjustable Pedal Switch C2089 . • Carry out the adjustable pedal switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Does the adjustable pedal switch pass the component test?**	**Yes** GO to B3 . **No** INSTALL a new adjustable pedal switch. CLEAR the DTCs. REPEAT the self-test.
B3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between adjustable pedal switch C2089-2, circuit GD133 (BK), harness side and ground.  N0055805 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit GD133 (BK). CLEAR the DTCs. REPEAT the self-test. **No** GO to B4 .
B4 CHECK CIRCUITS CPP09 (VT/OG) AND CPP10 (BN/BU) FOR A SHORT TOGETHER	
• Disconnect: Driver Seat Module (DSM) C341c. • Measure the resistance between adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side and C2089-5, circuit CPP10 (BN/BU), harness side.  N0060854 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to B5 .

B5 CHECK CIRCUITS CPP09 (VT/OG) AND CPP10 (BN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between: ▪ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side and ground. ▪ adjustable pedal switch C2089-5, circuit CPP10 (BN/BU), harness side and ground.  N0055806 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .
B6 CHECK CIRCUITS CPP09 (VT/OG) AND CPP10 (BN/BU) FOR AN OPEN	
• Measure the resistance between: ▪ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side and DSM C341c-5, circuit CPP09 (VT/OG), harness side. ▪ adjustable pedal switch C2089-5, circuit CPP10 (BN/BU), harness side and DSM C341c-6, circuit CPP10 (BN/BU), harness side. • **Are the resistances greater than 10,000 ohms?**	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to B7 .
B7 CHECK CIRCUITS CPP09 (VT/OG) AND CPP10 (BN/BU) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between ground and: ▪ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side and ground. ▪ adjustable pedal switch C2089-5, circuit CPP10 (BN/BU), harness side and ground.  N0055807 • **Is voltage present?**	**Yes** REPAIR the affected circuit(s) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .
B8 CHECK THE DSM CONNECTORS	
• Key in OFF position. • Disconnect the DSM connectors. • Check for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals.	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

• Connect the DSM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Adjustable Brake Pedal Does Not Operate Correctly — Using the Memory Set Switch/Using the Remote Transmitter; DTCs B1990 and B1991 — Pedal Forward/Rearward Potentiometer Feedback Circuit Failure and Short to Battery

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

To move the pedals to position 1, the memory set switch provides a ground for the driver seat module (DSM) through circuit CPS15 (VT/WH), through the memory set switch internal resistor and finally through circuit GD133 (BK). The DSM then provides voltage to the adjustable pedal motor along circuit CPP01 (WH/OG), through the adjustable pedal motor and back into the DSM along circuit CPP02 (BN) depending on the current pedal position.

To move the pedals to position 2, the memory set switch provides a ground for the DSM through circuit CPS16 (YE), through the memory set switch internal resistor and finally through circuit GD133 (BK). The DSM then provides voltage to the adjustable pedal motor along circuit CPP02 (BN), through the adjustable pedal motor and back into the DSM along circuit CPP01 (WH/OG) depending on the current pedal position.

The DSM uses a potentiometer attached to the pedal assembly to identify the current pedal position. The DSM sends a reference voltage along circuit LPP06 (YE/BU), through the potentiometer and back to the DSM along the signal return circuit, RPP06 (GN), and the pedal sense circuit, VPP16 (BU/BN).

Possible Causes

- Circuit open
- Circuit shorted
- Memory set switch
- DSM
- Adjustable pedal motor

PINPOINT TEST C: ADJUSTABLE BRAKE PEDAL DOES NOT OPERATE CORRECTLY — USING THE MEMORY SET SWITCH/USING THE REMOTE TRANSMITTER; DTCs B1990 AND B1991 — PEDAL FORWARD/REARWARD POTENTIOMETER FEEDBACK CIRCUIT FAILURE AND SHORT TO BATTERY

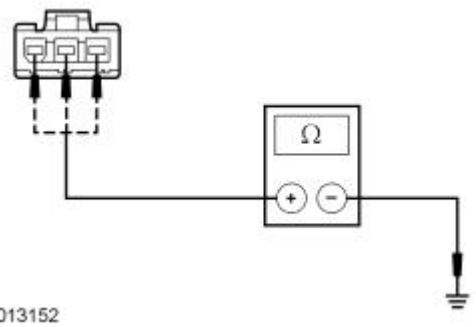
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
C1 CHECK THE DSM ADJUSTABLE PEDAL OUTPUT ACTIVE COMMAND	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Select PARK.	**Yes** GO to C2 . **No**

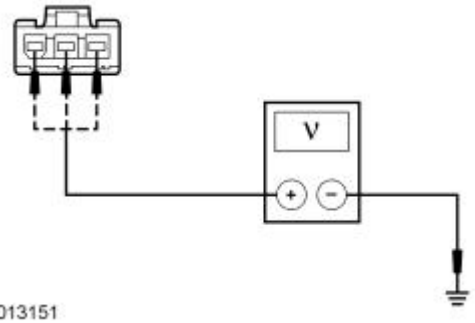
• Trigger the DSM adjustable pedal forward active command ON and then OFF. • Trigger the DSM adjustable pedal rearward active command ON and then OFF. • **Do the adjustable pedals respond correctly to the corresponding active commands?**	GO to C6 .
C2 CHECK THE DSM ADJUSTABLE PEDAL POSITION PID	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Monitor the DSM adjustable pedal position PID while moving the adjustable pedal switch into the forward position, then into the rearward position. • **Does the PID value increase with forward movement, and decrease with rearward movement, throughout the pedal's entire travel?**	**Yes** GO to C10 . **No** GO to C3 .
C3 CHECK CIRCUITS LPP06 (YE/BU), RPP06 (GN) AND VPP16 (BU/BN) FOR AN OPEN	

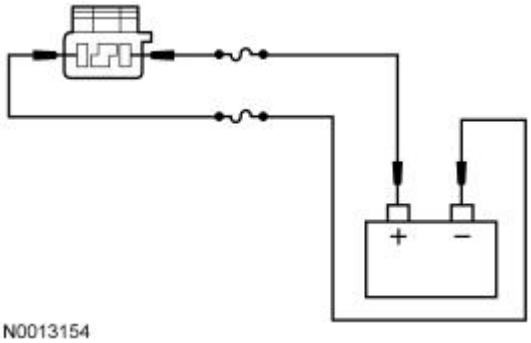
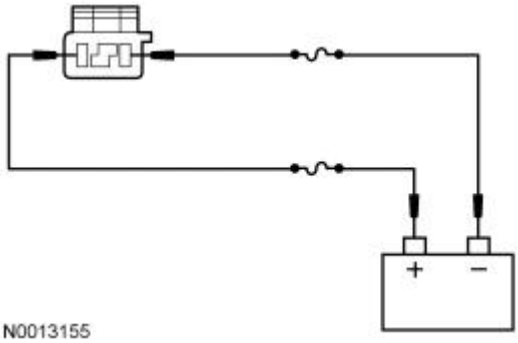
• Key in OFF position.
• Disconnect: Driver Seat Module (DSM) C341c, C341d and C341e.
• Disconnect: Adjustable Pedal Motor Potentiometer C2090.
• Measure the resistance between:
  ▪ adjustable pedal motor potentiometer C2090-1, circuit LPP06 (YE/BU), harness side and DSM C341c-20, circuit LPP06 (YE/BU), harness side.
  ▪ adjustable pedal motor potentiometer C2090-2, circuit VPP16 (BU/BN), harness side and DSM C341d-18, circuit VPP16 (BU/BN), harness side.
  ▪ adjustable pedal motor potentiometer C2090-3, circuit RPP06 (GN), harness side and DSM C341e-14, circuit RPP06 (GN), harness side.
• **Is the resistance greater than 10,000 ohms?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to C4 .

C4 CHECK CIRCUITS LPP06 (YE/BU), RPP06 (GN) AND VPP16 (BU/BN) FOR A SHORT TO GROUND	

• Measure the resistance between ground and:
  ▪ adjustable pedal motor potentiometer C2090-1, circuit LPP06 (YE/BU), harness side.
  ▪ adjustable pedal motor potentiometer C2090-2, circuit VPP16 (BU/BN), harness side.
  ▪ adjustable pedal motor potentiometer C2090-3, circuit RPP06 (GN), harness side.
 
 	
N0013152
• **Is the resistance less than 5 ohms?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to C5 .

C5 CHECK CIRCUITS LPP06 (YE/BU), RPP06 (GN) AND VPP16 (BU/BN) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between ground and:	**Yes** REPAIR the affected circuit(s).

■ adjustable pedal motor potentiometer C2090-1, circuit LPP06 (YE/BU), harness side. ■ adjustable pedal motor potentiometer C2090-2, circuit VPP16 (BU/BN), harness side. ■ adjustable pedal motor potentiometer C2090-3, circuit RPP06 (GN), harness side.  N0013151 • **Is any voltage present?**	CLEAR the DTCs. REPEAT the self-test. **No** GO to C10 .
C6 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Adjustable Pedal Motor C2003. • Disconnect: Driver Seat Module (DSM) C341b. • Measure the resistance between: ■ DSM C341b-13, circuit CPP01 (WH/OG), harness side and adjustable pedal motor C2003-2, circuit CPP01 (WH/OG), harness side. ■ DSM C341b-5, circuit CPP02 (BN), harness side and adjustable pedal motor C2003-1, circuit CPP02 (BN), harness side. • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self test. **No** GO to C7 .
C7 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ■ DSM C341a-13, circuit CPP01 (WH/OG), harness side. ■ DSM C341a-5, circuit CPP02 (BN), harness side. • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to C8 .
C8 CHECK CIRCUITS CPP01 (WH/OG) AND CPP02 (BN) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between ground and: ■ DSM C341a-13, circuit CPP01 (WH/OG), harness side. ■ DSM C341a-5, circuit CPP02 (BN), harness side. • **Is voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to C9 .
C9 CHECK ADJUSTABLE PEDAL MOTOR OPERATION	
• Key in OFF position. • Connect a fused (10A) jumper between: ■ adjustable pedal motor C2003 pin-1, component side and the battery positive terminal. ■ adjustable pedal motor C2003 pin-2, component side and battery negative terminal.	**Yes** GO to C10 . **No** INSTALL a new adjustable pedal motor. CLEAR the DTCs. REPEAT the self-test. REFER to Section 501-10 .


N0013154
• Connect a fused (10A) jumper between:
  ▪ adjustable pedal motor C2003 pin-2, component side and battery positive terminal.
  ▪ adjustable pedal motor C2003 pin-1, component side and the battery negative terminal.
 
N0013155
• **Does the adjustable pedal motor operate first in one direction and then in the opposite direction?**
	CLEAR the DTCs. REPEAT the self-test.

C10 CHECK THE DSM CONNECTORS	

• Key in OFF position.
• Disconnect the DSM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect the DSM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: Vibration When Brakes are Applied

Normal Operation

During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation alone or steering wheel nibble when the brakes are applied (frequency is proportional to the vehicle speed) indicates a concern with a brake or suspension component.

Possible Causes

- Brake disc(s)
- Suspension component(s)
- Wheel(s) and tire(s)

PINPOINT TEST D: VIBRATION WHEN BRAKES ARE APPLIED

Test Step	Result / Action to Take
D1 CHECK OASIS AND TSBs FOR BRAKE CONCERNS	
• Check the On-Line Automotive Service Information System (OASIS) and Technical Service bulletins (TSBs) for applicable brake concerns. • **Is the applicable information available on OASIS or in a TSB?**	**Yes** REFER to OASIS or the TSB. CARRY OUT any necessary repairs that are indicated by OASIS or the TSB. If the concern is still present, GO to D2 . **No** GO to D2 .
D2 ROAD TEST THE VEHICLE — LIGHT BRAKING	
• Inspect the wheels and tires. Refer to Section 204-00 . • Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force. • **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**	**Yes** GO to D5 . **No** GO to D3 .
D3 ROAD TEST THE VEHICLE — MODERATE TO HEAVY BRAKING	
• Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force. • **Is there a vibration/shudder?**	**Yes** GO to D4 . **No** The concern is not present at this time.
D4 NORMAL ACTUATION OF THE ABS SYSTEM DIAGNOSIS	
• During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation or steering wheel nibble (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component. • **Is the vibration/shudder vehicle speed sensitive?**	**Yes** GO to D6 . **No** The concern is not present at this time.
D5 CHECK THE FRONT SUSPENSION	
• Check the front suspension. Refer to Section 204-00 . • **Are all the suspension components in satisfactory condition?**	**Yes** GO to D6 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
D6 RESURFACE THE FRONT BRAKE DISCS	
• **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the	**Yes** GO to D7 . **No**

brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the front brake discs. Refer to Brake Disc Machining in this section. • Road test the vehicle. • **Is the vibration/shudder present?**	The concern is not present at this time.
D7 CHECK THE REAR SUSPENSION	
• Check the rear suspension. Refer to Section 204-00 . • **Are all the suspension components in satisfactory condition?**	**Yes** GO to D8 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
D8 RESURFACE THE REAR BRAKE DISC	
• **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the rear brake discs. Refer to Brake Disc Machining in this section. • Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** REFER to Section 100-04 to continue diagnosis of the vibration. **No** The concern is not present at this time.

Component Tests

Brake Booster

1. Check the hydraulic brake system for leaks or insufficient fluid.

2. With the transmission in NEUTRAL, stop the engine and apply the parking brake control. Apply the brake pedal several times to exhaust all vacuum in the system.

3. Apply the brake pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the power brake booster system is not functioning.

Brake Booster Operation

1. Remove the vacuum booster hose from the check valve connection. Manifold vacuum must be available at the check valve end of the vacuum booster hose with the engine at idle speed and the transmission in NEUTRAL. If the manifold vacuum is available to the power brake booster, connect the vacuum booster hose to the power brake booster check valve and repeat Steps 2 and 3 of the Brake Booster check. If no downward movement of the brake pedal is felt, install a new power brake booster.

2. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new power brake booster check valve and retest. If the

brake pedal feels spongy, bleed the hydraulic system to remove air. Refer to Brake System Bleeding in this section.

Check Valve

The function of the power brake booster check valve is to allow manifold vacuum to enter the power brake booster and prevent the escape of vacuum in case manifold vacuum is lost during sustained full throttle operation.

To test the function of the power brake booster check valve:

- start and run the engine for at least 10 seconds.
- operate the brake pedal to check for power assist.
- disconnect the vacuum booster hose from the power brake booster. Do not remove the power brake booster check valve from the power brake booster.
- there should be enough vacuum retained in the power brake booster for at least one more power-assisted brake operation.

Brake Master Cylinder — Bypass Condition

1. Disconnect the brake tubes at the brake master cylinder.

2. Plug the outlet ports of the brake master cylinder.

3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new one must be installed.

Brake Master Cylinder — Compensator Port

The purpose of the compensator ports in the brake master cylinder is to supply any additional brake fluid required by the system due to brake pad wear and to allow brake fluid returning from the brake tubes to the brake master cylinder to enter the brake master cylinder reservoir.

The returning brake fluid will cause a slight turbulence in the brake master cylinder reservoir. Turbulence seen in the brake master cylinder reservoir upon release of the brake pedal is normal and shows that the compensating ports are not plugged.

Brake Disc Machining

Printable View (83 KB)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

CAUTION: Do not use a bench lathe to machine the brake discs.

NOTE: Read the entire operating manual and view the video shipped with the lathe before installing, operating or repairing the lathe.

NOTE: If the thickness of the brake disc is less than the minimum thickness to machine specification, install a new brake disc. This will make sure that the brake disc will be above minimum thickness after machining.

NOTE: Do not machine new brake discs.

NOTE: Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specifications.

1. **NOTE:** It is not necessary to disconnect the brake line from the brake caliper.

   Position the brake caliper and brake caliper anchor bracket aside. For additional information, refer to Section 206-03 for front brake discs or Section 206-04 for rear brake discs.

2. For vehicles with a 2-piece brake disc and hub assembly:
   1. Mark the brake disc and the wheel stud for correct indexing during re-assembly.
   2. Remove the brake disc from the hub.
   3. **CAUTION: Do not use an abrasive sanding disc since it will remove paint or other protective finishes from the wheel or metal from the mounting surfaces, adversely affecting corrosion protection and brake disc lateral runout.**

      Remove corrosion from the wheel mounting surface, both disc mounting surfaces and hub mounting surface.
   4. Align the match marks and install the brake disc on the hub.

3. Machine the brake disc using an on-vehicle brake lathe.
   1. Install the hub adapter and silencer belt if necessary.
   2. Install the cutting lathe.
   3. If the lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. Total indicated reading (TIR) target is 0.000 mm (0.000 in), maximum is 0.08 mm (0.003 in).
   4. Center the cutting head, adjust the cutting bits and install the chip deflector.
   5. **NOTE:** The depth of cut should be between 0.10 and 0.20 mm (0.004 and 0.008 in). Lighter cuts will cause the bit to heat up and wear faster. Heavier cuts will cause poor brake disc surface finish.

Machine the brake disc.
6. Remove the lathe and, if installed, the silencer belt.
7. Remove the hub adapter.

4. Remove the metal shavings.

5. For vehicles with a 2-piece brake disc and hub assembly:
    1. Remove the brake disc from the hub.
    2. Remove metal shavings from the hub, the brake disc mounting surfaces and from the ABS sensors.
    3. Apply anti-seize lubricant to the hub mounting surface to prevent corrosion.
    4. Align the match marks and install the brake disc on the hub.

6. **NOTE:** It is not required to install new brake pads if friction material properties are within guidelines. For additional information, refer to Brake Pads in this section.

    Install the brake caliper and brake caliper anchor bracket. For additional information, refer to Section 206-03 for front brake discs or Section 206-04 for rear brake discs.

Brake System Bleeding

Printable View (212 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Master Cylinder, In Vehicle

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

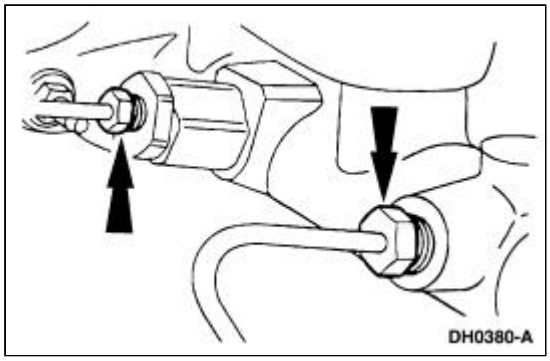
CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. **NOTE:** When a new brake master cylinder has been installed or the system has been emptied, or partially emptied, it should be primed to prevent air from getting into the system.

   Disconnect the brake master cylinder outlet tubes.



2. Install short brake tubes with ends submerged in the brake master cylinder reservoir and fill the brake master cylinder reservoir with clean, specified brake fluid.

3. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes without air bubbles.

4. Remove the short brake tubes and install the brake outlet tubes.

5. Bleed each brake tube at the brake master cylinder as follows:
    1. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
    2. Loosen the rearmost brake tube fitting until a stream of brake fluid comes out. Have an assistant maintain pressure on the brake pedal while tightening the brake tube fitting.
    3. Repeat this operation until clear, bubble-free fluid comes out.
    4. Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

6. While the assistant maintains pressure on the brake pedal, tighten the brake tube fittings.
    - Tighten to 25 Nm (18 lb-ft).

Anti-Lock Brake System (ABS)

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

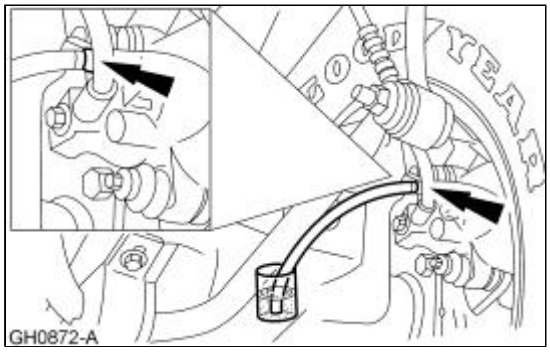
NOTE: This procedure must be performed if the anti-lock brake (ABS) hydraulic control unit (HCU) has been installed new.

NOTE: One conventional pressure bleed cycle consists of advancing the brake pedal to its depressed position, opening the disc brake caliper bleeder screw, allowing fluid to be released into the waste container, closing the disc brake caliper bleeder screw and releasing the brake pedal.

NOTE: Performing the diagnostic program routine drives entrapped air from the otherwise inaccessible lower section of the ABS valve into the upper sections (accessible by bleeding the brakes). Subsequent bleeding removes the air from the system.

NOTE: Add clean, specified brake fluid as necessary throughout the procedure.

1. Connect a clear hose to the RH rear disc brake caliper bleeder screw and the other end in a container partially filled with clean, specified brake fluid.



2. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.

3. Loosen the RH rear disc brake caliper bleeder screw until a stream of brake fluid comes out. Have an assistant maintain pressure on the brake pedal while tightening the RH rear disc brake caliper bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

4. Tighten the RH rear disc brake caliper bleeder screw.
    - Tighten to 16 Nm (12 lb-ft).

5. Repeat Steps 1 through 4 for the LH rear disc brake caliper bleeder screw, RH front disc brake caliper bleeder screw and the LH front disc brake caliper bleeder screw.
    - Tighten to 16 Nm (12 lb-ft).

6. **NOTE:** Go to the Help menu in the scan tool.

    Connect the scan tool to the vehicle data link connector (DLC) under the dash and follow the scan tool instructions.

7. Repeat the conventional bleed procedure as outlined in Steps 1 through 5.

8. If the brake pedal feels spongy, repeat the scan tool service bleed procedure.

Gravity

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

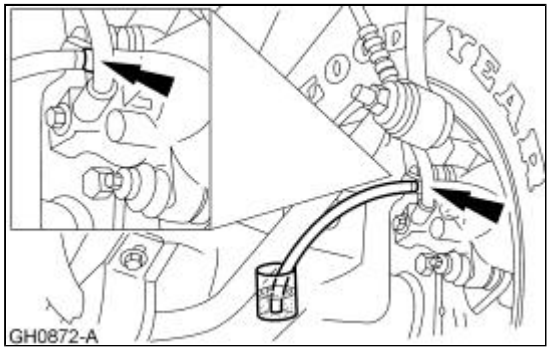
CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: When a new brake master cylinder has been installed or the system has been emptied, or partially emptied, it should be primed to prevent air from getting into the system.

1. Fill the brake master cylinder reservoir with clean, specified brake fluid.

2. Bleed the rear disc brake calipers.
    - Place a box-end wrench on the RH rear disc brake caliper bleeder screw.
    - Attach a rubber drain hose to the RH rear disc brake caliper bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.
    - Open the bleeder screw and leave open until clear bubble-free brake fluid flows.
        - Repeat for LH rear disc brake caliper.



3. Tighten the rear disc brake caliper bleeder screws.
    - Tighten to 16 Nm (12 lb-ft).

4. Bleed the front disc brake calipers.
    - Place a box-end wrench on the RH front disc brake caliper bleeder screw.
    - Attach a rubber drain hose to the RH front disc brake caliper bleeder screw and submerge

the free end of the tube in a container partially filled with clean, specified brake fluid.
- Open the bleeder screw and leave open until clear bubble-free brake fluid flows.
  - Repeat for LH front disc brake caliper.

5. Tighten the front disc brake caliper bleeder screws.
   - Tighten to 16 Nm (12 lb-ft).

Manual

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

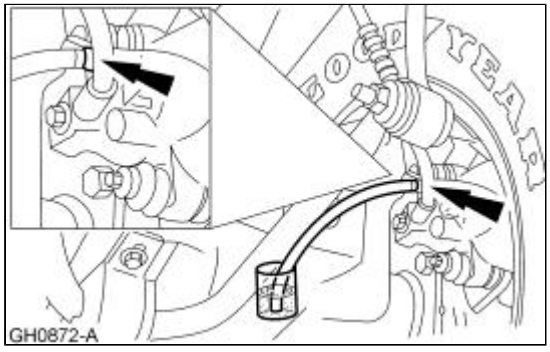
WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Place a box-end wrench on the RH rear disc brake caliper bleeder screw. Attach a rubber drain hose to the RH rear disc brake caliper bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.



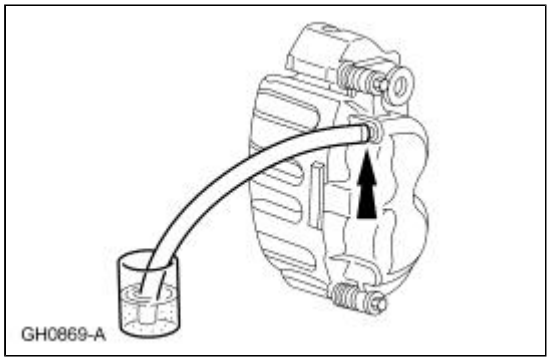
2. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.

3. Loosen the RH rear disc brake caliper bleeder screw until a stream of brake fluid comes out. Have an assistant maintain pressure on the brake pedal while tightening the RH rear disc brake caliper bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.

4. Tighten the RH rear disc brake caliper bleeder screw.
   - Tighten to 16 Nm (12 lb-ft).

5. Repeat Steps 1 through 4 for the LH rear disc brake caliper.

6. Place a box-end wrench on the RH front disc brake caliper bleeder screw. Attach a rubber drain hose to the RH front disc brake caliper bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.



7. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.

8. Loosen the RH front disc brake caliper bleeder screw until a stream of brake fluid comes out. Have an assistant maintain pressure on the brake pedal while tightening the RH front disc brake caliper bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

9. Tighten the RH front disc brake caliper bleeder screw.
    - Tighten to 16 Nm (12 lb-ft).

10. Repeat Steps 6 through 9 for the LH front disc brake caliper bleeder screw.

11. If necessary, bleed the brake master cylinder. For additional information, refer to Brake System Bleeding in this section.

Pressure

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

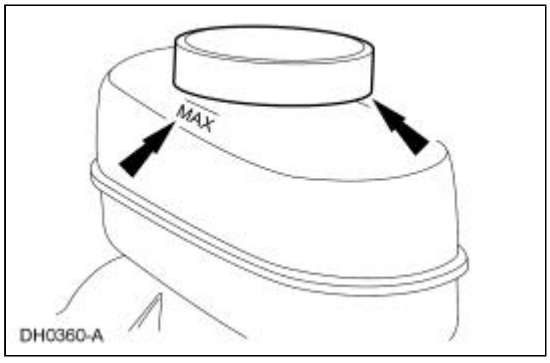
CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: Bleed the longest line first. Be sure the bleeder tank contains enough clean, specified brake fluid to complete the bleeding operation.

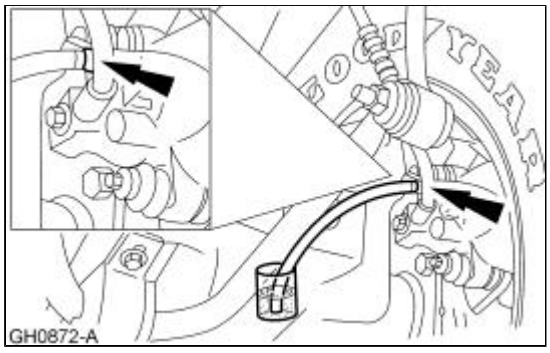
1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.



2. **NOTE:** Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.

   Install the bleeder adapter to the brake master cylinder reservoir and attach the bleeder tank hose to the fitting on the adapter.

3. Place a box-end wrench on the RH rear disc brake caliper bleeder screw. Attach a rubber drain hose to the RH rear disc brake caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.



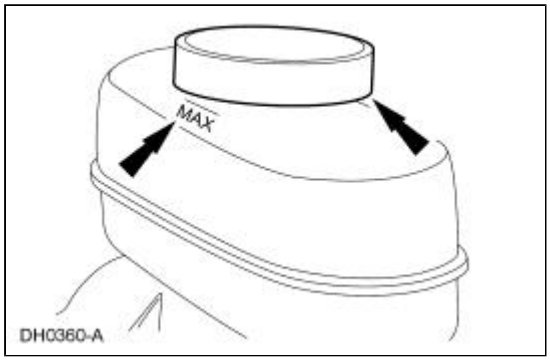
4. Open the valve on the bleeder tank.

5. Loosen the rear disc brake caliper bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten rear disc brake caliper bleeder screw and remove the rubber hose.
   - Tighten to 16 Nm (12 lb-ft).

6. Continue bleeding the rest of the system, going in order from the LH rear disc brake caliper to the RH front disc brake caliper, ending with the LH front disc brake caliper.

7. Close the bleeder tank valve and remove the tank hose from the adapter and remove the adapter.

8. Fill the brake master cylinder reservoir with clean, specified brake fluid and install the brake master cylinder filler cap.



Master Cylinder, Bench

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

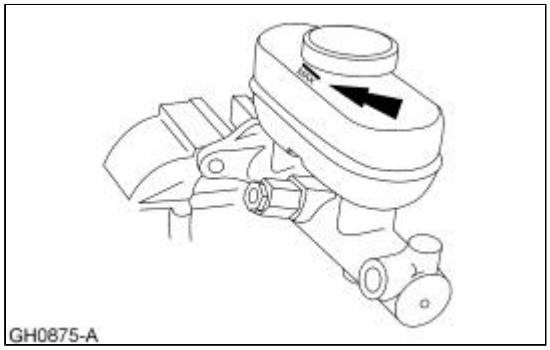
WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Support the brake master cylinder body in a vise and fill the brake master cylinder reservoir with clean, specified brake fluid.



2. Install short brake tubes with the ends submerged in the brake master cylinder reservoir.

3. Slowly depress the primary piston until clear fluid flows from both brake tubes, without air bubbles.

4. Remove the short brake tubes.

Brake System Leak Check

Printable View (78 KB)

1. **NOTE:** Brake fluid is water soluble and therefore evidence of leakage can be washed away if the vehicle is operated in rain or snow.

   Fill the brake master cylinder reservoir.

2. Apply and hold the brakes several times.

3. Check the brake master cylinder reservoir to verify fluid loss.

4. Inspect the brake system for signs of fresh brake fluid leakage.

5. Locate and correct the source of the external leak.

Printable View (79 KB)

General Specifications

Item	Specification
Brake Pads	
Minimum brake pad friction material thickness	2.0 mm (0.079 in)
Maximum brake pad friction material thickness variation (pad-to-pad)	2.0 mm (0.079 in)
Maximum brake pad friction material taper wear (in any direction)	3.0 mm (0.118 in)
Brake Disc	
Minimum brake disc thickness	27.0 mm (1.06 in)
Minimum thickness to machine brake disc	27.6 mm (1.08 in)
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolts	200	148
Brake caliper guide pins	55	41
Brake disc shield screws	17	13
Brake hose flow bolt	35	26

Front Disc Brake

Printable View (63 KB)

On front brake disc systems:

- the brake caliper bolts to the brake caliper anchor plate.
- the brake caliper anchor plate bolts to the wheel knuckle.
- a separate brake disc attaches to the wheel hub.

The brake caliper:

- is a guide pin, dual-piston type.
- housing has a fluid inlet at the center of the bore. A square section seal fitted into an annular groove in the caliper cylinder bore seals against hydraulic pressure, while rubber boots seal the caliper pistons and caliper bore from contamination.

The brake disc shield:

- bolts to the wheel knuckle.
- protects the inboard surface of the brake disc.

The pads are:

- contained within the brake caliper anchor plate.
- held to the brake caliper anchor plate abutments by disc brake anti-rattle clips.

Front Disc Brake

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Refer to Section 206-00 .

Disc Brake System — Exploded View

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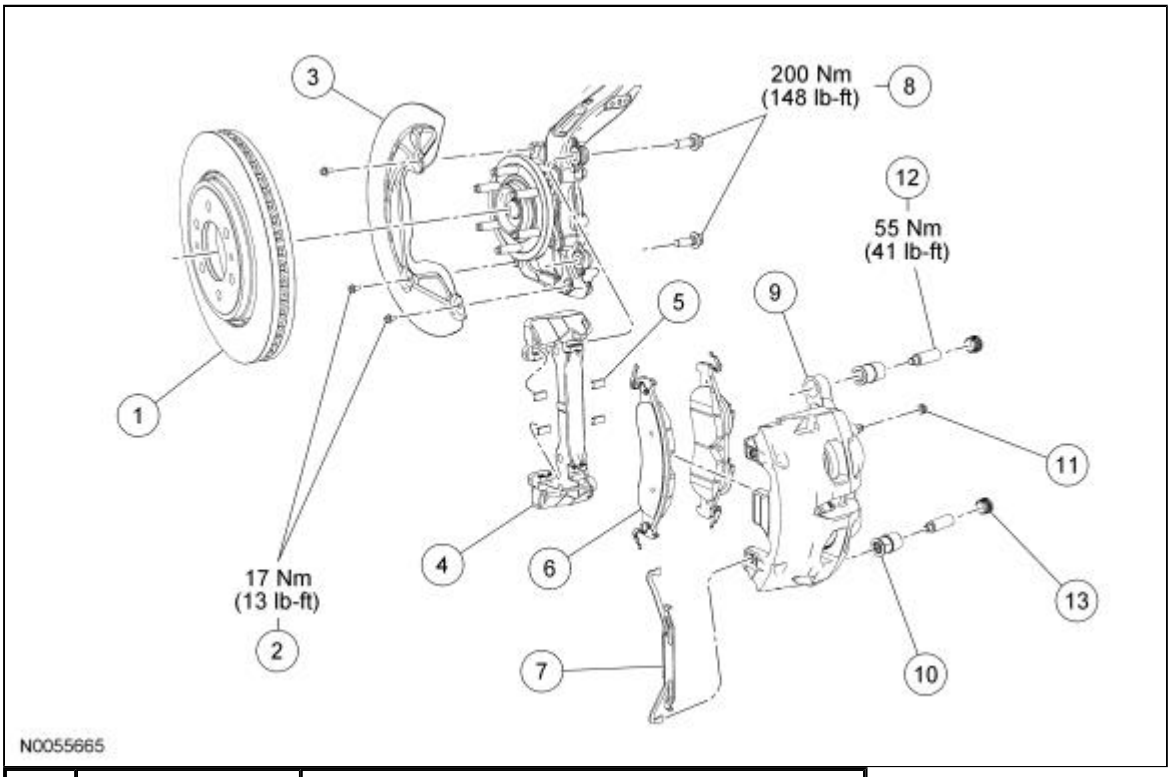


Item	Part Number	Description
1	1125	Brake disc
2	W505251	Brake disc shield screws (3 required)
3	2K005 LH/ 2K004 RH	Brake disc shield
4	2C292	Brake caliper anchor plate
5	—	Brake pad slide clip (4 required) (part of 2C540)
6	2001	Brake pads
7	2B164	Anchor housing spring
8	W712510	Brake caliper anchor plate bolts
9	2B120	Brake caliper assembly
10	—	Brake caliper guide pin bushing (2 required) (part of 2L527)
11	2208	Bleeder screw and cap
12	—	Brake caliper guide pin (part of 2L527)
13	—	Brake caliper guide pin bushing cap (2 required) (part of 2L527)

1. For additional information, refer to the procedures in this section.

Brake Pads

Printable View (375 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted or plastic surfaces. Do not spill brake fluid onto painted or plastic surfaces. If spilled, wipe up immediately.

1. If necessary, using a suitable suction device, remove the brake fluid from the master cylinder reservoir until it is half filled.

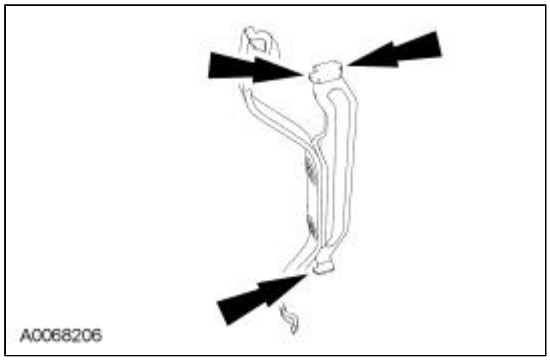
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

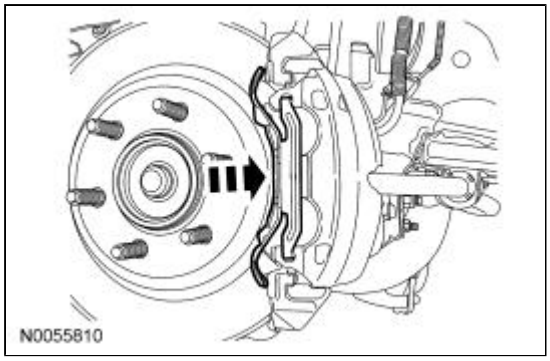
3. **CAUTION: If the anchor housing spring is to be removed, do not force the spring off the brake caliper or damage to the spring can occur.**

   CAUTION: Do not use any tools to remove the spring, use hand force only. Do not use excessive force or damage to the spring can occur.

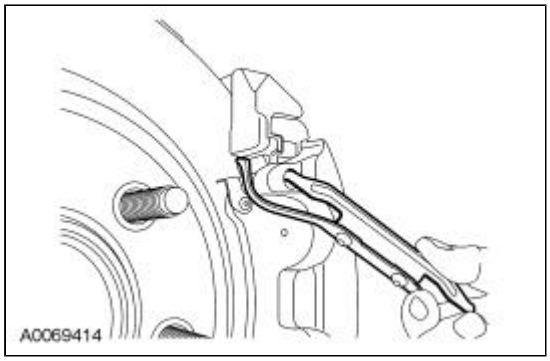
   NOTE: The LH side anchor housing spring must be installed with the 2-tabbed end in the upper brake caliper cavity.

   For the LH brake caliper, release the lower portion of the anchor housing spring.
   - Apply force to the center of the spring and pull outward at the bottom of the spring to remove it from the lower brake caliper cavity.





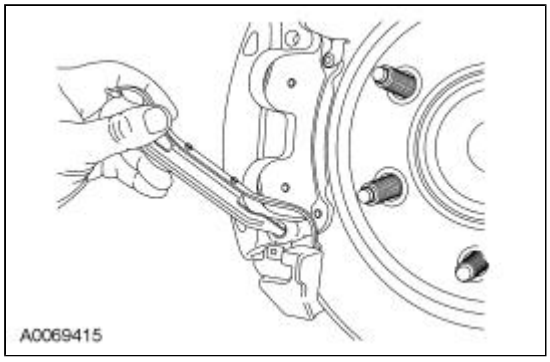
4. Rotate the spring upward and remove it from the brake caliper.



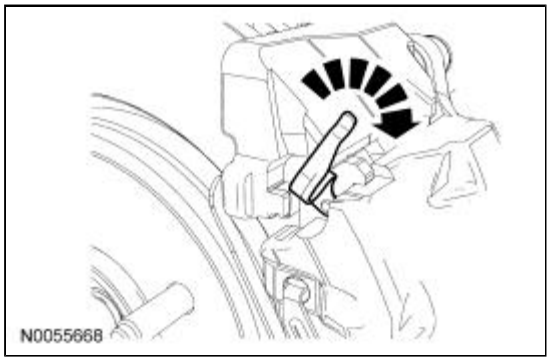
5. **NOTE:** The RH side anchor housing spring must be installed with the 2-tabbed end in the lower brake caliper cavity.

   For the RH brake caliper, release the upper portion of the anchor housing spring.
   - Apply force to the center of the spring and pull outward at the top of the spring to remove it from the upper brake caliper cavity.

6. Rotate the spring downward and remove it from the brake caliper.



7. Rotate the outer brake pad upper and lower retaining springs to disengage them from the brake caliper anchor plate.



8. **CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 guide pin busing caps, remove and discard the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.
   - Remove and discard the 2 brake caliper guide pin bushings.

9. Remove the 2 brake pads from the caliper.

10. Inspect the brake pads for wear and contamination, install new pads as necessary. For additional information, refer to the Diagnosis and Testing portion of Section 206-00 .

11. **NOTE:** Use a wood block or a used brake pad to protect the brake caliper piston boots.

    Compress the brake caliper piston.

12. Inspect the brake disc and resurface or install new as necessary. For additional information, refer to the Diagnosis and Testing portion of Section 206-00 .

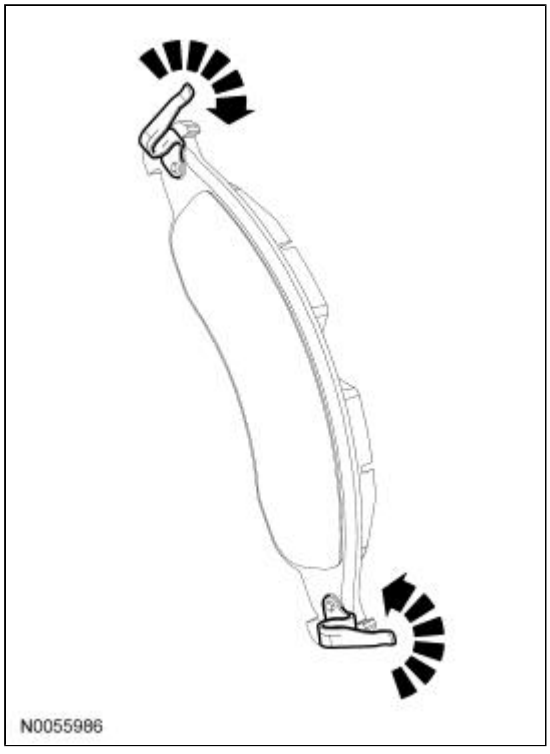
Installation

1. Clean the brake pad contact areas of the brake caliper.

2. Install new brake hardware as follows:
   1. Install the guide pin bushings into the caliper bores.
   2. Apply grease to the inside of the guide pin bushings. Do not apply grease to the guide pin threads.
   3. Push the guide pins into the bushings.

3. Install the inboard brake pad onto the caliper.

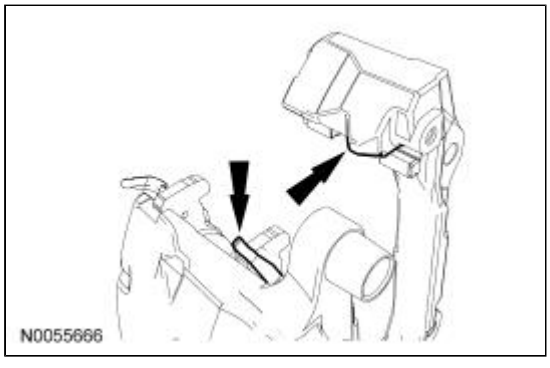
4. Rotate the outer brake pad upper and lower retaining springs 90 degrees.



5. Remove the protective paper from the outboard brake pad and install it onto the brake caliper.

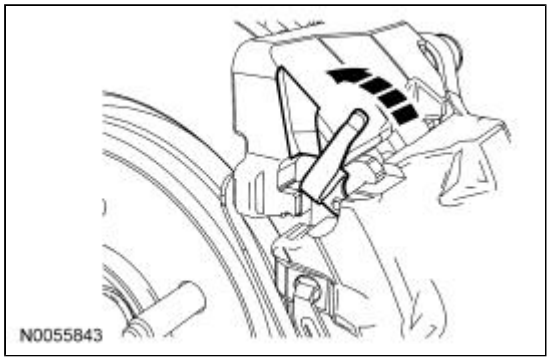
6. **NOTE:** Make sure that the inner brake pad retaining springs are correctly seated onto the brake caliper anchor plate.

   Position the brake caliper assembly onto the anchor plate.



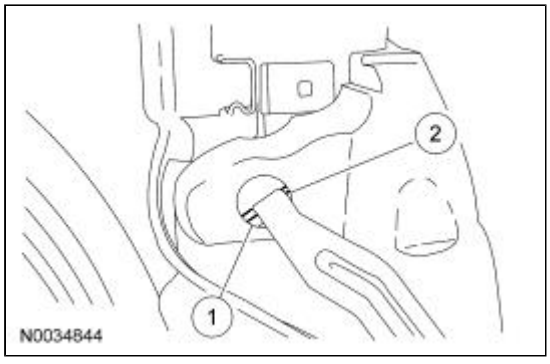
7. Install the 2 brake caliper guide pin bolts and the 2 bushing caps.
   - Tighten the bolts to 55 Nm (41 lb-ft).

8. Rotate the outer brake pad upper and lower retaining springs until they are correctly seated on the anchor plate.



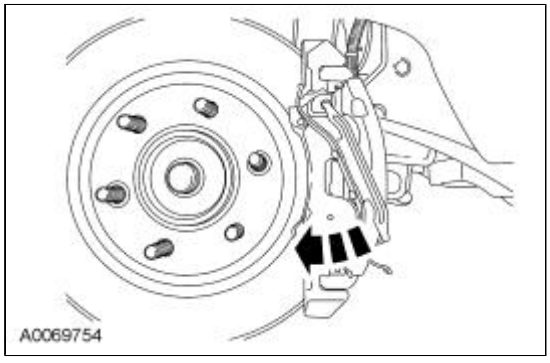
9. **NOTE:** If present, the 2-tabbed end of the anchor housing spring must be installed first.

   Install the anchor housing spring using the following procedure:
   1. Insert the tab of the spring into the brake caliper cavity.
   2. Twist the tab into the cavity (LH side in the upper brake caliper cavity, RH side in the lower brake caliper cavity).



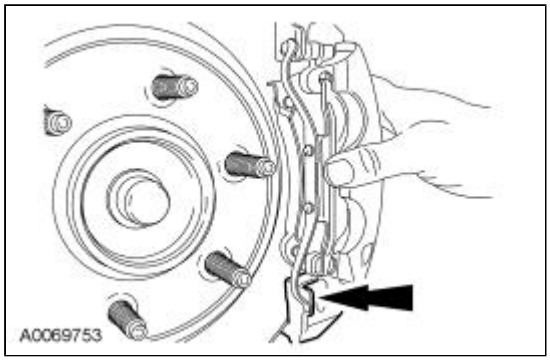
10. **NOTE:** LH anchor housing spring shown.

    Rotate the anchor housing spring and position the upper portion onto the anchor plate.



11. **NOTE:** LH anchor housing spring shown.

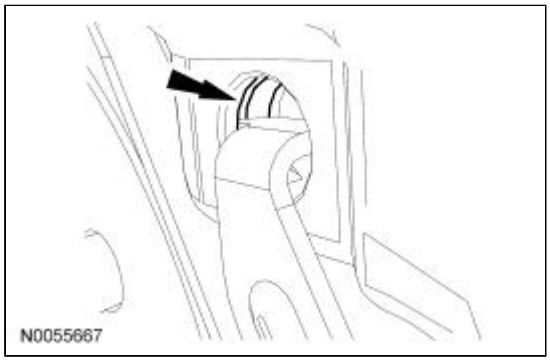
    Position the other anchor housing spring portion onto the anchor plate.



12. Push down and inward until the upper and lower ends of the anchor housing spring are latched and seated in the brake caliper cavities.

13. **NOTE:** The latch **MUST** be positioned as shown.

    Verify that the anchor housing spring is correctly latched by pulling on the spring.



14. Apply the brake several times to verify correct brake operation.

Brake Caliper

Printable View (81 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Removal and Installation

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the brake pads. For additional information, refer to Brake Pads in this section.
3. Remove the brake caliper flow bolt and the 2 copper washers.
   - Discard the copper washers.
   - To install, tighten to 35 Nm (26 lb-ft).
4. Inspect the brake caliper for leaks.
   - If leaks are found, a new brake caliper must be installed.
5. To install, reverse the removal procedure.
6. Bleed the brake system. For additional information, refer to Section 206-00 .

Brake Caliper Anchor Plate

Printable View (353 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted or plastic surfaces. Do not spill brake fluid onto painted or plastic surfaces. If spilled, wipe up immediately.

1. If necessary, using a suitable suction device, remove the brake fluid from the master cylinder reservoir until it is half filled.

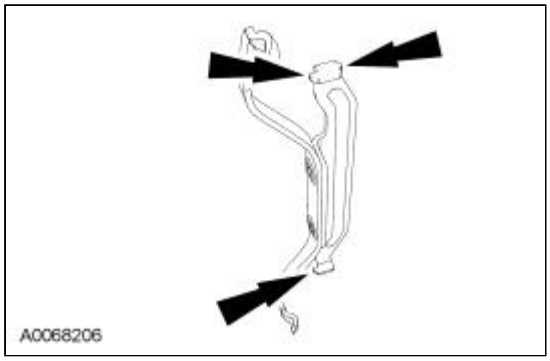
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

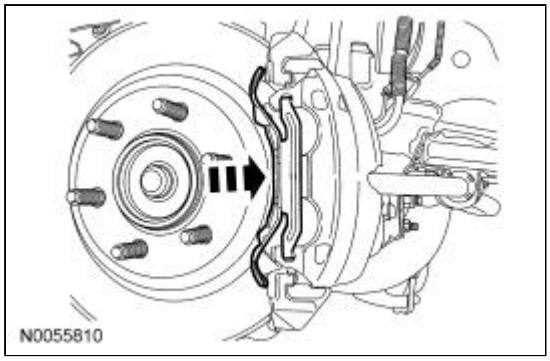
3. **CAUTION: If the anchor housing spring is to be removed, do not force the spring off the brake caliper or damage to the spring can occur.**

   CAUTION: Do not use any tools to remove the spring, use hand force only. Do not use excessive force or damage to the spring can occur.

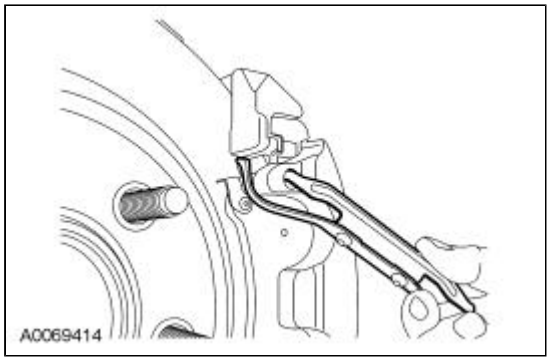
   NOTE: The LH side anchor housing spring must be installed with the 2-tabbed end in the upper brake caliper cavity.

   For the LH brake caliper, release the lower portion of the anchor housing spring.
   - Apply force to the center of the spring and pull outward at the bottom of the spring to remove it from the lower brake caliper cavity.





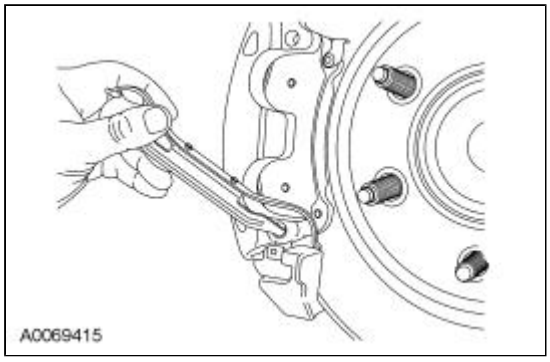
4. Rotate the spring upward and remove it from the brake caliper.



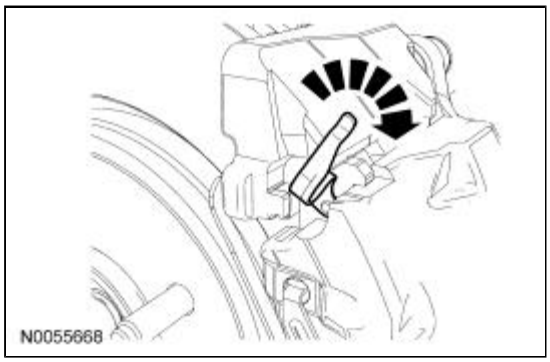
5. **NOTE:** The RH side anchor housing spring must be installed with the 2-tabbed end in the lower brake caliper cavity.

   For the RH brake caliper, release the upper portion of the anchor housing spring.
   - Apply force to the center of the spring and pull outward at the top of the spring to remove it from the upper brake caliper cavity.

6. Rotate the spring downward and remove it from the brake caliper.



7. Rotate the outer brake pad upper and lower retaining springs to disengage them from the brake caliper anchor plate.



8. **CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 guide pin bushing caps, remove and discard the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.
   - Remove and discard the 2 brake caliper guide pin bushings.

9. Remove the 2 brake caliper anchor plate bolts and the anchor plate.

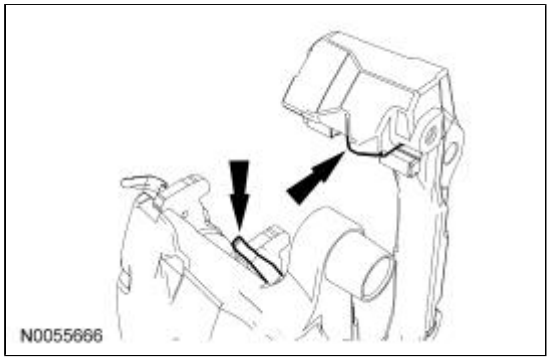
Installation

1. Position the brake caliper anchor plate and install the 2 anchor plate bolts.
   - Tighten to 200 Nm (148 lb-ft).

2. Install new brake hardware as follows:
   1. Install the guide pin bushings into the caliper bores.
   2. Apply grease to the inside of the guide pin bushings. Do not apply grease to the guide pin threads.
   3. Push the guide pins into the bushings.

3. **NOTE:** Make sure that the inner brake pad retaining springs are correctly seated onto the brake caliper anchor plate.

   Position the brake caliper assembly onto the anchor plate.



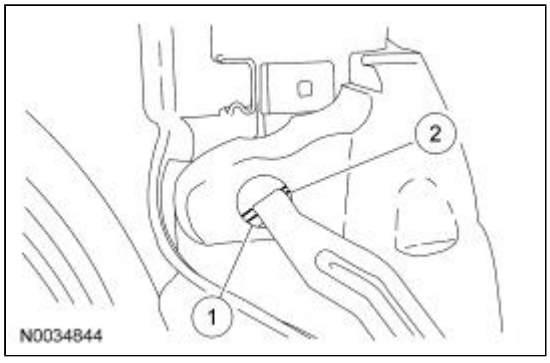
4. Install the 2 brake caliper guide pin bolts and the 2 bushing caps.
   - Tighten the bolts to 55 Nm (41 lb-ft).

5. Rotate the outer brake pad upper and lower retaining springs until they are correctly seated on

the anchor plate.

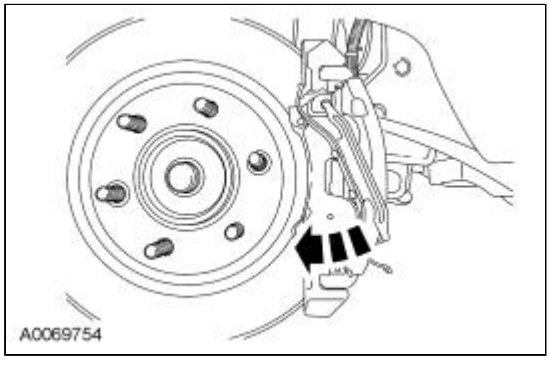
6. **NOTE:** If present, the 2-tabbed end of the anchor housing spring must be installed first.

   Install the anchor housing spring using the following procedure:
   1. Insert the tab of the spring into the brake caliper cavity.
   2. Twist the tab into the cavity (LH side in the upper brake caliper cavity, RH side in the lower brake caliper cavity).



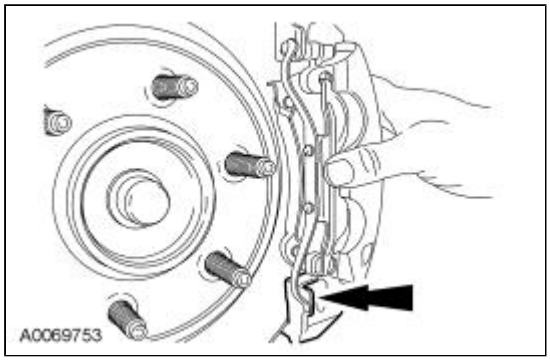
7. **NOTE:** LH anchor housing spring shown.

   Rotate the anchor housing spring and position the upper portion onto the anchor plate.



8. **NOTE:** LH anchor housing spring shown.

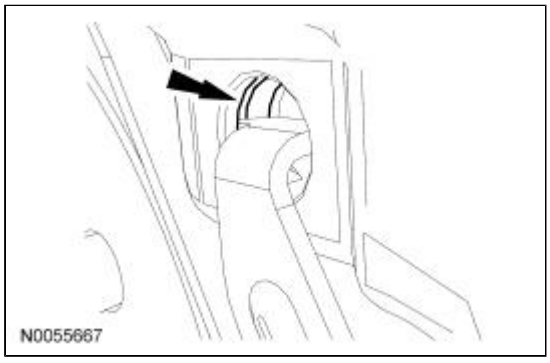
   Position the other anchor housing spring portion onto the anchor plate.



9. Push down and inward until the upper and lower ends of the anchor housing spring are latched and seated in the brake caliper cavities.

10. **NOTE:** Latch **MUST** be positioned as shown.

    Verify that the anchor housing spring is correctly latched by pulling on the spring.



11. Apply the brake several times to verify correct brake operation.

Brake Disc

Printable View (63 KB)

Removal and Installation

1. Remove the brake caliper anchor plate. For additional information, refer to Brake Caliper Anchor Plate in this section.
2. Remove the brake disc.
3. To install, reverse the removal procedure.

Brake Disc Shield

Printable View (63 KB)

Removal and Installation

1. Remove the brake disc. For additional information, refer to Brake Disc in this section.
2. Remove the brake disc shield screws.
   - To install, tighten to 17 Nm (13 lb-ft).
3. Remove the brake disc shield.
4. To install, reverse the removal procedure.

Printable View (79 KB)

General Specifications

Item	Specification
Brake Pads	
Minimum brake pad friction material thickness	2.0 mm (0.79 in)
Maximum brake pad friction material thickness variation (pad-to-pad)	2.0 mm (0.079 in)
Maximum brake pad friction material taper wear (in any direction)	3.0 mm (0.118 in)
Brake Disc	
Minimum brake disc thickness	19.0 mm (0.74 in)
Maximum brake disc runout	0.025 mm (0.001 in)
Maximum brake disc thickness variation	0.013 mm (0.005 in)
Lubricants	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
High Temperature Nickel Anti-Sieze Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Cleaners	
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolts	190	140
Brake caliper guide pin bolts	35	26
Brake hose flow bolts	35	26

Rear Disc Brake

Printable View (78 KB)

NOTE: The inboard and outboard brake pads are not interchangeable.

The rear brake system consists of the following:

- The brake disc is a vented, full-cast, drum-in-hat type.
- The disc brake caliper is a single-piston type.
- Each brake pad is equipped with a riveted spring clip that secures it to either the rear disc brake caliper piston or the rear disc brake caliper housing.

Rear Disc Brake

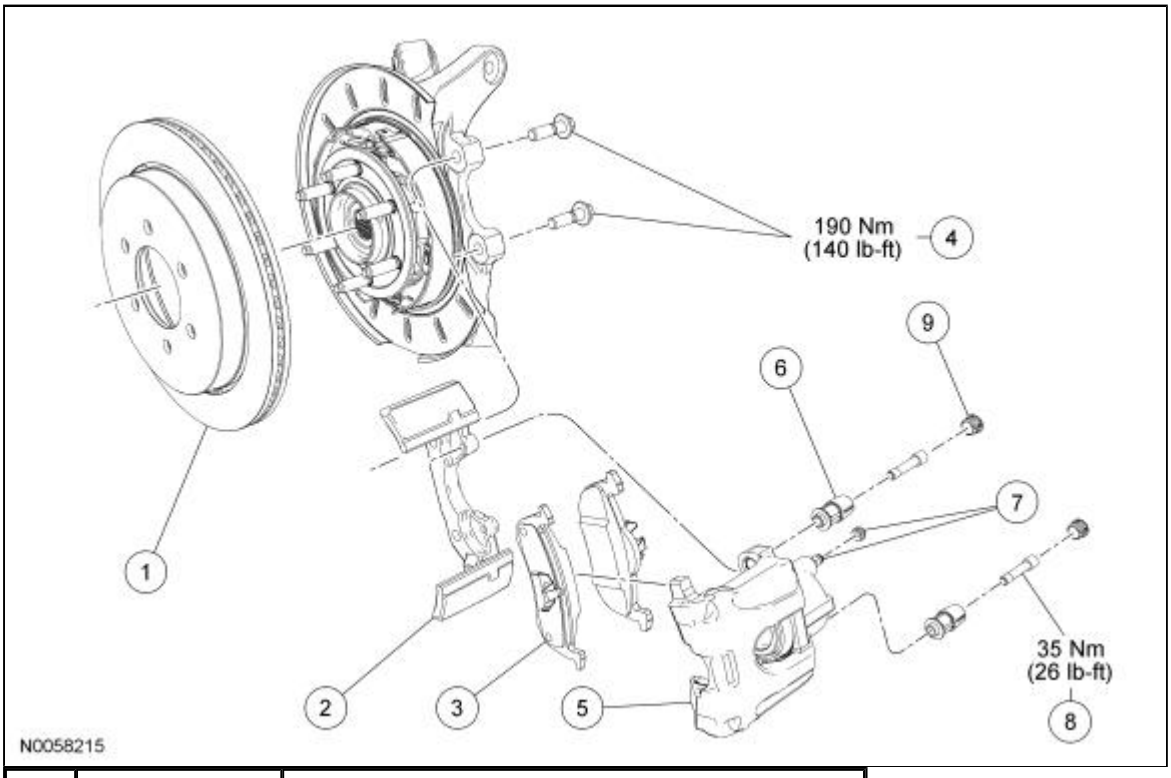
Printable View (62 KB)

Refer to Section 206-00 .

Disc Brake System — Exploded View

Printable View (169 KB)

Rear Brake Disc Components



Item	Part Number	Description
1	2C026	Brake disc
2	2B582	Brake caliper anchor plate kit
3	—	Brake pad (part of kit 2200)
4	W707292	Brake caliper anchor plate bolts (2 required)
5	2553 RH/ 2552 LH	Brake caliper
6	—	Brake caliper guide pin bushing (2 required) (part of kit 2C534)
7	2208	Bleeder screw and cap
8	—	Brake caliper guide pin (2 required) (part of kit 2C534)
9	—	Brake caliper guide pin cap (2 required) (part of kit 2C534)

1. For additional information, refer to the procedures in this section.

Brake Pads

Printable View (104 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Removal

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Using a suitable suction device, remove brake fluid in the master cylinder reservoir until the reservoir is half full.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. **CAUTION: Do not allow the brake caliper to hang by the flexible brake hose or damage to the hose can occur.**

   Remove the 2 brake caliper guide pin caps and bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.
   - Inspect the guide pin threads for damage and inspect the guide pin bushings for damage/wear. Install a new guide pin(s) and bushing(s) as necessary.

4. Remove the brake pads from the caliper.

5. **CAUTION: Install new pads if the lining(s) are worn to or past the specified thickness above the metal backing plate. Install new pads in complete axle sets.**

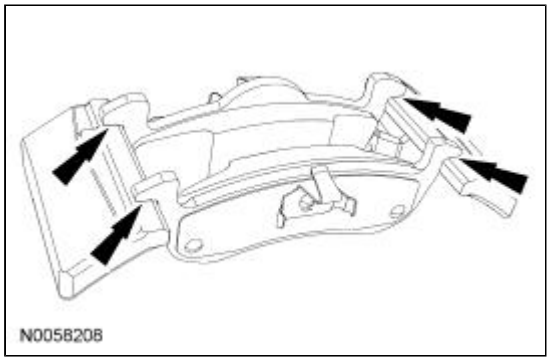
Inspect the brake pads for wear or contamination and install new pads as necessary. For additional information, refer to the Diagnosis and Testing portion of Section 206-00 .

6. Using a suitable clamp, press the piston into the caliper.

7. Inspect the brake disc and resurface or install a new brake disc as necessary. For additional information, refer to the Diagnosis and Testing portion of Section 206-00 .

Installation

1. Clean, dry and inspect the brake caliper anchor plate. Apply a light coat of lubricant to the 4 brake pad contact points on the anchor plate as indicated.



2. Install the brake pads to the caliper.

3. Position the caliper onto the anchor plate and install the 2 brake caliper guide pin bolts.
   - To install, tighten to 35 Nm (26 lb-ft).

4. Apply the brake several times to verify correct brake operation.

Brake Caliper

Printable View (104 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Removal and Installation

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

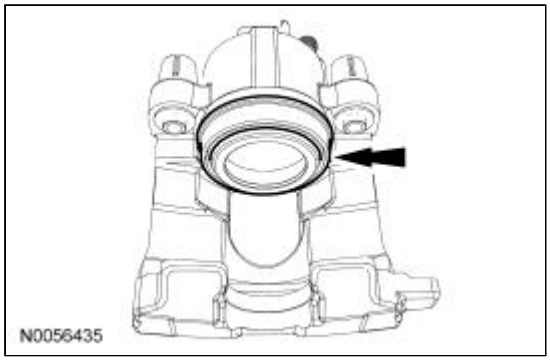
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the brake hose flow bolt and disconnect the hose.
   - Remove and discard the copper washers.
   - To install, tighten to 35 Nm (26 lb-ft).

3. Remove the 2 brake caliper guide pin caps and bolts.
   - Inspect the guide pin threads for damage and inspect the guide pin bushings for damage/wear. Install a new guide pin(s) and bushing(s) as necessary.
   - To install, tighten to 35 Nm (26 lb-ft).

4. Remove the brake caliper and remove the brake pads from the caliper.

5. Inspect the disc brake caliper dust boot for leaks and/or damage.
   - If leaks or damage are found, install a new brake caliper.



6. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to Section 206-00 .

Brake Caliper Anchor Plate

Printable View (101 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Removal and Installation

WARNING: Use of any other than approved DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove the fluid until the brake master cylinder reservoir is half full.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. **CAUTION: Do not allow the caliper and brake pad assembly to hang from the brake hose or damage to the hose can occur.**

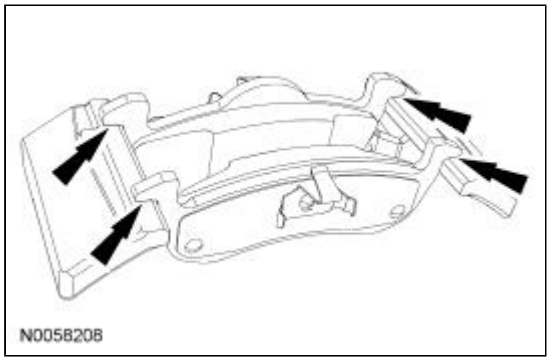
   Remove the 2 brake caliper guide pin caps and bolts and position the caliper and brake pad assembly aside.
   - Support the caliper using mechanic's wire.
   - Inspect the guide pin threads for damage and inspect the guide pin bushings for wear. Install a new guide pin(s) and bushing(s) as necessary.
   - To install, tighten to 35 Nm (26 lb-ft).

4. Remove the 2 brake caliper anchor plate bolts and the brake caliper anchor plate.
   - Inspect the caliper anchor plate bolt threads for damage and foreign material. Install cleaned and dried anchor plate bolts or install new as necessary.

- To install, tighten to 190 Nm (140 lb-ft).

5. To install, reverse the removal procedure.
   - Test the brakes for normal operation.

6. Clean, dry and inspect the brake caliper anchor plate. Apply a light coat of lubricant to the 4 brake pad contact points on the anchor plate as indicated.



Brake Disc

Printable View (80 KB)

Removal and Installation

1. With the vehicle in NEUTRAL. position it on a hoist. For additional information, refer to Section 100-02 .

2. **CAUTION: Do not allow the brake caliper and anchor plate assembly to hang by the flexible brake hose or damage to the hose can occur.**

   Remove the brake caliper anchor plate bolts and position the anchor plate and caliper assembly aside.
   - Support the caliper and anchor plate assembly with mechanic's wire.
   - Inspect the anchor plate bolt threads for damage and foreign material. Install cleaned and dried anchor plate bolts or install new as necessary.
   - To install, tighten to 190 Nm (140 lb-ft).

3. **NOTE:** If the brake disc binds on the parking brake shoe, remove the adjustment hole access plug and contract the parking brake shoe.

   Remove the brake disc.

4. Inspect the brake disc and resurface or install a new brake disc as necessary. For additional information, refer to the Diagnosis and Testing portion of Section 206-00 .

5. To install, reverse the removal procedure.

Printable View (63 KB)

General Specifications

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Front park brake cable P-clip-to-frame bolt	18	13	—
Parking brake control assembly bolts	20	15	—
Parking brake release handle bolt	3	—	27
Rear park brake cable-to-crossmember bolt	9	—	80
Wire form bracket bolt	18	13	—

Parking Brake

Printable View (62 KB)

The park brake system consists of the following:

- Foot-actuated park brake control
- Park brake release handle
- Front park brake cable
- Parking brake equalizer
- LH rear park brake cable
- RH rear park brake cable
- Park brake shoes and a drum-in-hat style brake disc

Parking Brake

Printable View (162 KB)

Principles of Operation—Automatic Parking Brake Release (Navigator)

The automatic parking brake release consists of the following components:

- Release actuator
- Electromechanical solenoid
- Gearshift lever position switch
- Parking brake warning indicator switch
- Wiring harnesses connecting the various components

When the parking brake is set and the gearshift lever is moved to R or D, the gearshift lever position switch closes. The anti-lock brake system (ABS) module energizes the electronic parking brake release relay. Once the parking brake is released, the parking brake warning indicator switch opens, and the ABS module energizes the electronic parking brake retract relay. The solenoid is energized only when both the parking brake warning indicator switch and the gearshift lever position switch are closed with the brake pedal applied.

Inspection and Verification

WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the RH kick panel area. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Release actuator
• Electromechanical solenoid
• Shift lever assembly
• Brake on/off switch
	• Smart junction box (SJB) fuses:
	  ▪ 16 (15A)
	  ▪ 33 (10A)
	• Wiring harness
	• Connectors
	• Circuitry

3. Check the operation of the parking brake with the vehicle on a hoist and the parking brake control fully released. Check for any cable damage and install a new cable as necessary.
4. Check the parking brake by depressing the parking brake control pedal. The parking brake must fully set upon full apply.
5. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

6. If the cause is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Parking brake will not apply	• Clearance	• CHECK the brake cable for slack or breaks. APPLY the park brake pedal to cycle the park brake system as necessary.
	• Grease-soaked parking brake shoe linings	• REPAIR the source of the leak and INSTALL a new parking brake shoe and lining.
	• Binding linkage	• CHECK for linkage binding and misalignment. LUBRICATE all friction points.
	• Parking brake shoe and lining	• INSTALL a new parking brake shoe and lining. CHECK the drum-in-hat surface for scoring and INSTALL new as necessary. REFER to Section 206-04 .
	• Worn or damaged parking brake components	• INSTALL new components as necessary.
• Parking brake will not release	• Parking brake control • Park brake handle binding • Parking brake cables binding • Binding parking brake components	• INSPECT and REPAIR as necessary.
• Automatic parking brake release does not operate	• Smart junction box (SJB) fuse (s) • Gearshift lever position switch • Wiring • Release actuator • Release relay • Reset relay	• RETRIEVE and RECORD any anti-lock brake system (ABS) diagnostic trouble codes (DTCs). If any ABS module DTCs are present, REPAIR them first. REFER to Section 206-09 . If no ABS module DTCs are present, Go To Pinpoint Test A .
• Excessive lining wear	• Brake drag	• CHECK the parking brake cables for a binding condition. INSPECT for broken or missing springs.
	• Rough brake disc drum surface	• INSTALL a new brake disc if drum section is badly scored. REFER to Section 206-04 .

Pinpoint Tests

Pinpoint Test A: Automatic Parking Brake Release Does Not Operate

Refer to Wiring Diagrams Cell 129 , Electronic Parking Brake for schematic and connector information.

Normal Operation

The parking brake uses an electrically operated solenoid to release the parking brake. With the brake pedal depressed and the gear shift lever moved from the PARK position, the solenoid retracts to release the parking brake. The solenoid is controlled by the release and retract relays which are controlled by the anti-lock brake system (ABS) module. The ABS module provides grounds for the release and reset relays, fused battery voltage is provided to the relays from battery junction box (BJB) fuse 16 (15A) along circuit SBP16 (VT/RD) for actuating the parking brake release solenoid. Fused ignition voltage is provided to the relays from BJB fuse 33 (10A) along circuit CBP33 (WH/BN) for activating the relays. The relays alternately provide power or ground to the park brake solenoid. Actuation of the relays depends on input signals from the brake pedal on/off (BOO) switch and the transmission microprocessor which sends the information along the high speed-communication area network (HS-CAN).

To release the parking brake release solenoid, the ABS module provides a ground path for the release relay along circuit CCB21 (GN/VT). This engages the release relay. The release relay is supplied fused battery voltage from BJB fuse 16 (15A) along circuit SBP16 (VT/RD). When the release relay is engaged, this voltage is supplied to the solenoid along circuit CCB17 (BU/GN), the solenoid is grounded along circuit CCB16 (WH/VT), through the reset relay and finally along circuit GD138 (BK/WH).

To reset the parking brake release solenoid, the ABS module provides a ground path for the reset relay along circuit CCB20 (BU/WH). This engages the relay. The reset relay is supplied fused battery voltage from BJB fuse 16 (15A) along circuit SBP16 (VT/RD). When the reset relay is engaged, this voltage is supplied to the solenoid along circuit CCB16 (WH/VT), the solenoid is grounded along circuit CCB17 (BU/GN), through the release relay and finally along circuit GD138 (BK/WH).

Possible Causes

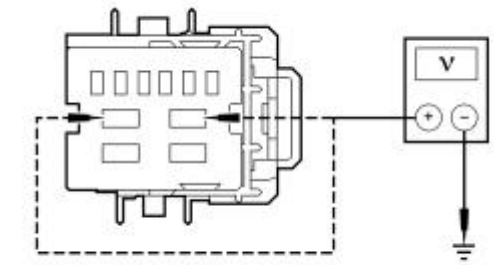
- Fuse(s)
- Circuit open
- Circuit shorted
- Park brake release relay
- Park brake reset relay
- Park brake release solenoid
- ABS module

PINPOINT TEST A: AUTOMATIC PARKING BRAKE RELEASE DOES NOT OPERATE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
A1 CHECK FOR BATTERY VOLTAGE AT THE RELAYS	

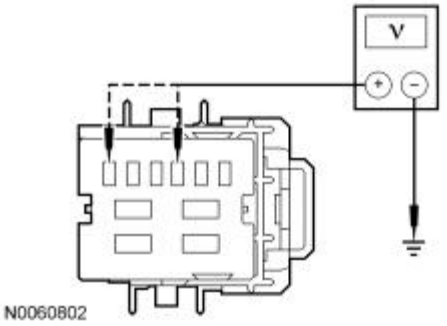
• Key in OFF position.
• Disconnect: Parking Brake Reset Relay.
• Disconnect: Parking Brake Release Relay.
• Measure the voltage between ground and:
  ▪ reset relay socket pin-5, circuit SBP16 (VT/RD), harness side.
  ▪ release relay socket pin-5, circuit SBP16 (VT/RD), harness side.
	Yes
	GO to A2 .
	
	No
	VERIFY BJB fuse 16 (15A) is OK. If OK, REPAIR circuit CBP33 (WH/BN). TEST the system for normal operation.



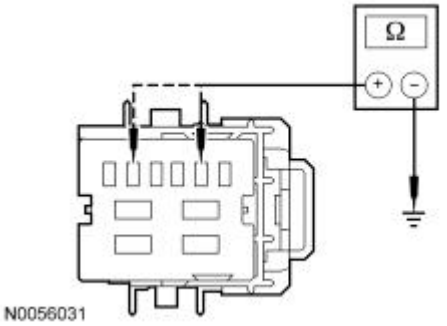
N0056029

- **Is the voltage greater than 10 volts?**

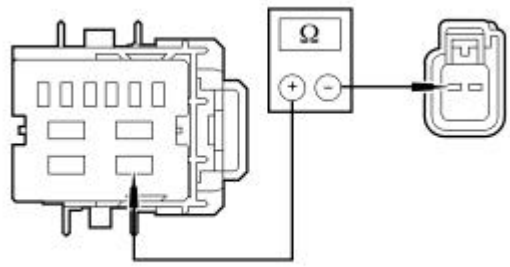
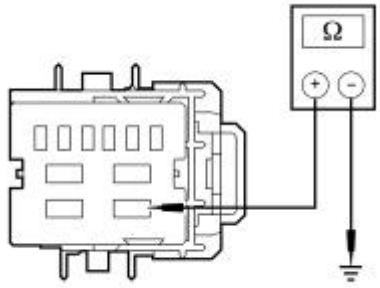
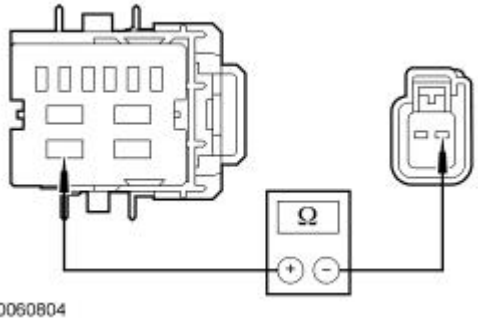
A2 CHECK FOR IGNITION VOLTAGE AT THE RELAYS	

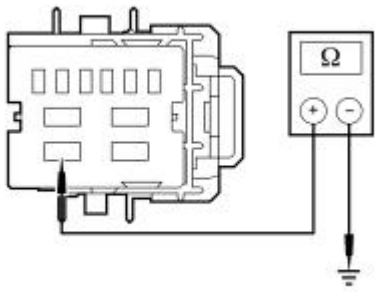
• Key in ON position.
• Measure the voltage between ground and:
  ▪ reset relay socket pin-2, circuit CBP33 (WH/BN), harness side.
  ▪ release relay socket pin-2, circuit CBP33 (WH/BN), harness side.
 
 	
N0060802
• **Is the voltage greater than 10 volts?**
	Yes
	GO to A3 .
	
	No
	VERIFY BJB fuse 33 (10A) is OK. If OK, REPAIR circuit CBP33 (WH/BN). TEST the system for normal operation.

A3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	

• Key in OFF position.
• Measure the resistance between ground and:
  ▪ reset relay socket pin-4, circuit GD138 (BK/WH), harness side.
  ▪ release relay socket pin-4, circuit GD138 (BK/WH), harness side.
 
 	
N0056031
• **Is the resistance greater than 10,000 ohms?**
	Yes
	REPAIR circuit GD138 (BK/WH). TEST the system for normal operation.
	
	No
	GO to A4 .

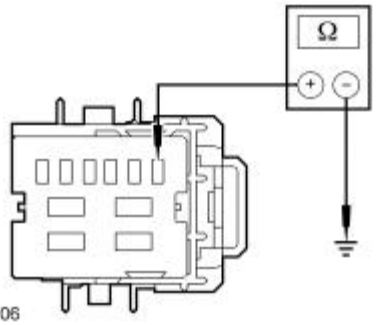
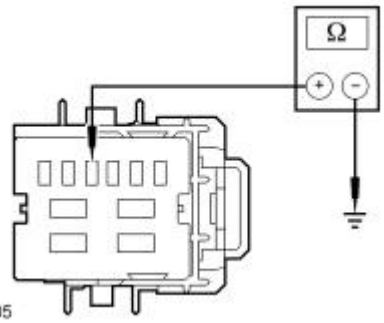
A4 CHECK CIRCUIT CCB17 (BU/GN) FOR AN OPEN	
• Disconnect: Park Brake Release Solenoid C2132. • Measure the resistance between release relay pin-3, circuit CCB17 (BU/GN), harness side and park brake release solenoid C2132-2, circuit CCB17 (BU/GN), harness side.	**Yes** REPAIR circuit CCB17 (BU/GN). TEST the system for normal operation.

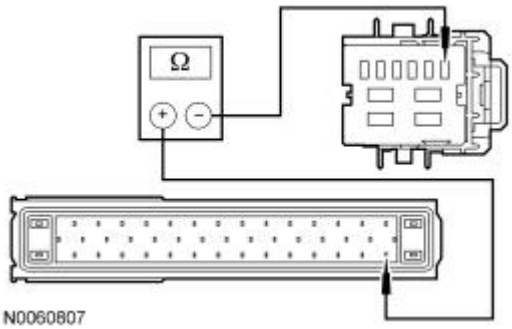
 N0060803 • **Is the resistance greater than 10,000 ohms?**	**No** GO to A5 .
A5 CHECK CIRCUIT CCB17 (BU/GN) FOR A SHORT TO GROUND	
• Measure the resistance between release relay pin-3, circuit CCB17 (BU/GN), harness side and ground.  N0056035 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit CCB17 (BU/GN). TEST the system for normal operation. **No** GO to A6 .
A6 CHECK CIRCUIT CCB16 (WH/VT) FOR AN OPEN	
• Measure the resistance between reset relay pin-3, circuit CCB16 (WH/VT), harness side and park brake release solenoid C2132-1, circuit CCB16 (WH/VT), harness side.  N0060804 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CCB16 (WH/VT). TEST the system for normal operation. **No** GO to A7 .
A7 CHECK CIRCUIT CCB16 (WH/VT) FOR A SHORT TO GROUND	
• Measure the resistance between reset relay pin-3, circuit CCB16 (WH/VT), harness side and ground.	**Yes** REPAIR circuit CCB16 (WH/VT). TEST the system for normal operation. **No** GO to A8 .



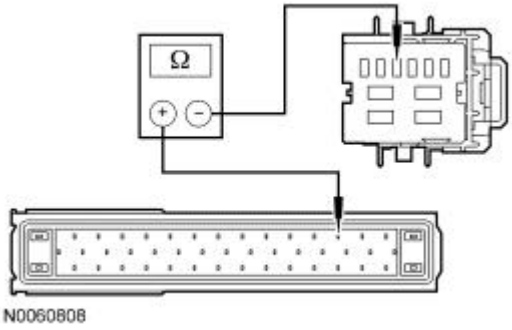
N0056033

- **Is the resistance less than 5 ohms?**

A8 CHECK THE RELEASE RELAY ABS MODULE GROUND • Connect the diagnostic tool. • Key in ON position. • Measure the resistance between release relay pin-1, circuit CCB21 (GN/VT), harness side and ground.  N0060806 • Trigger the electric park brake release relay active command to ENERGIZE. • **Is the resistance greater than 10,000 ohms when the active command is triggered ON?**	**Yes** TRIGGER the electric park brake release relay active command to DE-ENERGIZE. REPAIR circuit CCB21 (GN/VT). TEST the system for normal operation. **No** TRIGGER the electric park brake release relay active command to DE-ENERGIZE. GO to A9 .
A9 CHECK THE RETRACT RELAY ABS MODULE GROUND • Measure the resistance between reset relay pin-1, circuit CCB20 (BU/WH), harness side and ground.  N0060805 • Trigger the electric park brake reset relay active command to ENERGIZE. • **Is the resistance less than 5 ohms?**	**Yes** TRIGGER the electric park brake reset relay active command to DE-ENERGIZE. REPAIR circuit CCB20 (BU/WH). TEST the system for normal operation. **No** TRIGGER the electric park brake reset relay active command to DE-ENERGIZE. GO to A10 .
A10 CHECK CIRCUITS CCB20 (BU/WH) AND CCB21 (GN/VT) FOR AN OPEN • Key in OFF position. • Disconnect: ABS Module C135. • Measure the resistance between reset release relay pin-1, circuit CCB21 (GN/VT), harness side and ABS module C135-15, circuit CCB21 (GN/VT), harness side.	**Yes** REPAIR the affected circuit (s). TEST the system for normal operation. **No** GO to A11 .



- Measure the resistance between reset relay pin-1, circuit CCB20 (BU/WH), harness side and ABS module C135-44, circuit CCB20 (BU/WH), harness side.



- **Is the resistance greater than 10,000 ohms?**

A11 CHECK THE RELEASE SOLENOID OPERATION	
• Connect: Parking Brake Reset Relay. • Connect: Parking Brake Release Relay. • Connect: Park Brake Release Solenoid C2132. • Connect: ABS Module C135. • Key in ON position. • Trigger the electric park brake release relay active command to ENERGIZE. • Trigger the electric park brake release relay active command to DE-ENERGIZE. • Trigger the electric park brake reset relay active command to ENERGIZE. • Trigger the electric park brake reset relay active command to DE-ENERGIZE. • **Did the park brake release solenoid operation match the active commands?**	**Yes** GO to A12 . **No** INSTALL a new parking brake release solenoid. REFER to Parking Brake Release Solenoid in this section. TEST the system for normal operation.
A12 CHECK THE ABS MODULE CONNECTOR	

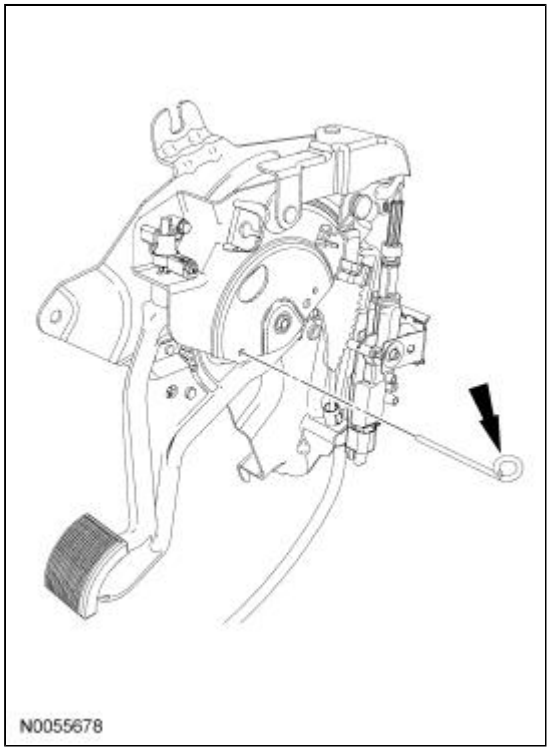
• Key in OFF position.
• Disconnect: ABS Module C135.
• Check the ABS module for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: ABS Module C135.
• Make sure the connector is seated correctly and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Parking Brake Cable Tension Release

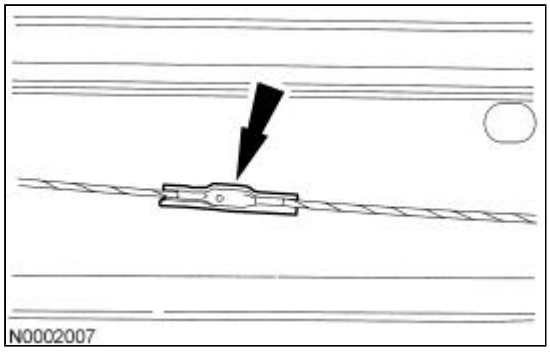
Printable View (119 KB)

1. Remove the LH cowl side trim panel. For additional information, refer to Section 501-05 .

2. With the help of an assistant, release the parking brake cable tension by pulling down on the intermediate cable at the cable-to-cable connector clip until the parking brake control sector rotates to its stop and a 4 mm (0.15 in) x 150 mm (5.9 in) retainer pin can be inserted.



3. Disconnect the cable-to-cable connector clip.



4. To reload the tension on the parking brake cable, follow the release procedure in reverse.
   - Make sure the cable-to-cable connector clip is connected to the front and rear cable before removing the brake control retaining pin, and the cable tension is reloaded slowly.

Parking Brake Control

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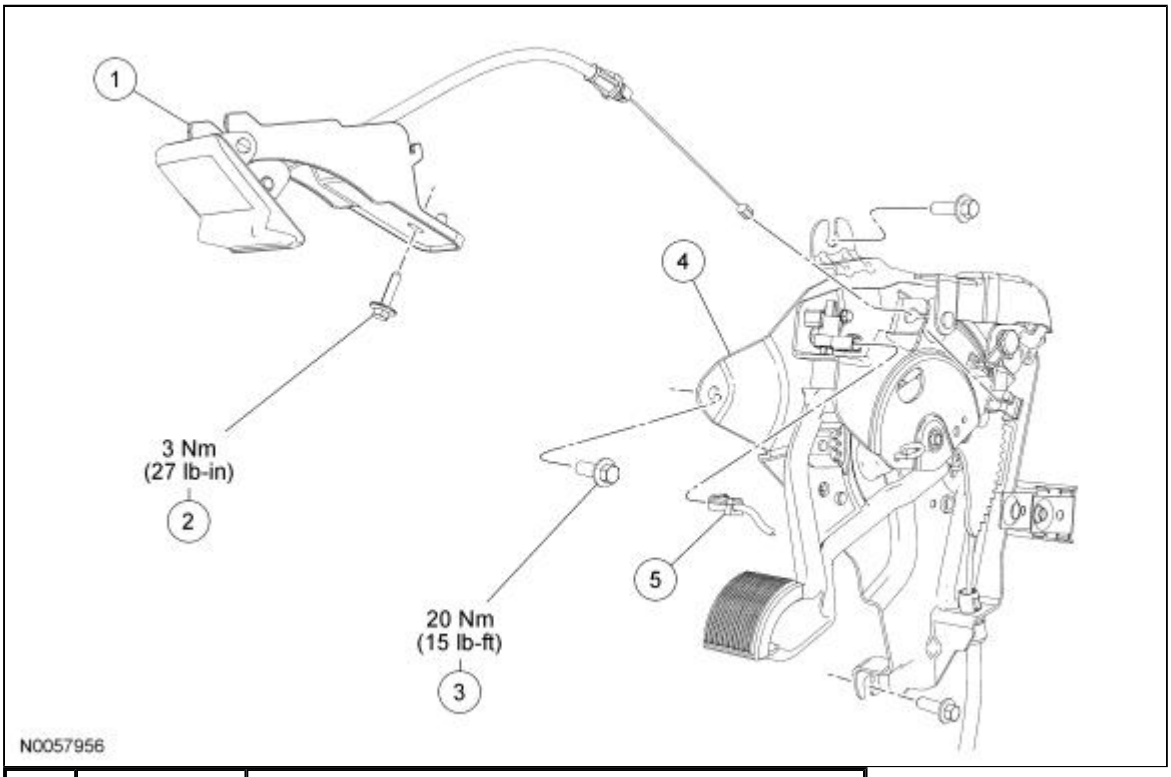


Item	Part Number	Description
1	2783	Parking brake release handle
2	W707628	Parking brake release handle bolt
3	W704522	Parking brake control assembly bolt (3 required)
4	2780	Parking brake control
5	—	Parking brake switch electrical connector (part of 14489)

Removal and Installation

1. Relieve tension on the parking brake cable system. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. If equipped, remove the parking brake release solenoid. For additional information, refer to Parking Brake Release Solenoid in this section.

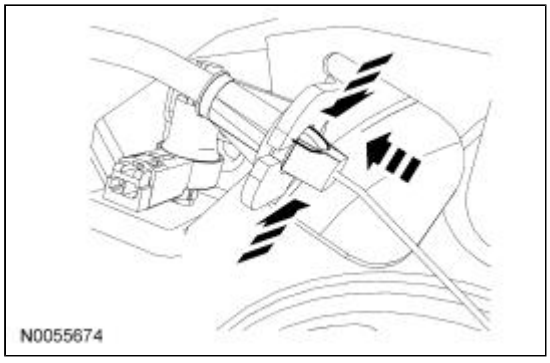
3. Remove the door scuff plate.

4. Remove the 2 screws and the instrument panel steering column cover.
   - Pull the weatherstrip back to release the edge of the panel.

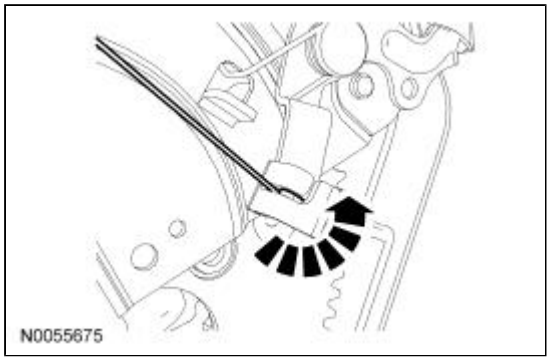
5. Remove the parking brake release handle bolt.
   - To install, tighten to 3 Nm (27 lb-in).

6. Remove the retainer and the cowl trim panel.

7. Compress the 2 tabs and disconnect the parking brake release cable from the parking brake control assembly.



8. Disconnect the parking brake release cable from the release lever and remove the parking brake release handle.

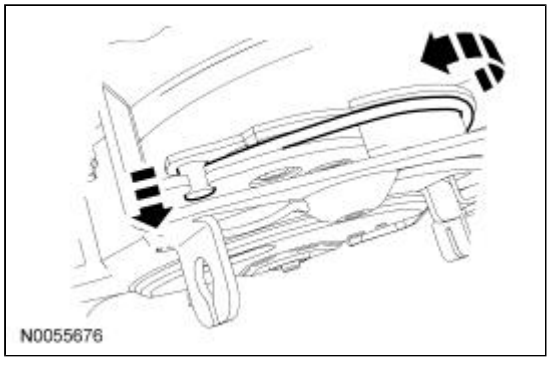


9. Disconnect the parking brake switch electrical connector.

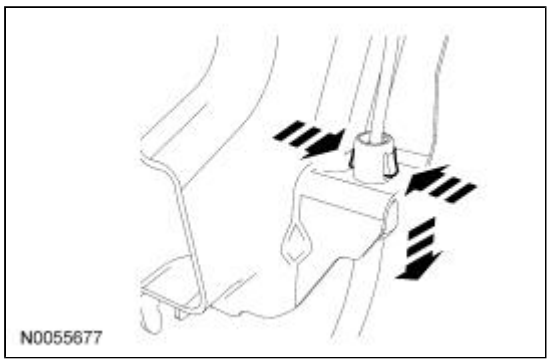
10. Remove the 3 parking brake control assembly bolts.
    - To install, tighten to 20 Nm (15 lb-ft).

11. Position the parking brake control assembly onto the floor.

12. Disconnect the parking brake cable from the take-up spool.



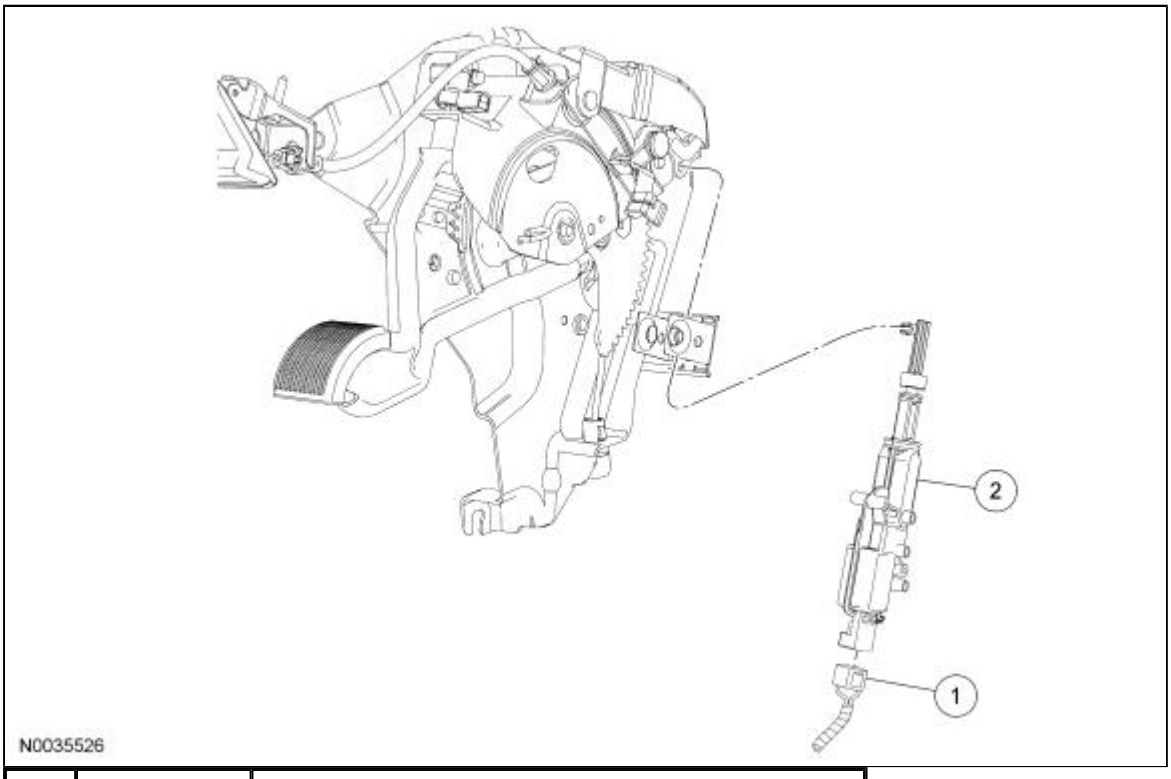
13. Compress the 2 tabs, disconnect the parking brake cable from the control assembly and remove the control assembly.



14. To install, reverse the removal procedure.

Parking Brake Release Solenoid

Printable View (131 KB)



Item	Part Number	Description
1	—	Parking brake release solenoid electrical connector
2	15A851	Parking brake release solenoid

Removal and Installation

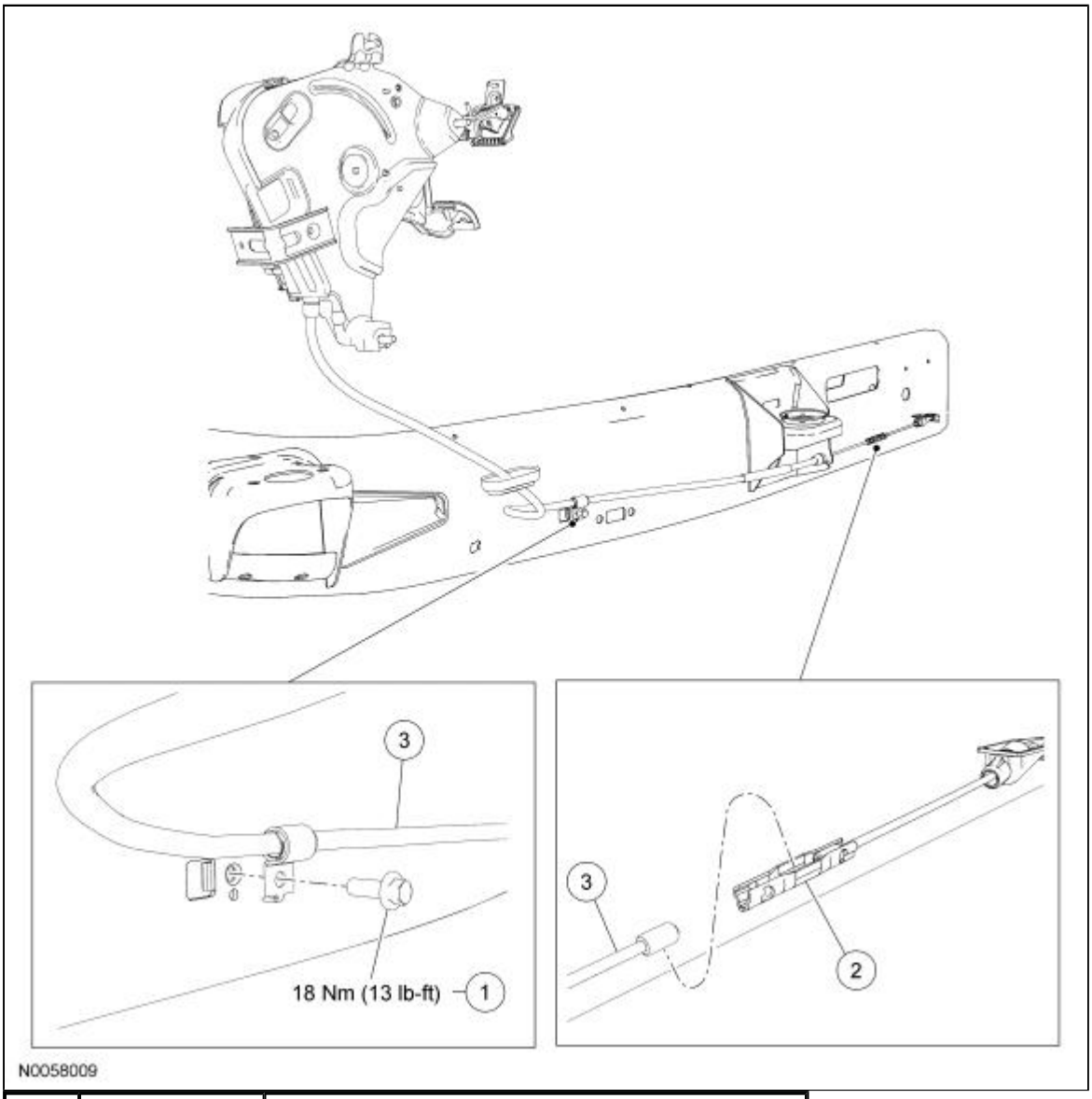
1. Disconnect the parking brake release solenoid electrical connector.

2. Remove the parking brake release solenoid.
   - Pry the mounting bracket apart slightly to release the solenoid.
   - Disengage the solenoid from the release lever.

3. To install, reverse the removal procedure.

Parking Brake Cable — Front

Printable View (139 KB)



Item	Part Number	Description
1	W506423	Front park brake cable P-clip-to-frame bolt
2	—	Park brake cable union
3	2853	Front park brake cable

Removal and Installation

1. Remove the parking brake control. For additional information, refer to Parking Brake Control in this section.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Remove the front park brake cable P-clip-to-frame bolt.

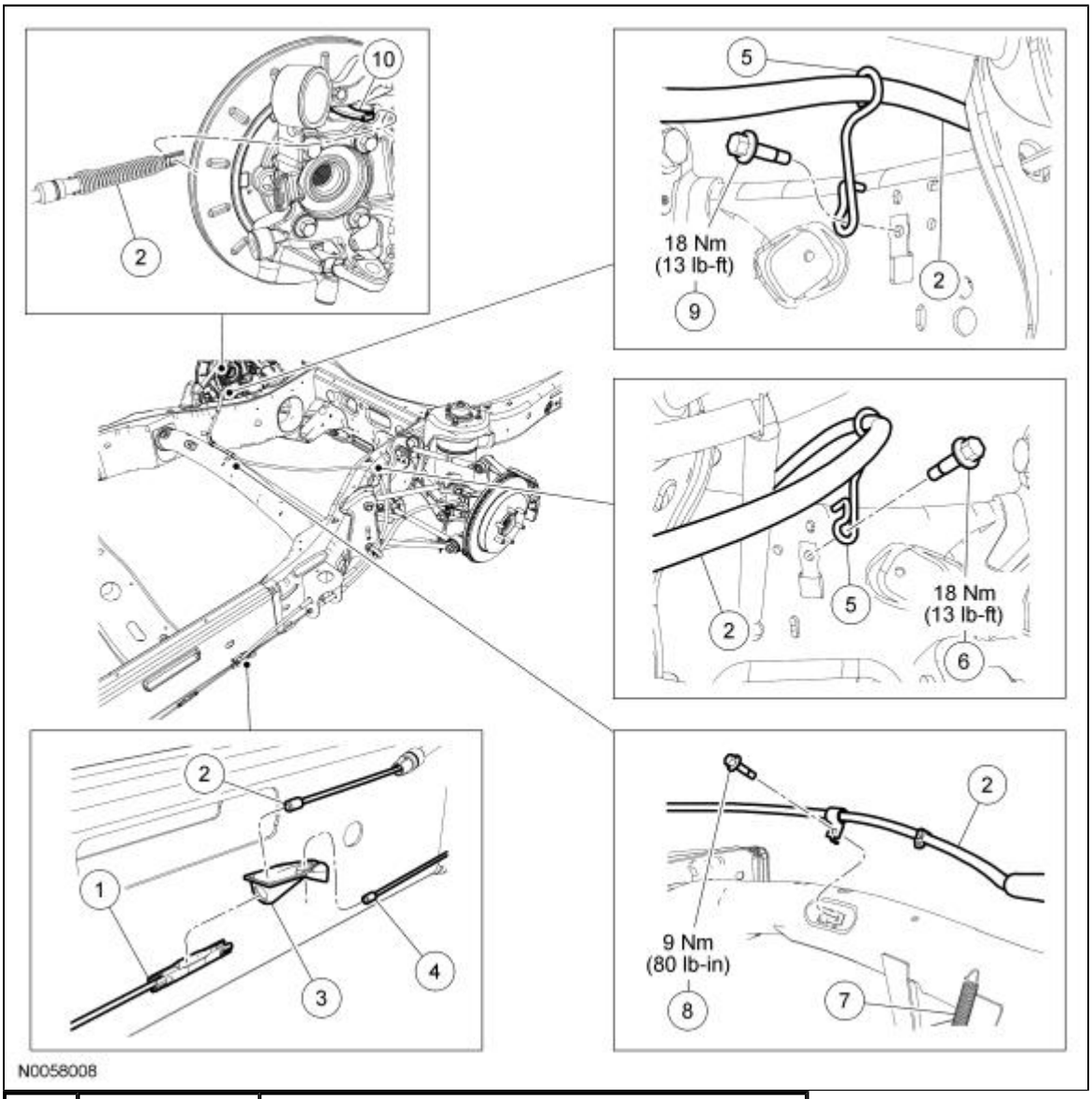
- To install, tighten to 18 Nm (13 lb-ft).

4. Remove the front parking brake cable and conduit.
    - Pry the rubber seal from the front floor pan.
    - Compress the retainer and release the conduit from the bracket.
    - Remove the front cable and conduit from the cable union.

5. To install, reverse the removal procedure.

Parking Brake Cable — Rear, RH

Printable View (234 KB)



Item	Part Number	Description
1	—	Parking brake cable union
2	2A635	RH parking brake cable
3	2A602	Parking brake cable equalizer
4	2A809	LH parking brake cable
5	—	Wire form bracket (part of 2A635)
6	W506423	Wire form bracket bolt
7	2A709	Parking brake cable retaining spring
8	W506014	Rear park brake cable-to-crossmember bolt
9	W506423	Wire form bracket bolt
10	2A637	RH parking brake shoe lever

Removal and Installation

1. Relieve the tension on the parking brake cable system. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Disconnect the RH rear cable from the cable union.

4. Compress the 2 tabs and release the conduit from the equalizer.

5. Remove the RH rear cable from the retaining clip.

6. Remove the bolt and the wire form bracket from the LH side of the vehicle.
    - To install, tighten to 18 Nm (13 lb-ft).

7. Remove the rear park brake cable-to-crossmember bolt.
    - To install, tighten to 9 Nm (80 lb-in).

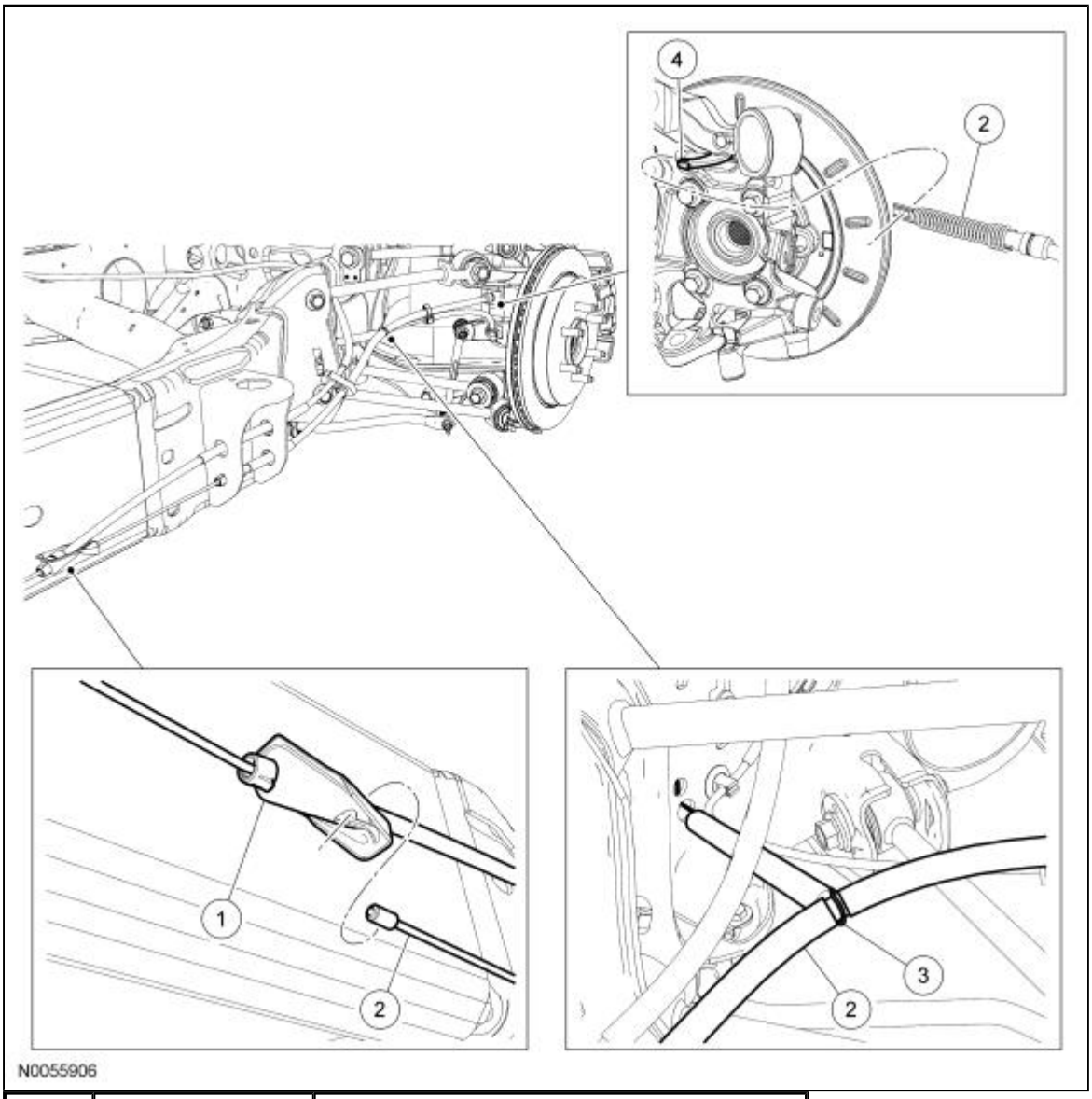
8. Remove the bolt and the wire form bracket from the RH side of the vehicle.
    - To install, tighten to 18 Nm (13 lb-ft).

9. Compress the 2 tabs and release the conduit, then unclip the cable end fitting from the parking brake shoe lever.

10. To install, reverse the removal procedure.

Parking Brake Cable — Rear, LH

Printable View (255 KB)



Item	Part Number	Description
1	2A602	Equalizer
2	2A809	LH rear park brake cable
3	2A709	Park brake cable retainer spring
4	2A637	Park brake shoe lever

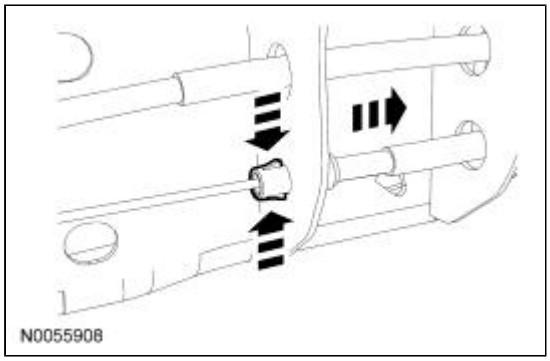
Removal and Installation

1. Relieve the tension on the parking brake cable system. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Separate the LH rear cable from the equalizer.

4. Remove the conduit from the bracket.
    1. Compress the 2 tabs.
    2. Remove the conduit from the bracket.



5. **NOTE:** Be sure to correctly install the park brake cable retainer spring and route cables between suspension links.

    Remove the LH rear cable.
    1. Remove the LH rear cable from the retaining clip.
    2. Disconnect the park brake cable retainer spring.
    3. If equipped, disconnect the anti-lock brake system (ABS) sensor wire from the retaining clip.

6. Remove the wireform bracket retaining bolt and the bracket.
    - To install, tighten to 17 Nm (13 lb-ft).

7. Compress the retainer and release the conduit, then unclip the cable end fitting from the parking brake shoe lever.

8. To install, reverse the removal procedure.

Parking Brake Shoes

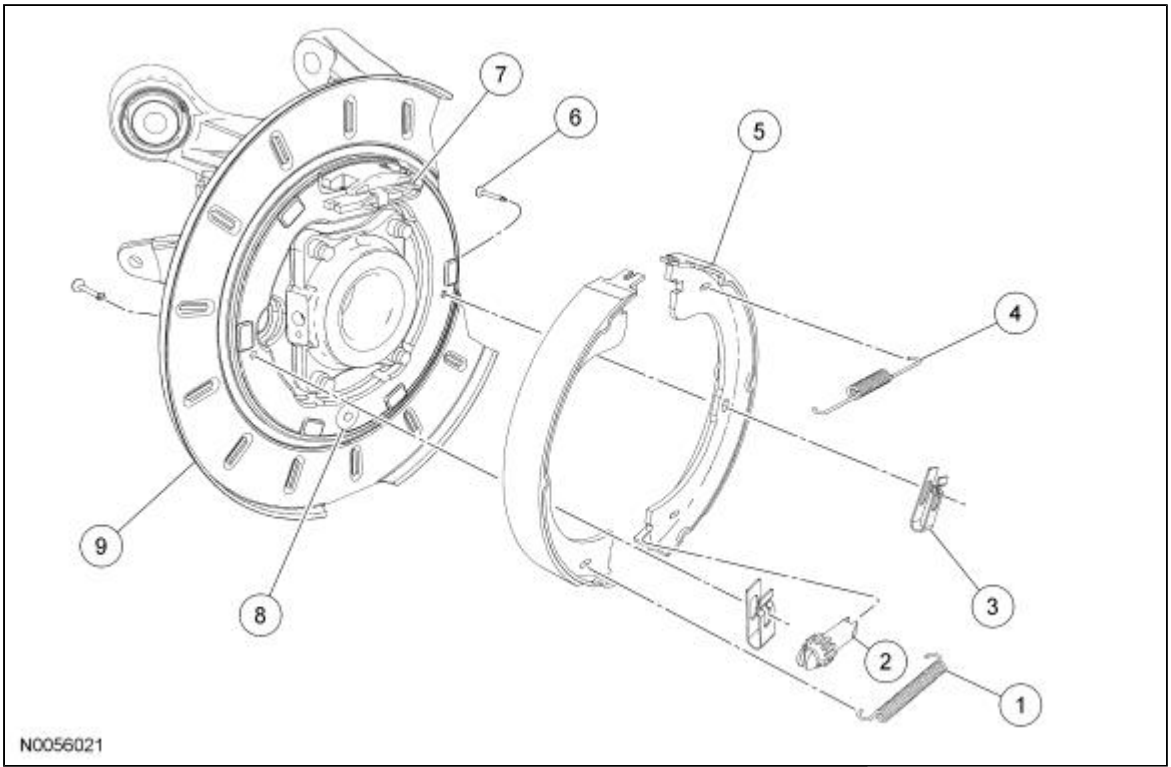
Printable View (250 KB)

Special Tool(s)

ST1468-A	Gauge, Brake Adjusting 206-D002 (D81L-1103-A) or equivalent

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A



Item	Part Number	Description
1	—	Parking brake shoe adjuster spring (part of 2648)
2	2041	Parking brake shoe adjuster
3	—	Parking brake shoe retaining clip (2 required) (part of 2648)
4	—	Parking brake shoe return spring (part of 2648)

5	2A753	Parking brake shoe (part of 2648)
6	—	Parking brake shoe retaining pin (2 required) (part of 2648)
7	2404	Parking brake shoe lever boot (Navigator/Expedition)
8	2092	Adjuster hole plug
9	2C029 LH/ 2C028 RH	Brake disc shield

Removal

1. Relieve the tension on the parking brake cable system. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. Remove the brake disc. For additional information, refer to Section 206-04 .

3. Remove the front parking brake shoe retaining clip and pin.

4. Remove the parking brake shoe adjuster.
   - Using a suitable tool, spread the bottom of the parking brake shoes apart.
   - Remove the parking brake shoe adjuster.

5. Remove the parking brake shoe adjuster spring.

6. Slide the front parking brake shoe up and out of the guide flange.

7. Remove the front parking brake shoe.
   - Rotate the front parking brake shoe outward.
   - Remove the parking brake shoe return spring.

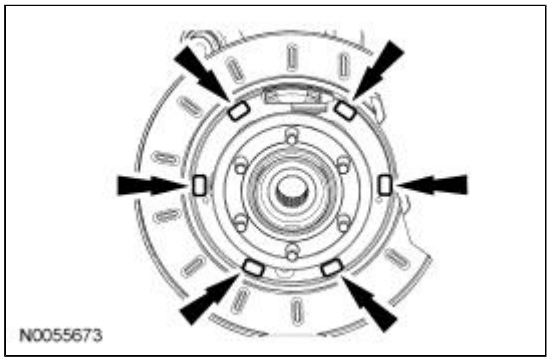
8. Remove the rear parking brake shoe.
   - Remove the retaining clip and pin.
   - Remove the rear parking brake shoe.

9. Inspect the components for excessive wear or damage and install new parts as required.

Installation

1. **CAUTION: Apply the grease only where indicated, do not apply the grease to the parking brake shoes. The grease will contaminate the brake shoe linings and damage to the linings will result.**

   Apply a light coat of grease to the 6 parking brake shoe contact points on the disc brake shield.



2. Install the rear parking brake shoe.
    - Hold the rear parking brake shoe in position.
    - Install the retaining pin and clip.

3. Install the front parking brake shoe.
    - Install the parking brake shoe return spring to the rear parking brake shoe and to the front parking brake shoe.
    - Rotate the front parking brake shoe into the guide flange.

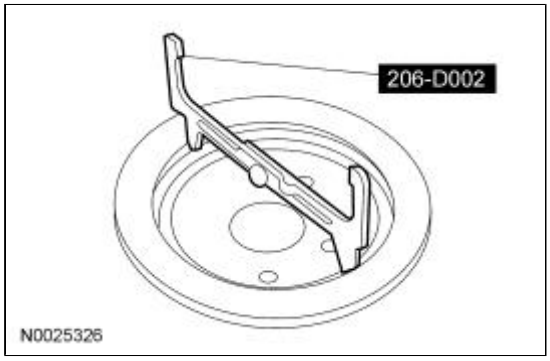
4. Slide the front parking brake shoe down into position on the flange.

5. Install the front parking brake shoe retaining pin and clip.

6. Install the parking brake shoe adjuster spring.

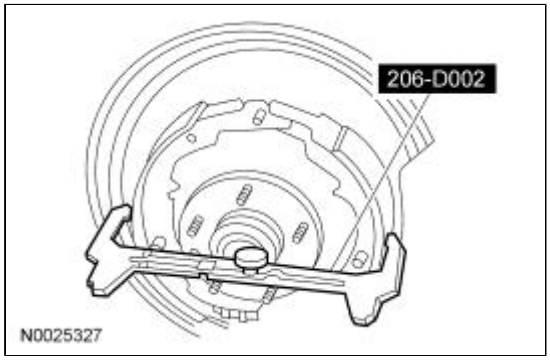
7. Install the parking brake shoe adjuster.
    - Using a suitable tool, spread the bottom of the parking brake shoes apart.
    - Install the parking brake shoe adjuster.

8. Using the special tool, measure the inside diameter of the drum portion of the rear brake disc.
    - Record the measurement.



9. **NOTE:** Make sure that the parking brake shoes are correctly centered. Take the measurement at the widest point across the center of the parking brake shoes.

    Using the special tool, measure the parking brake shoe diameter.
    - Rotate the adjuster to set the parking brake shoe diameter to 0.45 mm (0.02 in) less than the recorded inside diameter of the drum portion of the rear brake disc.



10. Install the brake disc. For additional information, refer to Section 206-04 .

11. **NOTE:** This step will require the aid of an assistant.

Enable the parking brake cable system.

- Pull down on the front parking brake cable at the coupler.
- Remove the retaining pin from the parking brake lever.

12. Check the parking brake for correct operation.

Printable View (63 KB)

General Specifications

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Torque Specifications

Description	Nm	lb-ft
Brake master cylinder nuts	25	18
Brake pedal bracket nuts and bolts	27	20
Brake pressure switch	18	13
Brake tube fittings	18	13

Hydraulic Brake Actuation

Printable View (81 KB)

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. The brake pedal is either fixed or adjustable; non-memory or memory is available. When the brake pedal is depressed, brake fluid is pushed from the master cylinder through the metal tubing and flexible hoses to the front disc brake calipers and the rear disc brake calipers. The front disc brake caliper pistons are forced outward against the brake pads and contact the braking surface of the brake discs. The brake fluid enters the rear disc brake calipers, forcing the rear disc brake caliper pistons outward against the brake pads. The brake pads press against the braking surface on the brake discs. When the brake pedal is released, the pressure is relieved, returning the brake caliper pistons and the brake pads to the released position.

The dual brake system is split front and rear with the front wheel brakes comprising one circuit and the rear wheel brakes, the other circuit.

The ability of a brake system to stop the vehicle is dependent on the available traction.

Brake Master Cylinder

The brake master cylinder is a dual-piston type.

The brake master cylinder is assisted by a power brake booster. Refer to Section 206-07 .

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair or replacement.

- Low brake fluid level detected without signs of leakage. This condition is caused by displacement of brake fluid from the brake master cylinder reservoir into the disc brake calipers to compensate for normal brake wear. Add brake fluid as needed.
- A momentary or slight ripple of brake fluid inside the brake master cylinder reservoir upon application or release of the brake pedal.
- A trace of brake fluid found on the outside of the power brake booster below the brake master cylinder mounting flange. This condition results from the lubricating action of the brake master cylinder wiping seal.

Brake Fluid Level Warning Switch

The brake fluid level warning switch is an integral part of the brake master cylinder reservoir. It consists of a float containing a magnet and a reed switch mounted in the bottom of the brake master cylinder reservoir.

When the brake fluid in the brake master cylinder reservoir gets to a predetermined level, the floating magnet actuates the reed switch, causing the red brake warning indicator to illuminate. Loss of brake fluid from either the primary (front) or secondary (rear) system will cause this system to activate. If the brake fluid level warning switch is inoperative, a new brake master cylinder reservoir must be installed.

Tubes and Hoses

CAUTION: Only authorized inlet hydraulic brake tubes should be used. These tubes are of a specific design and new authorized parts only should be installed.

Steel tubing with flex hoses are used in the hydraulic tubes between the brake master cylinder and the hydraulic control unit (HCU). Steel tubing is used between the HCU and the front and rear hoses.

Double flared brake tubing provides good leakproof connections.

When replacing hydraulic brake tubing, hoses or connectors, tighten all connections securely. After replacement, bleed the brake system. Refer to Section 206-00 .

Hydraulic Brake Actuation

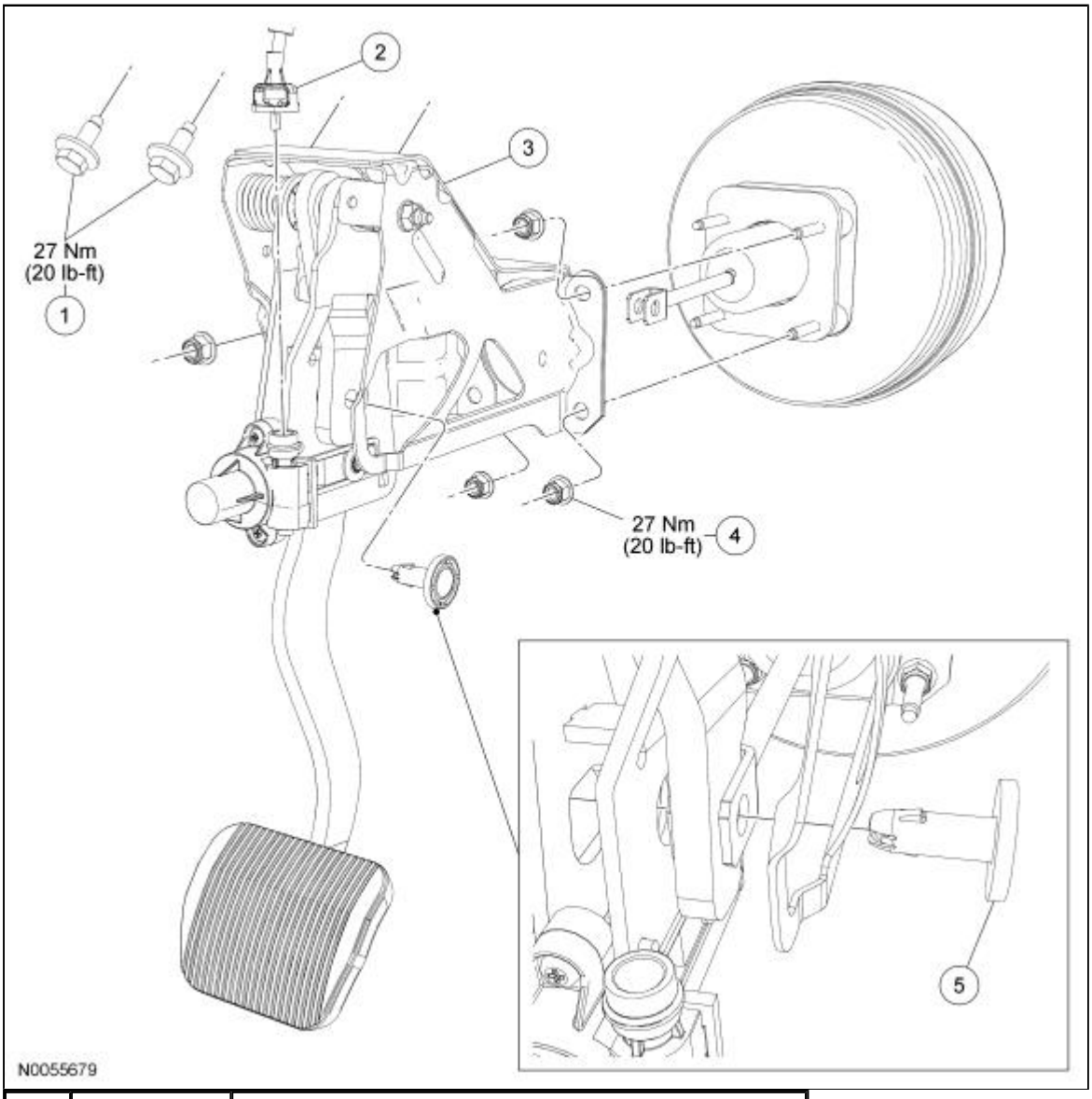
Printable View (62 KB)

Refer to Section 206-00 .

Brake Pedal and Bracket

Printable View (236 KB)

NOTE: Adjustable brake pedal and bracket shown, fixed brake pedal and bracket similar.



Item	Part Number	Description
1	W702368	Brake pedal bracket bolts (2 required)
2	—	Accelerator pedal-to-brake pedal cable (part of 9F836)
3	2450	Brake pedal and bracket
4	W520212	Brake pedal bracket nut (4 required)
5	2L523	Brake pedal pin

Removal and Installation

Adjustable pedal vehicles

1. **CAUTION: The brake pedal and the accelerator pedal must be in the same position when installing a new cable or a new pedal. The pedals must be all the way forward or all the way rearward.**

   Disconnect the battery negative cable. For additional information, refer to Section 414-01 .

2. If equipped, disconnect the accelerator pedal-to-brake pedal cable from the adjustable brake pedal motor.

All vehicles

3. **CAUTION: Always remove the stoplamp switch with the brake pedal secured to the brake booster push rod and with the brake pedal in the at-rest position. Do not press or pull on the brake pedal when removing the switch or damage to the switch can occur.**

   CAUTION: The stoplamp switch must be removed prior to removing the brake pedal and bracket, brake booster and associated mounting fasteners or damage to the switch can occur.

   Disconnect the electrical connector and turn the stoplamp switch clockwise to detach it from the brake pedal bracket.

4. **NOTE:** An 11 mm, 12-point socket or wrench can be used to compress the 2 tabs on the brake pedal arm pin.

   Remove the brake pedal arm pin and disconnect the brake booster push rod from the brake pedal arm.

5. Remove the bulkhead sound insulator.

6. Remove the 4 brake pedal bracket nuts.
   - To install, tighten to 27 Nm (20 lb-ft).

7. Remove the 2 brake pedal bracket bolts and remove the brake pedal and bracket.
   - To install, tighten to 27 Nm (20 lb-ft).

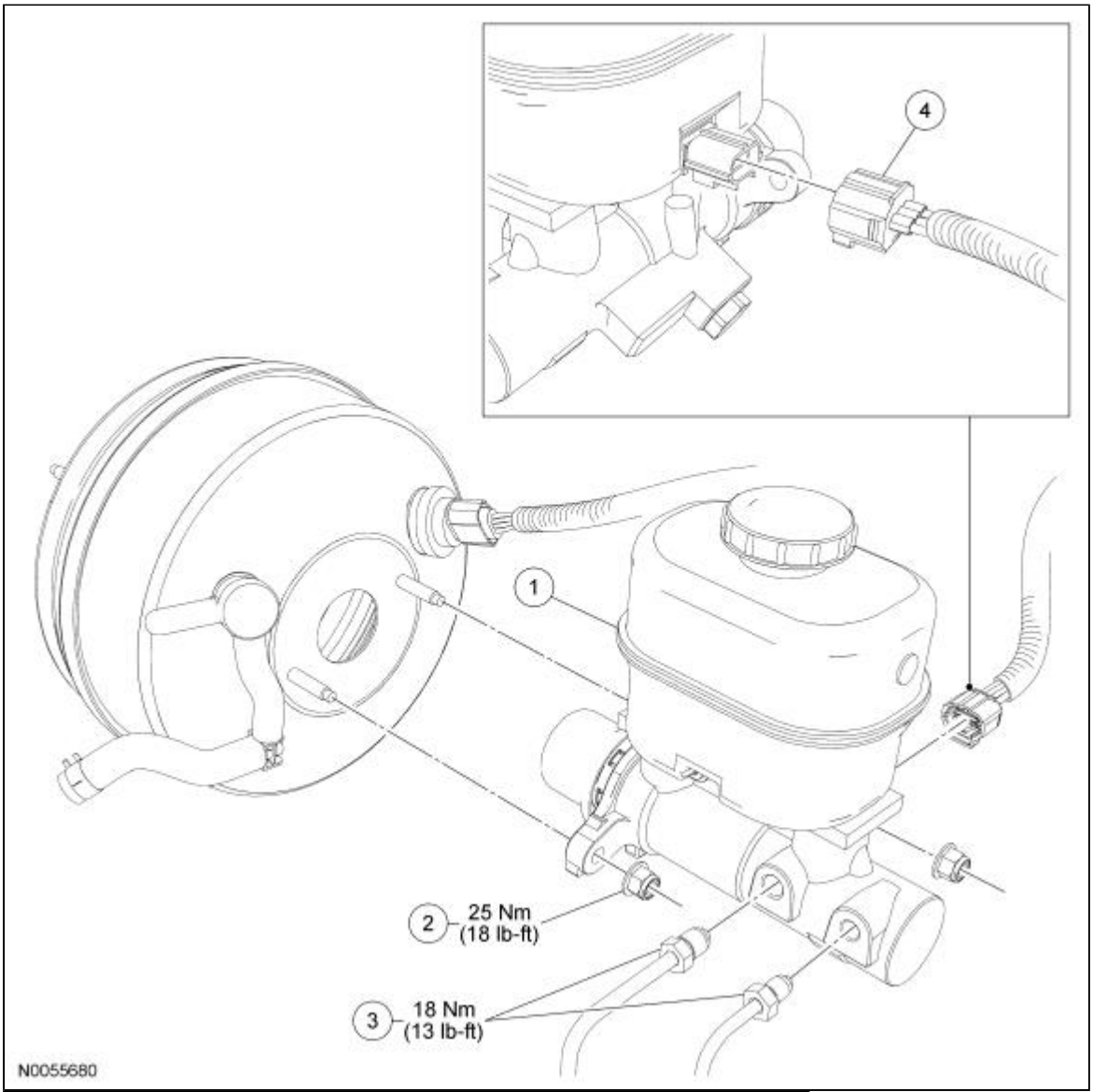
8. To install, reverse the removal procedure.

Brake Master Cylinder

Printable View (197 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1 (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	2C156	Brake master cylinder and reservoir assembly
2	W520212	Brake master cylinder nut (2 required)
3	—	Brake tube fittings (front part of 2B253, rear part of 2A040)

4	—	Brake pressure switch electrical connector

Removal and Installation

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the brake fluid level switch.
3. Loosen the brake tube fittings and disconnect the brake tubes.
   - Plug the master cylinder ports.
   - To install, tighten to 18 Nm (13 lb-ft).
4. Remove the 2 brake master cylinder nuts and the brake master cylinder.
   - To install, tighten to 25 Nm (18 lb-ft).
5. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to Section 206-00 .

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake booster-to-pedal bracket nuts	27	20	—
Brake master cylinder nuts	25	18	—
Degas bottle bolts	9	—	80
Power steering fluid reservoir screws	11	8	—

Brake Booster

Printable View (63 KB)

The power brake booster:

- is a dual diaphragm, vacuum-assisted power brake booster.
- reduces brake pedal pressure and travel distance.
- is divided into separate vacuum and atmospheric pressure chambers by a diaphragm.

If the power assist fails, the brake system will continue to operate with increased brake pedal effort.

Hose and Check Valve

The power brake booster check valve:

- closes when the engine is turned off.
- in the closed position, traps engine vacuum in the power brake booster.
- retains vacuum to provide several power-assisted brake applications with the engine off.

Power Brake System

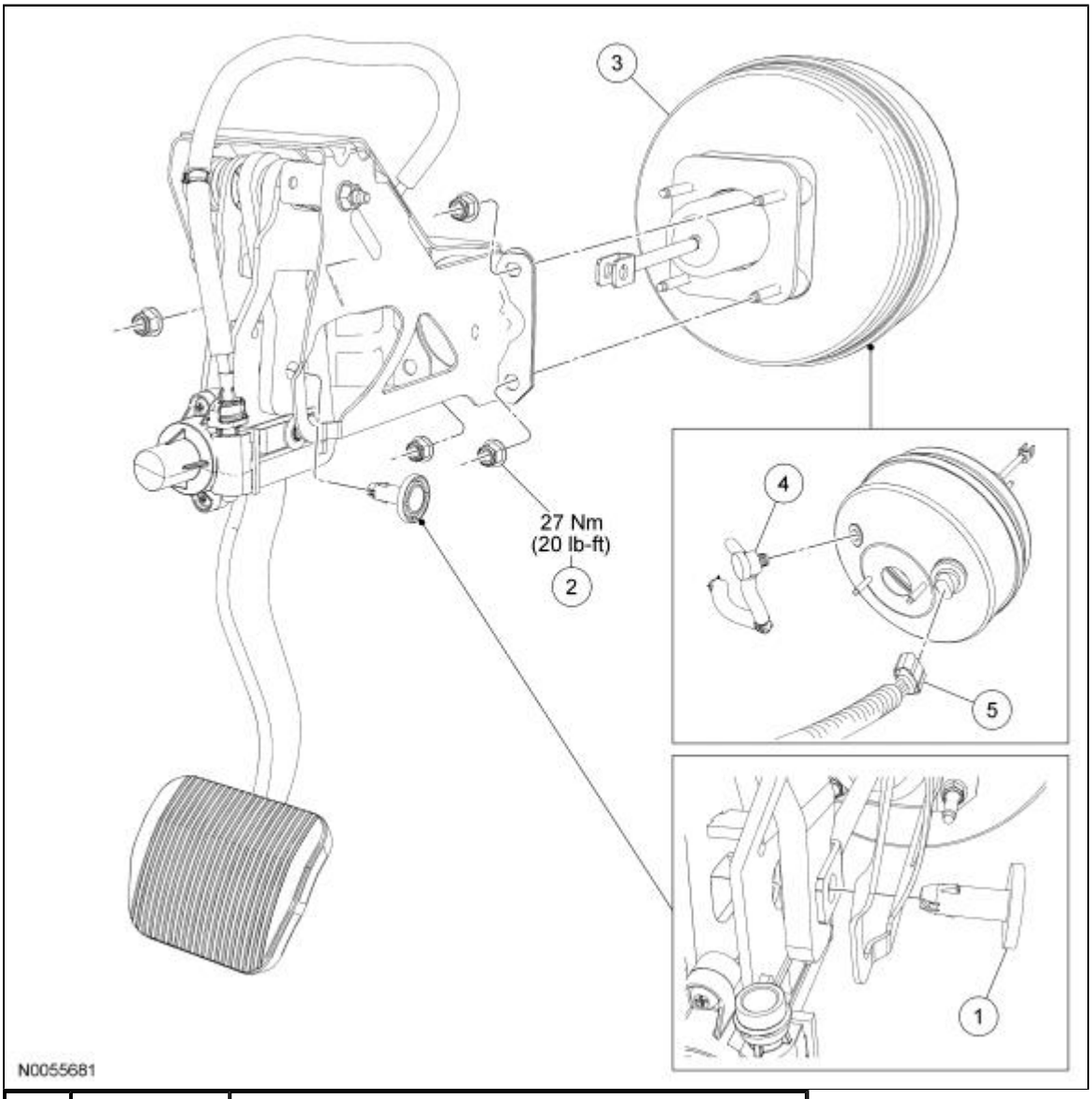
Printable View (62 KB)

Refer to Section 206-00 .

Brake Booster

Printable View (246 KB)

NOTE: Non-roll stability control equipped shown, roll stability control equipped similar.



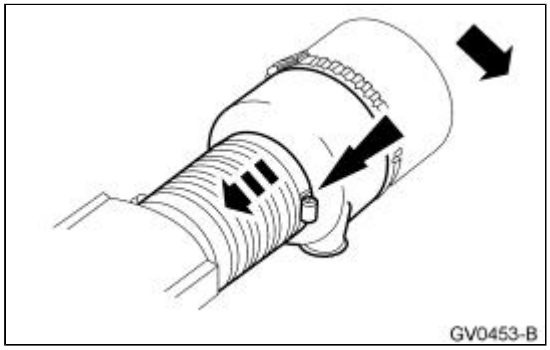
Item	Part Number	Description
1	2L523	Brake pedal pin
2	W702368	Brake booster-to-pedal bracket nut (4 required)
3	2005	Brake booster
4	9C490	Manifold vacuum outlet assembly
5	—	Pedal travel sensor electrical connector (part of 14A464)

Removal and Installation

All vehicles

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Loosen the clamp and separate the air cleaner outlet tube and resonator from the air cleaner.



3. Disconnect the mass air flow (MAF) sensor electrical connector.

4. Lift the air cleaner assembly from the air cleaner tray.

5. Remove the 3 power steering fluid reservoir screws and position the reservoir aside.
   - To install, tighten to 11 Nm (8 lb-ft).

6. Depress the brake pedal at least 3 times to deplete the vacuum in the booster.

7. Disconnect the brake fluid level switch.

8. **NOTE:** Support the master cylinder with mechanic's wire.

   Remove and discard the 2 brake master cylinder nuts and position the master cylinder aside.
   - To install, tighten to 25 Nm (18 lb-ft).

9. Remove the 2 degas bottle bolts and position the degas bottle aside.
   - To install, tighten to 9 Nm (80 lb-in).

Vehicles equipped with roll stability control

10. Disconnect the brake pedal travel solenoid electrical connector.

All vehicles

11. Disconnect the brake pedal travel sensor electrical connector.

12. Disconnect the manifold vacuum outlet assembly from the brake booster.

13. **CAUTION: Always remove the stoplamp switch with the brake pedal secured to the brake booster push rod and with the brake pedal in the at-rest position. Do not press or pull on the brake pedal when removing the switch or damage to switch can occur.**

    CAUTION: The stoplamp switch must be removed prior to removing the brake pedal and bracket, brake booster and associated mounting fasteners or damage to the switch can occur.

    Disconnect the electrical connector and turn the stoplamp switch clockwise to detach it from the

brake pedal bracket.

14. Remove the brake pedal arm pin and disconnect the booster push rod from the brake pedal arm.

15. Remove the 4 brake booster-to-pedal bracket nuts and remove the brake booster.
    - To access the retaining nuts, fold back the sound insulation.
    - To install, tighten to 27 Nm (20 lb-ft).

16. To install, reverse the removal procedure.

Printable View (65 KB)

General Specifications

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake system (ABS) module bolts	2	—	18
Front caliper anchor plate bolts	200	148	—
Front floor console bracket lower bolts	40	30	—
Front floor console bracket upper bolts	9	—	80
Front wheel speed harness bolt	12	9	—
Front wheel speed sensor bolt	18	13	—
HCU bracket-to-frame bolts	20	15	—
HCU-to-bracket bolts	9	—	80
Master cylinder primary and secondary brake tube fitting	25	18	—
Rear combination valve brake tube fitting	20	15	—
Rear wheel speed sensor bolt	18	13	—
RH and LH front brake tube fitting	20	15	—
Stability control sensor cluster bolts	12	9	—
Steering wheel rotation sensor bolts	3	—	27

Anti-Lock Control

Printable View (65 KB)

Anti-Lock Brake System (ABS)

The 4-wheel, 4-channel anti-lock brake system (ABS) consists of the following components:

- ABS module
- Front wheel speed sensor
- Front wheel speed sensor ring (integral to the front wheel bearing)
- Hydraulic control unit (HCU)
- Rear wheel speed sensor
- Rear wheel speed sensor ring (integral to the rear halfshaft)
- Yellow ABS warning indicator

The front wheel speed sensor rings are integral to the front hub and bearing assemblies. Refer to Section 204-01A or Section 204-01B .

The rear wheel speed sensor rings are integral to the rear halfshaft. Refer to Section 205-05 .

Anti-Lock Brake System (ABS) With Traction Control and Stability Assist

The anti-lock brake system (ABS) with stability assist consists of the following components:

- Active brake booster with integral solenoid
- Brake booster release switch
- Stability assist event indicator
- Steering position sensor
- Brake pressure sensor (part of HCU)
- Stability assist switch
- Lateral accelerometer (part of stability control sensor cluster)
- Longitudinal accelerometer (part of stability control sensor cluster)
- Roll rate sensor (part of stability control sensor cluster)
- Yaw rate sensor (part of stability control sensor cluster)

For removal and installation of the brake booster release switch, refer to Section 206-07 .

For removal and installation of the front wheel speed sensor indicators, refer to Section 204-01A for rear wheel drive (RWD) vehicles or Section 204-01B for four wheel drive (4WD) vehicles.

For removal and installation of the rear wheel speed sensor indicator, refer to Section 205-05 .

For removal and installation of the steering wheel position sensor, refer to Section 211-04 .

Anti-Lock Control

Printable View (375 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

Anti-Lock Brake System (ABS)

The anti-lock brake system (ABS) module manages anti-lock braking, traction control and engine control systems to maintain vehicle control during deceleration and acceleration.

When the ignition switch is in the RUN position, the ABS module does a preliminary electrical check and, at approximately 20 km/h (12 mph), the hydraulic pump motor is turned on for approximately 1/2 second. During this time a buzzing or humming noise may be heard and a vibration maybe felt in the brake pedal. This is a normal condition. Any malfunction of the ABS disables the stability assist and the ABS warning indicator illuminates. However, the power-assist braking system functions normally.

The ABS module must be configured when a new ABS module is installed.

Electronic Brake Distribution (EBD)

The electronic brake distribution (EBD) controls the rear brake pressure and acts as an electronic proportioning valve. It is controlled by the ABS module. When EBD is disabled, the ABS warning indicator illuminates.

Stability Assist

With the ignition switch in the START or RUN positions, the ABS module with stability assist functions similarly to a conventional ABS module by monitoring and comparing the rotational speed of each wheel. Wheel speeds are measured by the wheel speed sensor, which electrically senses each tooth of the sensor ring as it passes through the magnetic field of the sensor. When the ABS module detects an

impending wheel lock, wheel spin or vehicle motion that is inconsistent with the driver commands, brake pressure is modulated to the appropriate brake caliper(s). The ABS module triggers the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel(s) return to the desired speed, the ABS module returns the solenoid valves to their normal position and normal base brake operation is restored.

The ABS module communicates with the powertrain control module (PCM) to assist with traction control. When the drive wheels lose traction and begin to spin, with vehicle speed under 100 km/h (62 mph), the ABS module requests the PCM to reduce engine torque while simultaneously applying and releasing the appropriate brake caliper(s) to maintain traction. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the ABS module ends the request. The request ends when the driven wheel speed returns to the desired speed. After the vehicle speed exceeds 100 km/h (62 mph), the traction control is accomplished only through the PCM torque control.

The stability assist system constantly monitors the vehicle motion relative to the driver's intended course. This is done by using sensors to compare the driver's steering input and brake application with that of the actual vehicle motion. The system does not activate when the vehicle is traveling in reverse; however, the ABS and stability assist continue to function as usual.

The stability assist control switch allows the driver to control use of the stability assist system. This is independent of the ABS function, which cannot be switched off by the driver. The stability assist system status is indicated by a stability assist warning lamp in the message center. When the stability assist system is switched off, this indicator will illuminate. The anti-lock brake function continues to work as designed unless the yellow ABS warning indicator is also illuminated. Normal braking function always occurs, unless the red brake warning indicator is illuminated.

When stability assist activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The stability assist indicator flashes
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS
- If the event is severe and the driver's foot is not on the brake, the brake pedal will move to apply higher brake forces. A whooshing sound can also be heard from under the instrument panel in an event this severe

Some drivers may notice a slight movement of the brake pedal when the system checks itself. The brake pedal moves when an active test of the brake booster is run. During this test a small amount of pressure is generated at the master cylinder, but no pressure is generated in the brake calipers.

Roll Stability Control (RSC)

The roll stability control (RSC) system monitors the roll-rate sensor and existing stability assist sensors and calculates if the vehicle may be approaching a situation where rollover is probable. If such a situation exists, the RSC system applies preemptive action. When activated, the RSC system adjusts the brake torque at specific wheels in response to direct measurement of the vehicle roll motion. By adjusting brake torque, the system can reduce the cornering forces and, therefore, the total roll moment acting on the vehicle. Systems with RSC have an additional roll-rate sensor located within the sensor cluster and additional programming within the ABS module to help control the vehicle during sudden maneuvers.

Information from the roll-rate sensor is fed into the ABS module. The computer uses information from the ABS wheel speed sensors, the throttle position sensor, the steering wheel angle, the steering wheel rate of change and a yaw rate sensor that measures the change in vehicle direction. If the computer determines from all these inputs that conditions exist for a potential roll over, the system applies one or more brakes and reduces engine torque to make the vehicle more stable.

Stability Control Sensor Cluster

The sensor cluster (also called the accelerometer) consists of the yaw rate sensor, roll rate sensor,

lateral accelerometer and longitudinal accelerometer. The lateral accelerometer measures the acceleration that corresponds to the force involved when the vehicle slides sideways. This acceleration has 2 forms. The first is the centrifugal acceleration that is generated when the vehicle travels around in a circle. The second is the acceleration due to gravity. On level ground there is no contribution from this acceleration. However, if the vehicle is parked sideways on a bank or incline, the sensor measures some lateral acceleration due to gravity, even though the vehicle is not moving.

The longitudinal accelerometer measures the acceleration corresponding to the force involved when the vehicle moves forward and rearward in the horizontal plane, along the centerline of the vehicle's front and rear wheels.

The yaw rate sensor measures the relative vehicle motion about the vertical axis through its center of gravity.

The roll rate sensor measures the rate of rotation along the front to rear horizontal axis.

Steering Position Sensor

The steering position sensor measures the rate of rotation of the steering wheel by monitoring the steering wheel rotation ring as it passes through the sensor gap. The steering position sensor uses 2 signal lines to transmit information to the ABS module about whether the steering wheel is being turned left or right and how far it is being turned. The steering position sensor does not indicate the position of the steering wheel relative to straight-ahead. The stability assist system learns this position by comparing the steering wheel position with other signals and storing the position it has learned. The stability assist system confirms this position and modifies it as necessary during every new driving cycle.

Active Brake Booster

The active brake booster functions like a conventional brake booster with the added feature that it can be actuated electrically by the ABS module. The electrical brake booster actuation is necessary in severe stability assist events and makes sure that the HCU can generate enough brake pressure to maintain vehicle stability. The brake assist from the brake booster is especially useful in cold weather when the HCU cannot draw the brake fluid from the reservoir quickly at cold temperatures.

A solenoid within the active brake booster has a release switch to indicate when the driver is stepping on the brake pedal. The solenoid provides electrical actuation of the brake booster. Without the force of the input rod, the air valve is directly opened due to the movement of the energized solenoid. With increasing current applied to the solenoid, the air valve opens and output force is created. With decreasing current applied to the solenoid, the air valve is closed and the vacuum valve opens, reducing output force. The release switch indicates when the brake pedal has been applied. It is integrated into the booster key that normally sits against the rear shell of the boot in its rest position, and it adjoins the valve body when in its balance position. The switch itself provides indication from 2 positions. In its rest position it supplies 2 signals, normally open and normally closed. Upon application of sufficient force to initiate movement of the key away from the valve body, the brake booster switch changes state, signifying a driver application.

When the ABS module is activating the brake booster, the brake pedal is pulled forward as the valve body moves. The release switch is held in position by the input rod spring and remains against the valve body. Although the stoplamp switch changes state when the brake pedal drops, the release switch remains inactive until it encounters an external force from the driver or a stability assist event controlled by the ABS module.

The brake pedal force switch sends a brake application input to the ABS module. This signal is called driver brake application. This signal only changes state when the driver has applied the brake. If the ignition switch is in the RUN position, the brake booster is not electrically actuated, and no failure has been detected, the driver brake application signal indicates a brake application when either the brake on/off position (BOO) switch or the release switch (built into the brake booster) indicates that the driver has applied the brake pedal. If the ignition switch is in the OFF position, the driver brake application signal indicates a brake apply only when the BOO switch indicates that the driver is applying the brake pedal.

When the ignition switch is in the OFF position, failures cannot be detected. If there are failures, several layers of redundancy attempt to keep the driver brake application signal accurate. Control of the stoplamp operation is also required because the BOO switch can change states during a stability assist event when the driver is not applying the brake pedal. The switch can also change states during the system check of the brake booster. Only the stability assist system can interpret these changed states and determine which are actually due to driver brake application. Similarly, the stability assist system can take advantage of its other sensors to detect BOO switch failures.

ABS Module Configuration

The ABS module must be configured when a new module is installed. Refer to Section 418-01 . If installing a new ABS module with stability assist, the calibration procedure, as well as the configuration procedure, must be carried out.

ABS Module Calibration

If a new ABS module is installed, it must be configured. The ABS module also needs to be calibrated whenever a component specific to the stability assist system is disconnected or a new component is installed. For information regarding the DTCs that require the recalibration procedure, refer to the ABS Calibration List in this section. If a DTC is logged for any component of the stability assist system, the DTC must be cleared before carrying out the recalibration procedure. The need to recalibrate the ABS module is also indicated by the active/fail lamp flashing. The lamp will flash after clearing the DTCs that are indicated on the ABS Calibration List. If a DTC is retrieved after recalibration, refer to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. If installing a new ABS module, the calibration procedures, as well as the configuration procedure, must be carried out. For information regarding the module configuration and calibration, follow the scan tool directions for the calibration procedure.

When carrying out the lateral or longitudinal accelerometer yaw or roll rate calibration using the scan tool, the vehicle must be on a level surface, must not be moving, and the ignition switch must be in the RUN position.

Inspection and Verification

NOTE: If a new ABS module is installed, it must be configured. Refer to Section 418-01 . If equipped with stability assist, the ABS module must also be calibrated. Follow the scan tool directions.

1. Verify the customer concern.
2. Verify the stoplamps operate correctly by applying and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to Section 417-01 . If the stoplamps operate correctly, proceed to the next step.
3. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Base brake system
• Tire pressure
• Tire size or mismatched tires
• Hydraulic control unit (HCU)
• Wheel speed sensor ring
• Brake booster vacuum hose
• Suspension components
• Steering components
	• Battery junction box (BJB) fuse(s):
	  ▪ 6 (60A)
	  ▪ 9 (60A)
	  ▪ 77 (10A)
	• Circuitry
	• Brake on/off (BOO) switch
	• Steering position sensor
	• Brake booster solenoid

	• Stability control sensor cluster • Brake fluid level switch • Stability assist switch • Steering wheel rotation sensor • Wheel speed sensor • ABS module

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

6. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

9. Clear the continuous DTCs and carry out the self-test diagnostics for the ABS module.

10. If the DTCs retrieved are related to the concern, go to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

NOTE: The need to recalibrate the module is indicated by the active/fail lamp flashing. There are other service actions that can require recalibration when there is no flashing lamp. The lamp will flash after clearing the DTCs that are indicated in the ABS Module Calibration List.

Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B1342	ECU is Faulted	Anti-Lock Brake System (ABS) Module	**NOTE:** If other DTCs are present, REPAIR them before installing a new component. CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new module. REFER to Anti-Lock Brake System (ABS) Module in this

			section. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	ABS Module	Go To Pinpoint Test A .
B1676	Battery Pack Voltage Out of Range	ABS Module	Go To Pinpoint Test B .
B2477	Module Configuration Failure	ABS Module	CONFIGURE the ABS module. REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module . REPEAT the self-test.
B2741	Sensor Cluster Defective	ABS Module	FOLLOW the scan tool directions for the calibration procedure.
B2900	VIN Mismatch	ABS Module	VERIFY that the module has the correct as-built data. CHECK for correct powertrain control module (PCM) and ABS module configurations using the scan tool. RECONFIGURE the component as necessary. FOLLOW the scan tool directions for the ABS module configuration or REFER to Section 418-01 for the PCM. CLEAR the DTC. REPEAT the self-test.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	Go To Pinpoint Test C .
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS Module	Go To Pinpoint Test D .
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS Module	Go To Pinpoint Test D .
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS Module	Go To Pinpoint Test D .
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS Module	Go To Pinpoint Test D .
C1233	Speed Wheel LF Input Signal Missing	ABS Module	Go To Pinpoint Test E .
C1234	Speed Wheel RF Input Signal Missing	ABS Module	Go To Pinpoint Test E .
C1235	Speed Wheel RR Input Signal Missing	ABS Module	Go To Pinpoint Test E .
C1236	Speed Wheel LR Input Signal Missing	ABS Module	Go To Pinpoint Test E .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	ABS Module	Go To Pinpoint Test F .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	ABS Module	Go To Pinpoint Test F .
C1279	Yaw Rate Sensor Circuit Failure	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .

C1280	Yaw Rate Sensor Signal Fault	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C1281	Lateral Accelerometer Circuit Failure	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C1282	Lateral Accelerometer Signal Fault	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C1285	Booster Solenoid Circuit Failure	ABS Module	Go To Pinpoint Test H .
C1287	Booster Pedal Force Switch Circuit Failure	ABS Module	Go To Pinpoint Test I .
C1288	Pressure Sensor Main/Primary Input Circuit Failure	ABS Module	CLEAR the DTCs. REPEAT the self-test. If DTC C1287 is present, make sure all HCU and ABS module fasteners are tightened to their correct torque specification. If all fasteners are tightened to their correct torque specification, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section.
C1440	Pressure Sensor Main/Primary Signal Faulted	ABS Module	CLEAR the DTCs. REPEAT the self-test. If DTC C1287 is present, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section.
C1470	TCS Function Disabled (brake fluid temperature is above a pre-set limit)	ABS Module	ALLOW the brake fluid time to cool. CLEAR the DTC. TEST DRIVE the vehicle and verify ABS operation.
C1516	Roll Rate Sensor Signal Fault	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C1517	Roll Rate Sensor Circuit Failure	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C1805	Mismatched PCM and/or ABS-TC Module	ABS Module	CHECK for correct PCM and ABS module configuration using the scan tool. RECONFIGURE the component as necessary. FOLLOW the scan tool

			directions for the ABS module configuration or REFER to Section 303-01 for the PCM. CLEAR the DTC. REPEAT the self-test.
C1963	Stability Control Inhibit Warning	ABS Module	This DTC is for information only. GO to the Principles of Operation. CLEAR the DTC. REPEAT the self-test.
C1991	Module Calibration Failure	ABS Module	Follow the scan tool directions for the calibration procedure.
C1996	Active Yaw and/or Roll Control Disabled	ABS Module	This DTC can be set if the ABS module system is activated for 15 seconds of continuous operation. CHECK for any major chassis modifications, gross suspension misalignment or other items that can alter the vehicle tracking dynamics. CLEAR the DTC. REPEAT the self-test.
C2769 (ABS with stability assist)	Longitudinal Acceleration Sensor Electrical Failure (sensor cluster fault)	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C2769 (standard ABS)	Longitudinal Acceleration Sensor Electrical Fault	ABS Module	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
C2770 (ABS with stability assist)	Longitudinal Acceleration Sensor Plausibility Failure (sensor cluster fault)	ABS Module	**NOTE:** When correctly installed, the electrical connector will be on the LH side of the vehicle. VERIFY that the stability control sensor cluster (accelerometer) is correctly installed. If the sensor is not correctly installed, REINSTALL the sensor. If the sensor is correctly installed, Go To Pinpoint Test G .
C2770 (standard ABS)	Longitudinal Acceleration Sensor Plausibility Failure	ABS Module	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
C2777	Sensor Cluster Bus Failure	ABS Module	Go To Pinpoint Test G .
C2778	Sensor Cluster Power Supply Failure	ABS Module	Go To Pinpoint Test G .
U0001	High Speed CAN Communication Bus	ABS Module	REFER to Section 418-00 to diagnose the high speed communication area network (HS-CAN) bus.
U0100	Lost Communication With ECM/PCM	ABS Module	REPAIR all other DTCs first. If DTC U0100 is still present REFER to Section 418-00 to diagnose the high speed communication area network (HS-CAN) bus.
U0101	Lost Communication with TCM	ABS Module	REPAIR all other DTCs first. If DTC U0101 is still present REFER to Section 418-00 to diagnose the HS-CAN bus.
U0114	Lost Communication With Four-Wheel Drive Clutch Control Module	ABS Module	REPAIR all other DTCs first. If DTC U0114 is still present REFER to Section 418-00 to diagnose the HS-CAN bus.
U0140	Lost Communication with Body Control Module	ABS Module	REPAIR all other DTCs first. If DTC U0140 is still present, REFER to Section 418-00 to diagnose the high speed communication area network (HS-CAN) bus.

U0155	Lost Communication With Instrument Cluster	ABS Module	REPAIR all other DTCs first. If DTC U0155 is still present REFER to Section 418-00 to diagnose the HS-CAN bus.
U0401	Invalid Data Received From ECM/PCM	ABS Module	If other DTCs are present along with U0401, REPAIR those DTCs first. If U0401 is the only DTC present, CARRY OUT the PCM self-test, RETRIEVE and RECORD any DTCs. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the PCM.
U0402	Invalid Data Received From Transmission Control Module	ABS Module	If other DTCs are present along with U0402, REPAIR those DTCs first. If U0402 is the only DTC present, CARRY OUT the transmission control module self-test, RETRIEVE and RECORD any DTCs. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the transmission control module.
U0414	Invalid Data Received From Four-Wheel Drive Clutch Control Module	ABS Module	If other DTCs are present along with U0414, REPAIR those DTCs first. If U0414 is the only DTC present, CARRY OUT the four-wheel drive clutch control module self-test, RETRIEVE and RECORD any DTCs. REFER to Section 308-07A to diagnose the four-wheel drive clutch control module.
U1901	CAN Network #2 Communication Bus Fault	ABS Module	Go To Pinpoint Test G .
U2050	No Application Present	ABS Module	CONFIGURE the ABS module. REFER to Section 418-01 . CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test.
U2051	One or More Calibration Files Missing or Corrupt	ABS Module	CALIBRATE the ABS module, follow the directions on the scan tool. CLEAR the DTCs. CARRY OUT the ABS module self-test. RETRIEVE and RECORD any DTCs. If DTC U2051 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test.

Anti-Lock Brake System (ABS) Calibration List

NOTE: The need to calibrate the ABS module is indicated by the stability assist active/fail lamp flashing. The lamp flashes after the DTCs on the calibration list are cleared.

DTC	Description	Calibration
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	YES
C1278	Steering Wheel Angle 1 and 2 Signal Fault	YES
C1279	Yaw Rate Sensor Circuit Failure	YES
C1280	Yaw Rate Sensor Signal Fault	YES
C1281	Lateral Accelerometer Circuit Failure	YES
C1282	Lateral Accelerometer Signal Fault	YES
C1285	Booster Solenoid Circuit Failure	YES

C1287	Booster Pedal Force Switch Circuit Failure	YES
C1288	Pressure Sensor Main/Primary Input Circuit Failure	YES
C1440	Pressure Sensor Main/Primary Signal Faulted	YES
C1516	Roll Rate Sensor Signal Fault	YES
C1517	Roll Rate Sensor Circuit Fault	YES
C1963	Stability Control Inhibit Warning	NO
C1991	Module Calibration Failure	YES
C1996	Active Yaw and/or Roll Control Disabled	YES
C2769	Longitudinal Acceleration Sensor Electrical Failure	YES
C2770	Longitudinal Acceleration Sensor Plausibility Fault	YES
C2777	Sensor Cluster Bus Failure	YES
C2778	Sensor Cluster Power Supply Failure	YES

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

• No communication with the anti-lock brake system (ABS) module	• Battery junction box (BJB) fuse(s):
	  ▪ 6 (60A)
	  ▪ 9 (60A)
	  ▪ 77 (10A)
	• Circuitry
	• ABS module
		• REFER to Section 418-00 to diagnose the no communication problem.

• The red brake warning indicator stays on when the ignition switch is in the RUN position	• Circuitry • Instrument cluster • Brake fluid level sensor • Instrument cluster	• REFER to Section 413-01 .
• The yellow anti-lock brake warning indicator does not self-check	• Instrument cluster • Circuitry	• REFER to Section 413-01 .
• The stability assist system cannot be disabled	• Circuitry • Stability/traction control switch • ABS module	• Go To Pinpoint Test J .

Pinpoint Tests

Pinpoint Test A: DTC B1483 — Brake Pedal Input Circuit Failure

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

When the brake pedal is pressed, the stoplamp switch routes voltage through circuit CLS17 (YE/GN) to

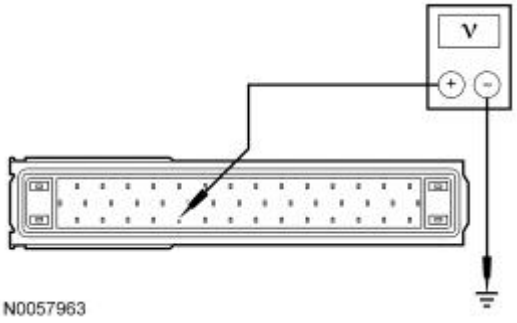
the anti-lock brake system (ABS) module.

Possible Causes

- Circuit open
- ABS module

PINPOINT TEST A: DTC B1483 — BRAKE PEDAL INPUT CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
A1 CHECK THE STOPLAMP OPERATION	
• Press the brake pedal. • **Do the stoplamps operate correctly?**	**Yes** GO to A2 . **No** REFER to Section 417-01 .
A2 CHECK CIRCUIT CLS17 (YE/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: ABS Module C135. • Measure the voltage between ABS module C135-6, circuit CLS17 (YE/GN), harness side and ground, while pressing the brake pedal.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** REPAIR circuit CLS17 (YE/GN). CLEAR the DTC. REPEAT the self-test.
A3 CHECK THE ABS MODULE CONNECTORS	

• Key in OFF position.
• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: DTC B1676 — Battery Pack Voltage Out of Range

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to operate the anti-lock brake system (ABS) module, hydraulic pump and isolation valves is in a range between 10 and 16 volts.

Fused battery voltage is supplied by battery junction box (BJB) fuse 6 (60A) along circuit SBB06 (BN/RD) and by BJB fuse 9 (60A) along circuit SBB09 (RD). Fused ignition voltage is supplied by BJB fuse 77 (10A) along circuit CBB77 (WH). Ground is provided along circuit GD120 (BK/GN).

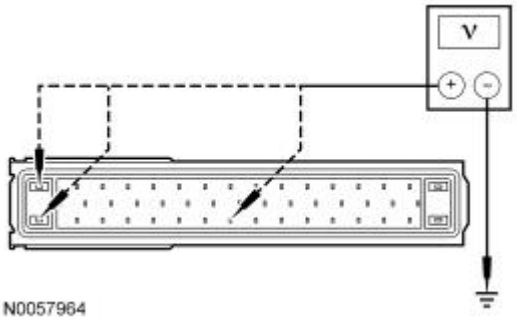
Possible Causes

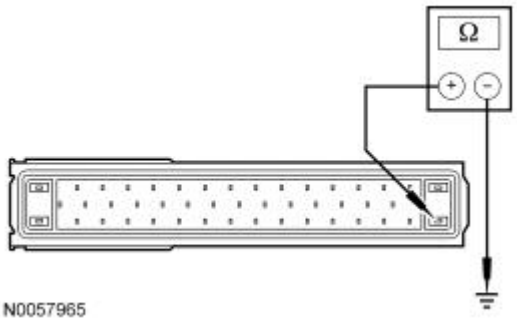
- Fuse(s)
- Circuit open
- Charging system
- ABS module

PINPOINT TEST B: DTC B1676 — BATTERY PACK VOLTAGE OUT OF RANGE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
B1 CHECK THE BATTERY VOLTAGE • Key in OFF position. • Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running. • **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**	**Yes** GO to B2 . **No** REFER to Section 414-00 .

B2 CHECK THE VOLTAGE TO THE ABS MODULE
• Key in OFF position.
• Disconnect: ABS Module C135.
• Key in ON position.
• Measure the voltage between ground and:
  ▪ ABS module C135-1, circuit SBB09 (RD), harness side.
  ▪ ABS module C135-8, circuit CBB77 (WH), harness side.
  ▪ ABS module C135-32, circuit SBB06 (BN/RD), harness side.
 
 	
• **Is the voltage greater than 10 volts?**
	Yes
	GO to B3 .
	
	No
	VERIFY BJB fuses 6 (60A), 9 (60A) and 77 (10A) are OK. If OK, REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.

B3 CHECK CIRCUIT A_GD120 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between ABS module C135-16, circuit GD120 (BK/GN), harness side and ground.  N0057965 • **Is the resistances less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR circuit GD120 (BK/GN). CLEAR the DTC. REPEAT the self-test.
B4 CHECK THE ABS MODULE CONNECTORS	

• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC C1095 — ABS Hydraulic Pump Motor Circuit Failure

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to operate the hydraulic pump is in a range between 10 and 16 volts.

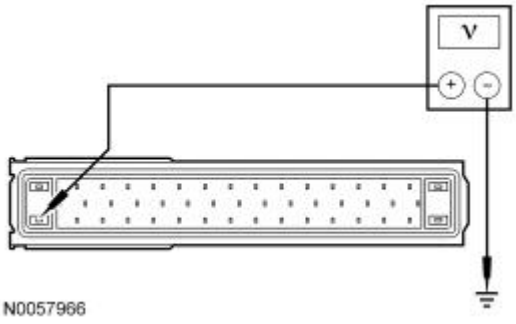
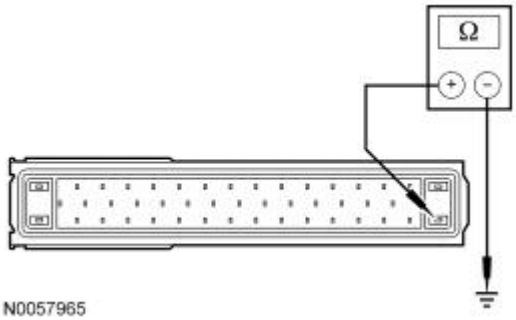
Fused battery voltage is supplied by battery junction box (BJB) fuse 9 (60A) along circuit SBB09 (RD). Ground is provided along circuit GD120 (BK/GN).

Possible Causes

- Fuse
- Circuit open
- Hydraulic pump motor
- Anti-lock brake system (ABS) module

PINPOINT TEST C: DTC C1095 — ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
C1 CHECK THE ANTI-LOCK BRAKE SYSTEM (ABS) PUMP MOTOR	
• Key in ON position. • **Is the ABS pump motor running all the time?**	**Yes** GO to C5 . **No** GO to C2 .
C2 CHECK THE PUMP MOTOR OPERATION	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Using the scan tool, trigger the ABS module pump motor ON active command. • **Does the ABS pump motor run for approximately 2 seconds?**	**Yes** TRIGGER the ABS module pump motor OFF active command. CLEAR the DTCs. CHECK the yellow ABS warning indicator while driving the vehicle (the brakes must not be applied) above 20 km/h (12 mph). If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs. If DTC C1095 is retrieved, GO to C5 . For all other DTCs, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. **No** TRIGGER the ABS module pump motor OFF active command. GO to C3 .
C3 CHECK CIRCUIT SBB09 (RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: ABS Module C135. • Measure the voltage between ABS module C135-1, circuit SBB09 (RD), harness side and ground.  N0057966 • **Is the voltage greater than 10 volts?**	**Yes** GO to C4 . **No** VERIFY the BJB fuse 9 (60A) is OK. If OK, REPAIR circuit SBB09 (RD). CLEAR the DTC. REPEAT the self-test.
C4 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Measure the resistance between ABS module C135-16, circuit GD120 (BK/GN), harness side and ground.  N0057965	**Yes** GO to C5 . **No** REPAIR circuit GD120 (BK/GN). CLEAR the DTC. REPEAT the self-test.

• **Is the resistances less than 5 ohms?**	
C5 CHECK THE ABS MODULE CONNECTORS	

• Key in OFF position.
• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC C1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR) — Speed Wheel Sensor Input Circuit Failure

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active wheel speed sensor generates a signal that is sent to the anti-lock brake system (ABS) module. The wheel speed sensor circuitry connects to the ABS module connector C135 through 2 wires and a connector at each wheel speed sensor. When the ignition switch is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage through the right front wheel speed sensor and the related circuitry to determine if it is functional.

Voltage is supplied to the active wheel speed sensors from the ABS module, ground is also supplied by the ABS module.

Possible Causes

- Wheel speed sensor(s)
- Circuit open
- Circuit shorted
- ABS module

PINPOINT TEST D: DTC C1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR) — SPEED WHEEL SENSOR INPUT CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

CAUTION: No measurements should be taken with the wheel speed sensor connected. Damage to the wheel speed sensor will result.

NOTE: Any time a wheel speed sensor is removed, thoroughly clean the mounting surfaces and apply a thin coating of grease.

Test Step	Result / Action to Take
D1 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	

• Key in OFF position.
• Disconnect: ABS Module C135.
• Disconnect: Suspect Wheel Speed Sensor.
• Key in ON position.
• **For DTC C1145** , measure the voltage between:
  ▪ ABS module C135-34, circuit VCA05 (GY/VT), harness side and ground.
  ▪ ABS module C135-33, circuit RCA19 (VT), harness side and ground.
• **For DTC C1155** , measure the voltage between:
  ▪ ABS module C135-45, circuit VCA03 (VT/WH), harness side and ground.
  ▪ ABS module C135-46, circuit RCA17 (YE), harness side and ground.
• **For DTC C1165** , measure the voltage between:
  ▪ ABS module C135-43, circuit VCA06 (WH/OG), harness side and ground.
  ▪ ABS module C135-42, circuit RCA20 (BN), harness side and ground.
• **For DTC C1175** , measure the voltage between:
  ▪ ABS module C135-36, circuit VCA04 (BU/OG), harness side and ground.
  ▪ ABS module C135-37, circuit RCA18 (BN/GN), harness side and ground.
• **Is voltage present?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to D2 .

D2 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND	

• Key in OFF position.
• **For DTC C1145** , measure the resistance between:
  ▪ ABS module C135-34, circuit VCA05 (GY/VT), harness side and ground.
  ▪ ABS module C135-33, circuit RCA19 (VT), harness side and ground.
• **For DTC C1155** , measure the resistance between:
  ▪ ABS module C135-45, circuit VCA03 (VT/WH), harness side and ground.
  ▪ ABS module C135-46, circuit RCA17 (YE), harness side and ground.
• **For DTC C1165** , measure the resistance between:
  ▪ ABS module C135-43, circuit VCA06 (WH/OG), harness side and ground.
  ▪ ABS module C135-42, circuit RCA20 (BN), harness side and ground.
• **For DTC C1175** , measure the resistance between:
  ▪ ABS module C135-36, circuit VCA04 (BU/OG), harness side and ground.
  ▪ ABS module C135-37, circuit RCA18 (BN/GN), harness side and ground.
• **Is the resistance greater than 10,000 ohms?**
	Yes
	GO to D3 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

D3 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN	

• **For DTC C1145** , measure the resistance between:
  ▪ ABS module C135-34, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side.
  ▪ ABS module C135-33, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side.
• **For DTC C1155** , measure the resistance between:
  ▪ ABS module C135-45, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-2,
	Yes
	GO to D4 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

circuit VCA03 (VT/WH), harness side. ▪ ABS module C135-46, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side. • **For DTC C1165** , measure the resistance between: ▪ ABS module C135-43, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side. ▪ ABS module C135-42, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side. • **For DTC C1175** , measure the resistance between: ▪ ABS module C135-36, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side. ▪ ABS module C135-37, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side. • **Is the resistance less than 5 ohms?**	
D4 CHECK FOR WHEEL SPEED SENSOR CIRCUITS SHORTED TOGETHER	
• **For DTC C1145** , measure the resistance between RF wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side. • **For DTC C1155** , measure the resistance between LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side. • **For DTC C1165** , measure the resistance between RR wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side. • **For DTC C1175** , measure the resistance between LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side. • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D5 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
D5 CHECK THE ABS MODULE OUTPUT	
NOTE: If the 2 wheel speed sensor circuits are shorted together, the anti-lock brake system (ABS) module will shut down those circuits and no voltage will be present at the connectors. If this happens, cycle the ignition key and take the measurement again, being careful not to short the 2 wheel speed sensor circuits together. • Connect: ABS Module C135. • Key in ON position. • **For DTC C1145** , measure the voltage between RF wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side. • **For DTC C1155** , measure the voltage between LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side. • **For DTC C1165** , measure the voltage between RR wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side. • **For DTC C1175** , measure the voltage between LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness	**Yes** INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. CLEAR the DTC. REPEAT the self-test. **No** GO to D6 .

side LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side. • **Is the voltage greater than 10 volts?**	
D6 CHECK THE ABS MODULE CONNECTORS	

• Key in OFF position.
• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — Speed Wheel Input Signal Missing

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The wheel speed sensor and sensor ring generate a signal to the anti-lock brake system (ABS) module that is proportional to the wheel speed. The ABS module compares the wheel speed inputs from all wheel speed sensors to determine an impending wheel lockup.

Possible Causes

- Mismatched tire sizes
- Wheel speed sensor ring
- Wheel speed sensor
- ABS module

PINPOINT TEST E: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — SPEED WHEEL INPUT SIGNAL MISSING

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

CAUTION: No measurements should be taken with the wheel speed sensor connected. Damage to the wheel speed sensor will result.

NOTE: Any time a wheel speed sensor is removed, thoroughly clean the mounting surfaces and apply a thin coating of grease.

Test Step	Result / Action to Take
E1 CHECK FOR ABS MODULE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Key in ON position.	**Yes**

• Connect the diagnostic tool. • Enter the following diagnostic mode on the diagnostic tool: ABS Module Self-test. • Retrieve the ABS module DTCs. • **Is DTC C1145, C1155, C1165 or C1175 present?**	Go To Pinpoint Test D . **No** GO to E2 .
E2 MONITOR THE WHEEL SPEED SENSOR PIDS	
• Enter the following diagnostic mode on the diagnostic tool: ABS Module PIDs. • Monitor the wheel speed PIDs while driving the vehicle at a constant speed. • **Are the wheel speed PIDs consistent with the vehicle speed and each other?**	**Yes** CLEAR the DTCs. DRIVE the vehicle. RETRIEVE the DTCs. If DTC C1233, C1234, C1235 or C1236 is present, GO to E9 . For all other DTCs, GO to the Anti-Lock Brake System (ABS) Diagnostic Trouble Code (DTC) Chart. **No** GO to E3 .
E3 CHECK THE WHEEL SPEED SENSOR AND MOUNTING	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • **CAUTION: Examine the wheel speed sensor wire carefully, using a good light source. Failure to verify damage in the wheel speed sensor wire can lead to unnecessary installation of a new component.** • Inspect the wheel speed sensor for looseness. • **Is the wheel speed sensor and mounting OK?**	**Yes** TIGHTEN the wheel speed sensor to specification, REFER to Specifications in this section. CLEAR the DTCs. GO to E4 . **No** GO to E5 .
E4 RECHECK THE WHEEL SPEED SENSOR PIDS	
• Enter the following diagnostic mode on the diagnostic tool: ABS Module PIDs. • Use the scan tool to monitor the ABS module wheel speed sensor PIDs while driving the vehicle at a constant speed. • **Are all the wheel speed sensor PID values similar?**	**Yes** The vehicle is OK. The concern may have been caused by a loose wheel speed sensor. **No** GO to E5 .
E5 CHECK THE WHEEL SPEED SENSOR FOR DAMAGE	
• Key in OFF position. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • **CAUTION: Examine the wheel speed sensor wire carefully with a good light source. Failure to verify damage in the wheel speed sensor wire can lead to unnecessary installation of a new component.** • Inspect the wheel speed sensor and attached wire harness for general damage. • **Is the wheel speed sensor and harness OK?**	**Yes** GO to E6 . **No** INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. CLEAR the DTC. REPEAT the self-test.
E6 CHECK FOR WHEEL SPEED SENSOR RING DAMAGE	
• Remove the wheel speed sensor. Refer to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. • Inspect the wheel speed sensor ring for damaged or missing teeth. Rotate the wheel to verify that no	**Yes** GO to E7 . **No** INSTALL a new wheel hub and

teeth are missing. • **Is the wheel speed sensor ring OK?**	bearing assembly. Refer to the appropriate section in Group 204 for the procedure. CLEAR the DTCs. REPEAT the self-test.
E7 CHECK FOR WHEEL BEARING DAMAGE	
• Inspect the wheel bearings for damage. • **Are the wheel bearings OK?**	**Yes** GO to E8 . **No** INSTALL a new wheel hub and bearing assembly. Refer to the appropriate section in Group 204 for the procedure. CLEAR the DTCs. REPEAT the self-test.
E8 CHECK THE ABS MODULE OUTPUT	
NOTE: If the 2 wheel speed sensor circuits are shorted together, the anti-lock brake system (ABS) module will shut down those circuits and no voltage will be present at the connectors. If this happens, cycle the ignition key and take the measurement again, being careful not to short the 2 wheel speed sensor circuits together. • Disconnect: Suspect Wheel Speed Sensor. • Key in ON position. • **For DTC C1234** , measure the voltage between wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side. • **For DTC C1233** , measure the voltage between wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side. • **For DTC C1235** , measure the voltage between wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side. • **For DTC C1236** , measure the voltage between wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side. • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to E9 .
E9 CHECK THE ABS MODULE CONNECTORS	
• Key in OFF position. • Disconnect all the ABS connectors. • Check for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals. • Connect all the ABS connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC C1277 And C1278 — Steering Wheel Angle 1 and 2 Circuit Failure/Signal Faulted

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The steering position sensor monitors the steering wheel position when the toothed-wheel on the steering shaft passes through the magnetic field produced by the sensor.

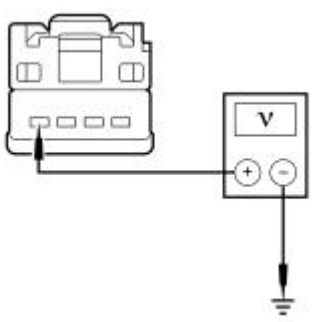
The steering wheel position (in degrees) is sent to the anti-lock brake system (ABS) module along circuit VCS06 (GY/BN) and circuit VCS07 (VT/OG). Voltage is supplied by the ABS module along circuit CCS01 (VT/WH) and ground is provided by the ABS module along circuit RCS02 (BU/WH).

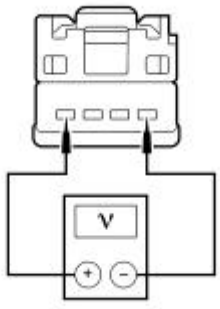
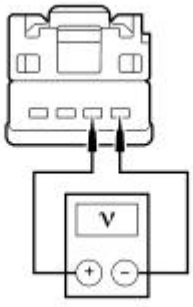
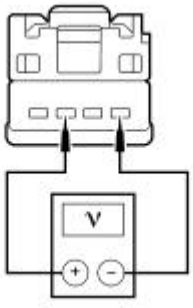
Possible Causes

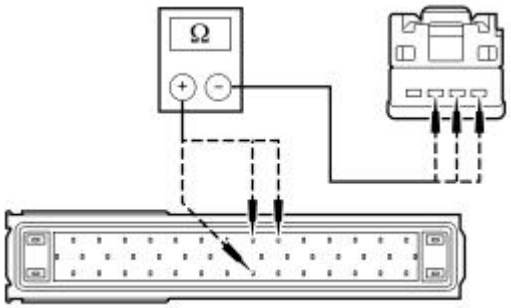
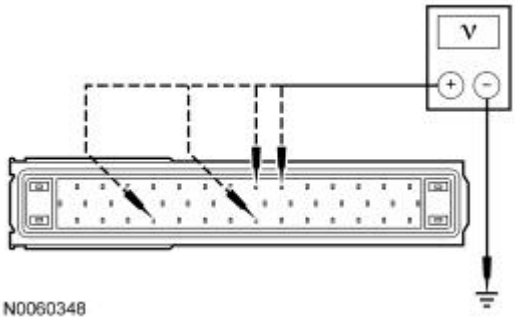
- Circuit open
- Circuit shorted
- Steering position sensor
- ABS module

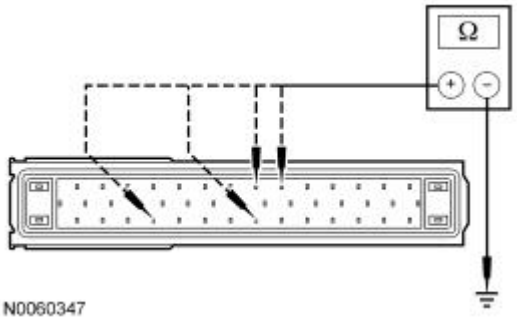
PINPOINT TEST F: DTC C1277 AND C1278 — STEERING WHEEL ANGLE 1 AND 2 CIRCUIT FAILURE/SIGNAL FAULTED

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
F1 MONITOR THE STEERING POSITION SENSOR PIDs	
• Connect the diagnostic tool. • Key in ON position. • Using the scan tool, monitor the ABS module steering wheel rotation sensor PIDs while rotating the steering wheel clockwise and counter-clockwise very slowly, from lock to lock. • **Do the PIDs change in intervals of 4.5 degrees?**	**Yes** CLEAR the DTCs. DRIVE the vehicle. RETRIEVE the DTCs. If DTC C1277 or C1279 are present, GO to F9 . For all other DTCs, GO to the Anti-Lock Brake System (ABS) Diagnostic Trouble Code (DTC) Chart. **No** GO to F2 .
F2 CHECK CIRCUIT CCS01 (VT/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: Steering Wheel Rotation Sensor C226. • Key in ON position. • Measure the voltage between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and ground.  N0057967 • **Is the voltage greater than 10 volts?**	**Yes** GO to F3 . **No** REPAIR circuit CCS01 (VT/WH). CLEAR the DTCs. REPEAT the self-test.

F3 CHECK CIRCUIT RSC02 (BU/WH) FOR AN OPEN	
• Measure the voltage between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and steering wheel rotation sensor C226-1, circuit RSC02 (BU/WH) harness side.  N0043016 • **Is the voltage greater than 9.5 volts?**	**Yes** GO to F4 . **No** REPAIR circuit RSC02 (BU/WH). CLEAR the DTCs. REPEAT the self-test.
F4 CHECK CIRCUIT VSC06 (GY/BN) FOR AN OPEN	
• Measure the voltage between steering wheel rotation sensor C226-2, circuit VSC06 (GY/BN), harness side and steering wheel rotation sensor C226-1, circuit RSC02 (BU/WH) harness side.  N0043017 • **Is the voltage between 4.75 volts and 5.25 volts?**	**Yes** GO to F5 . **No** REPAIR circuit VSC06 (GY/BN). CLEAR the DTCs. REPEAT the self-test.
F5 CHECK CIRCUIT VSC07 (VT/OG) FOR AN OPEN	
• Measure the voltage between steering wheel rotation sensor C226-3, circuit VSC07 (VT/OG), harness side and steering wheel rotation sensor C226-1, circuit RSC02 (BU/WH) harness side.  N0043018 • **Is the voltage between 4.75 volts and 5.25 volts?**	**Yes** GO to F6 . **No** REPAIR circuit VSC07 (VT/OG). CLEAR the DTCs. REPEAT the self-test.
F6 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: ABS Module C135. • Measure the resistance between: ▪ ABS module C135-9, circuit VCS07 (VT/OG),	**Yes** GO to F7 . **No**

harness side and steering wheel rotation sensor C226-3, circuit VCS07 (VT/OG), harness side. ■ ABS module C135-40, circuit RCS02 (BU/WH), harness side and steering wheel rotation sensor C226-1, circuit RCS02 (BU/WH), harness side. ■ ABS module C135-41, circuit VCS06 (GY/BN), harness side and steering wheel rotation sensor C226-2, circuit VCS06 (GY/BN), harness side.  N0057968 ● **Is the resistance less than 5 ohms?**	REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F7 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
● Key in ON position. ● Measure the voltage between: ■ ABS module C135-9, circuit VCS07 (VT/OG), harness side and ground. ■ ABS module C135-40, circuit RCS02 (BU/WH), harness side and ground. ■ ABS module C135-41, circuit VCS06 (GY/BN), harness side and ground. ■ ABS module C135-5, circuit CCS01 (VT/WH), harness side and ground.  N0060348 ● **Is voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test. **No** GO to F8 .
F8 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR A SHORT TO GROUND	
● Key in OFF position. ● Measure the resistance between: ■ ABS module C135-9, circuit VCS07 (VT/OG), harness side and ground. ■ ABS module C135-40, circuit RCS02 (BU/WH), harness side and ground. ■ ABS module C135-41, circuit VCS06 (GY/BN), harness side and ground. ■ ABS module C135-5, circuit CCS01 (VT/WH), harness side and ground.	**Yes** INSTALL a new steering wheel rotation sensor. REFER to Steering Wheel Rotation Sensor in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS

 • **Are the resistances greater than 10,000 ohms?**	module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F9 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS connector.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect the ABS connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: DTC C1279, C1280, C1281, C1282, C1516, C1517, C2769, C2770, C2777, C2778 and U1901 — Sensor Cluster Fault and CAN #2 Bus Network Fault

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The yaw rate sensor, roll rate sensor, lateral accelerometer and longitudinal accelerometer are contained in one assembly called the sensor cluster. The sensor cluster measures the vehicle acceleration, roll rate and yaw rate, then sends the information to the anti-lock brake system (ABS) module along the communication area network 2 (CAN2) bus.

Voltage is supplied by the ABS module along circuit CCA09 (VT/BN), ground is provided by the ABS module along circuit RCA09 (GN/VT) and the sensor information is transmitted to the ABS module along circuits VCA23 (BU/WH) and circuit VCA24 (GN/OG).

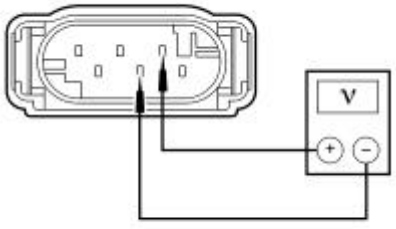
Possible Causes

- Circuit open
- Circuit shorted
- Sensor cluster incorrectly mounted
- Sensor cluster internal fault
- ABS module

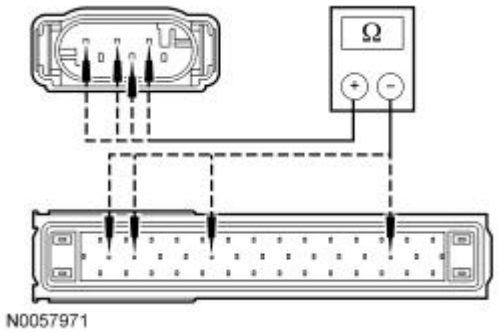
PINPOINT TEST G: DTC C1279, C1280, C1281, C1282, C1516, C1517, C2769, C2770, C2777, C2778 AND U1901— SENSOR CLUSTER FAULT AND CAN #2 BUS NETWORK FAULT

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

NOTE: The vehicle must be on level ground, not on a hoist and at a complete standstill when calibrating the sensor cluster and reading PIDs. Any vehicle movement will result in false values for this test.

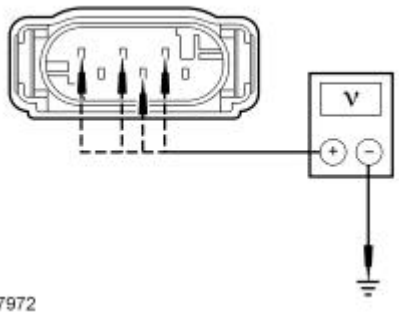
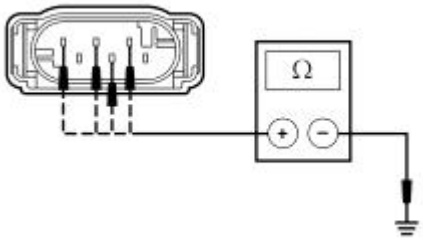
Test Step	Result / Action to Take
G1 CHECK FOR DTCs FROM THE SELF-TEST	
• Connect the diagnostic tool. • Key in ON position. • Using the scan tool, carry out the ABS module self-test. • Retrieve and record any DTCs. • **Are any DTCs retrieved?**	**Yes** GO to G2 . **No** The system is operating correctly. The condition may have been caused by an incomplete or inaccurate calibration.
G2 CHECK THE VOLTAGE FROM THE ABS MODULE	
• Connect: ABS Module C135. • Key in ON position. • Measure the voltage between sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side and sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.  N0057973 • **Is the voltage greater than 10 volts?**	**Yes** GO to G3 . **No** GO to G7 .
G3 CHECK THE ABS MODULE YAW RATE PID	
• Key in OFF position. • Connect: Sensor Cluster C3073. • Key in ON position. • **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement will result in false values for this test. • Monitor the ABS module yaw rate PID. • **Is the ABS module yaw rate PID value between -0.05 and 0.05?**	**Yes** GO to G4 . **No** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. CLEAR DTCs. REPEAT the self-test.
G4 CHECK THE ABS MODULE LATERAL ACCELERATION PID	
• Enter the following diagnostic mode on the diagnostic tool: ABS Module PID. • **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement will result in false values for this test. • Monitor the ABS module lateral acceleration PID. • **Is the ABS module lateral acceleration PID value between -0.007 and 0.007?**	**Yes** GO to G5 . **No** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. CLEAR the DTCs. REPEAT the self-test.

G5 CHECK THE ABS MODULE LONGITUDINAL ACCELERATION PID	
• Enter the following diagnostic mode on the diagnostic tool: ABS Module PID. • **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement will result in false values for this test. • Monitor the ABS module longitudinal acceleration PID. • **Is the ABS module longitudinal acceleration PID value between -0.004 and 0.004?**	**Yes** GO to G6 . **No** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. CLEAR the DTCs. REPEAT the self-test.
G6 CHECK THE ABS MODULE ROLL RATE PID	
• Enter the following diagnostic mode on the diagnostic tool: ABS Module PID. • **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement will result in false values for this test. • Monitor the ABS module roll rate PID. • **Is the ABS module roll rate PID value between -0.05 and 0.05?**	**Yes** GO to G7 . **No** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. CLEAR the DTCs. REPEAT the self-test.
G7 CHECK THE SENSOR CLUSTER CIRCUITS FOR AN OPEN	

• Key in OFF position.
• Disconnect: Sensor Cluster C3073.
• Disconnect: ABS Module C135.
• Measure the resistance between:
  ▪ ABS module C135-18, circuit VCA23 (BU/WH), harness side and sensor cluster C3073-2, circuit VCA23 (BU/WH), harness side.
  ▪ ABS module C135-19, circuit VCA24 (GN/OG), harness side and sensor cluster C3073-1, circuit VCA24 (GN/OG), harness side.
  ▪ ABS module C135-22, circuit CCA09 (VT/BN), harness side and sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side.
  ▪ ABS module C135-29, circuit RCA09 (GN/VT), harness side and sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.
 
 	
N0057971
• **Is the resistances less than 5 ohms?**
	Yes
	GO to G8 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

G8 CHECK THE SENSOR CLUSTER CIRCUITS FOR A SHORT TO VOLTAGE	

• Key in ON position.
• Measure the voltage between ground and:
  ▪ sensor cluster C3073-1, circuit VCA24 (GN/OG), harness side.
  ▪ sensor cluster C3073-2, circuit VCA23 (BU/WH),
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool

harness side. ■ sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side. ■ sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.  N0057972 • **Is voltage present?**	directions for the calibration procedure. REPEAT the self-test. **No** GO to G9 .
G9 CHECK THE SENSOR CLUSTER CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between ground and: ■ sensor cluster C3073-1, circuit VCA24 (GN/OG), harness side. ■ sensor cluster C3073-2, circuit VCA23 (BU/WH), harness side. ■ sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side. ■ sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.  A0091341 • **Is the greater less than 10,000 ohms?**	**Yes** GO to G10 . **No** REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.
G10 CHECK THE ABS MODULE CONNECTORS	
• Key in OFF position. • Disconnect all the ABS connectors. • Check for: ■ corrosion. ■ pushed-out pins. ■ spread terminals. • Connect all the ABS connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: DTC C1285 — Booster Solenoid Circuit Failure

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active brake booster has internal solenoids that assist driver brake applications or can apply the brakes when needed if the driver loses control.

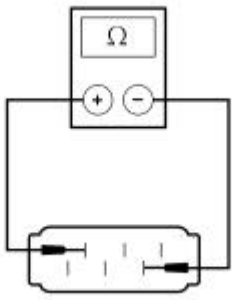
Voltage is supplied to the solenoid by the anti-lock brake system (ABS) module along circuit CCA22 (GY/YE) and ground is provided by the ABS module along circuit VCA22 (GN/BN).

Possible Causes

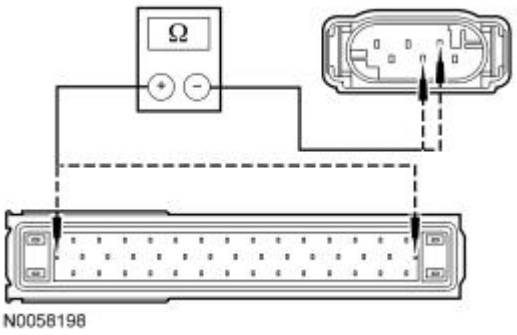
- Circuit open
- Circuit shorted
- Active brake booster
- ABS module

PINPOINT TEST H: DTC C1285 — BOOSTER SOLENOID CIRCUIT FAILURE

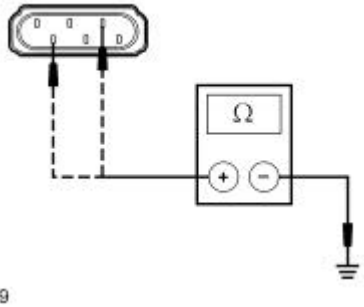
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
H1 CHECK FOR DTCs FROM THE SELF-TEST	
• Key in ON position. • Connect the diagnostic tool. • Enter the following diagnostic mode on the diagnostic tool: Clear the diagnostic trouble codes (DTCs). • Carry out the ABS module self-test using the scan tool. • Enter the following diagnostic mode on the diagnostic tool: Retrieve DTCs. • **Are any DTCs retrieved?**	**Yes** If DTC C1285 is retrieved or the brake booster portion of the recalibration procedure indicates a failure, GO to H2 . If any other DTC is retrieved, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. **No** The system is operating correctly.
H2 CHECK THE BRAKE BOOSTER SOLENOID	
• Key in OFF position. • Disconnect: Active Brake Booster C149. • Measure the resistance between active brake booster C149 pin 3 and pin 4, component side.  A0083461	**Yes** GO to H3 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance between 1 and 2 ohms?**	
H3 CHECK CIRCUITS CCA22 (GY/YE) AND VCA22 (GN/BN) FOR AN OPEN	

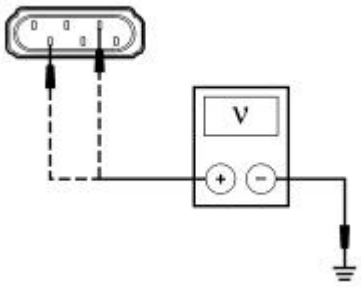
• Disconnect: ABS Module C135.
• Measure the resistance between:
  ■ ABS module C135-17, circuit CCA22 (GY/YE), harness side and active brake booster C149-3, circuit CCA22 (GY/YE), harness side
  ■ ABS module C135-31, circuit VCA22 (GN/BN), harness side and active brake booster C149-4, circuit VCA22 (GN/BN), harness side.
 
 	
N0058198
• **Is the resistance less than 5 ohms?**
	Yes
	GO to H4 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

H4 CHECK CIRCUITS CCA22 (GY/YE) AND VCA22 (GN/BN) FOR A SHORT TO GROUND	

• Measure the resistance between ground and:
  ■ active brake booster C149-3, circuit CCA22 (GY/YE), harness side
  ■ active brake booster C149-4, circuit VCA22 (GN/BN) harness side.
 
 	
A0084049
• **Is the resistance greater than 10,000 ohms?**
	Yes
	GO to H5 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

H5 CHECK CIRCUITS CCA22 (GY/YE) AND VCA22 (GN/BN) FOR A SHORT TO VOLTAGE	

• Key in ON position.
• Measure the voltage between ground and:
  ■ active brake booster C149-3, circuit CCA22 (GY/YE), harness side
  ■ active brake booster C149-4, circuit VCA22 (GN/BN) harness side.
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to H6 .

 A0084050 • **Is voltage present?**	
H6 CHECK THE ACTIVE BRAKE BOOSTER SOLENOID FOR CORRECT OPERATION	
• Key in OFF position. • Connect: Active Brake Booster C149. • Connect: ABS Module C135. • Start the engine and wait approximately one minute to create vacuum in the brake booster then stop the engine. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: ABS Module Active Command. • While observing the brake pedal for movement, trigger the booster solenoid ON active command. • **Does the brake pedal move?**	**Yes** GO to H7 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTCs. RECALIBRATE the ABS module. REPEAT the self-test.
H7 CHECK THE ABS MODULE CONNECTORS	

• Key in OFF position.
• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: DTC C1287 — Brake Booster Pedal Force Switch Circuit Failure

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active brake booster contains a normally open and a normally closed pedal force switch that operates according to driver brake applications.

The anti-lock brake system (ABS) module provides a reference voltage to the pedal force switch along circuit CCA29 (GN/BU). The voltage returns along either the normally open pedal force circuit CCA26 (BU/GY) or the normally closed pedal force circuit CCA25 (VT/GY), depending on the driver brake application.

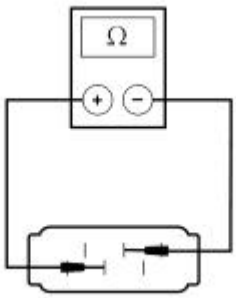
Possible Causes

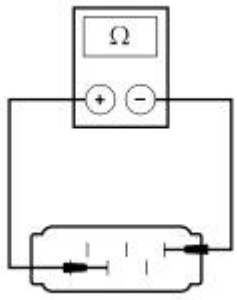
- Circuit open
- Circuit shorted
- Active brake booster

- ABS module

PINPOINT TEST I: DTC C1287 — BRAKE BOOSTER PEDAL FORCE SWITCH CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

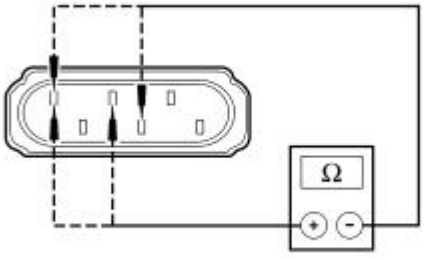
Test Step	Result / Action to Take
I1 CHECK FOR DTCs FROM THE SELF-TEST	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Clear the diagnostic trouble codes (DTCs). • Carry out the ABS module self-test using the scan tool. • Enter the following diagnostic mode on the diagnostic tool: Retrieve DTCs. • **Are any DTCs retrieved?**	**Yes** If DTC C1287 is retrieved, GO to I2 . If any other DTC is retrieved, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. **No** The system is operating correctly.
I2 CHECK THE NORMALLY CLOSED RELEASE SWITCH	
• Key in OFF position. • Disconnect: Active Brake Booster C149. • Measure the resistance between active brake booster C149 pin 2 and pin 5, component side, while pressing and releasing the brake pedal.  A0083463 • **Is the resistance less than 5 ohms with the brake pedal released and greater than 10,000 ohms with the brake pedal applied?**	**Yes** GO to I3 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTCs. REPEAT the self-test.
I3 CHECK THE NORMALLY OPEN RELEASE SWITCH	
• Measure the resistance between active brake booster C149 pin 1 and pin 5, component side, while pressing and releasing the brake pedal.	**Yes** GO to I4 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTCs. REPEAT the self-test.



A0083464

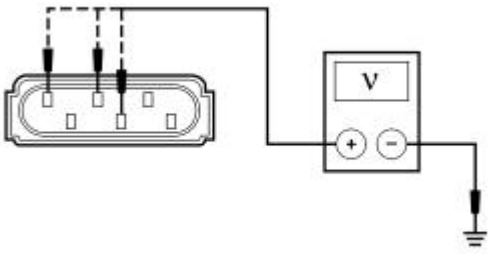
- **Is the resistance greater than 10,000 ohms with the brake pedal released and less than 5 ohms with the brake pedal applied?**

I4 CHECK THE ACTIVE BRAKE BOOSTER CIRCUITS FOR A SHORT TOGETHER	

• Disconnect: ABS Module C135.
• Measure the resistance between:
  ▪ active brake booster C149-1, circuit CCA26 (BU/GY), harness side and active brake booster C149-2, circuit CCA25 (VT/GY), harness side.
  ▪ active brake booster C149-2, circuit CCA25 (VT/GY), harness side and active brake booster C149-5, circuit CCA29 (GN/BU), harness side.
  ▪ active brake booster C149-1, circuit CCA26 (BU/GY), harness side, and active brake booster C149-5, circuit CCA29 (GN/BU), harness side.
 
 	
N0028814
• **Are the resistances greater than 10,000 ohms?**
	Yes
	GO to I5 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

I5 CHECK THE ACTIVE BRAKE BOOSTER CIRCUITS FOR A SHORT TO VOLTAGE	

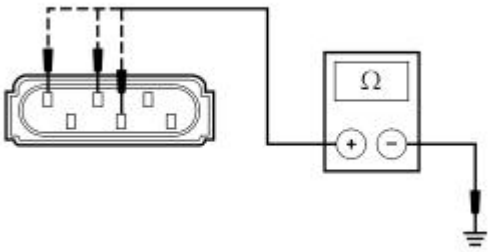
• Key in ON position.
• Measure the voltage between ground and:
  ▪ active brake booster C149-1, circuit CCA26 (BU/GY), harness side.
  ▪ active brake booster C149-2, circuit CCA25 (VT/GY), harness side.
  ▪ active brake booster C149-5, circuit CCA29 (GN/BU), harness side.
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. REPEAT the self-test.
	
	No
	GO to I6 .



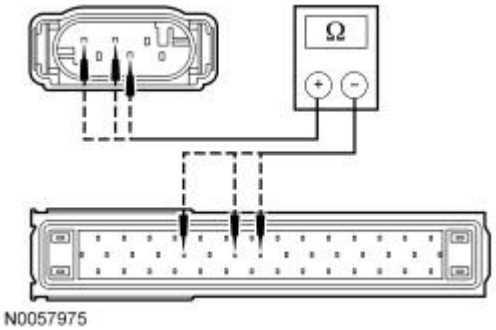
A0083551

- **Is voltage present?**

I6 CHECK THE ACTIVE BRAKE BOOSTER CIRCUITS FOR SHORTS TO GROUND	

• Key in OFF position.
• Measure the resistance between ground and:
  ▪ active brake booster C149-1, circuit CCA26 (BU/GY), harness side.
  ▪ active brake booster C149-2, circuit CCA25 (VT/GY), harness side.
  ▪ active brake booster C149-5, circuit CCA29 (GN/BU), harness side.
 	
 
 	
A0083552
• **Are the resistances greater than 10,000 ohms?**
	Yes
	GO to I7 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

I7 CHECK THE BRAKE BOOSTER CIRCUITS FOR AN OPEN	

• Measure the resistance between:
  ▪ active brake booster C149-1, circuit CCA26 (BU/GY), harness side and ABS module C135-23, circuit CCA26 (BU/GY), harness side.
  ▪ active brake booster C149-2, circuit CCA25 (VT/GY), harness side and ABS module C135-24, circuit CCA25 (VT/GY), harness side.
  ▪ active brake booster C149-5, circuit CCA29 (GN/BU), harness side and ABS module C135-21, circuit CCA29 (GN/BU), harness side.
 	
 
 	
N0057975
	Yes
	GO to I8 .
	
	No
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance less than 5 ohms?**	
I8 CHECK THE ABS MODULE CONNECTORS	

• Key in OFF position.
• Disconnect all the ABS connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect all the ABS connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Stability Assist System Cannot be Disabled

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

Engine torque modulation is achieved by regulating fuel and spark to the cylinders. The stability assist system operates using the anti-lock brake system (ABS) module to interact with the powertrain control module (PCM) to reduce engine torque if one or both rear wheels lose traction and begin to spin during acceleration.

The stability/traction control switch is a momentary contact switch and is part of the liftgate release and hazard switch assembly. When the switch is pressed, ABS module circuit CCA15 (YE/GY) is momentarily grounded through the switch along circuit GD138 (BK/WH). The ABS module then sends information to the PCM along the high speed communication area network (HS-CAN) to modulate the engine torque.

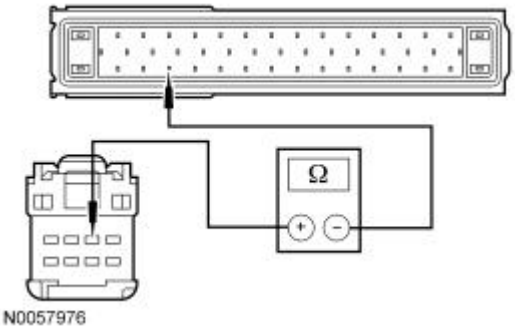
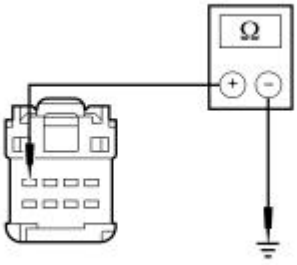
Possible Causes

- Circuit open
- Stability/traction control switch
- ABS module

PINPOINT TEST J: THE STABILITY ASSIST SYSTEM CANNOT BE DISABLED

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
J1 CHECK THE STABILITY/TRACTION CONTROL SWITCH PID	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: ABS Module PID. • **NOTE:** Press and hold the switch for at least one	**Yes** REFER to Section 418-00 to diagnose the HS-CAN bus. TEST the system for normal operation. **No** GO to J2 .

second. • Monitor the ABS module traction control push button input status PID while pressing and releasing the stability/traction control switch. • **Does the switch position match the PID?**	
J2 CHECK CIRCUIT CCA15 (YE/GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: Stability Assist Switch C2361. • Disconnect: ABS Module C135. • Measure the resistance between ABS module C135-4, circuit CCA15 (YE/GY), harness side and stability assist switch C2361-2, circuit CCA15 (YE/GY), harness side.  N0057976 • **Is the resistance less than 5 ohms?**	**Yes** GO to J3 . **No** REPAIR circuit CCA15 (YE/GY). TEST the system for normal operation.
J3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between stability assist switch C2361-4, circuit GD138 (BK/WH), harness side and ground.  N0057977 • **Is the resistance less than 5 ohms?**	**Yes** GO to J4 . **No** REPAIR circuit GD138 (BK/WH). TEST the system for normal operation.
J4 CHECK THE STABILITY ASSIST SWITCH FOR AN OPEN	
• Measure the resistance between stability assist switch C2361 pin 2 and pin 4, component side while pressing and releasing the switch. • **Is the resistance greater than 10,000 ohms with the switch released and less than 5 ohms with the switch pressed?**	**Yes** GO to J5 . **No** INSTALL a new stability assist switch, REFER to Stability/Traction Control Switch — Expedition or Stability/Traction Control Switch — Navigator in this section. TEST the system for normal operation.
J5 CHECK THE ABS MODULE CONNECTORS	
• Key in OFF position. • Disconnect all the ABS connectors. • Check for:	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this

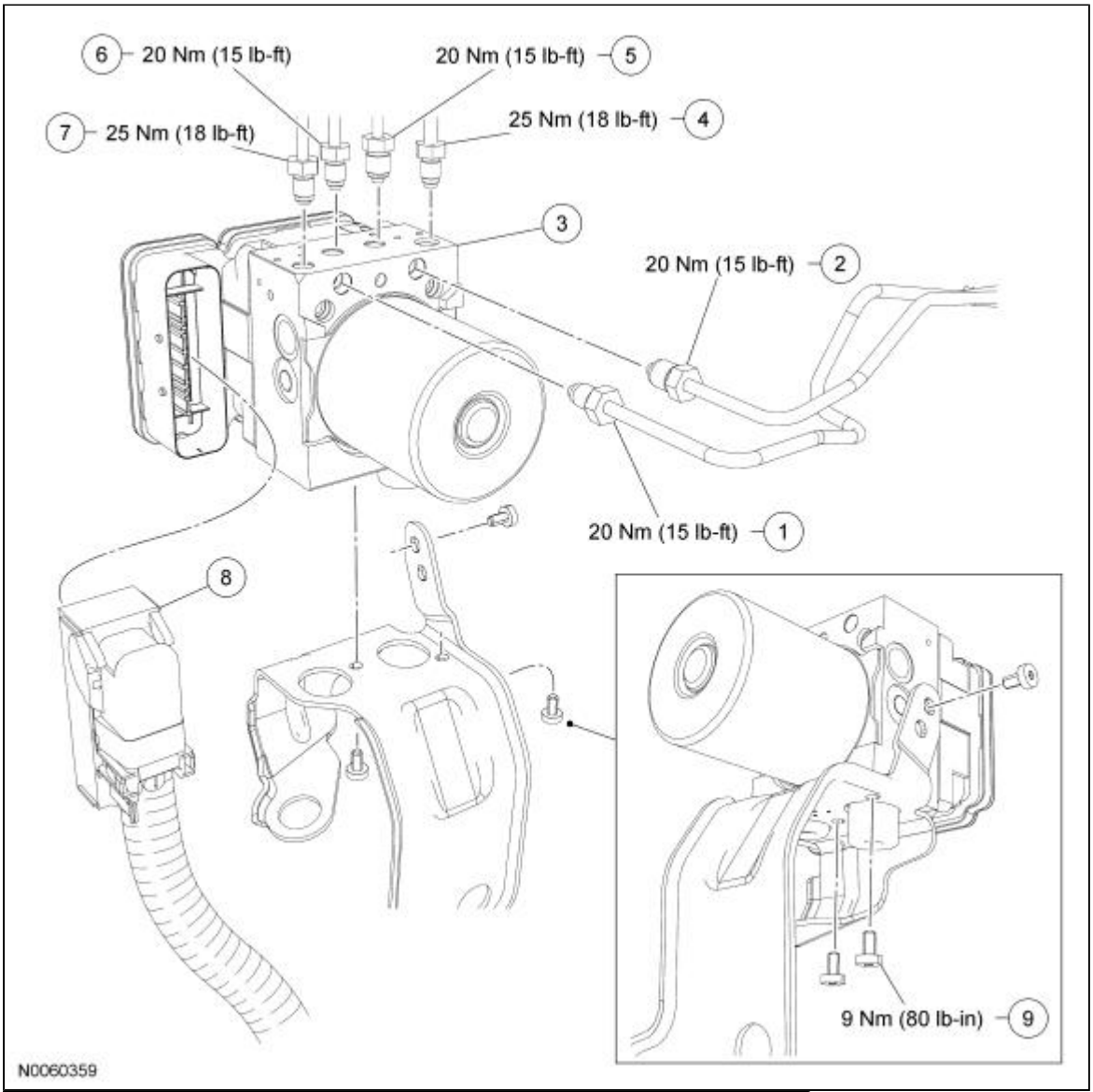
■ corrosion. ■ pushed-out pins. ■ spread terminals. ● Connect all the ABS connectors and make sure they seat correctly. ● Operate the system and verify the concern is still present. ● **Is the concern still present?**	section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Hydraulic Control Unit (HCU)

Printable View (214 KB)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	2B523	Rear combination valve brake tube
2	2264	LH front brake tube
3	2C405	Hydraulic control unit (HCU)

4	2A040	Master cylinder secondary brake tube
5	2263	RH front brake tube
6	2B523	Rear combination valve brake tube
7	2B253	Master cylinder primary brake tube
8	—	Anti-lock brake system (ABS) module electrical connector (part of 14A464)
9	2C346	HCU-to-bracket bolt (3 required)

Removal and Installation

WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. **CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

   Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Disconnect the anti-lock brake system (ABS) module electrical connector.

3. **CAUTION: Only authorized inlet hydraulic brake tubes should be used. These tubes are of specific design and only authorized parts should be used when installing new inlet brake tubes.**

   NOTE: Plug each open port to prevent brake fluid from spilling.

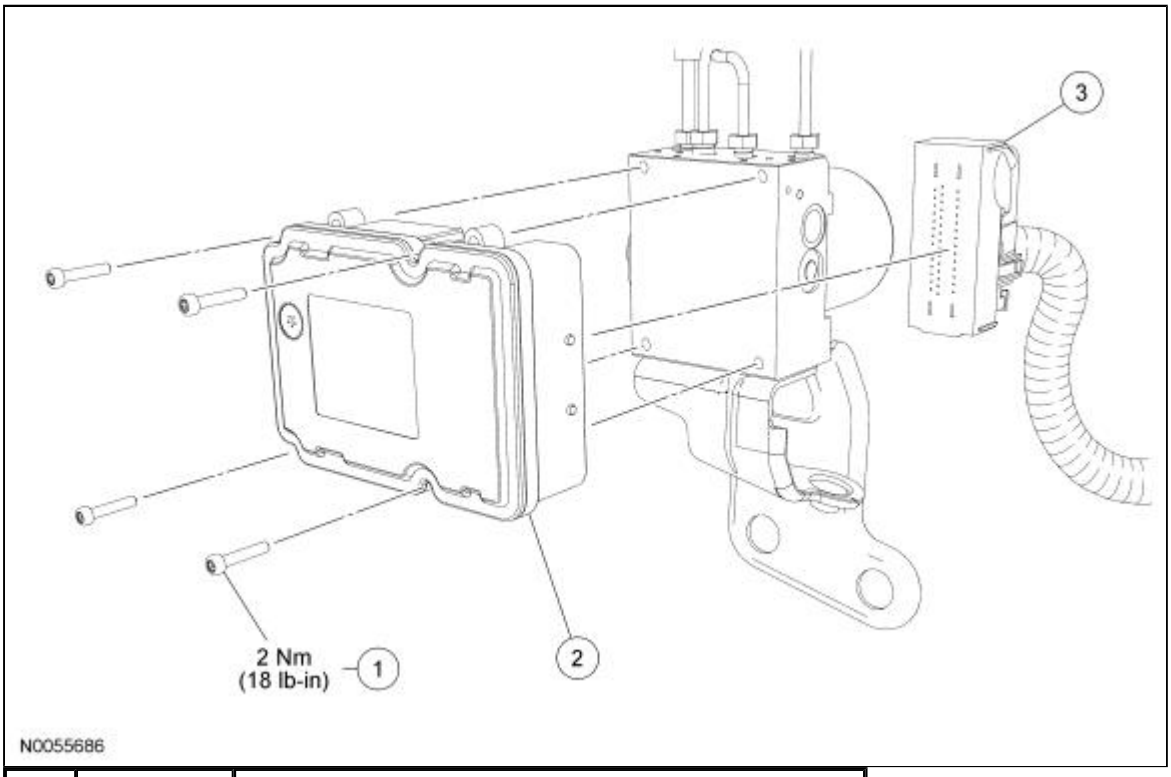
   Disconnect the 6 brake tube fittings.
   - To install:
     - tighten the master cylinder brake tube fittings to 25 Nm (18 lb-ft).
     - tighten the remaining brake tube fittings to 20 Nm (15 lb-ft).

4. Remove the 3 hydraulic control unit (HCU)-to-bracket bolts and the HCU.
   - To install, tighten to 9 Nm (80 lb-in).

5. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to Section 206-00 .

Anti-Lock Brake System (ABS) Module

Printable View (141 KB)



Item	Part Number	Description
1	—	Anti-lock brake system (ABS) module bolt (4 required) (part of 2C219)
2	2C219	ABS module
3	—	ABS module electrical connector (part of 14A464)

Removal and Installation

NOTE: When installing a new module, it must be calibrated and configured (either by download/upload or uploading the as-built data method).

1. **CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

   Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

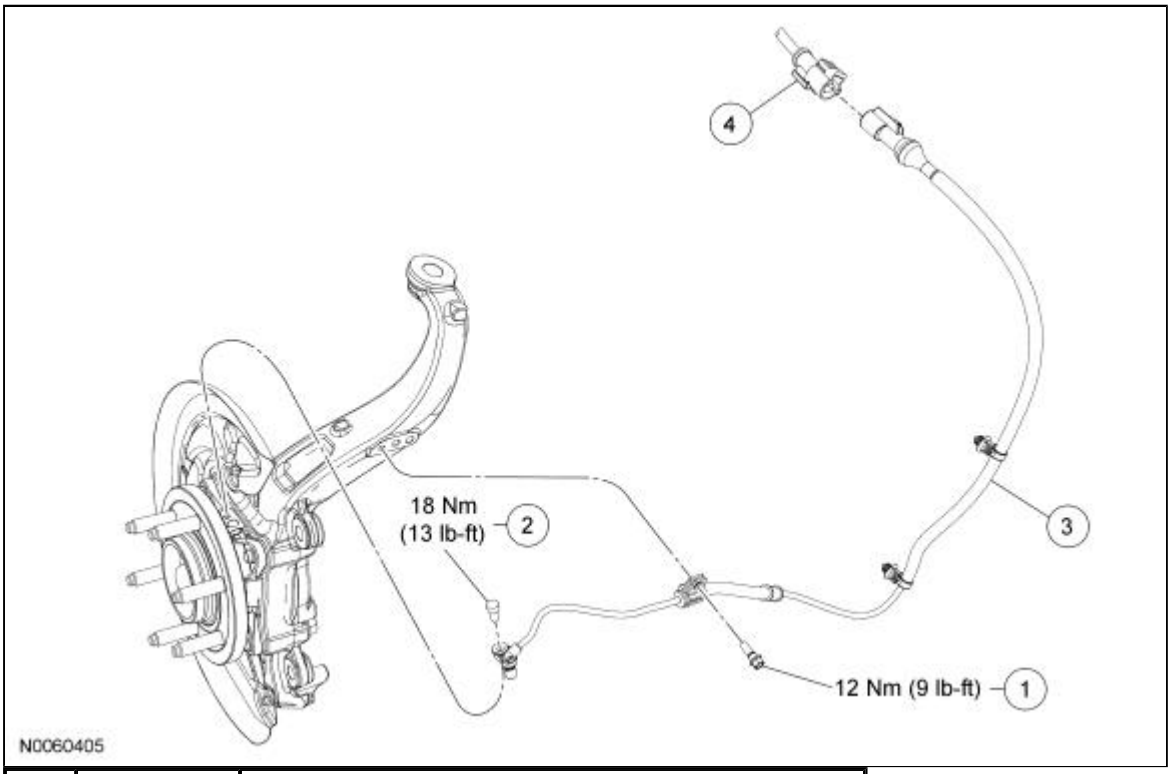
2. Disconnect the anti-lock brake system (ABS) module electrical connector.

3. Remove the 4 bolts and the ABS module.
   - To install, tighten to 2 Nm (18 lb-in).

4. To install, reverse the removal procedure.
   - If installing a new ABS module, program the module. For additional information, refer to Section 418-01 .

Wheel Speed Sensor — Front

Printable View (138 KB)



Item	Part Number	Description
1	—	Front wheel speed sensor harness retainer bolt
2	—	Front wheel speed sensor bolt
3	2C204	Front wheel speed sensor
4	—	Front wheel speed sensor electrical connector (part of 14250)

Removal and Installation

1. **NOTE:** If equipped, turn the air suspension switch to the OFF position.

   With the vehicle in NEUTRAL, position it on a hoist

2. Disconnect the wheel speed sensor electrical connector.

3. Remove the wheel speed sensor harness retainer bolt and detach the retainers.
   - To install, tighten to 12 Nm (9 lb-ft).

4. **CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can result.**

   Remove the 2 caliper anchor bolts and position the caliper, pads and anchor plate aside.
   - Support the caliper with mechanic's wire.

- To install, tighten to 200 Nm (148 lb-ft).

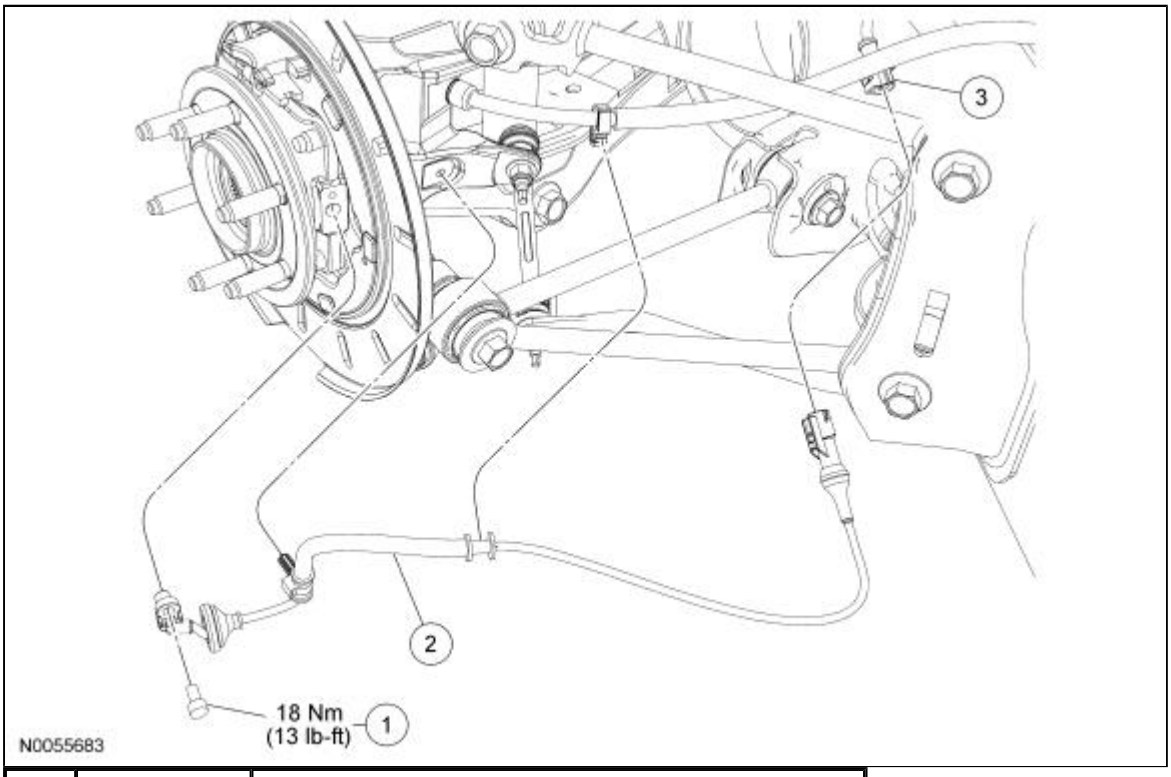
5. Remove the brake disc.

6. Remove the front wheel speed sensor bolt and the sensor.
    - To install, tighten to 18 Nm (13 lb-ft).

7. To install, reverse the removal procedure.

Wheel Speed Sensor — Rear

Printable View (168 KB)



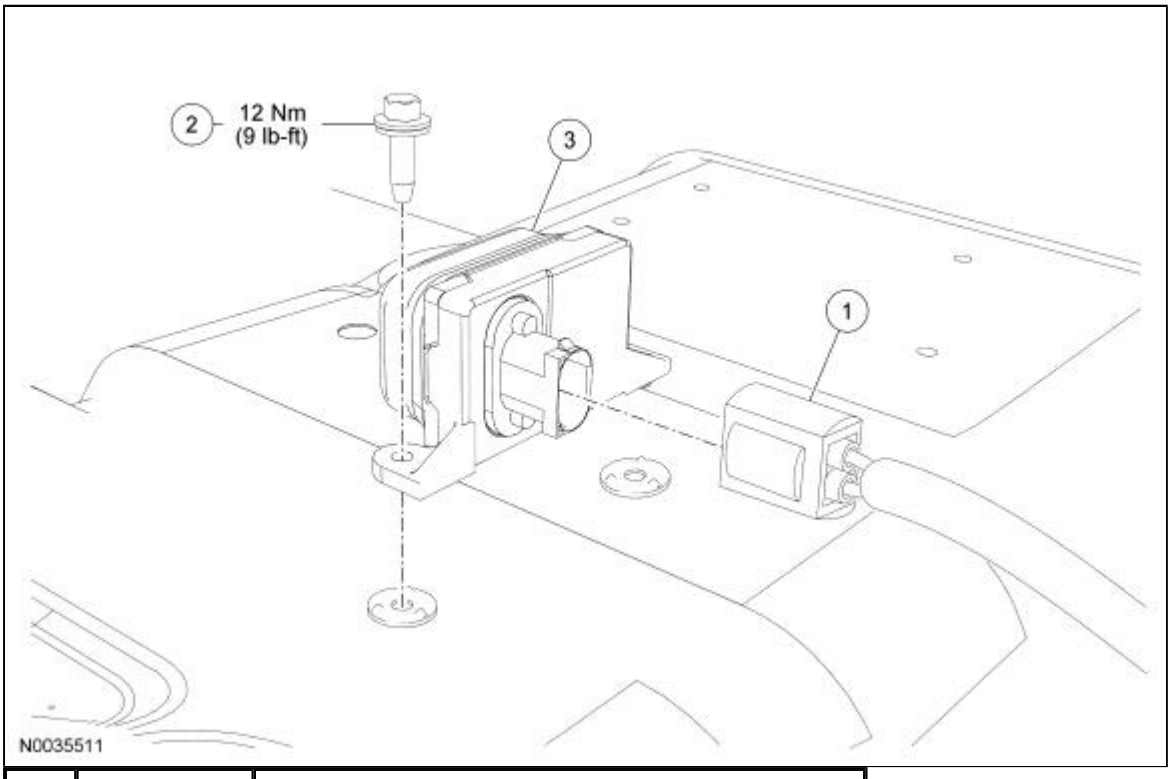
Item	Part Number	Description
1	2B663	Rear wheel speed sensor bolt
2	2C190	Rear wheel speed sensor
3	—	Body harness electrical connector (part of 14A464)

Removal and Installation

1. Remove the parking brake shoes. For additional information, refer to Section 206-05 .
2. Disconnect the wheel speed sensor harness from the retaining clips.
3. Remove the rear wheel speed sensor bolt and the sensor.
   - To install, tighten to 18 Nm (13 lb-ft).
4. To install, reverse the removal procedure.

Stability Control Sensor Cluster

Printable View (161 KB)

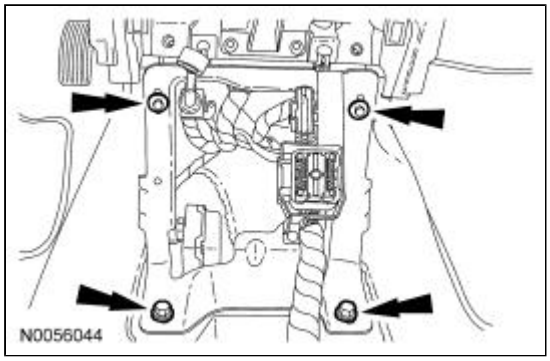


Item	Part Number	Description
1	—	Stability control sensor cluster electrical connector
2	W505255	Stability control sensor cluster bolt (2 required)
3	3C187	Stability control sensor cluster

Removal and Installation

NOTE: The lateral and longitudinal accelerometer and the roll rate sensor are located within the yaw rate sensor, stability control sensor cluster.

1. Remove the front floor console. For additional information, refer Section 501-12 .
2. Disconnect the stability control sensor cluster electrical connector.
3. Remove the 4 bolts and the bracket.
   - To install:
     - Tighten the upper bolts to 9 Nm (80 lb-in).
     - Tighten the lower bolts to 40 Nm (30 lb-ft).

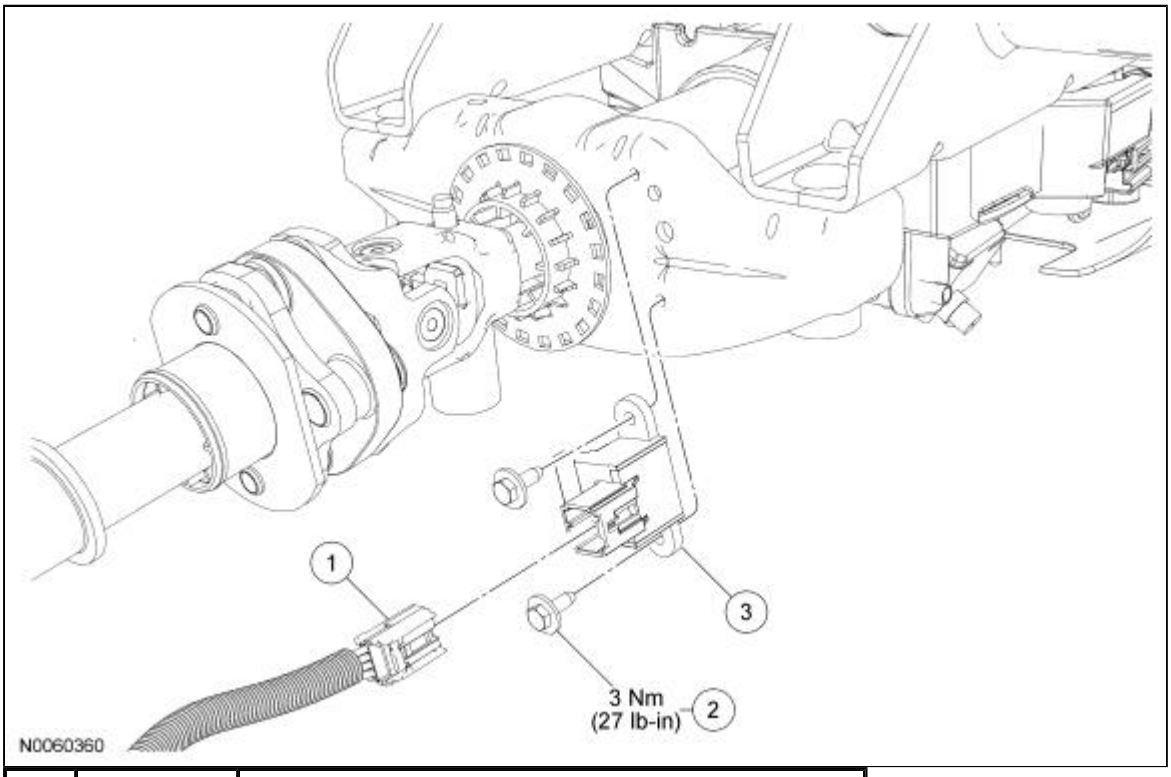


4. Remove the 2 bolts and the stability control sensor cluster.
    - To install, tighten to 12 Nm (9 lb-ft).

5. To install, reverse the removal procedure.

Steering Wheel Rotation Sensor

Printable View (156 KB)



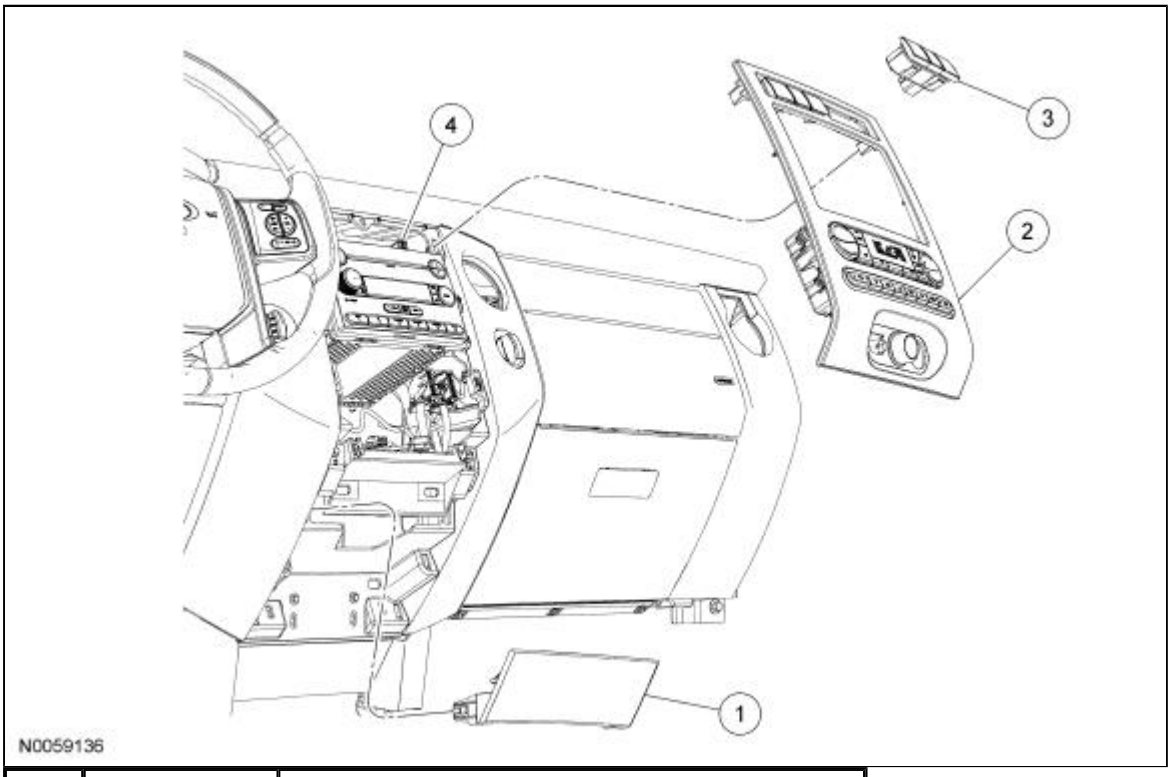
Item	Part Number	Description
1	N802141	Steering wheel rotation sensor bolts (2 required)
2	3F818	Steering wheel rotation sensor
3	—	Steering wheel rotation sensor electrical connector (part of 14489)

Removal and Installation

1. Disconnect the steering wheel rotation sensor electrical connector.
2. Remove the 2 bolts and the steering wheel rotation sensor.
   - To install, tighten to 3 Nm (27 lb-in).
3. To install, reverse the removal procedure.

Stability/Traction Control Switch — Expedition

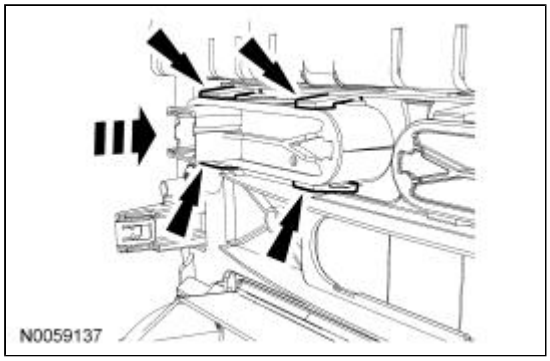
Printable View (186 KB)



Item	Part Number	Description
1	—	Lower instrument cluster center finish panel
2	04302	Upper instrument cluster center finish panel
3	13350	Traction control switch assembly
4	—	Electrical connector (part of 14401)

Removal and Installation

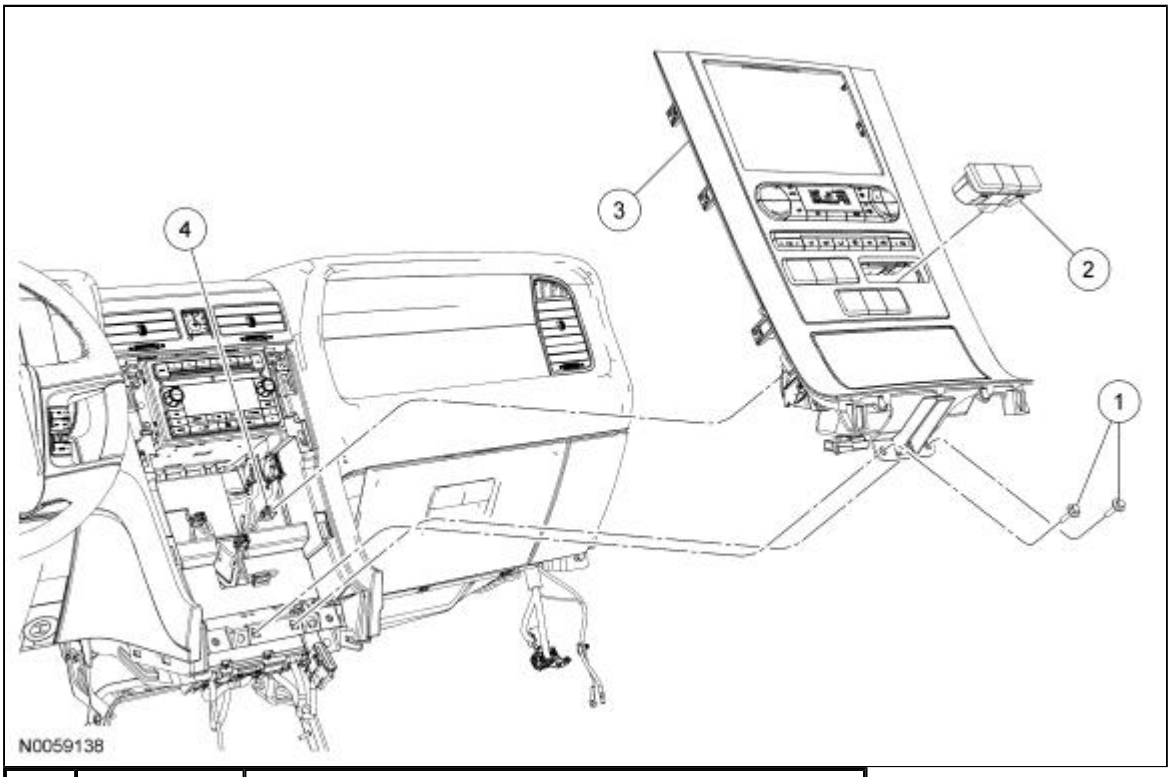
1. Remove the lower instrument cluster center finish panel.
2. Remove the upper instrument cluster center finish panel.
    - Disconnect the electrical connectors.
3. Depress the 4 tabs and remove the traction control switch assembly.



4. To install, reverse the removal procedure.

Stability/Traction Control Switch — Navigator

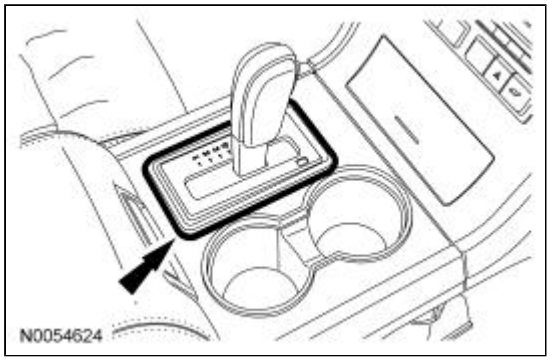
Printable View (242 KB)



Item	Part Number	Description
1	—	Instrument cluster center finish panel screws (2 required)
2	04302	Traction control switch assembly
3	13350	Lower instrument cluster center finish panel
4	—	Electrical connector (part of 14401)

Removal and Installation

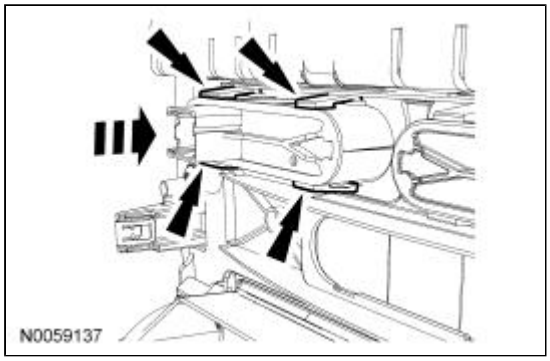
1. Apply the parking brake and move the shift lever to NEUTRAL.
2. Disconnect the battery negative cable. For additional information, refer to Section 414-01 .
3. Remove the shift lever trim ring.



4. Remove the front floor console finish panel.

5. Remove the lower instrument cluster finish panel.
    1. Remove the 2 lower instrument cluster finish panel screws.
    2. Pull out on the panel to disengage the clips.
    3. Disconnect the electrical connectors.

6. Depress the 4 tabs and remove the traction control switch assembly.



7. To install, reverse the removal procedure.

Printable View (81 KB)

General Specifications

Item	Specification
Lubricants	
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®
Fluid capacity (included in pump reservoir fill)	1.3L (2.7 pt) (approximate)
Power Steering Gear	
Type	Rack and Pinion
Ratio	20:1
Static steering wheel turning effort Navigator Expedition	 4.0 Nm (35 lb-in) 5.0 Nm (44 lb-in)
Turning effort Navigator Expedition	 2.14 kg (4.7 lbs) 2.68 kg (5.9 lbs)
Turns of steering wheel (lock to lock — linkage disconnected)	3.75
Tie-rod articulation torque	5 Nm (44 lb-in)
Power Steering Purge Vacuum	
Minimum vacuum	67-84 kPa (20-25 in-Hg)
Power Steering Pump	
Flow (Navigator)	11L ± 0.8L @ 345 kPa (3.0 gpm ± 0.2 gpm @ 50 psi) engine speed @ 1,200 rpm
Flow (Expedition)	11L ± 0.8L @ 345 kPa (3.0 gpm ± 0.2 gpm @ 50 psi) engine speed @ 1,200 rpm 9.5L ± 0.8L @ 345 kPa (2.6 gpm ± 0.2 gpm @ 50 psi) engine speed @ 3,000 rpm
Minimum capacity	6.6L @ 5,171 kPa (1.6 gpm @ 750 psi) engine speed @ 500 rpm
Relief pressure	8,963 - 10,204 kPa (1,300 - 1,480 psi)

Steering System

Printable View (63 KB)

The steering system consists of the following components:

- Power steering pump
- Fluid reservoir
- Steering column
- Steering gear
- Fluid cooler

For information on the power steering pump, steering gear, steering lines and fluid reservoir, refer to Section 211-02 .

For information on the steering wheel, column assembly and intermediate shaft, refer to Section 211-04 .

Steering System

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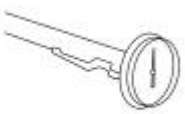
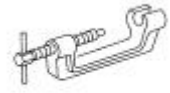
Special Tool(s)

 ST1396-A	Dial Thermometer 0-220°F 023-R0007 or equivalent
ST1477-A	Power Steering Analyzer 211-F001 (014-00207) or equivalent
ST1689-A	Gauge, Spring Tension 211-034 (T74P-3504-Y)
ST1398-A	DIS/EDIS Tach Adapter 211-105 (T85M-3395-A)
 ST1494-A	Remover/Installer C-Frame and Screw 211-023 (T74P-3044-A1)

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

Inspection and Verification

CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump can result.

NOTE: Make the following preliminary checks before repairing the steering system:

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical
• Fluid level • Tire pressure • Tires • Drive belt • Drive belt tensioner • Steering column alignment • Tie-rod ends • Suspension components • Steering column shaft U-joints • Intermediate shaft bolts • Power steering reservoir baffle • Power steering reservoir filter • Power steering pressure lines, fittings or O-rings • Power steering return hoses and clamps • Steering gear • Power steering pump

3. **NOTE:** The areas that should be inspected for possible contamination are the power steering reservoir filter, flow control and pressure relief valve in the pump and the check valve in the inlet port on the power steering gear (if equipped).

   Inspect the power steering fluid for the following conditions:
   - Aerated or foamy: Purge the power steering system. Refer to Power Steering System Purging in this section.
   - Overheating or contamination: Flush the power steering system. Refer to Power Steering System Flushing in this section.

4. Check the power steering system for fluid leaks.
   - Check the power steering fluid level.

     NOTE: It may be necessary to add power steering fluid to achieve the correct level.

     With the ignition OFF:
   - Wipe off the power steering pump, power steering pressure hose, power steering return hose, power steering fluid cooler, hose assembly and steering gear.
   - **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump can occur.**

     Start the engine and turn the steering wheel from stop-to-stop several times and check for leaks.

5. Inspect the power steering pressure and return hoses, fittings and O-rings for leaks.

- If a leak is detected at a power steering pressure or return hose, install a new hose. Refer to Section 211-02 .
- If a leak is detected between a fitting nut, seal the fitting nut using a Teflon® joint seal.
- If a leak is detected at a fitting or clamp plate, tighten to specification. If the leak is still evident,

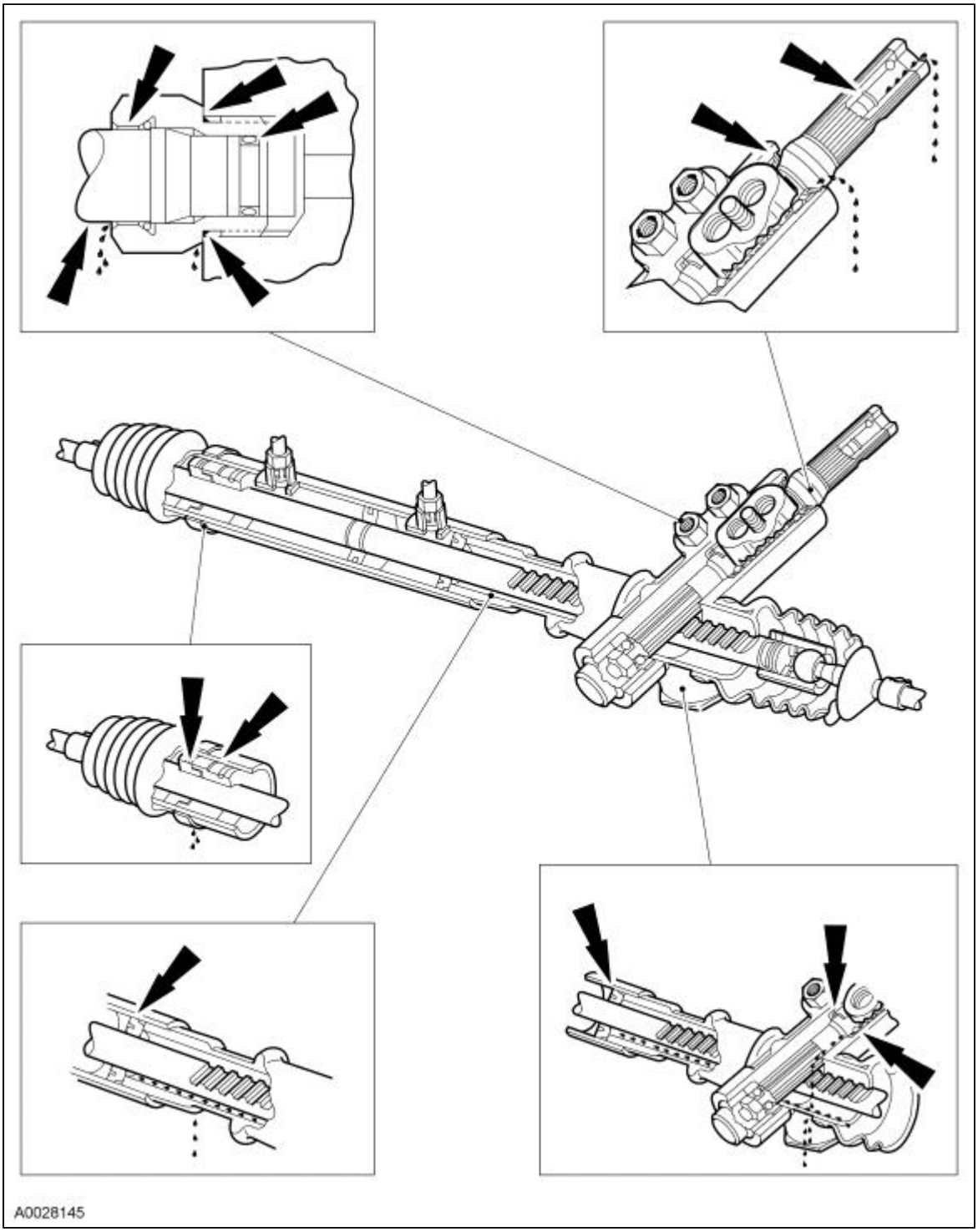
visually inspect the fittings, clamp plate, O-rings and Teflon® seals. Install new components as necessary. Refer to Section 211-02 .

- If a leak is detected at the power steering reservoir, install a new reservoir. Refer to Section 211-02 .
- If a leak is detected at a constant tension spring clamp, verify that the hose is fully installed on the fitting and that the hose clamp is correctly positioned. If the leak remains, install a new constant tension spring clamp.
- If a leak is detected at a screw clamp joint, tighten the screw clamp. If the leak remains, inspect the tube end and install a new hose. Refer to Section 211-02 .
- If a leak is detected at the power steering pump, install a new power steering pump. Refer to Section 211-02 .

NOTE: To inspect for leaks it may be necessary to remove the squeeze-type clamp from the steering gear boots.

6. Inspect the power steering gear for leaks. If a leak is detected at the power steering gear, install a new power steering gear. Refer to Section 211-02 .

External Leak Check — Potential Power Rack-and-Pinion Steering Gear Leak Points



7. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

8. If the cause is not visually evident, verify the symptom and GO to Symptom Chart .

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Feedback

Feedback is a roughness felt in the steering wheel when the vehicle is driven over rough pavement.

Hard Steering or Lack of Assist

Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and binding.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and is felt by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn, or the steering correction, is completed.

Shimmy

Shimmy, as felt by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Steering system noise	• Low fluid level • Fluid aeration	• Go To Pinpoint Test A .

	• Steering gear • Power steering pump • Loose or damaged steering linkage • Loose or damaged suspension component(s) • Steering column • Steering column boot bearing • Intermediate shaft • Loose dash boot seal	
• Steering is very difficult/very easy	• Seized intermediate shaft U-joints • Damaged, fractured steering column bearing(s) • Steering gear • Power steering pump • Power steering hoses • Binding dash boot seal	• Go To Pinpoint Test B .
• Excessive steering wheel play	• Steering gear • Steering column • Steering column intermediate shaft • Steering linkage • Ball joints	• Go To Pinpoint Test C .
• Steering system drift/pull/wander	• Tire pressure • Wheel alignment • Steering gear • Unevenly loaded vehicle • Steering column intermediate shaft • Frame alignment	• CORRECT the vehicle loading as necessary. Go To Pinpoint Test D .
• Feedback	• Loose, worn or damaged tie rod	• GO to Component Tests, Tie-Rod Articulation Torque in this section.
	• Loose, worn or damaged tie-rod ends	• GO to Component Tests, Steering Linkage in this section.
	• Loose or damaged steering gear insulators or bolts	• INSTALL new steering gear insulators or bolts if necessary, or TIGHTEN the bolts as needed.
	• Loose lower steering column shaft U-joint bolts	• INSTALL new bolts or TIGHTEN the bolts. REFER to Section 211-04 .
	• Loose suspension bushings, fasteners or ball joints	• INSTALL new components as necessary. REFER to Section 204-01A rear wheel drive (RWD) or Section 204-01B

		four wheel drive (4WD).
	• Worn or damaged steering column bearing(s)	• INSTALL new steering column bearing(s). REFER to Section 211-04 .
• Poor returnability/sticky steering	• Binding lower steering column shaft U-joints	• INSTALL a new lower steering column shaft. REFER to Section 211-04 .
	• Loose, worn or damaged tie rod	• GO to Component Tests, Tie-Rod Articulation Torque in this section.
	• Loose, worn or damaged tie-rod ends	• GO to Component Tests, Steering Linkage in this section.
	• Suspension components	• REFER to Section 204-00 .
	• Binding steering column bearing(s) • Binding dash boot seal	• INSTALL new steering column bearing(s). REFER to Section 211-04 .
• Shimmy	• Loose, worn or damaged tie-rod end	• GO to Component Tests, Steering Linkage in this section.
	• Loose, worn or damaged tie rod	• GO to Component Tests, Tie-Rod Articulation Torque in this section.
	• Suspension components	• REFER to Section 204-00 .

Pinpoint Tests

Pinpoint Test A: Steering System Noise

Normal Operation

The power steering pump, which is driven by the crankshaft through a drive belt and pulleys, develops the hydraulic pressure necessary to operate the system. When the engine is running, fluid is drawn into the power steering pump from the power steering pump reservoir. Hydraulic fluid is pressurized in the power steering pump and sent to the steering gear. The rotary valve determines fluid direction to assist the driver in the turning of the vehicle. When the steering wheel is turned, the steering gear converts this hydraulic pressure and flow into mechanical motion that will move the front wheels in the direction of the turn. The steering gear uses tie rods to connect the front knuckles, which then pivot on the ball joints, steering the vehicle.

Possible Causes

- Fluid
- Engine drive belt
- Steering column components
- Steering linkage
- Power steering gear
- Power steering pump

PINPOINT TEST A: STEERING SYSTEM NOISE

Test Step	Result / Action to Take
A1 CHECK FOR MECHANICAL NOISE • Test drive the vehicle to verify the steering system noise. • **Does the steering system make a clunk noise?**	**Yes** CHECK for loose, worn or damaged tie-rod ends. REFER to Component Tests, Steering Linkage in this section. CHECK for loose or worn steering gear isolators (if applicable). INSTALL new isolators if necessary. REFER to Section 211-02 . If the noise is from the steering column, CHECK the steering column intermediate shaft for grounding through the body and REPAIR as necessary. If the noise is from the steering column boot bearing, INSTALL a new steering column boot bearing. REFER to Section 211-04 . If the noise is from the suspension components, INSTALL new suspension components as necessary. REFER to Section 204-01A rear wheel drive (RWD) or Section 204-01B four wheel drive (4WD). If the noise is from loose, worn or damaged intermediate shaft U-joint(s), INSTALL a new lower steering column shaft. REFER to Section 211-04 . **No** If a squeak is present in the steering column, REPAIR the steering column mountings or ALIGN the steering column as necessary. REFER to Section 211-04 . For all other concerns, GO to A2 .
A2 VERIFY THE CONCERN **NOTE:** Make sure the vehicle is on a flat dry surface, the transmission is in PARK and the windows are rolled up. **NOTE:** Some power steering noise is expected. If in doubt of the acceptability of the noise level, evaluate another vehicle of the same model and powertrain. • Key in START position. • Turn the steering wheel 1/2 turn off-center to the RIGHT then 1/2 turn off-center to the LEFT. • **Is the power steering noisy?**	**Yes** If a grunt noise is present, VERIFY the steering column boot is OK and the exhaust system is not grounding out. If a moan is present, VERIFY that the tie-rod ends and ball joints are OK. GO to A3 . **No** If a squeal is present, INSPECT and INSTALL a new engine drive belt or belt tensioner as necessary. REFER to Section 303-00 . If the steering system noise is a hiss or whistle, INSPECT the steering column boot at the dash panel. REPAIR or INSTALL a new boot as necessary. REFER to Section 211-04 . INSPECT the steering gear input shaft and valve for wear or damage. REFER to Section

	211-02 . INSPECT the power steering gear, intermediate shaft and power steering lines and hoses for grounding to the body and REPAIR as necessary. INSPECT for openings or missing plugs in the instrument panel cowl and REPAIR as necessary. If there are no missing plugs or openings in the cowl, grounded power steering gear, intermediate shaft or power steering lines or hoses, GO to A6 .
A3 CHECK FOR A COLD START NOISE **NOTE:** Some noise during an extremely cold start (-25.5°C [-14°F]) is normal and should improve as the steering system warms up, usually within 60 seconds. • Key in START position. • Verify the noise condition. • **Is the noise present only during cold start up?**	**Yes** CHECK for contamination in the power steering reservoir screen. FLUSH the power steering system as necessary. REFER to Power Steering System Flushing in this section. TEST the system for normal operation. **No** GO to A4 .
A4 INSPECT THE POWER STEERING FLUID • Key in OFF position. • With the engine OFF, inspect the power steering fluid for aeration. • **Is the power steering fluid foamy or aerated?**	**Yes** GO to A5 . **No** PURGE the power steering system. REFER to Power Steering System Purging in this section. If a whine or moan is still present, INSTALL a new power steering pump. REFER to Section 211-02 . If a grunt is still present, INSTALL a new power steering gear. REFER to Section 211-02 .
A5 CHECK THE POWER STEERING FLUID LEVEL WITH THE ENGINE ON AND OFF **NOTE:** Record the vacuum level when the pump noise occurs with no steering input. Vacuum level should be greater than 10 in-Hg with the CII pump and 15 in-Hg with the CIII pump. • Key in START position. • With the engine running, inspect the power steering fluid level. • Key in OFF position. • With the engine OFF, inspect the power steering fluid level. • **Does the power steering fluid level change with the engine off?**	**Yes** PURGE the power steering system. REFER to Power Steering System Purging in this section. **No** GO to A6 .
A6 CHECK THE POWER STEERING PUMP **NOTE:** Do not turn the steering wheel to either the right or left stop. Power steering relief noise will occur and is normal at the stop positions.	**Yes** INSTALL a new power steering gear. REFER to Section 211-02 .

• Key in START position. • With the engine running, rotate the steering wheel 90 degrees to the left then 180 degrees to the right. • **Does the frequency of the hiss change between the LEFT and RIGHT positions?**	**No** INSTALL a new power steering pump. REFER to Section 211-02 .

Pinpoint Test B: Steering Is Very Difficult/Very Easy

Normal Operation

The power steering pump, which is driven by the crankshaft through a drive belt and pulleys, develops the hydraulic pressure necessary to operate the system. When the engine is running, fluid is drawn into the power steering pump from the power steering pump reservoir. Hydraulic fluid is pressurized in the power steering pump and sent to the steering gear. The rotary valve determines fluid direction to assist the driver in the turning of the vehicle. When the steering wheel is turned, the steering gear converts this hydraulic pressure and flow into mechanical motion that will move the front wheels in the direction of the turn. The steering gear uses tie rods to connect the front knuckles, which then pivot on the ball joints, steering the vehicle.

Possible Causes

- Ball joint(s)
- Steering column
- Intermediate shaft
- Steering gear
- Power steering pump

PINPOINT TEST B: STEERING IS VERY DIFFICULT/VERY EASY

Test Step	Result / Action to Take
B1 CHECK THE STEERING COLUMN BEARINGS AND THE INTERMEDIATE SHAFT	
NOTE: Be sure to keep the clockspring centered when disconnecting the intermediate shaft. Refer to Section 501-20B . • Check the steering column and intermediate shaft for grounding. • Disconnect the steering column intermediate shaft at the steering column. • Verify that the intermediate shaft U-joints do not bind and move freely and that the steering column bearing rotates freely. • **Are the steering column bearing and intermediate shaft U-joints OK?**	**Yes** GO to B2 . **No** If the steering column or the intermediate shaft are grounding, REPAIR as necessary. If the steering column bearings or the intermediate shaft are binding. INSTALL a new intermediate shaft or steering column. REFER to Section 211-04 .
B2 CHECK THE FRONT BALL JOINTS	
• Check that the front ball joints move freely and are not binding or sticking. Refer to Section 204-00 . • **Are the front ball joints OK?**	**Yes** GO to B3 . **No** INSTALL new ball joint(s) as necessary. REFER to

	Section 204-01A rear wheel drive (RWD) or Section 204-01B four wheel drive (4WD).
B3 MONITOR ENGINE RPM CHANGES	
NOTE: Make sure the vehicle is on a flat, dry surface. • Key in START position. • **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump can occur.** • Turn the steering wheel once to the LEFT stop position and then to the RIGHT stop position. • Note the engine rpm during the turns. • **Does the engine rpm change when turning the steering wheel?**	**Yes** If no power steering assist is present and the engine rpm changes, INSTALL a new steering gear. REFER to Section 211-02 . If left-to-right variation is present, INSTALL a new steering gear. REFER to Section 211-02 . If no power steering assist is present and the engine rpm does not change, INSTALL a new power steering pump. REFER to Section 211-02 . If excessive effort is required in one or both directions, INSTALL a new power steering pump. REFER to Section 211-02 . **No** CARRY OUT the Pump Flow and Pressure Test. REFER to Component Tests in this section.

Pinpoint Test C: Excessive Steering Wheel Play

Normal Operation

When the steering wheel is turned, the steering shaft rotates in the steering column on bearings. This mechanical motion is then converted to hydraulic pressure that assists in the effort that it takes to steer the vehicle. The hydraulic pressure from the power steering pump to the power steering gear is then converted back to mechanical motion that will move the front wheels in the direction of the turn. The steering gear uses tie-rod ends to connect the front knuckles to one another. The knuckles then pivot on the ball joints in order to steer the vehicle.

Possible Causes

- Steering column fasteners
- Steering column
- Steering linkage component(s)

PINPOINT TEST C: EXCESSIVE STEERING WHEEL PLAY

Test Step	Result / Action to Take
C1 CHECK THE STEERING COLUMN BEARING	
• Inspect the steering column mounting fasteners and bearing for looseness. • **Are the fasteners and bearing OK?**	**Yes** GO to C2 . **No** TIGHTEN the steering column mounting fasteners or INSTALL a new steering column. REFER to Section 211-04 .
C2 CHECK THE STEERING LINKAGE FOR LOOSENESS	
• Carry out the Steering Linkage	**Yes**

component test. Refer to Component Tests in this section. • **Is the steering linkage OK?**	REFER to Section 204-00 to diagnose the suspension components. **No** INSTALL new steering linkage components as necessary. REFER to Section 211-02 .

Pinpoint Test D: Steering System Drift/Pull/Wander

Normal Operation

When the steering wheel is turned, the steering shaft rotates in the steering column on bearings. This mechanical motion is then converted to hydraulic pressure that assists in the effort that it takes to steer the vehicle. The hydraulic pressure from the power steering pump to the power steering gear is then converted back to mechanical motion that will move the front wheels in the direction of the turn. The steering gear uses tie-rod ends to connect the front knuckles to one another. The knuckles then pivot on the ball joints in order to steer the vehicle.

Possible Causes

- Tire pressure
- Tire wear
- Wheel alignment
- Steering column
- Intermediate shaft
- Steering gear mount(s)
- Steering gear
- Suspension component(s)

PINPOINT TEST D: STEERING SYSTEM DRIFT/PULL/WANDER

Test Step	Result / Action to Take
D1 CHECK FOR TIRE PULL	
• Rotate the front wheel and tire assemblies side-to-side. Refer to Section 204-04 . • Carry out a road test on a smooth, flat road. • **Does the vehicle drift/pull?**	**Yes** If the vehicle pulls in the opposite direction, GO to D2 . If the vehicle pulls in original direction, GO to D3 . **No** The concern has been corrected.
D2 ROTATE THE WHEEL AND TIRE ASSEMBLIES FRONT TO REAR	
• Rotate the wheel and tire assemblies front to rear. Refer to Section 204-04 . • Carry out a road test on a smooth, flat road. • **Does the vehicle drift/pull?**	**Yes** GO to D3 . **No** The concern has been corrected.
D3 CHECK THE STEERING COLUMN INTERMEDIATE SHAFT	
NOTE: Be sure to keep the clockspring centered when disconnecting the intermediate shaft. Refer to Section 501-20B .	**Yes** GO to D4 .

• Check the steering column and intermediate shaft for grounding. • Disconnect the steering column intermediate shaft at the steering column. • Inspect the steering column intermediate shaft U-joints for looseness or wear. • **Are the steering column intermediate shaft U-joints OK?**	**No** INSTALL a new steering column intermediate shaft. REFER to Section 211-04 .
D4 CHECK THE STEERING GEAR MOUNTING	
• Check the steering gear mounts for looseness or wear. • **Are the steering gear mounts OK?**	**Yes** GO to D5 . **No** INSTALL new steering gear mount(s). REFER to Section 211-02 .
D5 CHECK THE STEERING GEAR	
• Carry out the Steering Gear Valve component test. Refer to Component Tests in this section. • **Is the steering gear valve OK?**	**Yes** GO to D6 . **No** REPAIR or INSTALL a new steering gear. REFER to Section 211-02 .
D6 CHECK THE SUSPENSION COMPONENTS	
• Check for loose or worn suspension components. REFER to Section 204-01A rear wheel drive (RWD), Section 204-01B four wheel drive (4WD) or Section 204-02 . • **Are the suspension components OK?**	**Yes** GO to D7 . **No** INSTALL new suspension component(s). REFER to Section 204-01A rear wheel drive (RWD), Section 204-01B four wheel drive (4WD) or Section 204-02 .
D7 CHECK THE WHEEL ALIGNMENT	
NOTE: The vehicle will tend to pull toward the side with the least positive caster and the most positive camber. • Using a suitable alignment system, measure the wheel alignment settings. Refer to Section 204-00 . • **Are the alignment settings within specifications?**	**Yes** CHECK for correct frame alignments. REFER to Section 501-02 . **No** ADJUST the alignment angles to specifications. DO NOT exceed the specifications. TEST the system for normal operation.

Component Tests

Steering Linkage

1. **NOTE:** Excessive vertical motion of the studs relative to the sockets may indicate excessive wear.

   With the vehicle on the ground and the parking brake applied, start the vehicle and carry out the following:
   - Have an assistant rotate the steering wheel back and forth 360 degrees and watch for the relative motion of the studs in the steering linkage ball sockets.
   - Watch for loose steering gear mounting.

2. As an additional check, with the key ON engine OFF (KOEO) and the front wheels raised off the ground, grasp the wheel at the front and rear and watch for excessive play or binding in the joints

while trying to steer the wheels.

3. Install new components if necessary. Tighten any worn, damaged or loose components.

Turning Effort Test

NOTE: Make sure the front wheels are correctly aligned and the tire pressure is correct before checking the steering effort.

1. Park the vehicle on dry concrete and set the parking brake.
2. Insert a thermometer into the power steering fluid reservoir.
3. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

   Idle the engine for 2 to 3 minutes. Turn the steering wheel from stop-to-stop several times to warm the fluid to 50-60°C (122-140°F).
4. With the engine running, attach the spring scale to the rim of the steering wheel.
5. Measure the pull required to turn the steering wheel one complete revolution in each direction. Refer to General Specifications, Steering Wheel Turning Effort in this section.

Pump Flow and Pressure Test

WARNING: Do not touch the flowmeter during the test procedure, or severe burns and serious injury can occur. Failure to follow these instructions may result in personal injury.

1. **CAUTION: Make sure the connection point will not interfere with any of the engine accessory drive components or drive belts.**

   Install the power steering analyzer at the high pressure port of the power steering pump. Make sure the power steering analyzer gate valve is fully open.
2. Place a dial thermometer in the power steering pump reservoir.
3. Check the power steering fluid level. If necessary, add the specified power steering fluid.
4. Install a digital tachometer.
5. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

   Start the engine. Set the parking brake. Place the transmission in NEUTRAL. Raise the power steering fluid temperature to 74-80°C (165-175°F) by rotating the steering wheel fully to the left and right several times.
6. With the steering wheel in the straight-ahead position, set the engine speed to 2,100 rpm. Record the flow rate and pressure readings.
   - If the flow rate is below the flow rate specification, continue with the test procedure.
   - If the pressure reading is above the maximum pressure specification, check the power steering hoses for kinks and restrictions.
7. Partially close the gate valve to obtain 5,171 kPa (750 psi). Set the engine speed at idle. Record

the flow rate.

- If the flow is less than the specified flow rate, install a new power steering pump.

8. **CAUTION: Do not allow the gate valve to remain closed for more than 5 seconds.**

   Completely close and partially open the gate valve 3 times. Record the pressure relief valve actuation pressure reading.

   - If the pressure does not meet the relief pressure specification, then install a new power steering pump.

9. Set engine speed to 2,100 rpm. Record the flow rate.
   - If the flow rate varies more than 3.785 liters/minute (1 gallon/minute) from the initial flow rate reading, install a new power steering pump.

10. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

    Set the engine speed at idle. Turn (or have an assistant turn) the steering wheel to the left and right stops. Record flow rate and pressure readings at the stops.

    - The pressure reading at both stops should be nearly the same as the maximum pump relief pressure.
    - The flow rate should drop below 1.9 liters/minute (0.5 gallons/minute).
    - If the pressure does not reach the maximum pump relief pressure or the flow rate does not drop below the specified value, excessive internal leakage is occurring. Install a new steering gear as necessary. Refer to Section 211-02 .

11. Turn (or have an assistant turn) the steering wheel slightly in both directions and release quickly while watching the pressure gauge.
    - The pressure reading should move from the normal back pressure reading and snap back as the steering wheel is released.
    - If the pressure returns slowly or sticks, the rotary valve in the steering gear is sticking or the steering column is binding. Check the steering column and linkages before repairing the steering gear.

Tie-Rod Articulation Torque

NOTE: This check may be done with the steering gear on or off the vehicle.

1. Disconnect the tie-rod end from the front wheel knuckle. Refer to Section 211-02 .

2. Move the front wheel knuckle tie rod back and forth 3 times.

3. Hook a spring scale over the tie rod, the tie-rod end or the threaded portion of the front wheel knuckle tie rod, and measure the force required to move the front wheel knuckle tie rod. Refer to General Specifications, Tie-Rod Articulation Torque in this section.

4. If the force required to move the front wheel knuckle tie rod does not meet the specifications, install a new front wheel knuckle tie rod. Refer to Section 211-02 .

Steering Gear Valve

1. With the vehicle in motion, place the transmission in NEUTRAL and turn the engine OFF.
   - If the vehicle does not pull with the engine OFF, repair or install a new steering gear. Refer to Section 211-02 .

2. If the vehicle pulls with the engine OFF, switch the right side front wheel to the left side of the

vehicle and the left side front wheel to the right side of the vehicle.

3. If the vehicle pulls to the opposite side, switch the front wheels with the rear wheels keeping them on the same side of the vehicle.

4. If the vehicle pull direction does not change, check the front suspension components, wheel alignment and frame alignment. Refer to Section 204-00 or an appropriate frame dimensions manual.

Power Steering System Flushing

Printable View (82 KB)

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

WARNING: Do not mix oil types. Any mixture or any unapproved oil can lead to seal deterioration and leaks. A leak can ultimately cause loss of fluid, which can result in a loss of power steering assist. Failure to follow these instructions may result in personal injury.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Disconnect the power steering fluid return hose from the reservoir.
   - Remove the clamp.
4. Plug the power steering fluid reservoir inlet port.
5. Attach an extension hose to the power steering return hose.
6. **NOTE:** Do not reuse the power steering fluid that has been flushed from the power steering system.

   Place the open end of the extension hose into a suitable container.
7. **CAUTION: Do not overfill the reservoir.**

   Fill the power steering fluid reservoir with new fluid.
8. **CAUTION: Do not allow the power steering pump to run completely dry of power steering fluid.**

   Start the engine while simultaneously turning the steering wheel to lock and then immediately turn the ignition switch to the OFF position.
9. **CAUTION: Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.**

   CAUTION: Do not overfill the reservoir.

   Fill the power steering fluid reservoir with the approved power steering fluid.

10. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.

11. Remove the extension hose from the power steering return hose.

12. Remove the plug from the power steering fluid reservoir inlet port.

13. Install the power steering return hose to the reservoir.
    - Install the clamp.

14. **NOTE:** It is necessary to correctly fill the power steering system to remove any trapped air and completely fill the power steering system components.

    If, after correctly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to purge the power steering system. For additional information, refer to Power Steering System Purging in this section.

    Fill the power steering system. For additional information, refer to Power Steering System Filling in this section.

Power Steering System Purging

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Special Tool(s)

ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure can result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

1. **NOTE:** A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

   Remove the power steering pump reservoir cap. Check the fluid.

2. Raise the front wheels off the floor. Refer to the appropriate section in Group 100 for the procedure.

3. Tightly insert the stopper of the vacuum pump into the reservoir.

4. Start the engine.

5. Install the vacuum pump, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).

6. If equipped with Hydro-Boost®, apply the brake pedal twice.

7. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

Cycle the steering wheel fully from stop-to-stop 10 times.

8. Stop the engine.

9. Release the vacuum and remove the vacuum pump.

10. **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir.
    - Use approved transmission fluid.

11. Start the engine.

12. Install the vacuum pump. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).

13. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

    Cycle the steering wheel fully from stop-to-stop 10 times.

14. Stop the engine, release the vacuum and remove the vacuum pump.

15. **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir as needed and install the reservoir cap.

16. Visually inspect the power steering system for leaks.

17. **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir as needed and visually inspect the power steering system for leaks.

18. Install the reservoir cap.

Power Steering System Filling

Printable View (98 KB)

Special Tool(s)

ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent
ST2826-A	Fill Adapter Manifold, Power Steering 211-327 or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

1. **CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure can result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

   Remove the power steering pump reservoir cap.

2. Tightly install the evacuation cap to the power steering pump reservoir.

3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir.

4. Install the vacuum pump to the fill adapter manifold control valve.

5. Install the hose to the opposite fill adapter manifold control valve and submerge the open end of the hose into a container of new power steering fluid.

6. **NOTE:** The fill adapter manifold control valves are in the open position when the point of the handles face the center of the fill adapter manifold.

Close the fill adapter manifold control valve connected to the power steering fluid container.

7. Open the fill adapter manifold control valve connected to the vacuum pump.

8. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

9. Observe the vacuum gauge for 30 seconds.

10. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), correct any leaks in the power steering system or the filling tools before proceeding.

11. **NOTE:** The vacuum pump gauge reading will drop slightly during this step.

    Slowly open the fill adapter manifold control valve connected to the power steering fluid container until power steering fluid completely fills the hose.

12. Close the fill adapter manifold control valve connected to the power steering fluid container.

13. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

14. Close the fill adapter manifold control valve connected to the vacuum pump.

15. Slowly open the fill adapter manifold control valve connected to the power steering fluid container.

16. When the power steering fluid has drained from the hose connected to the power steering fluid container, close the fill adapter manifold control valve connected to the power steering fluid container.

17. Remove the tools from the vehicle.

18. Install the power steering reservoir cap.

19. **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

    NOTE: There will be a slight drop in the power steering fluid level in the power steering fluid reservoir when the engine is started.

    Start the engine and turn the steering wheel from stop-to-stop.

20. If equipped with Hydro-Boost®, apply the brake pedal twice.

21. Turn the ignition switch to the OFF position.

22. **CAUTION: Do not overfill the reservoir.**

    Remove the power steering reservoir cap and fill the reservoir.

23. Install the power steering reservoir cap.

Printable View (81 KB)

General Specifications

Item	Specification
Lubricants	
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Cooling fan shroud bolts	3	—	27
Engine appearance cover bolts	5	—	44
Inner tie rod	120	89	—
Oil drip shield bolts	11	8	—
Power steering fluid reservoir bolt	6	—	53
Power steering pressure line bracket-to-engine nut	40	30	—
Power steering pressure line bracket-to-crossmember bolt	6	—	53
Power steering pressure line-to-power steering pump fitting	65	48	—
Power steering pump bolts	25	18	—
Steering column shaft-to-steering gear bolt	30	22	—
Steering line clamp plate bolt	23	17	—
Steering gear turn tube line clamp plate bolt	11	8	—
Steering gear turn tube fitting-to-steering gear	29	21	—
Steering gear-to-crossmember bolts	440	325	—
Tie-rod end nut	115	85	—
Tie-rod end jam nut	103	76	—

Power Steering

Printable View (64 KB)

The power steering system consists of the following:

- Power steering pump
- Power steering fluid reservoir
- Rack-and-pinion steering gear
- Power steering fluid cooler (part of A/C condenser)
- Power steering pressure and return lines/hoses

Power Steering Pump

The CIII power steering pump has the following features:

- It is a belt-driven, vane-type, power steering pump.
- It is mounted directly to the engine by 3 bolts.
- The power steering pump is replaced as an assembly.
- The identification tag attached to the power steering pump indicates the model number and bar code. Refer to the identification tags when installing a new pump.

Power Steering Gear

The steering gear has the following features:

- Torsion-bar type hydraulic assisted system
- Reduces road shock and vibration
- Includes a rotary-style hydraulic valve
- Serviceable turn tubes and seals

Steering Gear Identification

The steering gear has a bar code label on the bottom LH side of the housing. The label includes the part number as well as a manufacturing code. The code is also stamped into the housing on the web between the RH and LH mounts.

- 21306A0203

The code is interpreted as follows:

- 213 — Julian Date (August1)
- 06 — Year
- A0203 — Serial Number

Power Steering

Printable View (62 KB)

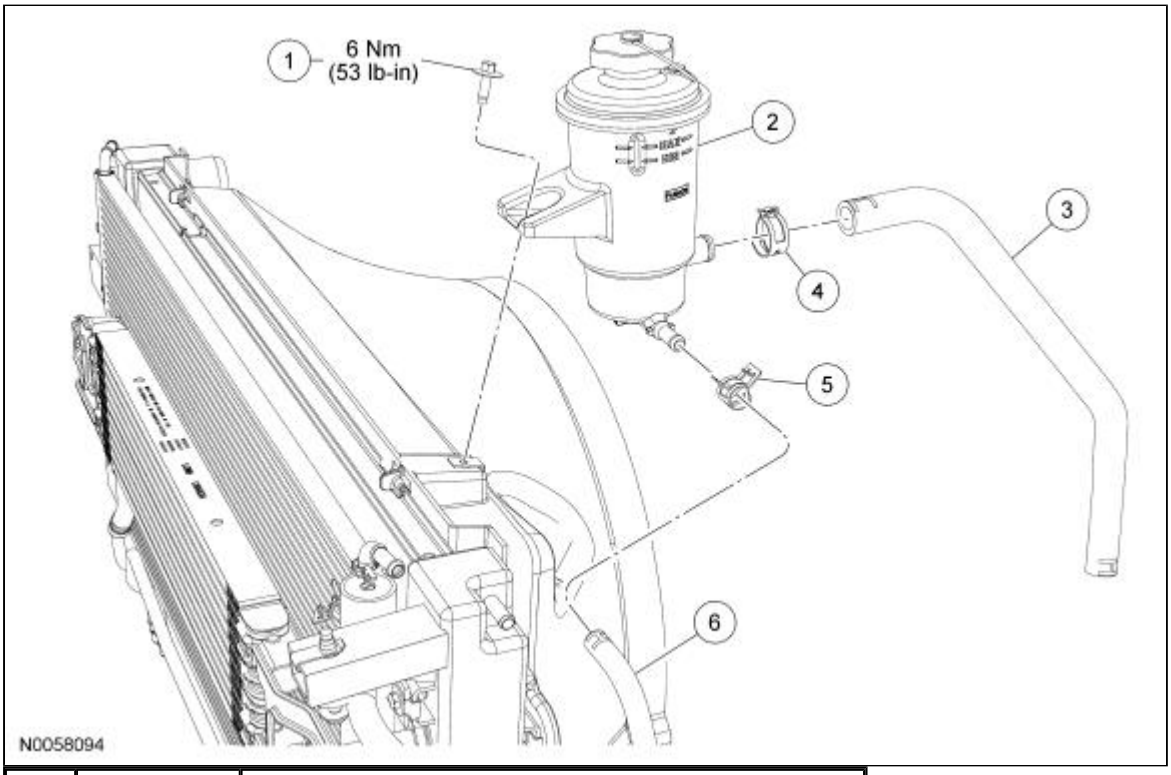
Refer to Section 211-00 .

Power Steering Fluid Reservoir

Printable View (238 KB)

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

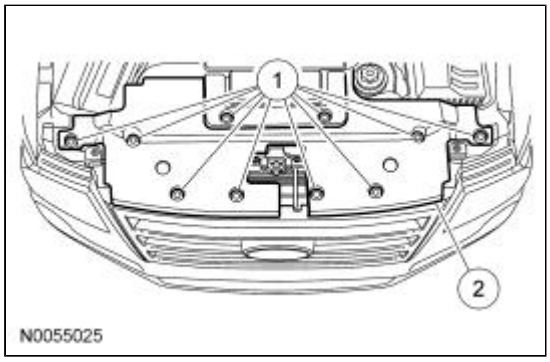


Item	Part Number	Description
1	W503924	Power steering fluid reservoir bolt
2	3A697	Power steering fluid reservoir
3	3691	Power steering fluid reservoir-to-pump supply hose
4	W525923	Clamp
5	W525960	Clamp
6	3D746	Power steering fluid cooler-to-power steering fluid reservoir hose

Removal and Installation

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

1. Remove the upper air deflector
    1. Remove the 10 upper air deflector pushpin-type retainers.
    2. Remove the air deflector.



2. Remove the air cleaner element. For additional information, refer to Section 303-12 .

3. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.

4. Release the clamp and disconnect the power steering return hose from the power steering fluid reservoir.

5. Release the clamp and disconnect the power steering pump supply hose from the power steering fluid reservoir.

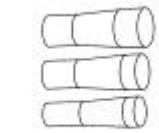
6. Remove the power steering fluid reservoir bolt and reservoir.
    - To install, tighten to 6 Nm (53 lb-in).

7. To install, reverse the removal procedure.
    - Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Pump

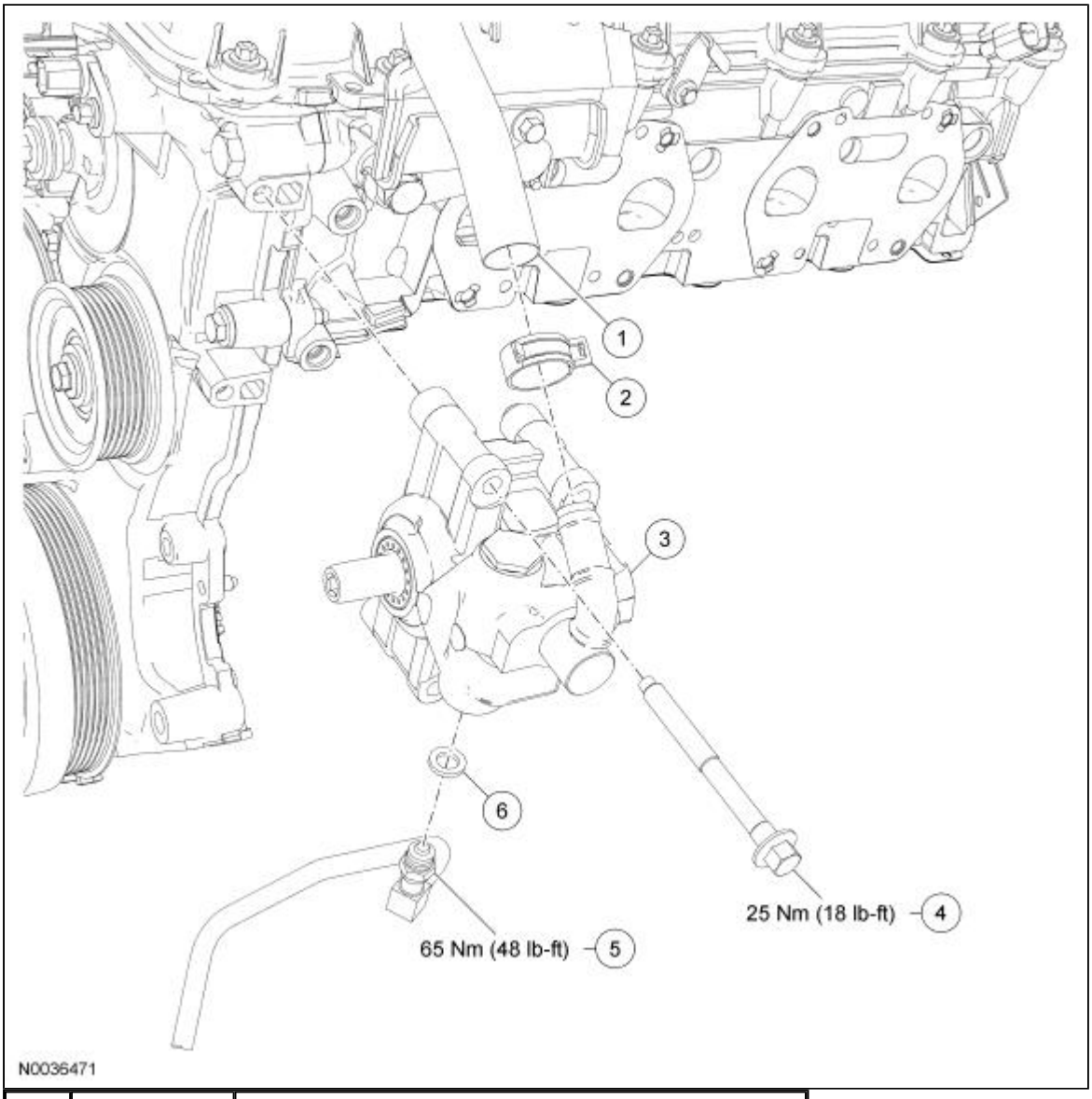
Printable View (296 KB)

Special Tool(s)

 ST1444-A	Installer Set, Teflon® Seal 211-D207 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®



Item	Part Number	Description
1	3E525	Power steering fluid reservoir-to-pump supply hose
2	W525923	Clamp
3	3A674	Power steering pump
4	W707225	Power steering pump bolt (3 required)
5	—	Power steering pressure line fitting (part of 3A719)
6	3E552	Power steering pressure line Teflon® O-ring seal

Removal and Installation

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

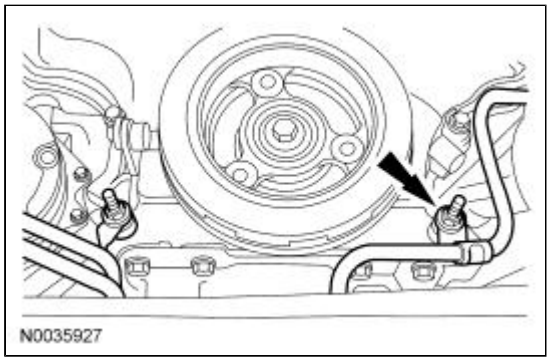
NOTE: A new Teflon® O-ring seal must be installed any time the line is disconnected from the power steering pump.

1. Remove the power steering pump pulley. For additional information, refer to Power Steering

Pump Pulley in this section.

2. Release the clamp and disconnect the supply hose from power steering pump.

3. Remove the power steering pressure line bracket-to-engine nut.
   - To install, tighten to 40 Nm (30 lb-ft).



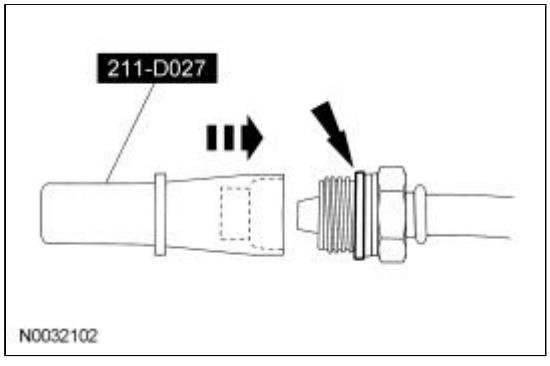
4. **NOTE:** A new Teflon® O-ring seal must be installed any time the line is disconnected from the power steering pump.

   Disconnect the power steering pressure line-to-power steering pump fitting.
   - Discard the Teflon® O-ring seal.
   - To install, tighten to 65 Nm (48 lb-ft).

5. Remove the 3 bolts and the power steering pump.
   - To install, tighten to 25 Nm (18 lb-ft).

6. **NOTE:** A new Teflon® O-ring seal must be installed any time the line is disconnected from the power steering pump.

   To install, reverse the removal procedure.
   - Using the special tool, install a new Teflon® O-ring on the pressure line-to-pump fitting.



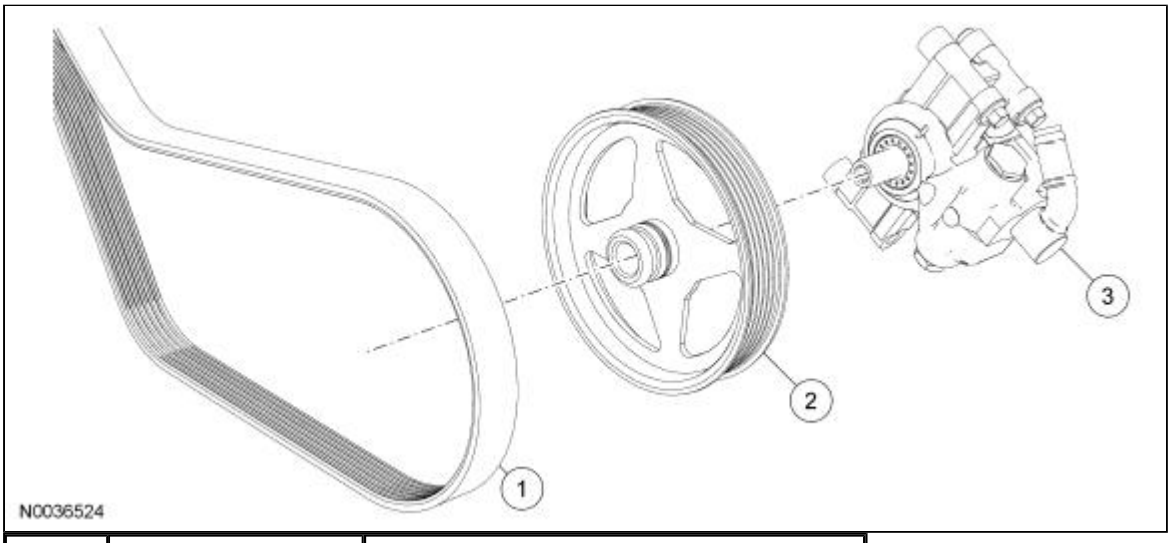
7. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Pump Pulley

Printable View (359 KB)

Special Tool(s)

ST1290-A	Remover, Power Steering Pump Pulley 211-016 (T69L-10300-B)
ST1586-A	Installer, Power Steering Pump Pulley 211-185 (T91P-3A733-A)

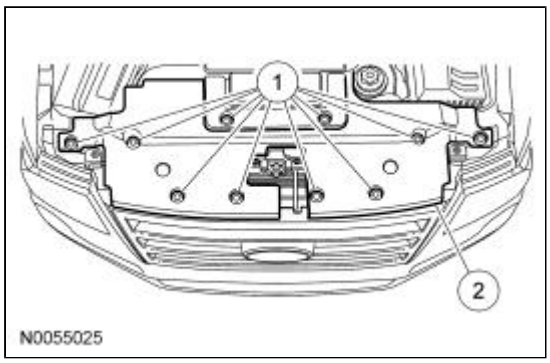


Item	Part Number	Description
1	8620	Accessory drive belt
2	3A733	Power steering pump pulley
3	3A674	Power steering pump

Removal

1. With the vehicle in NEUTRAL , position it on a hoist. For additional information, refer to Section 100-02 .

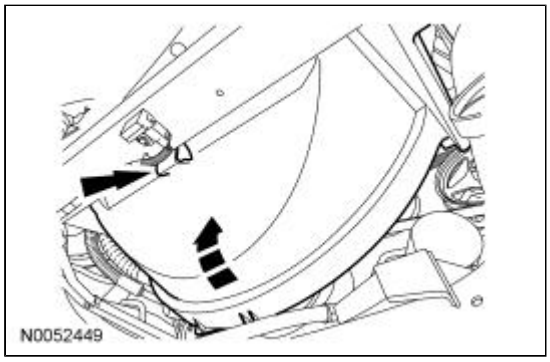
2. Remove the upper air deflector
   1. Remove the 10 upper air deflector pushpin-type retainers.
   2. Remove the air deflector.



3. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

4. Remove the 2 upper cooling fan shroud bolts.

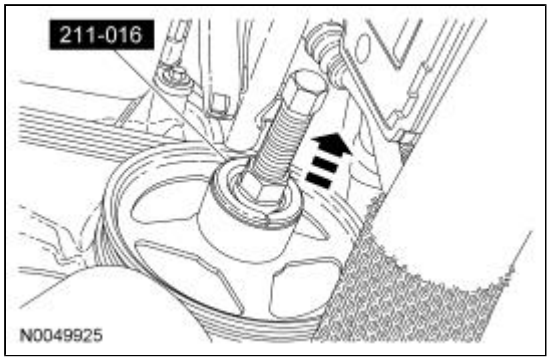
5. Release the lower cooling fan shroud tab and rotate the shroud upwards.



6. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the power steering pump pulley.

7. Position the cooling fan shroud assembly upward to gain clearance to install the special tool.

8. Using the special tool, remove the power steering pump pulley.

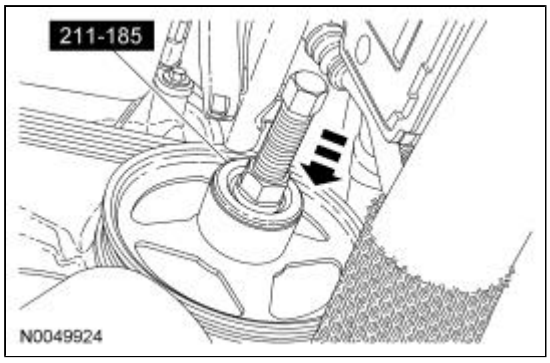


Installation

1. **CAUTION: If the pulley has been removed and installed twice, install a new power steering pump pulley.**

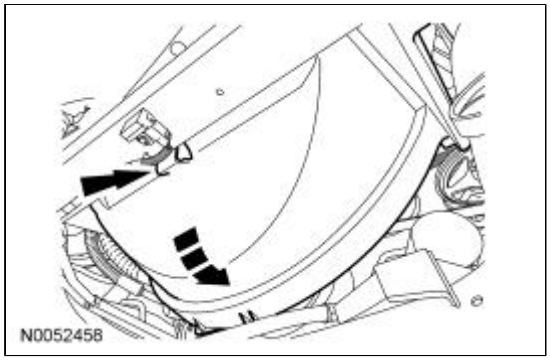
   CAUTION: Inspect the pulley for paint marks in the web area near the hub. If there are 2 paint marks, install a new pulley. If there is 1 paint mark or none at all, use a paint pencil to mark the web area of the pulley near the hub.

Using the special tool, install the power steering pump pulley.



2. Rotate the accessory drive belt tensioner clockwise and install the accessory drive belt to the power steering pump pulley. For additional information on accessory drive belt routing, refer to Section 303-05 .

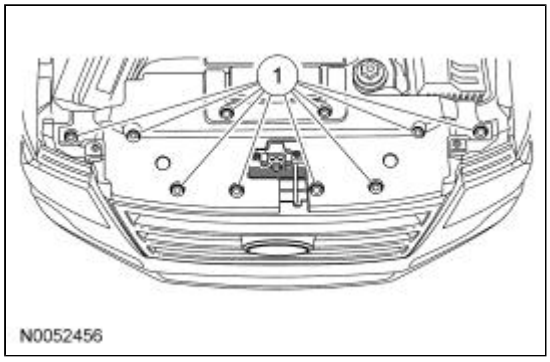
3. Lower the cooling fan shroud assembly.
   - Release the lower cooling fan shroud tab, rotate shroud downward.



4. Install the 2 upper cooling fan shroud bolts.
   - Tighten to 3 Nm (27 lb-in).

5. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

6. Install the upper air deflector and the 10 pushpin-type retainers.

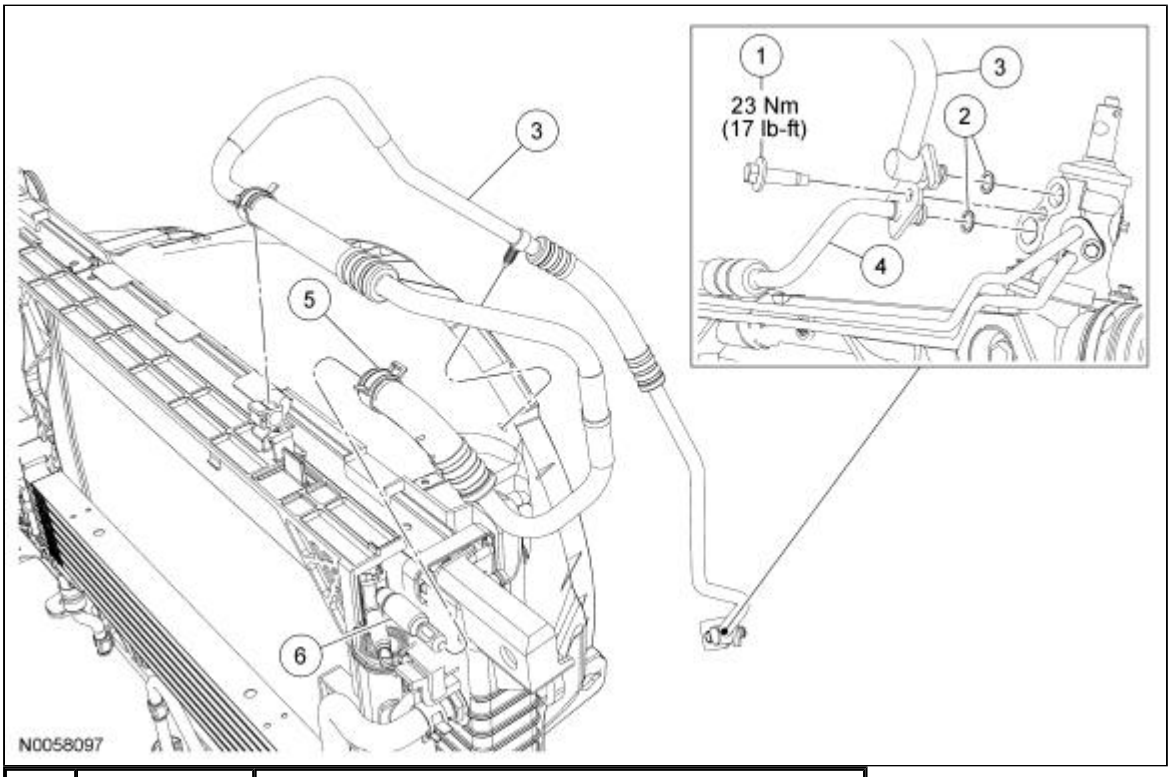


Steering Gear to Fluid Cooler Return Hose

Printable View (295 KB)

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®



Item	Part Number	Description
1	W707622	Power steering line clamp plate bolt
2	3F886/ 3F886	O-ring seals (2 required)
3	W525923	Power steering gear-to-fluid cooler return hose
4	3A719	Power pressure steering pump line
5	W525923	Power steering gear-to-fluid cooler return hose clamp

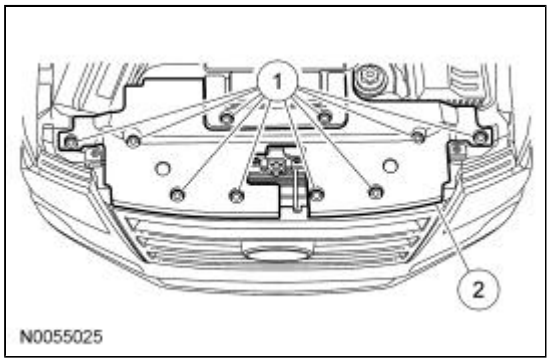
Removal and Installation

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

NOTE: New O-ring seals must be installed any time the lines are disconnected from the steering gear.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the upper air deflector.
    1. Remove the 10 upper air deflector pushpin-type retainers.
    2. Remove the air deflector.

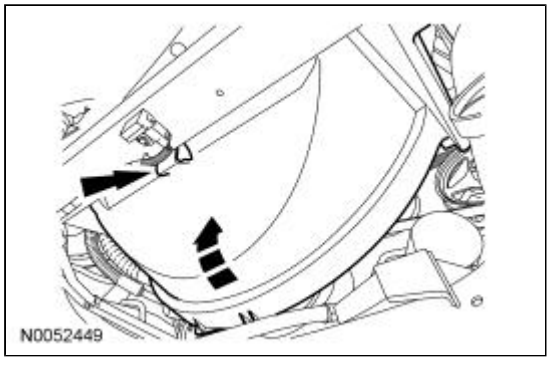


3. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

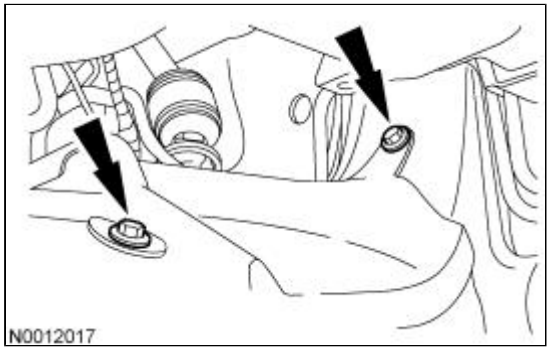
4. Release the clamp and disconnect the power steering return hose from the power steering fluid cooler.

5. Release the power steering return hose from the cooling fan shroud clips.

6. Release the lower cooling fan shroud tab and rotate the shroud upward.



7. Remove the 2 bolts and the oil drip shield.
    - To install, tighten to 11 Nm (8 lb-ft).



8. **NOTE:** New O-ring seals must be installed any time the lines are disconnected from the steering gear.

    Remove the power steering line clamp plate bolt, rotate the clamp plate and disconnect the power

steering return line from the power steering gear.

- To install, tighten to 23 Nm (17 lb-ft).
- Discard the steering line O-ring seals.

9. **NOTE:** New O-ring seals must be installed any time the lines are disconnected from the steering gear.

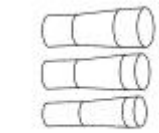
   To install, reverse the removal procedure.

   - Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Pump to Steering Gear Pressure Line

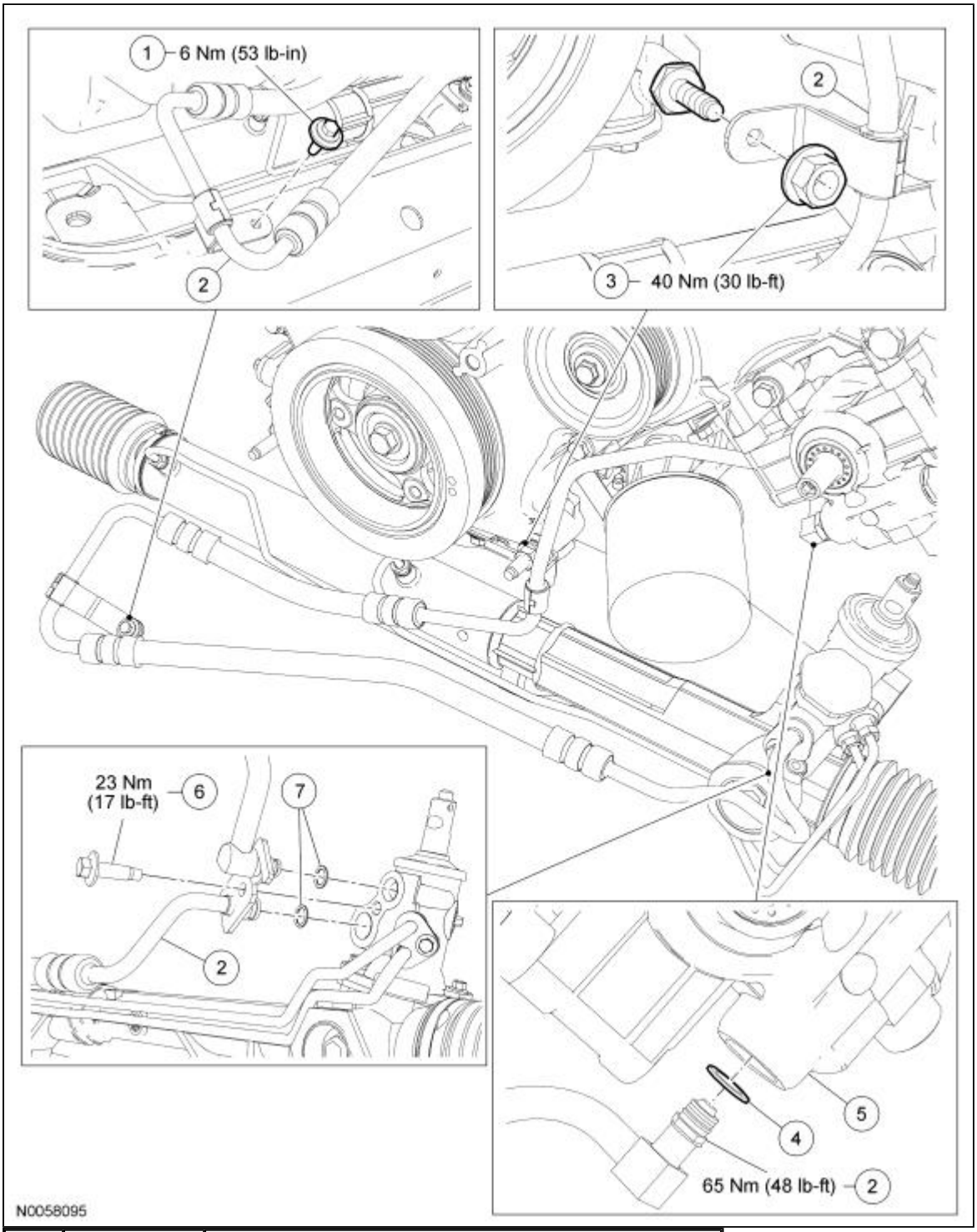
Printable View (428 KB)

Special Tool(s)

 ST1444-A	Installer Set, Teflon® Seal 211-D207 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®



Item	Part Number	Description
1	W701834	Power steering pressure line bracket-to-crossmember bolt
2	3A719	Power steering pressure lines
3	N621939	Power steering pressure line bracket-to-engine nut
4	3E552	Power steering pressure line Teflon® O-ring seal
5	3A674	Power steering pump
6	W704331	Power steering line clamp plate bolt
7	3F886	O-ring seals (2 required)

Removal and Installation

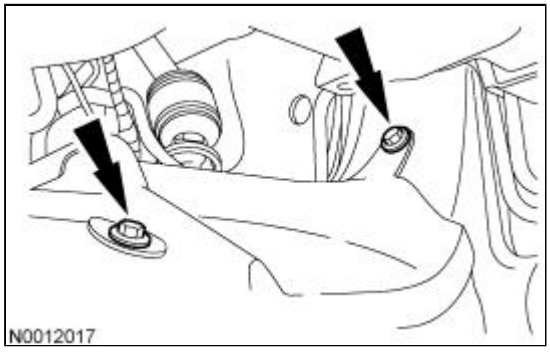
CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

NOTE: New O-ring seals must be installed any time the lines are disconnected from the steering gear.

NOTE: A new Teflon® O-ring seal must be installed any time the power steering line is disconnected from the power steering pump.

1. Remove the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley in this section.

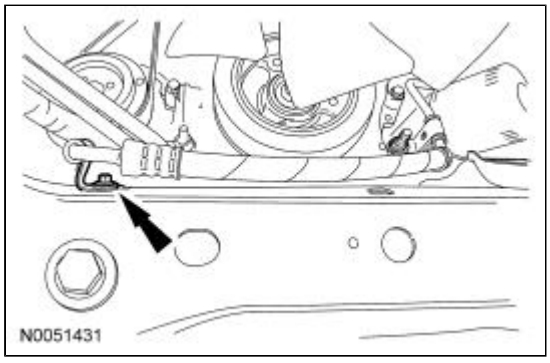
2. Remove the 2 bolts and the oil drip shield.
   - To install, tighten to 11 Nm (8 lb-ft).



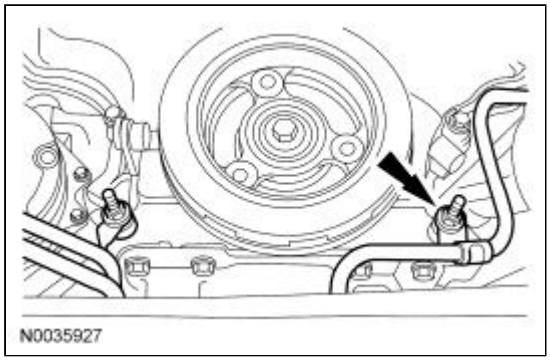
3. **NOTE:** A new Teflon® O-ring seal must be installed any time the power steering line is disconnected from the power steering pump.

   Disconnect the power steering pressure line-to-power steering pump fitting.
   - Discard the Teflon® O-ring seal.
   - To install, tighten to 65 Nm (48 lb-ft).

4. Remove the power steering pressure line bracket-to-crossmember bolt.
   - To install, tighten to 6 Nm (53 lb-in).



5. Remove the power steering pressure line bracket-to-engine nut.
   - To install, tighten to 40 Nm (30 lb-ft).



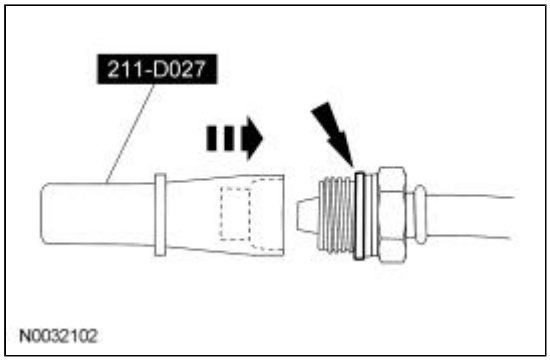
6. **NOTE:** A new O-ring seal must be installed any time the power steering line is disconnected from the power steering gear.

   Remove the power steering line clamp plate bolt, rotate the clamp plate and disconnect the power steering line.
   - Discard the O-ring seals.
     - To install, tighten to 23 Nm (17 lb-ft).

7. **NOTE:** A new O-ring seal must be installed any time the power steering line is disconnected from the power steering gear.

   NOTE: A new Teflon® O-ring seal must be installed any time the power steering line is disconnected from the power steering pump.

   To install, reverse the removal procedure.
   - Using the special tool, install a new Teflon® O-ring on the pressure line-to-pump fitting and pressure line-to-steering gear.



8. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Fluid Cooler

Printable View (62 KB)

1. The power steering fluid cooler is integral to the A/C condenser core. For additional information, refer to Section 412-01 .

Steering Gear

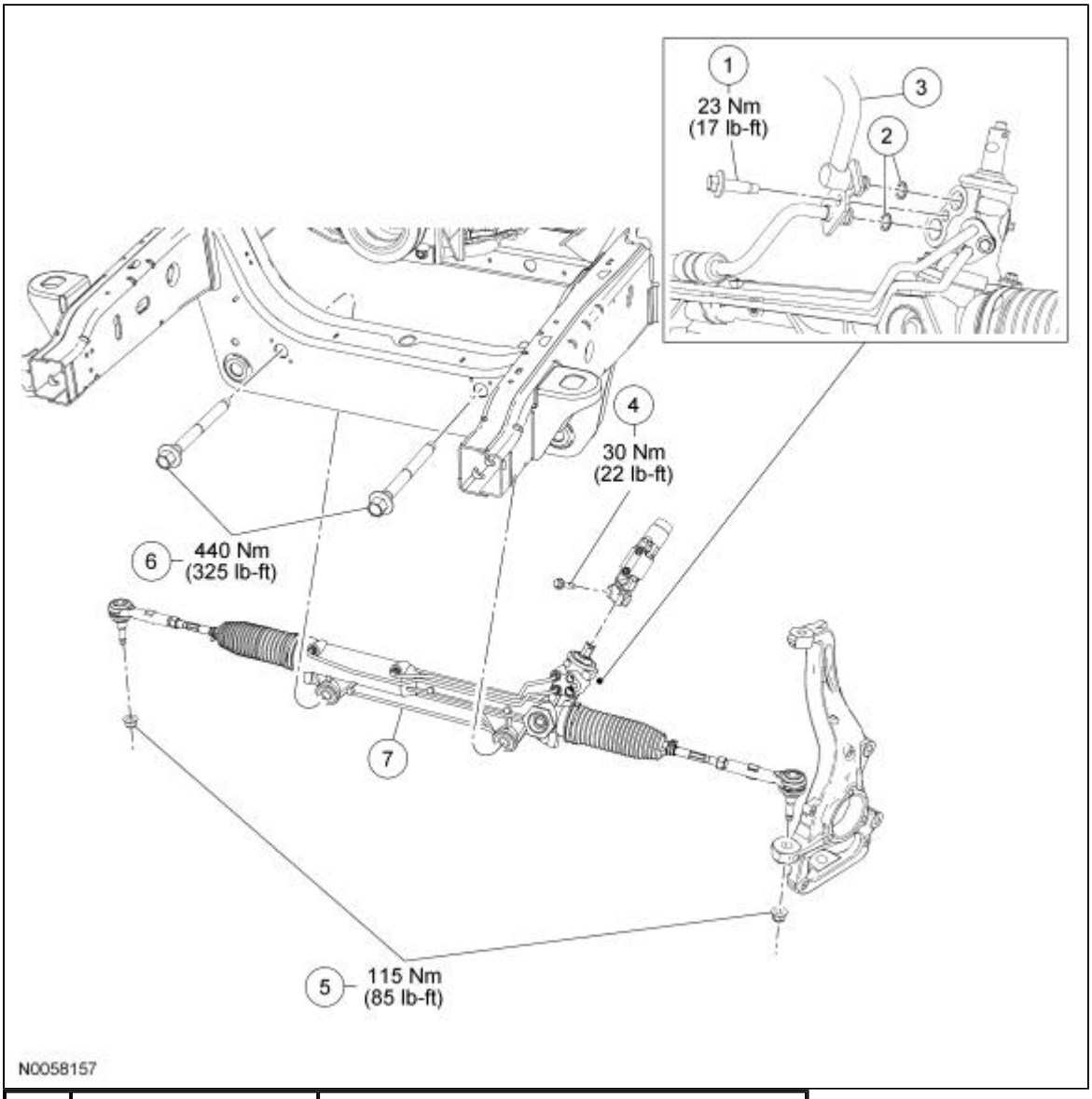
Printable View (421 KB)

Special Tool(s)

ST2945-A	Seperator, Ball Joint Tool 204-592

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®



Item	Part Number	Description
1	W707622	Power steering line clamp plate bolt
2	3F886-AA/ 3F886-BB	Power steering line O-ring seals (2 required)
3	3D746	Power steering return line
4	N808684	Steering column shaft-to-steering gear bolt
5	W520215	Outer tie-rod end nuts (2 required)
6	W711590	Steering gear bolts (2 required)
7	3504	Steering gear

Removal and Installation

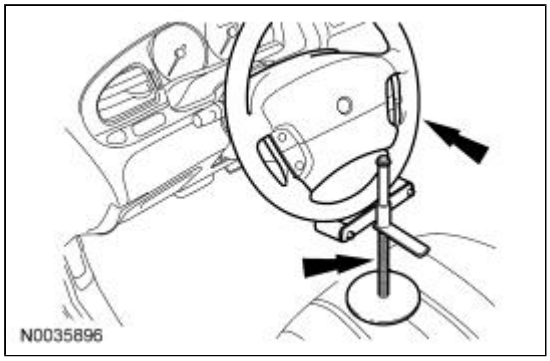
CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

NOTE: New O-ring seals must be installed any time the lines are disconnected from the steering gear.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **CAUTION: Do not allow the steering column shaft to rotate while disconnected from the gear or damage to the clockspring can occur. if there is evidence that the steering column shaft has rotated, the clockspring must be recentered. For additional information, refer to Section 501-20B .**

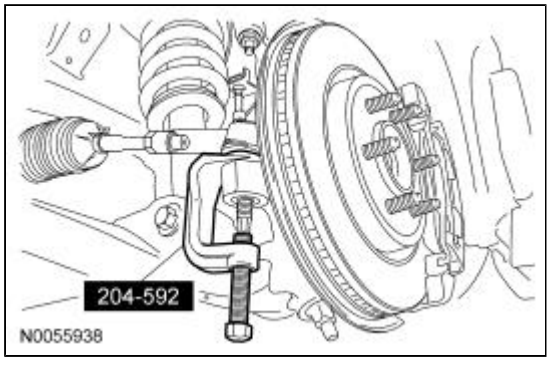
   Hold the steering wheel in the straight ahead position using a suitable holding device.



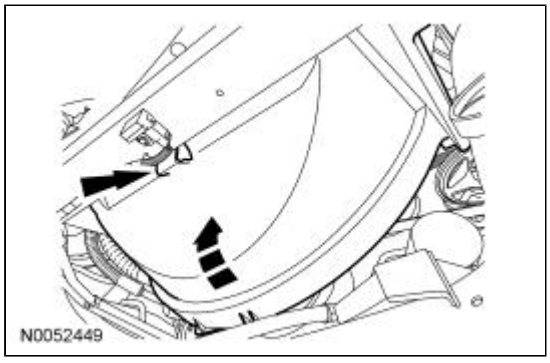
3. Remove and discard the tie-rod end nuts.

4. **CAUTION: Do not damage the tie-rod boot when installing the special tool.**

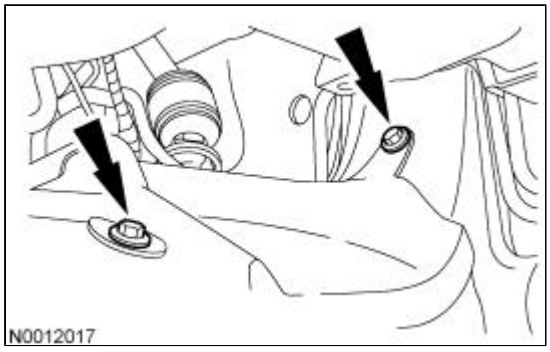
   Using the special tool, disconnect the tie-rod ends from the wheel knuckles.



5. Release the lower cooling fan shroud tab and rotate the shroud upward.



6. Remove the 2 bolts and the oil drip shield.



7. **CAUTION: Do not allow the steering column shaft to rotate while it is disconnected from the steering gear or damage to the clockspring can result. If there is evidence that the steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Remove the steering column shaft-to-steering gear bolt and disconnect the steering column shaft from the steering gear.

8. **CAUTION: New O-ring seals must be installed any time the lines are disconnected from the steering gear.**

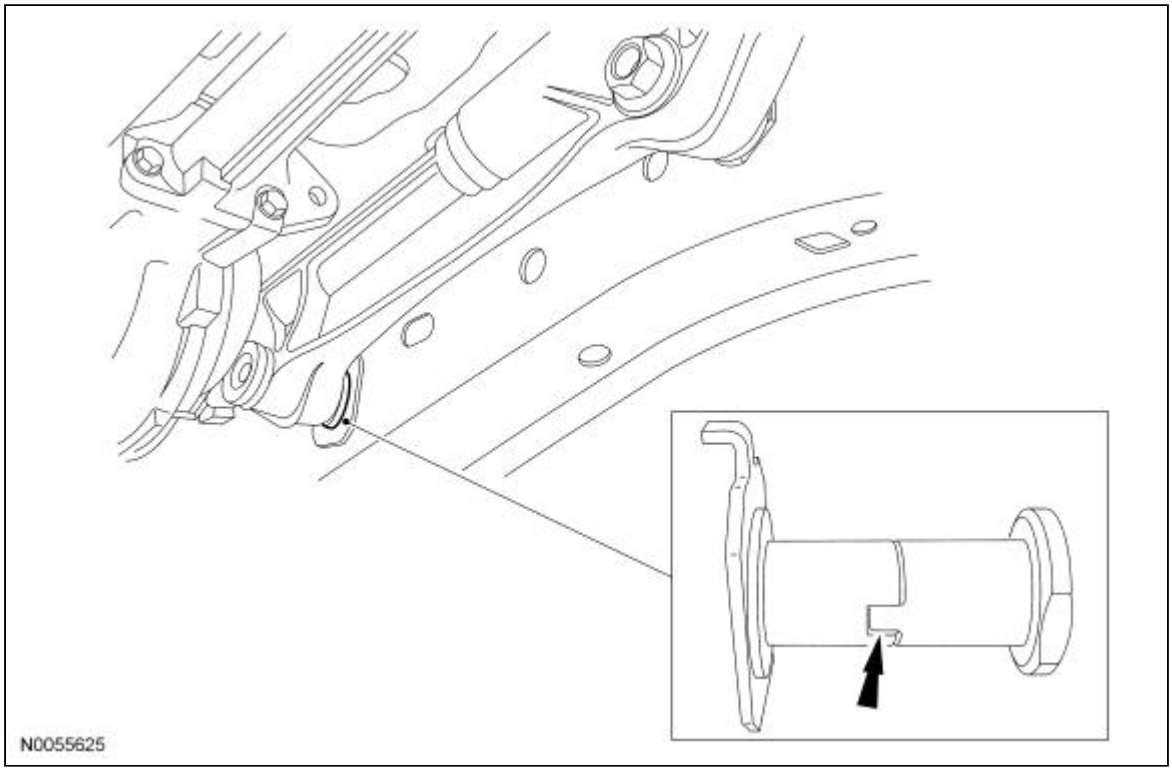
   Remove the steering line clamp plate bolt, rotate the clamp plate and disconnect the power steering lines.
   - Discard the O-rings seals.

9. Remove the 2 steering gear bolts and remove the steering gear.
   - Discard the bolts.

Installation

1. **CAUTION: Make sure the LH steering gear bushing is seated correctly or premature failure of the steering gear can occur. The RH side bushing does not have locking tabs.**

   Position the steering gear and install the 2 steering gear bolts.
   - Tighten to 440 Nm (325 lb-ft).

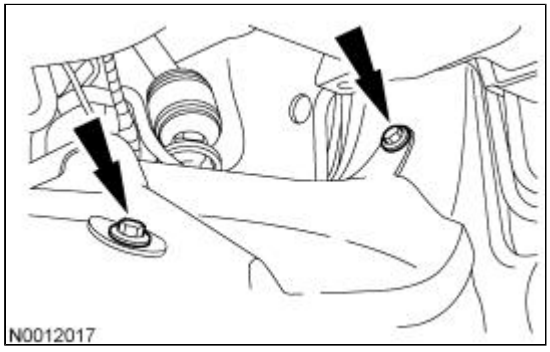


2. Connect the steering column shaft and install the bolt.
    - Tighten to 30 Nm (22 lb-ft).

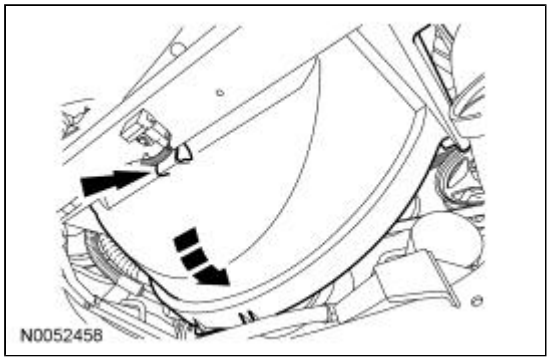
3. **NOTE:** New O-ring seals must be installed any time the line is disconnected from the power steering gear.

   Connect the steering lines, rotate the clamp plate and install the clamp plate bolt.
    - Tighten to 23 Nm (17 lb-ft).

4. Install the oil drip shield and the 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).

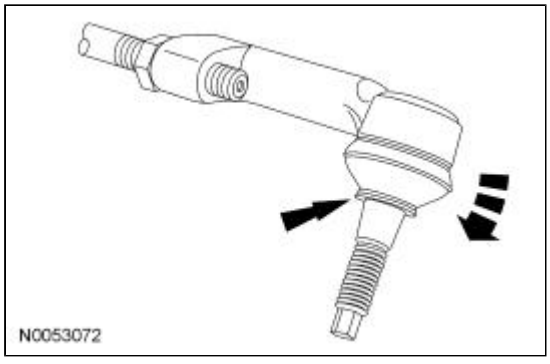


5. Release the lower cooling fan shroud tab and rotate the shroud downward.



6. **CAUTION: Make sure that the tie-rod end boots are seated correctly on the tie-rod ends or premature failure can occur.**

   Connect the tie-rod ends to the wheel knuckles and install the nuts.
   - Tighten to 115 Nm (85 lb-ft).



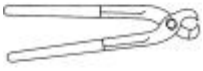
7. Fill the power steering system. For additional information, refer to Section 211-00 .

8. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Inner Tie Rod

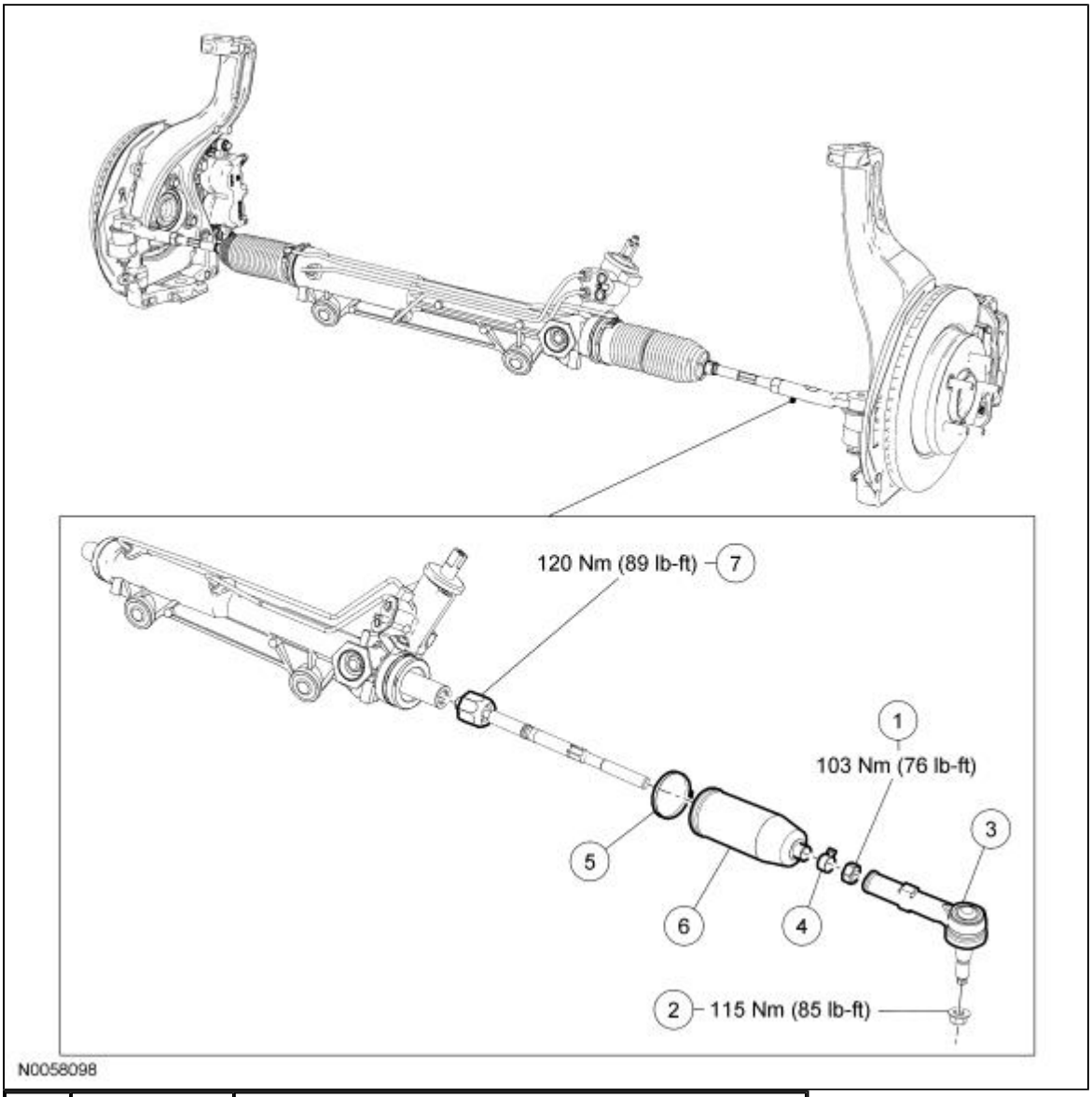
Printable View (306 KB)

Special Tool(s)

ST2945-A	Separator Ball Joint Tool 204-592
ST1427-A	Inner Tie-Rod Socket Tool 211-D029 or equivalent
 ST1525-A	Boot Clamp Pliers 205-D067 (D87P-1098-A) or equivalent

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	W711590	Outer tie-rod end jam nut (part of 3280) (2 required)
2	W520215	Outer tie-rod end nut (2 required)
3	3A130	Outer tie-rod end (2 required)
4	3C650A	Outer bellows boot clamp (2 required)
5	3C650B	Inner bellows boot clamp (2 required)
6	3K661	Steering gear bellows boot (2 required)
7	3280	Inner tie rod (2 required)

Removal

CAUTION: The steering gear bellows boots and clamps are designed to provide an airtight seal and protect the internal components of the steering gear. If the seal is not airtight, the vacuum generated during turning will draw water and contamination into the gear, causing premature damage.

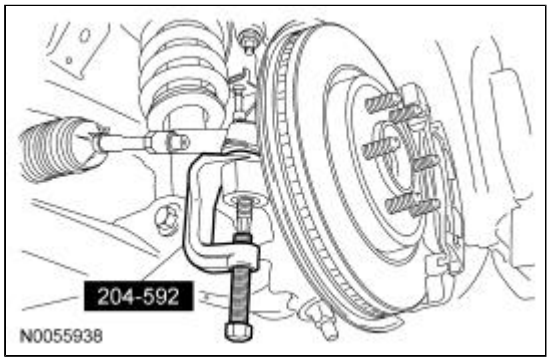
CAUTION: Zip ties do not produce an airtight seal and must not be used.

CAUTION: The inner tie-rod ball joint grease is not compatible with water. Contamination trapped in the grease will degrade the life of the joint.

CAUTION: If present, the orientation of the vent tube must be noted so the boots and vent tubes can be installed in the correct location.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Loosen the tie-rod end jam nut.
3. Remove and discard the tie-rod end nut.
4. **CAUTION: Careful not to damage the tie-rod boot when installing the special tool.**

   Using the special tool, disconnect the tie-rod end from the wheel knuckle.



5. **NOTE:** Count the number of turns required to remove the tie-rod end for reference during installation.

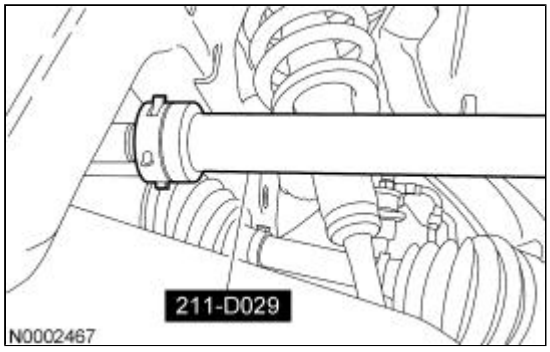
   Remove the tie-rod end.
6. Remove the tie-rod end jam nut.
7. **NOTE:** New bellows boot clamps must be installed.

   Remove and discard the inner and outer bellows boot clamp.
8. Remove the steering gear bellows boot.
9. **CAUTION: Place the steering gear at the center position. Use a 1-1/16 inch crowfoot on the flat of the rack gear to resist rotation and to prevent damage during removal and installation of the inner tie rod.**

   NOTE: If repairing the RH side, it will be necessary to pull back the LH inner tie-rod boot to hold the steering gear.

   NOTE: An assistant may be needed for removal of the RH inner tie rod.

   Using the special tool, remove the inner tie rod.

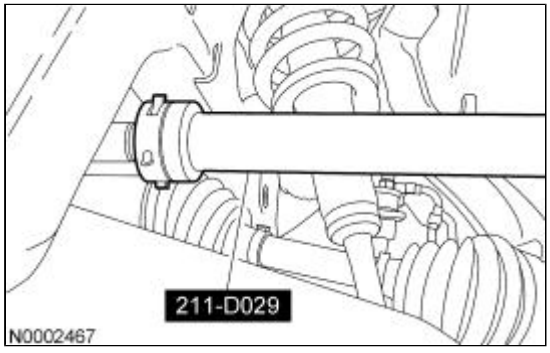


10. **CAUTION: Thoroughly remove any abrasive material. This material is extremely harmful to the steering gear.**

    Thoroughly clean and inspect all the parts to be reused. Install new parts as necessary.

Installation

1. Using the special tool, install the inner tie rod.
   - Tighten to 120 Nm (89 lb-ft).

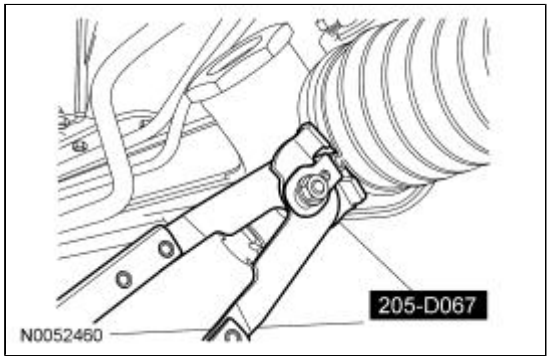


2. **NOTE:** Apply steering gear grease to the steering gear bellows boot groove in the inner tie rod.

   NOTE: Make sure the steering gear bellows boot is positioned correctly over the steering gear housing bead and the groove in the inner tie rod.

   Install the steering gear bellows boot.

3. Using the special tool, install a new inner bellows boot clamp.



4. **NOTE:** Make sure the end of the steering gear bellows is positioned between the 2 grooves on the inner tie rod or an internal leak can result.

Install a new outer bellows boot clamp.

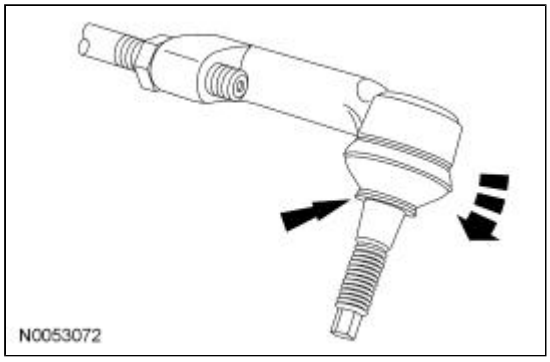
5. Thread the tie-rod end jam nut onto the inner tie rod.

6. **NOTE:** Install the tie-rod end the same number of turns as recorded during the removal.

   Install the tie-rod end to the inner tie rod.

7. **CAUTION: Make sure that the tie-rod end boots are seated correctly on the tie-rod ends or premature failure can occur.**

   Connect the tie-rod end to the wheel knuckle and install a new tie-rod end nut.
   - Tighten to 115 Nm (85 lb-ft).



8. Tighten the tie-rod end jam nut.
   - Tighten to 103 Nm (76 lb-ft).

9. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Printable View (81 KB)

General Specifications

Item	Specification
Lubricants	
Premium Long-Life Grease XG-1C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Clockspring bracket-to-steering column screws	6	—	53
Driver air bag module bolts	9	—	80
Hood release handle bolt	9	—	80
Shift cable bracket bolts	21	15	—
Steering column reinforcement cover bolts	9	—	80
Steering column shaft dash seal bolts	12	9	—
Steering column shaft-to-steering column bolt	30	22	—
Steering column shaft-to-steering gear bolt	30	22	—
Steering column shroud screws	2	—	18
Steering column support bracket-to-instrument panel nuts	30	22	—
Steering wheel bolt	40	30	—
Tilt lever screw	6	—	53
Upper steering column shaft-to-lower steering column shaft bolt	48	35	—

Steering Column

Printable View (63 KB)

For shift interlock service information, refer to Section 307-05 .

For ignition lock cylinder service information, refer to Section 501-14 .

For steering column switch service information, refer to Section 211-05 .

For steering wheel rotation sensor service information, refer to Section 206-09 .

Steering Column

Printable View (188 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B

Principles of Operation

Steering Column

The steering column is the mechanical linkage between the steering wheel and the steering gear. It houses the steering column switches and is able to tilt to various positions for driver preference. The steering wheel is bolted to the steering column shaft that runs down the center of the steering column. The steering column shaft goes through the dash panel and connects to the steering gear. The steering column shaft connections are made by U-joint type couplings. The steering column shaft is centered by roller ball bearings, which are contained within the steering column. The power tilt steering column is controlled by an electrical motor that is activated by a rocker-type switch located on the LH side of the steering column just below the multi-function switch. When the power tilt switch is pressed, it allows the steering column to adjust up or down. The switch is not serviceable, if a new switch is needed then a new steering column lower shroud must be installed. The power tilt motor is not serviceable, if a new motor is needed then a new steering column must be installed. The other steering column switches (multi-function and ignition) are mounted to the steering column. These switches are covered by the upper and lower steering column shrouds and can be accessed by removing the shrouds.

Programming Power Tilt Steering Column Positions

A power tilt steering column position can be stored at any time.

Programming power tilt steering column positions can be accomplished by doing the following:

- To store the power tilt steering column position to memory, the driver must move the steering column to the preferred position using the power tilt switch. The driver must then depress the memory SET switch. Within 5 seconds, the driver must select a memory position. Memory No. 1 is selected by depressing the 1 switch. Memory No. 2 is selected by depressing the 2 switch.

- If no memory switch input is received within the 5 second time limit, the operation is aborted. If one of the following inputs is received during the 5 second programming limit, the operation is also aborted:
  - Power tilt switch
  - Adjustable pedal switch
  - Power driver seat switch
  - Power outside rearview mirrors switch
  - Memory SET switch

To program the remote keyless entry (RKE) transmitter, refer to Section 501-14 .

Recalling a Power Tilt Steering Column Position

Once the driver has stored a preferred power tilt steering column position, the driver can recall the setting by depressing the corresponding memory switch or by using a programmed remote transmitter. Recalling a stored power tilt steering column position can be accomplished by doing the following:

- The driver can recall a preferred power tilt steering column position by depressing one or both of the memory recall switches. Pressing memory switch 1 will initiate a recall of the power tilt steering column position stored in memory No. 1. Pressing memory switch 2 will initiate a recall of the power tilt steering column position stored in memory No. 2.
- A remote transmitter can be used to recall previously set memory positions. The remote transmitters are manufactured with an assigned personality number (1 or 2) and are so designated on the back of the remote transmitter case. The remote transmitters assigned with personalities 1 and 2 can only recall memory positions 1 and 2, respectively.
- Memory recall occurs when the unlock switch is pressed on the remote transmitters. A second press of the unlock switch, which unlocks the passenger doors, does not initiate a memory recall.
- A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.

Easy Entry/Easy Exit

The easy exit function moves the steering column to the full upward position when the ignition key is removed from the ignition switch. The driver seat module (DSM) receives a key out command over the MS-CAN communication network and powers the steering column upward. This function will not operate if the steering column is less than the travel distance to the full upward position or the function has been deactivated. The DSM will also cancel this operation if a valid input command is received, such as the power tilt column switch or memory recall request.

The DSM will record the current steering column position before powering the steering column for an easy exit function. This recorded position will be used to return the steering column to this position on the easy entry operation. During easy entry operation, the steering column is returned to the position previous to the easy exit operation. Easy entry operation will be cancelled if a valid input command is received by the DSM.

The easy exit/easy entry feature can be activated or deactivated using a scan tool or via the message center (if equipped). Refer to Section 418-01 or the owner's literature.

Power Tilt Steering Column Hard Stop/Soft Stop

A hard stop occurs when the power tilt column physically reaches the end of travel either up or down and cannot go any further. A soft stop occurs when the power tilt column stops before physically reaching the end of travel. The hard stop is set by steering column design and cannot be changed or adjusted. The soft stop is set by the DSM. To prevent necessary stress on the power tilt column and motor, the DSM will set 2 soft stop positions, one for tilt up and one for tilt down. The DSM will use a preset distance from the hard stop to determine where the soft stop will occur.

The soft stops must be relearned by the DSM whenever a new steering column or DSM is installed. Refer to the Setting the Soft Stop procedure.

Setting the Soft Stop

Use the following procedure to set the soft stops once a new power tilt steering column or a DSM has been installed.

During the setting procedure, one second after the power tilt column reaches the full range of travel either up or down, the DSM will move the column a small amount in the opposite direction that the switch is being pressed. Once the steering column has moved this small amount the soft stop is set and the switch can be released.

1. Turn the ignition key to the ON position.
2. Press the power tilt column switch to the up position.
3. Keep the switch pressed, one second after the column reaches the full range of travel up, it will then move down a small amount. The up soft stop has been set, release the switch.
4. Press the power tilt column switch to the down position.
5. Keep the switch pressed, one second after the column reaches the full range of travel down, it will then move up a small amount. The down soft stop has been set, release the switch.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
● Power column tilt switch ● Power column tilt motor ● Steering column ● Steering column shrouds	● Circuitry ● Driver seat module (DSM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).
5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.

- check the scan tool connection to the VCM.
- refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the driver seat module (DSM).

9. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B2341	Tilt Steering Column Motor Stalled	DSM	Go To Pinpoint Test A .
B2A42	Tilt Steering Column Up Switch Circuit Short To Ground	DSM	Go To Pinpoint Test C .
B2A43	Tilt Steering Column Down Switch Circuit Short To Ground	DSM	Go To Pinpoint Test C .
B2334	Tilt Steering Column Up/Down Position Feedback Circuit Short To Battery/Open Circuit	DSM	Go To Pinpoint Test D .
B2335	Tilt Steering Column Up/Down Position Feedback Circuit Short To Ground	DSM	Go To Pinpoint Test D .
—	All other DSM DTCs	DSM	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The tilt adjustment is inoperative — using the power tilt switch	• Circuitry • Power column tilt switch • Power column tilt motor • DSM	• Go To Pinpoint Test A .

• The tilt adjustment is inoperative — using the memory SET switch	• Circuitry • Memory SET switch • Power column tilt motor • DSM	• If the seats and mirrors are also inoperative using the memory SET switch, REFER to Section 501-10 . • If only the tilt adjustment is inoperative using the memory SET switch, Go To Pinpoint Test B .
• The tilt adjustment is inoperative — using the remote transmitter	• Circuitry • Keyless entry transmitter • Power column tilt motor • DSM	• If the seats and mirrors are also inoperative using the remote transmitter, REFER to Section 501-10 . • If only the tilt adjustment is inoperative using the remote transmitter, Go To Pinpoint Test B .
• The tilt adjustment is inoperative — using the easy entry/exit feature	• Power tilt adjustment not programmed into the easy entry/exit feature • Circuitry • Power column tilt motor • DSM	• PROGRAM the power tilt into the easy entry/exit feature using the scan tool or the message center (if equipped). • If the seats and mirrors are also inoperative using the easy entry/exit feature, REFER to Section 501-10 . • If only the tilt adjustment is inoperative using the easy entry/exit feature, Go To Pinpoint Test B .

Pinpoint Tests

Pinpoint Test A: The Tilt Adjustment is Inoperative — Using the Power Tilt Switch or DTC B2341 — Tilt Steering Column Motor Stalled

Refer to Wiring Diagrams Cell 128 , Adjustable Steering Column for schematic and connector information.

Normal Operation

To tilt the steering column up, the power column tilt switch provides a ground path for the driver seat module (DSM) along circuit CPP14 (BN/WH), through the power column tilt switch and finally along circuit GD133 (BK). The DSM then provides voltage to the power column tilt motor along circuit CPP04 (GY), into the adjustable pedal motor and back into the DSM along circuit CPP05 (WH/VT).

To tilt the steering column down, the power column tilt switch provides a ground path for the DSM along circuit CPP15 (YE/VT), through the adjustable pedal switch and finally along circuit GD133 (BK). The DSM then provides voltage to the power column tilt motor along circuit CPP05 (WH/VT), into the power column tilt motor and back into the DSM along circuit CPP04 (GY).

The power column tilt motor includes a Hall-effect position sensor, the DSM supplies a reference voltage and ground to this sensor. This enables the position sensor to send a signal back to the DSM to indicate the position of the power column tilt motor. The DSM uses this information to return the column to a stored preprogrammed position when pressing the memory SET switch or a remote transmitter. Refer to Section 501-10 and the owner's guide for information on programming the DSM for storing memory seat, adjustable pedal, adjustable mirror and adjustable steering column positions.

The power tilt switch is not serviceable, if a new switch is needed then a new steering column lower shroud must be installed. The power tilt motor and Hall-effect position sensor assembly are not serviceable, if a new assembly is needed then a new steering column must be installed.

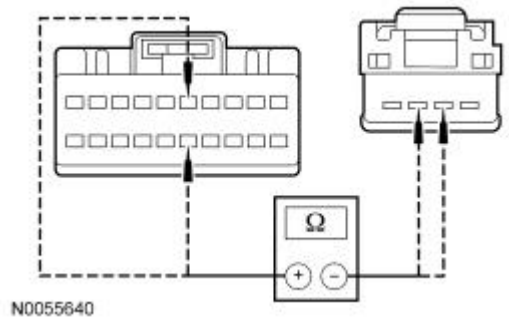
Possible Causes

- Circuit open
- Power column tilt switch
- Power column tilt motor
- DSM

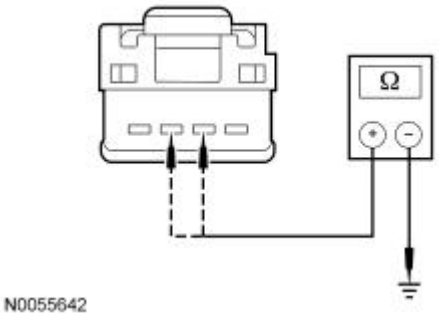
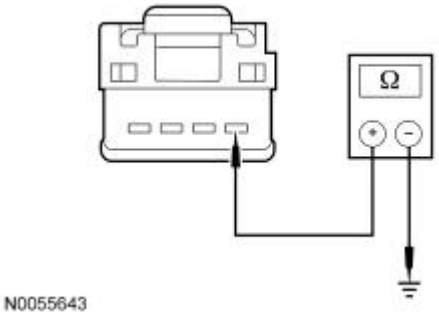
PINPOINT TEST A: THE TILT ADJUSTMENT IS INOPERATIVE — USING THE POWER TILT SWITCH OR DTC B2341 — TILT STEERING COLUMN MOTOR STALLED

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
A1 CHECK THE DSM FOR CORRECT POWER TILT PIDS • Connect the diagnostic tool. • Key in ON position. • Monitor the DSM tilt steering column input switch status PIDs while activating the power tilt switch in both directions. • **Does the PID value agree with the switch position within one second of releasing the switch?**	**Yes** Go To Pinpoint Test B . **No** GO to A2 .

A2 CHECK CIRCUITS CPP14 (BN/WH) AND CPP15 (YE/VT) FOR AN OPEN
• Key in OFF position.
• Disconnect: DSM C341d.
• Disconnect: Power Tilt Switch C2250.
• Measure the resistance between:
  ▪ power tilt switch C2250-2, circuit CPP14 (BN/WH), harness side and DSM C341d-5, circuit CPP14 (BN/WH), harness side.
  ▪ power tilt switch C2250-3, circuit CPP15 (YE/VT), harness side and DSM C341d-15, circuit CPP15 (YE/VT), harness side.
 
 	
• **Is the resistance greater than 10,000 ohms?**
	Yes
	REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to A3 .

A3 CHECK CIRCUITS CPP14 (BN/WH) AND CPP15 (YE/VT) FOR A SHORT TO GROUND • Measure the resistance between ground and: ▪ power tilt switch C2250-2, circuit CPP14 (BN/WH), harness side.	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs.

▪ power tilt switch C2250-3, circuit CPP15 (YE/VT), harness side.  N0055642 • **Is the resistance less than 5 ohms?**	REPEAT the self-test. **No** GO to A4 .
A4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between power tilt switch C2250-1, circuit GD133 (BK), harness side and ground.  N0055643 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit GD133 (BK). CLEAR the DTCs. REPEAT the self-test. **No** GO to A5 .
A5 CHECK THE POWER TILT SWITCH FOR A SHORT	
• Measure the resistance between: ▪ power tilt switch C2250 pin-1 and pin-2, component side. ▪ power tilt switch C2250 pin-1 and pin-3, component side. ▪ power tilt switch C2250 pin-2 and pin-3, component side. • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new steering column lower shroud (the power tilt switch is part of the lower shroud). CLEAR the DTCs. REPEAT the self-test. **No** GO to A6 .
A6 CHECK THE POWER TILT SWITCH FOR AN OPEN	
• While pushing the switch in the up position, measure the resistance between power tilt switch C2250 pin-1 and pin-2, component side. • While pushing the switch in the down position, measure the resistance between power tilt switch C2250 pin-2 and pin-3, component side. • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new steering column lower shroud (the power tilt switch is part of the lower shroud). CLEAR the DTCs. REPEAT the self-test. **No** GO to A7 .
A7 CHECK THE DSM CONNECTOR	
• Check DSM connector C341d for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals. • Connect: DSM C341d. • Connect: Power Tilt Switch C2250. • Make sure the connectors are seated correctly then operate	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No**

the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Tilt Adjustment is Inoperative — Using the Memory Set Switch/Using the Remote Transmitter/Using the Easy Entry/Exit Feature

Refer to Wiring Diagrams Cell 128 , Adjustable Steering Column for schematic and connector information.

Normal Operation

To move the power tilt column to position 1, the memory SET switch provides a ground for the driver seat module (DSM) through circuit CPS15 (VT/WH), through the memory SET switch internal resistor and finally through circuit GD133 (BK). The DSM then sends voltage to the power tilt motor through circuits CPP04 (GY) and CPP05 (WH/VT) depending on the current column position. To move the power tilt column to position 2, the memory SET switch provides a ground for the DSM through circuit CPS16 (YE), through the memory SET switch internal resistor and finally through circuit GD133 (BK).

The DSM sends voltage to the power tilt motor through circuits CPP04 (GY) and CPP05 (WH/VT) depending on the current column position. The DSM uses a Hall-effect position sensor, attached to the column motor assembly, to identify the current column position. The DSM sends a reference voltage along circuit LPP08 (BU), through the Hall-effect position sensor and back to the DSM along the signal return circuit, RPP08 (GY/BU).

The power tilt motor and Hall-effect position sensor assembly are not serviceable, if a new assembly is needed then a new steering column must be installed.

Possible Causes

- Circuit open
- Circuit shorted
- Memory SET switch
- Remote transmitter
- Power tilt motor
- DSM

PINPOINT TEST B: THE TILT ADJUSTMENT IS INOPERATIVE — USING THE MEMORY SET SWITCH/USING THE REMOTE TRANSMITTER/USING THE EASY ENTRY/EXIT FEATURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
B1 CHECK THE DSM FOR CORRECT POWER TILT OUTPUT	
• **NOTE:** When commanded, the DSM will move the steering column a maximum of 1 second. • Using the scan tool, activate the following DSM tilt steering column commands: TILT UP and TILT DOWN. • **Does the steering column move in the appropriate direction when commanded?**	**Yes** The system is operating correctly at this time. Concern may have been caused by a loose connector. CHECK the power tilt motor connector, the power tilt switch connector and the DSM connectors for looseness. CLEAR the DTCs. REPEAT the self-test.

	No GO to B2 .
B2 CHECK THE POWER TILT MOTOR CIRCUITS FOR AN OPEN	

• Key in OFF position.
• Disconnect: DSM C341b.
• Disconnect: DSM C341d.
• Disconnect: DSM C341e.
• Disconnect: Power Tilt Motor C227.
• Measure the resistance between:
  ▪ DSM C341b-1, circuit CPP04 (GY), harness side and power tilt switch C227-3, circuit CPP04 (GY), harness side.
  ▪ DSM C341b-9, circuit CPP05 (WH/VT), harness side and power tilt switch C227-1, circuit CPP05 (WH/VT), harness side.
  ▪ DSM C341d-6, circuit RPP08 (GY/BU), harness side and power tilt switch C227-2, circuit RPP08 (GY/BU), harness side.
  ▪ DSM C341e-7, circuit LPP08 (BU), harness side and power tilt switch C227-4, circuit LPP08 (BU), harness side.
• **Is the resistance greater than 10,000 ohms?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to B3 .

B3 CHECK THE POWER TILT MOTOR CIRCUITS FOR A SHORT TO GROUND	

• Measure the resistance between ground and:
  ▪ DSM C341b-1, circuit CPP04 (GY), harness side.
  ▪ DSM C341b-9, circuit CPP05 (WH/VT), harness side.
  ▪ DSM C341d-6, circuit RPP08 (GY/BU), harness side.
  ▪ DSM C341e-7, circuit LPP08 (BU), harness side.
• **Is the resistance less than 5 ohms?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to B4 .

B4 CHECK THE POWER TILT MOTOR CIRCUITS FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and:
  ▪ DSM C341b-1, circuit CPP04 (GY), harness side.
  ▪ DSM C341b-9, circuit CPP05 (WH/VT), harness side.
  ▪ DSM C341d-6, circuit RPP08 (GY/BU), harness side.
  ▪ DSM C341e-7, circuit LPP08 (BU), harness side.
• **Is any voltage present?**
	Yes
	REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to B5 .

B5 CHECK THE POWER TILT MOTOR OPERATION	
• Key in OFF position. • Connect a fused (10A) jumper wire between power tilt motor C227-1, circuit CPP04 (GY), component side and the battery positive terminal. Momentarily connect a jumper wire between power tilt motor C227-3, circuit CPP05 (WH/VT), component side. • Connect a fused (10A) jumper wire between	**Yes** GO to B6 . **No** INSTALL a new steering column (the power tilt motor is part of the steering column). CLEAR the DTCs. REPEAT the self-test. REFER to Steering Column in

power tilt motor C227-3, circuit CPP05 (WH/VT), component side and the battery positive terminal. Momentarily connect a jumper wire between power tilt motor C227-1, circuit CPP04 (GY), component side. • **Does the power tilt motor operate first in one direction and then in the opposite direction?**	this section. CLEAR the DTCs. REPEAT the self-test.

B6 CHECK THE DSM CONNECTOR
• Check DSM connectors C341b, C341d and C341e for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: DSM C341b.
• Connect: DSM C341d.
• Connect: DSM C341e.
• Connect: Power Tilt Motor C227.
• Make sure the connectors are seated correctly then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTCs B2A42 And B2A43 — Tilt Steering Column Up Switch Circuit Short to Ground and Tilt Steering Column Down Switch Circuit Short to Ground

Refer to Wiring Diagrams Cell 128 , Adjustable Steering Column for schematic and connector information.

Normal Operation

To tilt the steering column up, the power column tilt switch provides a ground path for the driver seat module (DSM) along circuit CPP14 (BN/WH), through the power column tilt switch and finally along circuit GD133 (BK). The DSM then provides voltage to the power column tilt motor along circuit CPP04 (GY), into the adjustable pedal motor and back into the DSM along circuit CPP05 (WH/VT).

To tilt the steering column down, the power column tilt switch provides a ground path for the DSM along circuit CPP15 (YE/VT), through the adjustable pedal switch and finally along circuit GD133 (BK). The DSM then provides voltage to the power column tilt motor along circuit CPP05 (WH/VT), into the power column tilt motor and back into the DSM along circuit CPP04 (GY).

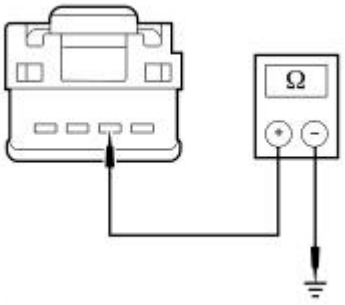
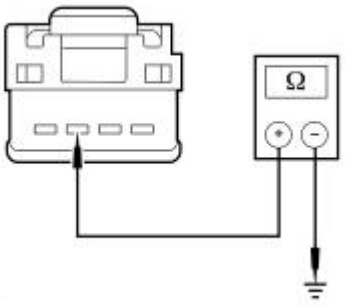
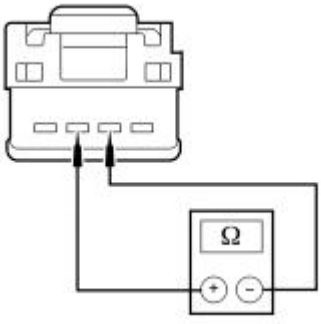
The power tilt switch is not serviceable, if a new switch is needed then a new steering column lower shroud must be installed.

Possible Causes

- Circuit shorted
- Power column tilt switch
- DSM

PINPOINT TEST C: DTCS B2A42 AND B2A43 — TILT STEERING COLUMN UP SWITCH CIRCUIT SHORT TO GROUND AND TILT STEERING COLUMN DOWN SWITCH CIRCUIT SHORT TO GROUND

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
C1 CHECK CIRCUIT CPP14 (BN/WH) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: DSM C341d. • Disconnect: Power Tilt Switch C2250. • Measure the resistance between power tilt switch C2250-2, circuit CPP14 (BN/WH), harness side and ground.  N0055644 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit CPP14 (BN/WH). CLEAR the DTCs. REPEAT the self-test. **No** GO to C2 .
C2 CHECK CIRCUIT CPP15 (YE/VT) FOR A SHORT TO GROUND	
• Measure the resistance between power tilt switch C2250-3, circuit CPP15 (YE/VT), harness side and ground.  N0055645 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit CPP15 (YE/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to C3 .
C3 CHECK CIRCUITS CPP15 (YE/VT) AND CPP14 (BN/WH) FOR A SHORT TOGETHER	
• Measure the resistance between power tilt switch C2250-3, circuit CPP15 (YE/VT), harness side and power tilt switch C2250-2, circuit CPP14 (BN/WH), harness side.  N0055646 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test. **No** GO to C4 .
C4 CHECK THE POWER TILT SWITCH FOR A SHORT	
• Measure the resistance between: ▪ power tilt switch C2250 pin-1 and pin-2, component side.	**Yes** INSTALL a new steering column lower shroud (the

▪ power tilt switch C2250 pin-1 and pin-3, component side. ▪ power tilt switch C2250 pin-2 and pin-3, component side. • **Is the resistance less than 5 ohms?**	power tilt switch is part of the lower shroud). CLEAR the DTCs. REPEAT the self-test. **No** GO to C5 .
C5 CHECK THE DSM CONNECTORS	
• Check DSM connector C341d for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminals. • Connect: DSM C341d. • Make sure the connector is seated correctly then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test D: DTCs B2334 and B2335 — Tilt Steering Column Up/Down Position Feedback Circuit Short to Battery/Open Circuit and Tilt Steering Column Up/Down Position Feedback Circuit Short to Ground

Refer to Wiring Diagrams Cell 128 , Adjustable Steering Column for schematic and connector information.

Normal Operation

The power column tilt motor includes a Hall-effect position sensor, the driver seat module (DSM) supplies a reference voltage and ground to this sensor. This enables the position sensor to send a variable voltage back to the DSM to indicate the position of the power column tilt motor. The DSM uses this information to return the column to a stored preprogrammed position when pressing the memory SET switch or a remote transmitter. Refer to Section 501-10 and the owner's literature for information on programming the DSM for storing memory seat, adjustable pedal, adjustable mirror and adjustable steering column positions.

The power tilt motor and Hall-effect position sensor assembly are not serviceable, if a new assembly is needed then a new steering column must be installed.

Possible Causes

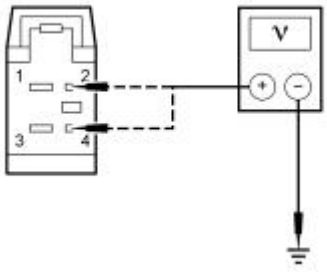
- Power tilt motor
- DSM

PINPOINT TEST D: DTCS B2334 AND B2335 — TILT STEERING COLUMN UP/DOWN POSITION FEEDBACK CIRCUIT SHORT TO BATTERY/OPEN CIRCUIT AND TILT STEERING COLUMN UP/DOWN POSITION FEEDBACK CIRCUIT SHORT TO GROUND

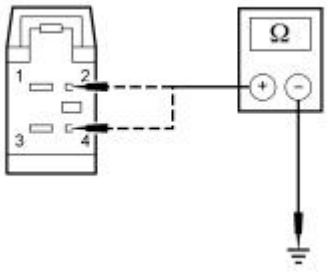
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
D1 CHECK CIRCUITS RPP08 (GY/BU) AND LPP08 (BU) FOR A	

SHORT TO VOLTAGE	

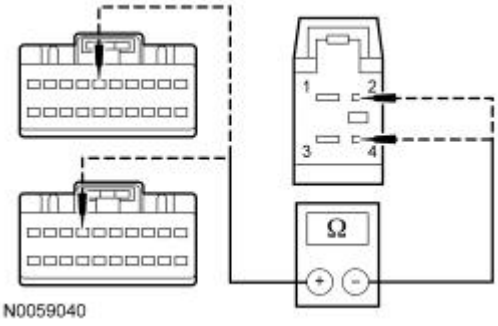
• Key in OFF position.
• Disconnect: DSM C341d.
• Disconnect: DSM C341e.
• Disconnect: Power Tilt Motor C227.
• Key in ON position.
• Measure the voltage between ground and:
  ▪ power tilt motor C227-2, circuit RPP08 (GY/BU), harness side.
  ▪ power tilt motor C227-4, circuit LPP08 (BU), harness side.
 
 	
N0059038
• **Is any voltage present?**
	Yes
	REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to D2 .

D2 CHECK CIRCUITS RPP08 (GY/BU) AND LPP08 (BU) FOR A SHORT TO GROUND	

• Key in OFF position.
• Measure the resistance between ground and:
  ▪ power tilt motor C227-2, circuit RPP08 (GY/BU), harness side.
  ▪ power tilt motor C227-4, circuit LPP08 (BU), harness side.
 
 	
N0059039
• **Is the resistance less than 5 ohms?**
	Yes
	REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to D3 .

D3 CHECK CIRCUITS RPP08 (GY/BU) AND LPP08 (BU) FOR AN OPEN	

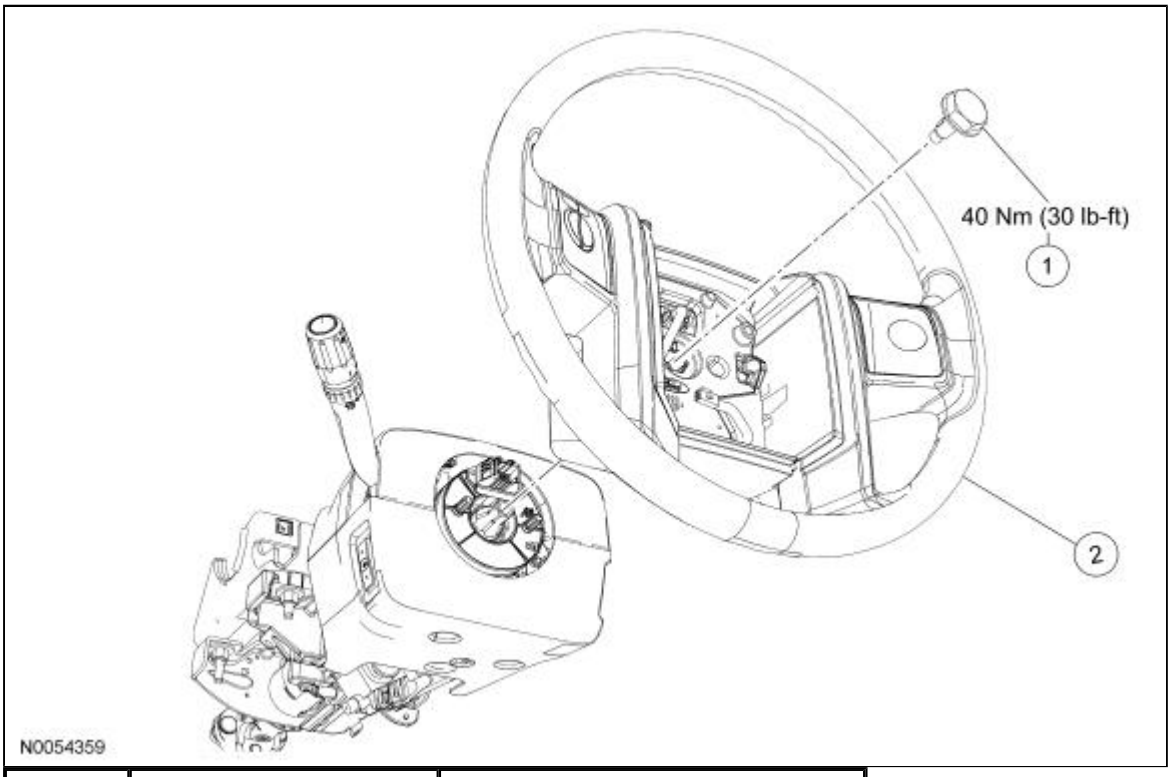
• Measure the resistance between ground and:
  ▪ power tilt motor C227-2, circuit RPP08 (GY/BU), harness side and DSM C341d-6, circuit RPP08 (GY/BU), harness side.
  ▪ power tilt motor C227-4, circuit LPP08 (BU), harness side and DSM C341e-7, circuit LPP08 (BU), harness side.
	Yes
	REPAIR the affected circuit (s). CLEAR the DTCs. REPEAT the self-test.
	
	No
	GO to D4 .

 N0059040 • **Is the resistance greater than 10,000 ohms?**	
D4 CHECK THE DSM CONNECTORS	

• Check DSM connectors C341d and C341e for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminals.
• Connect: DSM C341d.
• Connect: DSM C341e.
• Make sure the connectors are seated correctly then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Steering Wheel

Printable View (169 KB)



Item	Part Number	Description
1	N807493	Steering wheel bolt
2	3600	Steering wheel

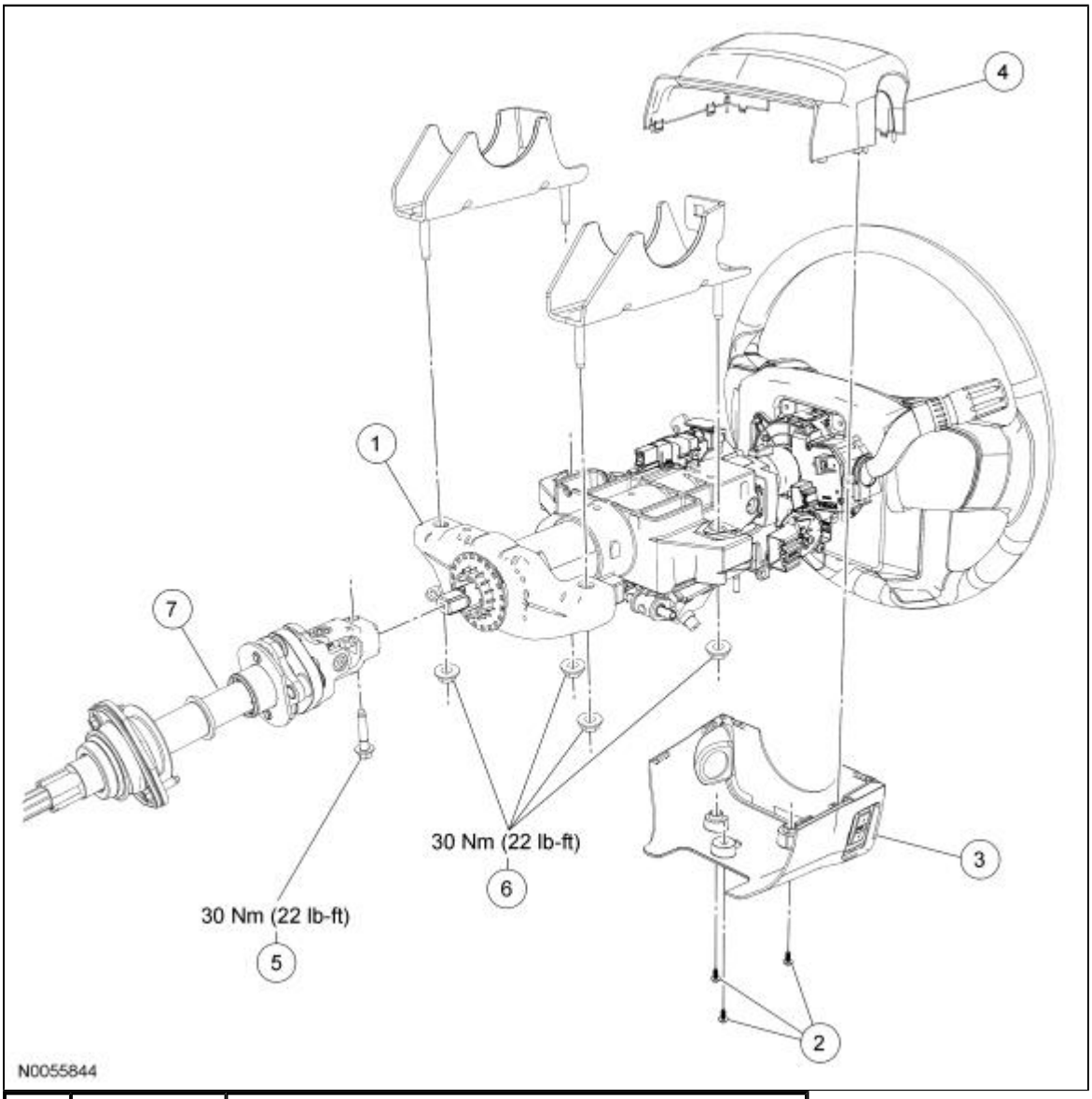
Removal and Installation

1. Remove the driver air bag module. For additional information, refer to Section 501-20B .
2. Turn the steering wheel to the straight-ahead position.
3. Remove and discard the steering wheel bolt.
   - To install, tighten to 40 Nm (30 lb-ft).
4. Remove the steering wheel while routing the wires from the clockspring through the steering wheel.
5. **NOTE:** A new steering wheel bolt must be installed.

   To install, reverse the removal procedure.

Steering Column

Printable View (401 KB)



Item	Part Number	Description
1	3C529	Steering column
2	W710485	Lower steering column shroud screws (3 required)
3	3533	Lower steering column shroud
4	3530	Upper steering column shroud
5	N808684	Upper steering column shaft-to-steering column bolt
6	N806423	Steering column support-to-instrument panel nuts (4 required)
7	14A099	Upper steering column shaft

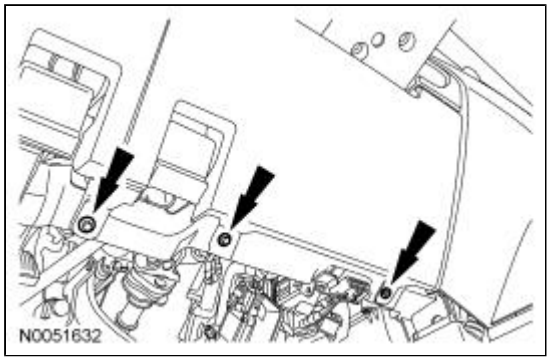
Removal and Installation

All vehicles

1. Place the steering wheel in the straight-ahead position and turn the ignition switch to the OFF position.
    - Remove the key.

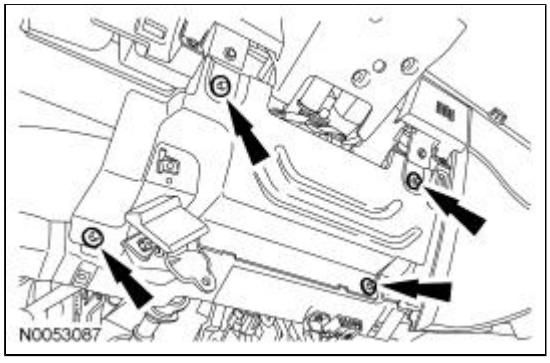
2. Depower the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .

3. Remove the lower steering column opening cover.
    - Remove the 3 screws and pull out to release the top retaining clips and remove the lower steering column opening cover.



4. Remove the 2 bolts and position aside the hood release handle.

5. Remove the 4 bolts and the steering column reinforcement cover.
    - To install, tighten to 9 Nm (80 lb-in).



Vehicles with column shift

6. Release the tabs and slide the gear selector cover away from the steering column shrouds.

All vehicles

7. Remove the 3 screws and the upper and lower steering column shrouds.
    - If equipped, disconnect the power tilt electrical connector switch from the lower shroud.
    - To install, tighten to 2 Nm (18 lb-in).

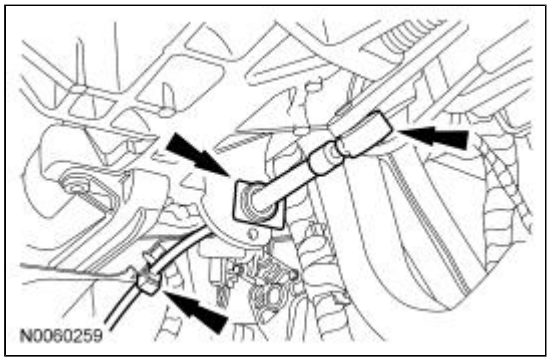
8. Disconnect the following electrical connectors.
    - Clockspring
    - PATS transceiver
    - Ignition switch
    - Multi-function switch
    - Steering angle rotational sensor
    - Key release interlock actuator (if equipped).

Vehicles with power tilt

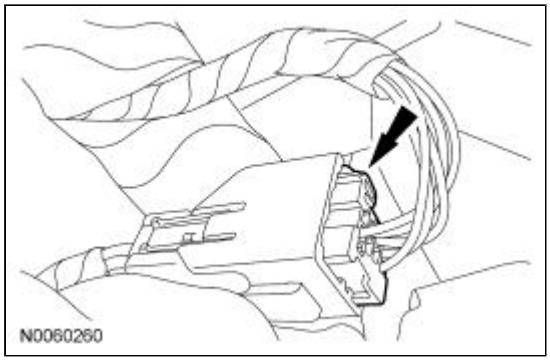
9. Disconnect the power tilt motor electrical connector.

Vehicles with column shift

10. Detach the shift cable from the steering column and the bracket.

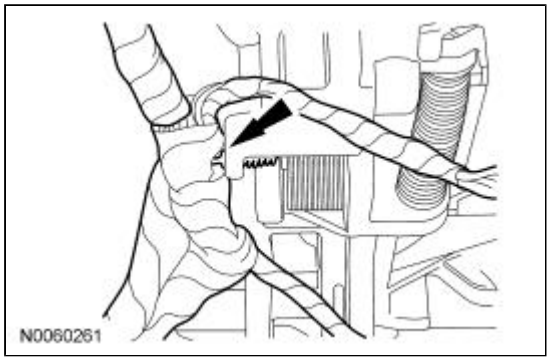


11. Disconnect the overdrive cancel switch and brake shift interlock solenoid jumper harness connector located at the top of the lower steering column support bracket.



All vehicles

12. Detach the wiring harness retainer from the steering column and position the wiring harness aside.



13. **CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

    Remove the bolt and detach the upper steering column shaft from the steering column.
    - Discard the bolt.
    - To install, tighten to 30 Nm (22 lb-ft).

14. Remove the 4 nuts and the steering column.
    - Discard the nuts.
        - To install, tighten to 30 Nm (22 lb-ft).

15. **CAUTION: Make sure that the steering column support is flush with the instrument panel before tightening the nuts.**

    CAUTION: Make sure the electrical wiring harness is routed correctly and secured to the steering column or damage to the wires and/or connectors can occur.

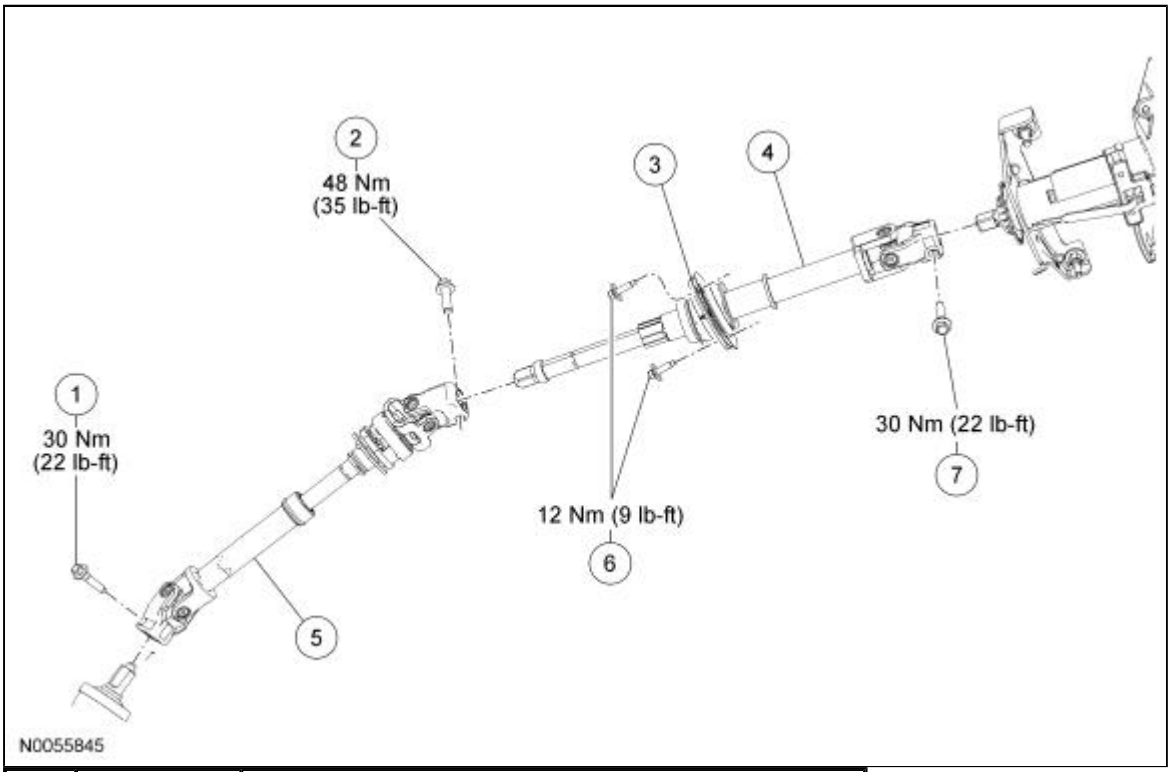
    To install, reverse the removal procedure.

Vehicles with power tilt

16. Reset the steering column soft stops. For additional information, refer to Diagnosis and Testing in this section.

Steering Column Shaft

Printable View (152 KB)



Item	Part Number	Description
1	N808684	Lower steering column shaft-to-steering gear bolt
2	N801614	Lower steering column shaft-to-upper steering column shaft bolt
3	3D677	Steering column shaft dash seal
4	3E751	Upper steering column shaft
5	3B676	Lower steering column shaft
6	W705132	Steering column shaft dash seal bolts
7	N808684	Upper steering column shaft-to-steering column bolt

Removal and Installation

1. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .

2. Place the steering wheel and the front wheels in the straight-ahead position. Turn the ignition switch to the OFF position and remove the key.

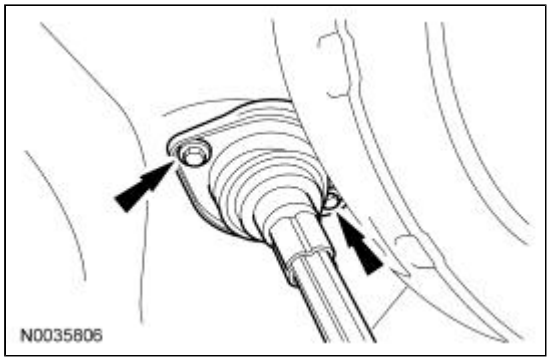
3. **CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clock spring must be recentered. For additional information, refer to Section 501-20B .**

Remove the bolt and disconnect the steering column shaft from the steering column.

- Discard the bolt.
- To install, tighten to 30 Nm (22 lb-ft).

4. Remove the bolt and disconnect the upper intermediate shaft from the lower intermediate shaft.
   - Discard the bolt.
   - To install, tighten to 48 Nm (35 lb-ft).

5. Remove the 2 bolts, the dash seal and the upper intermediate shaft.
   - To install, tighten to 12 Nm (9 lb-ft).



6. Remove the bolt and disconnect the lower steering column shaft from the steering gear.
   - Discard the bolt.
   - To install, tighten to 30 Nm (22 lb-ft).

7. **CAUTION: New steering column shaft bolts must be installed.**

   To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Ignition switch screws	5	44
Tilt lever screw	6	53

Steering Column Switches

Printable View (62 KB)

The steering column switches consist of the following:

- Multi-function switch, which controls the:
  - turn signal
  - windshield wiper/washer
  - rear wiper/washer
  - headlamp dimmer/flash-to-pass
- Ignition switch

Steering Column Switches

Printable View (312 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

Ignition Switch

The ignition switch is controlled by the ignition lock cylinder with a key. When the ignition lock cylinder is turned using the key, a mechanical connection positions the ignition switch to the selected position and allows the ignition switch to send voltage to specific components.

Multi-function Switch

The multi-function switch (high beam/low beam, flash-to-pass, turn signal and windshield wiper) controls the various components electrically. The headlamp switch sends constant voltage to the headlamps when placed in the ON position, while the flash-to-pass is a momentary switch used to send voltage to the headlamp high beams only. The headlamp high beam/low beam switch sends voltage to the low or high beam headlamps while the headlamps are on. The turn signal switch portion of the multi-function switch operates the left and right turn signals. The windshield wiper switch function uses a ground signal to activate the various wiper modes and the wiper/washer.

Key Release Interlock Actuator

On vehicles equipped with a floor-mounted transmission selector lever, the key release interlock actuator (also known as the key removal inhibit solenoid) is an electronically controlled solenoid that prevents the ignition key from being removed from the ignition cylinder unless the transmission selector lever is in the PARK position. The actuator is mounted to the steering column directly behind the ignition cylinder.

When the transmission selector lever is placed in a position other than PARK, the park detection switch opens and the key release interlock engages. This prevents the ignition key from being removed from

the ignition cylinder.

When the transmission selector lever is placed in the PARK position, the park detection switch closes and the key release interlock disengages, allowing the ignition key to be removed from the ignition cylinder.

On vehicles equipped with a column-mounted transmission selector lever, the key release interlock actuator is a mechanically controlled device that prevents the ignition key from being removed from the ignition cylinder unless the transmission selector lever is in the PARK position.

When the transmission selector lever is placed in a position other than PARK, the shift assembly cable moves to block the ignition key from being removed from the ignition cylinder.

When the transmission selector lever is placed in the PARK position, the shift assembly cable moves to allow the ignition key to be removed from the ignition cylinder.

Inspection and Verification

1. Verify the customer concern by operating the multi-function switch or ignition switch.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Multi-function switch
• Ignition switch
• Key efforts
• Steering column shrouds
	• Battery junction box (BJB) fuse 46 (40A)
	• Smart junction box (SJB) fuse(s):
	  ▪ 27 (20A)
	  ▪ 28 (5A)
	• Circuitry
	• Instrument cluster
	• Passive anti-theft system (PATS) module
	• Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module

(PCM).

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the smart junction box (SJB).

9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Ignition Switch Mechanical Check

Test the mechanical operation of the ignition switch by rotating the lock cylinder through all switch positions. The movement should not stick or bind and should return from the START position back to the RUN position without assistance (spring return). If sticking or binding is encountered, check for the following:

- Burrs on the lock cylinder key
- Insufficient lube on the lock cylinder
- Bent or damaged the ignition rod
- Object rubbing against the ignition rod
- Excessive rubbing of the actuator against the transmission shift socket
- Binding lock cylinder
- Shroud rubbing the against lock cylinder
- Burrs or foreign material around the rack and pinion actuator in the lock cylinder housing
- Insufficient lube on the actuator (Do not apply lubricant to the inside of the ignition switch.)
- Binding ignition switch

If the steering wheel lock is engaged with the wheels loaded against a curb, high effort will be necessary to turn the key from lock. Turn the steering wheel to either side of the lock to unload the system.

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B2A20	Ignition Stuck In START	Smart junction box (SJB)	Go To Pinpoint Test F .
B2844	Ignition Fault	Smart junction box (SJB)	Go To Pinpoint Test G .
U2472	Unexpected Ignition State	Smart junction box (SJB)	Go To Pinpoint Test G .
—	All Other DTCs	Smart junction box (SJB)	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

• The ignition switch is inoperative	• Smart junction box (SJB) fuse 27 (20A) • Circuitry • Ignition switch • SJB	• Go To Pinpoint Test A .

• No power in ACC	• Smart junction box (SJB) fuse(s):
	  ▪ 43 (10A)
	  ▪ 45 (5A)
	• Circuitry
	• Ignition switch
	• SJB
		• Go To Pinpoint Test B .

• No power in RUN	• Battery junction box (BJB) fuse 46 (40A)
	• Smart junction box (SJB) fuse(s):
	  ▪ 42 (10A)
	  ▪ 43 (10A)
	  ▪ 44 (10A)
	  ▪ 45 (5A)
	  ▪ 46 (40A)
	• Circuitry
	• Run/start relay
	• Ignition switch
	• SJB
		• Go To Pinpoint Test C .

• No power in START	• Smart junction box (SJB) fuse 28 (5A) • Circuitry • Starter motor relay • Ignition switch • SJB	• Go To Pinpoint Test D .
• The ignition key is hard to turn	• Key • Ignition lock cylinder • Ignition switch rod • Ignition switch	• Go To Pinpoint Test E .
• The multi-function switch does not operate correctly	• Multi-function switch	• CARRY OUT the Multi-function Switch Continuity Test for electrical diagnosis. Refer to Wiring Diagrams Cell 149 for schematic and connector information.
• The ignition key cannot be removed from the ignition cylinder (vehicles equipped with a floor-mounted transmission selector lever)	• Circuitry • Key release interlock actuator • Park detection switch (part of the transmission selector lever)	• Go To Pinpoint Test F .
• The ignition key can be	• Circuitry	• Go To Pinpoint

removed from the ignition cylinder regardless of gear selector position (vehicles equipped with a floor-mounted transmission selector lever)	• Key release interlock actuator • Park detection switch (part of the transmission selector lever)	Test F .

Pinpoint Tests

Pinpoint Test A: The Ignition Switch is Inoperative

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch receives fused battery voltage along circuit SBP27 (BU/RD) from smart junction box (SJB) fuse 27 (20A). The ignition switch then sends that voltage out to various systems depending on ignition switch position. The ignition switch has 4 possible states:

- OFF — No power on any circuits
- ACC — Power on circuit CDC33 (VT/GN)
- RUN — Power on circuits CDC34 (WH/OG), CDC33 (VT/GN) and CDC32 (BN/YE)
- START — Power on circuits CDC35 (BU/WH)

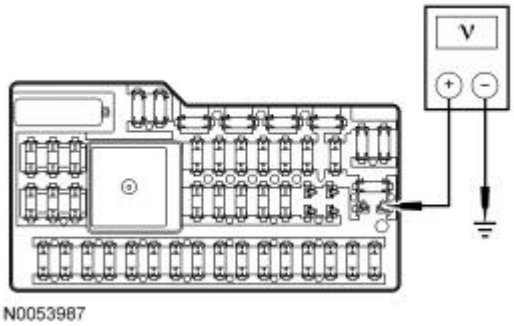
Possible Causes

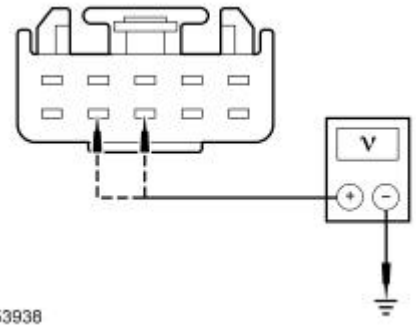
- Fuse
- Circuit open
- Ignition switch

PINPOINT TEST A: THE IGNITION SWITCH IS INOPERATIVE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
A1 CHECK FOR VOLTAGE AT SJB FUSE 27 (20A)	
• Key in OFF position. • Disconnect: SJB Fuse 27 (20A). • Measure the voltage between SJB fuse 27, input side and ground.	**Yes** GO to A2 . **No** INSTALL a new SJB. TEST the system for normal operation.

 N0053987 • **Is the voltage greater than 10 volts?**	

A2 CHECK FOR VOLTAGE ON CIRCUIT SBP27 (BU/RD)
• Connect: SJB fuse 27 (20A).
• Disconnect: Ignition Switch C250.
• Measure the voltage between ground and:
  ▪ ignition switch C250-8, circuit SBP27 (BU/RD), harness side.
  ▪ ignition switch C250-9, circuit SBP27 (BU/RD), harness side.
 
N0053938
• **Are the voltages greater than 10 volts?**
	Yes
	INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.
	
	No
	VERIFY SJB fuse 27 (20A) is OK. If OK, REPAIR circuit SBP27 (BU/RD). TEST the system for normal operation.

Pinpoint Test B: No Power in ACC

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

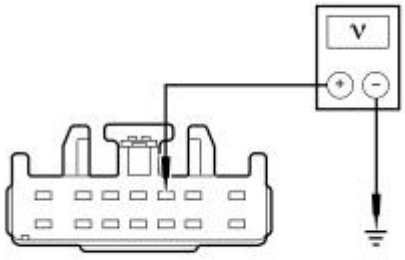
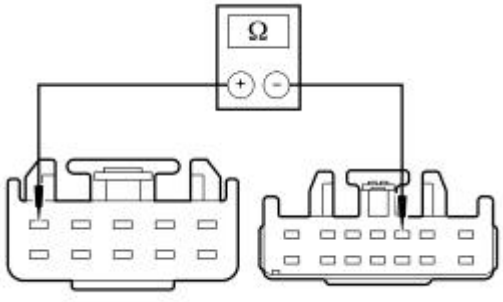
When the ignition switch is placed in ACC, fused ignition voltage is sent to smart junction box (SJB) C2280f-3 along circuit CDC33 (VT/GN).

Possible Causes

- Fuse(s)
- Circuit open
- Ignition switch
- Smart junction box

PINPOINT TEST B: NO POWER IN ACC

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
B1 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** GO to B2 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.
B2 CHECK FOR VOLTAGE ON CIRCUIT CDC33 (VT/GN)	
• Key in OFF position. • Disconnect: SJB C2280f. • Key in ACCESSORY position. • Measure the voltage between SJB C2280f-3, circuit CDC33 (VT/GN), harness side and ground.  N0053939 • **Is the voltage greater than 10 volts?**	**Yes** VERIFY SJB fuse 43 (10A) and 45 (5A) are OK. If OK, GO to B4 . **No** GO to B3 .
B3 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Ignition Switch C250. • Measure the resistance between ignition switch C250-5, circuit CDC33 (VT/GN), harness side and SJB C2280f-3, circuit CDC33 (VT/GN), harness side.  N0053940 • **Is the resistance greater than 10,000 ohms?**	**Yes** VERIFY SJB fuse 43 (10A) and 45 (5A) are OK. If OK, REPAIR circuit CDC33 (VT/GN). TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE SJB CONNECTORS	

• Check SJB C2208f for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminal.
• Connect: SJB C2280f.
• Make sure the connector is seated correctly, then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or

	corroded connector.

Pinpoint Test C: No Power in RUN

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in RUN, fused ignition voltage is sent to:

- Smart junction box (SJB) C2280f-3 along circuit CDC33 (VT/GN)
- SJB C2280f-4 along circuit CDC32 (BN/YE)
- SJB C2208g-45 along circuit CDC34 (WH/OG)
- Pin 1 of the run/start relay in the battery junction box (BJB) along circuit CDC34 (WH/OG)

Fused battery voltage is provided to pin 3 of the run/start relay from BJB fuse 46 (40A).

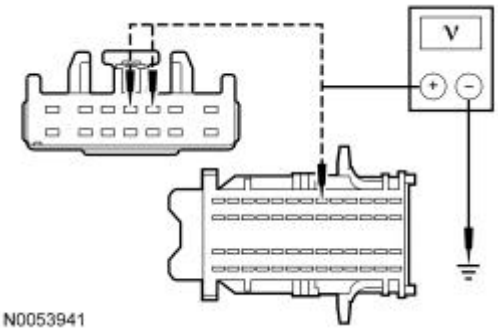
Possible Causes

- Fuse(s)
- Circuit open
- Run/start relay
- Ignition switch
- Smart junction box
- Battery junction box

PINPOINT TEST C: NO POWER IN RUN

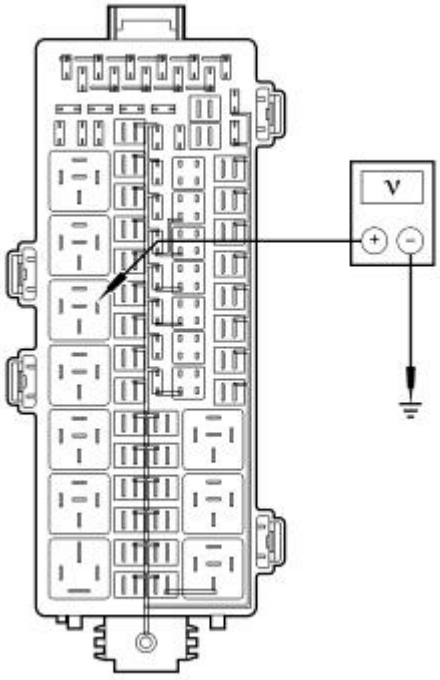
CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

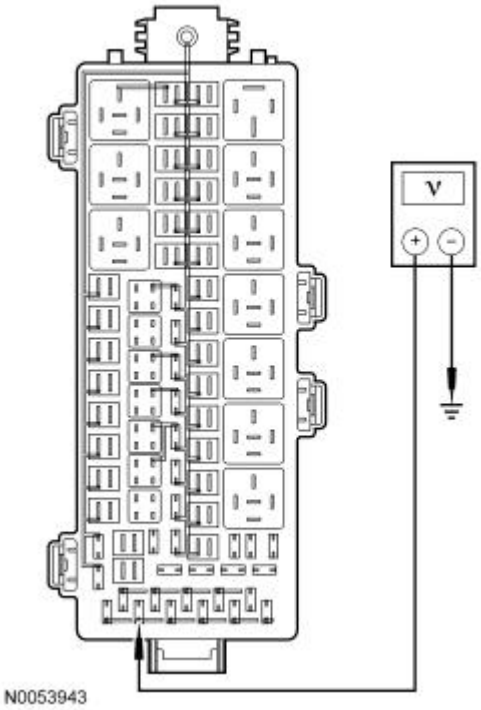
Test Step	Result / Action to Take
C1 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** GO to C2 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.
C2 CHECK FOR VOLTAGE AT THE SJB	
• Key in OFF position. • Disconnect: SJB C2280f. • Disconnect: SJB C2280g. • Key in ON position. • Measure the voltage between ground and: ▪ SJB C2280f-3, circuit CDC33 (VT/GN), harness side. ▪ SJB C2280f-4, circuit CDC32 (BN/YE), harness side. ▪ SJB C2280g-45, circuit CDC34 (WH/OG), harness side.	**Yes** GO to C3 . **No** REPAIR the affected circuit(s). TEST the system for normal operation.



N0053941

- **Are the voltages greater than 10 volts?**

C3 CHECK FOR VOLTAGE AT THE RUN/START RELAY	
• Key in OFF position. • Connect: SJB C2280f. • Connect: SJB C2280g. • Disconnect: Run/Start Relay. • Key in ON position. • Measure the voltage between run/start relay cavity 1, circuit CDC34 (WH/OG), harness side and ground.  N0053942 • **Is the voltage greater than 10 volts?**	**Yes** GO to C4 . **No** REPAIR circuit CDC34 (WH/OG). TEST the system for normal operation.
C4 CHECK THE RUN/START RELAY	
• Carry out the Mini ISO Relay Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the relay OK?**	**Yes** GO to C5 . **No** INSTALL a new relay. TEST the system for normal operation.
C5 CHECK FOR VOLTAGE AT BJB FUSE 46 (40A)	
• Key in OFF position. • Connect: Run/Start Relay. • Disconnect: BJB Fuse 46.	**Yes** GO to C6 .

• Key in ON position. • Measure the voltage between BJB fuse 46 input side and ground.  • **Is the voltage greater than 10 volts?**	**No** VERIFY BJB fuse 46 (40A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.
C6 CHECK THE SJB CONNECTORS	

• Disconnect: SJB C2280g.
• Disconnect: SJB C2280h.
• Check the connectors for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminal.
• Connect: SJB C2280g.
• Connect: SJB C2280h.
• Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test D: No Power in START

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition switch is placed in START, fused ignition voltage is sent to:

- Smart junction box (SJB) C2280g-32 along circuit CDC35 (BU/WH)
- SJB C2208g-45 along circuit CDC34 (WH/OG)
- Pin 1 of the run/start relay in the BJB along circuit CDC34 (WH/OG)

Fused battery voltage is provided to pin 3 of the run/start relay from BJB fuse 46 (40A) and to pin 3 of the starter motor relay from BJB fuse 40 (30A).

Possible Causes

- Fuse(s)

- Circuit open
- Run/start relay
- Starter motor relay
- Ignition switch
- Smart junction box
- Battery junction box

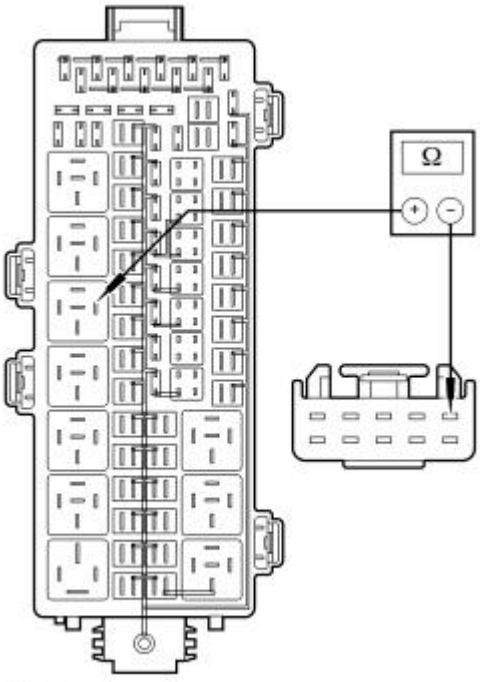
PINPOINT TEST D: NO POWER IN START

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
D1 CHECK THE IGNITION SWITCH • Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** GO to D2 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.

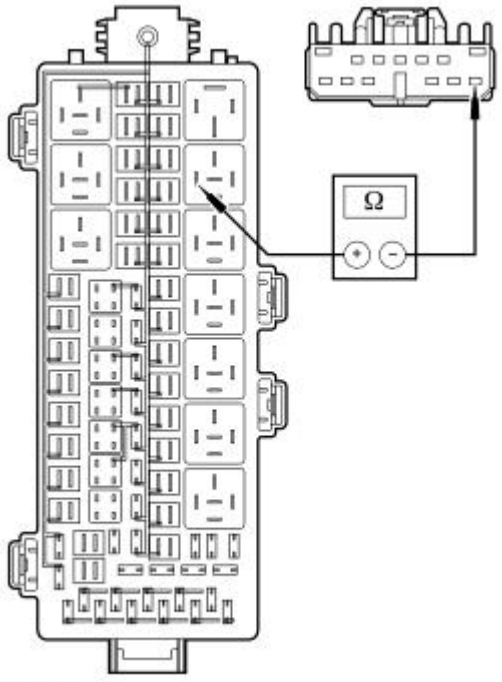
D2 CHECK START AND RUN CIRCUITS FOR AN OPEN
• Key in OFF position.
• Disconnect: Ignition Switch C250.
• Disconnect: SJB C2280g.
• Measure the resistance between:
  ▪ ignition switch C250-7, circuit CDC32 (BN/YE), harness side and SJB C2280g-4, circuit CDC32 (BN/YE), harness side.
  ▪ ignition switch C250-10, circuit CDC35 (BU/WH), harness side and SJB C2280g-32, circuit CDC35 (BU/WH), harness side.
• **Are the resistances greater than 10,000 ohms?**
	Yes
	REPAIR the affected circuit(s). TEST the system for normal operation.
	
	No
	GO to D3 .

D3 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN • Disconnect: Run/Start Relay. • Measure the resistance between ignition switch C250-1, circuit CDC34 (WH/OG) and run/start relay cavity 1, circuit CDC34 (WH/OG), harness side.	**Yes** REPAIR circuit CDC34 (WH/OG). TEST the system for normal operation. **No** GO to D4 .



- **Is the resistance greater than 10,000 ohms?**

D4 CHECK THE RUN/START RELAY	
• Carry out the Mini ISO Relay Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the relay OK?**	**Yes** GO to D5 . **No** INSTALL a new relay. TEST the system for normal operation.
D5 CHECK CIRCUIT CDC38 (WH/VT) FOR AN OPEN	
• Disconnect: Starter Motor Relay. • Disconnect: SJB C2280a. • Measure the resistance between SJB C2280a-8, circuit CDC38 (WH/VT), harness side and starter motor relay cavity 1, circuit CDC38 (WH/VT), harness side.	**Yes** REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation. **No** GO to D6 .

 • **Is the resistance greater than 10,000 ohms?**	
D6 CHECK THE STARTER MOTOR RELAY	**Yes** GO to D7 . **No** INSTALL a new relay. TEST the system for normal operation.
• Carry out the Mini ISO Relay Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the relay OK?**	
D7 CHECK THE SMART JUNCTION BOX (SJB) CONNECTORS	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

• Check SJB connectors C2280a, C2280g and C2280h for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminal.
• Connect: SJB C2280a.
• Connect: SJB C2280g.
• Connect: SJB C2280h.
• Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
• **Is the concern still present?**	

Pinpoint Test E: The Ignition Key is Hard to Turn

Normal Operation

The ignition lock cylinder is the mechanical link to the ignition switch.

Possible Causes

- Ignition switch
- Ignition key
- Ignition lock cylinder

PINPOINT TEST E: THE IGNITION KEY IS HARD TO TURN

Test Step	Result / Action to Take
E1 CHECK THE STEERING WHEEL POSITION	
NOTE: The ignition lock cylinder should return from the START position back to the RUN position without assistance. • Check to see if the steering wheel is turned and locked full left or full right. • **Is the steering wheel locked full left or full right?**	**Yes** APPLY turning effort to the steering wheel in the direction of lock while turning the key to the RUN position. TEST the system for normal operation. **No** GO to E2.
E2 CHECK THE IGNITION LOCK CYLINDER KEY	
• Check the ignition lock cylinder key for burrs, damaged key or incorrect key cut. • **Is the key OK?**	**Yes** GO to E3. **No** INSTALL a new ignition key. TEST the system for normal operation.
E3 CHECK THE IGNITION LOCK CYLINDER	
• Remove the ignition lock cylinder. Refer to Section 501-14. • Check the ignition lock cylinder by rotating the ignition lock cylinder through all of the switch positions. • **Does the ignition lock cylinder stick or bind in any of the positions?**	**Yes** INSTALL a new ignition lock cylinder. REFER to Section 501-14. **No** GO to E4.
E4 CHECK THE IGNITION LOCK CYLINDER HOUSING	
• Check for binding or sticking ignition switch actuating rod, burrs around the rack-and-pinion actuator in the ignition lock cylinder housing, or insufficient lubrication. • **Is the ignition switch actuating rod, rack-and-pinion actuator and lubrication OK?**	**Yes** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation. **No** REPAIR or LUBRICATE as necessary. TEST the system for normal operation.

Pinpoint Test F: B2A20 — Ignition Stuck in START

Refer to Wiring Diagrams Cell 13, Power Distribution/SJB for schematic and connector information.

Normal Operation

The smart junction box (SJB) continuously monitors the ignition switch state, if the SJB receives a START signal for more than 30 seconds, DTC B2A20 will be set.

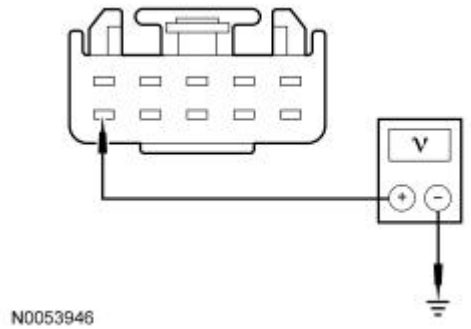
The ignition switch is spring loaded to automatically return to the RUN position after being placed in the START position.

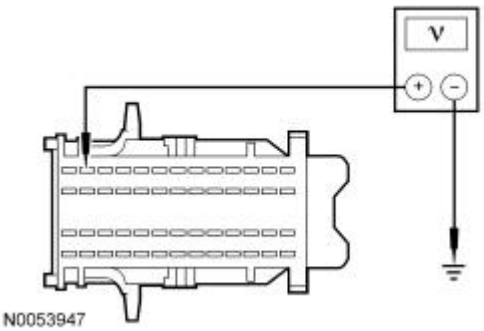
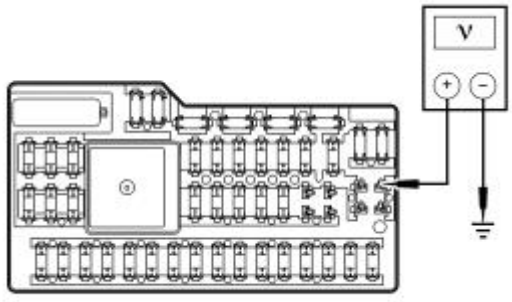
Possible Causes

- Circuit shorted
- Ignition switch
- Smart junction box

PINPOINT TEST F: B2A20 — IGNITION STUCK IN START

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
F1 CHECK THE IGNITION SWITCH MECHANICAL FUNCTION • Inspect the ignition switch for mechanical function. Refer to Ignition Switch Mechanical Check in Inspection and Verification. • **Is the ignition switch OK?**	**Yes** GO to F2 . **No** Go To Pinpoint Test E .
F2 CHECK THE IGNITION SWITCH FOR A SHORT • Carry out the ignition switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** GO to F3 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.
F3 CHECK CIRCUIT CDC35 (BU/WH) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: Ignition Switch C250. • Disconnect: SJB C2280g. • Measure the voltage between ignition switch C250-10, circuit CDC35 (BU/WH), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation. **No** GO to F4 .
F4 CHECK CIRCUIT CBP28 (GY/VT) FOR A SHORT TO VOLTAGE • Disconnect: Radio C240a. • Measure the voltage between SJB C2280g-2, circuit CBP28 (GY/VT), harness side and ground.	**Yes** REPAIR circuit CBP28 (GY/VT). TEST the system for normal operation. **No** GO to F5 .

 N0053947 • **Is any voltage present?**	
F5 CHECK THE SJB FOR A SHORT TO VOLTAGE	
• Disconnect: SJB fuse 28 (5A). • Measure the voltage between SJB fuse 28 (5A), input side and ground.  N0053986 • **Is voltage present?**	**Yes** INSTALL a new SJB. REPEAT the self-test. **No** GO to F6 .
F6 CHECK THE SJB CONNECTORS	
• Check SJB connectors C2280a and C2280h for: ▪ corrosion. ▪ pushed-out pins. ▪ spread terminal. • Connect: SJB C2280a. • Connect: SJB C2280h. • Make sure the connectors are seated correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test G: DTCs B2844 and U2472 — Ignition Fault and Unexpected Ignition State

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

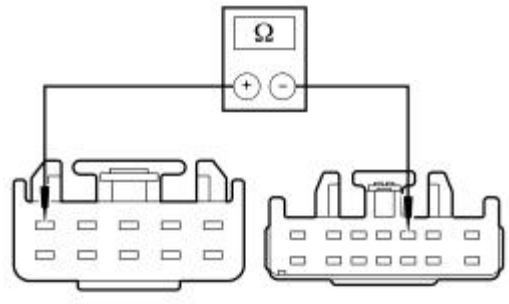
The smart junction box (SJB) continuously monitors the ignition switch state. If the SJB receives an invalid ignition state or cannot receive the ignition switch state during normal operation, DTC B2844 is set. If the SJB does not receive the ignition RUN signal, or any ignition switch signal, while performing an SJB self test, DTC U2472 is set.

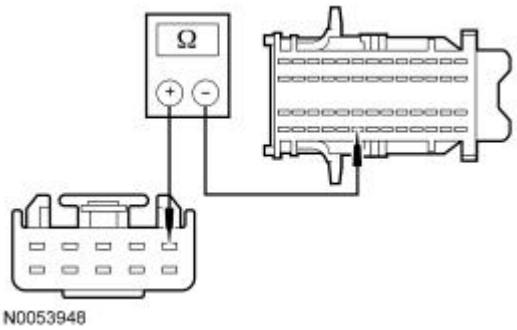
Possible Causes

- Circuit open
- Circuit shorted
- Ignition switch
- SJB

PINPOINT TEST G: DTCs B2844 AND U2472 — IGNITION FAULT AND UNEXPECTED IGNITION STATE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
G1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Key in ON position. • Carry out the on-demand self test for the SJB. Retrieve and record any DTCs. • **Is DTC U2472 present?**	**Yes** GO to G2. **No** For DTC B2844, GO to G5. For DTC B2A20, Go To Pinpoint Test F. For all other SJB DTCs, REFER to Section 419-10.
G2 CHECK THE IGNITION SWITCH	
• Key in OFF position. • Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** GO to G3. **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation.
G3 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN	
• Disconnect: Ignition Switch C250. • Disconnect: SJB C2280f. • Measure the resistance between ignition switch C250-5, circuit CDC33 (VT/GN), harness side and SJB C2280f-3, circuit CDC33 (VT/GN), harness side.  N0053940 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CDC33 (VT/GN). TEST the system for normal operation. **No** GO to G4.
G4 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN	
• Disconnect: SJB C2280g. • Measure the resistance between ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280g-45, circuit CDC34 (WH/OG), harness side.	**Yes** REPAIR circuit CDC34 (WH/OG). TEST the system for normal operation.

 • **Is the resistance greater than 10,000 ohms?**	**No** GO to G7 .
G5 CHECK THE IGNITION CIRCUITS FOR A SHORT TO VOLTAGE	

• Key in OFF position.
• Disconnect: Ignition Switch C250.
• Disconnect: SJB C2280g.
• Disconnect: SJB C2280f.
• Disconnect: Run/Start Relay.
• Measure the voltage between ground and:
  ▪ SJB C2280f-3, circuit CDC33 (VT/GN), harness side.
  ▪ SJB C2280f-4, circuit CDC32 (BN/YE), harness side.
  ▪ SJB C2280g-32, circuit CDC35 (BU/WH), harness side.
  ▪ SJB C2280g-45, circuit CDC34 (WH/OG), harness side.
  ▪ run/start relay cavity 1, circuit CDC34 (WH/OG), harness side.
• **Is voltage present?**
	Yes
	REPAIR the affected circuit(s). TEST the system for normal operation.
	
	No
	GO to G6 .

G6 CHECK THE IGNITION CIRCUITS FOR AN OPEN	

• Measure the resistance between:
  ▪ ignition switch C250-5, circuit CDC33 (VT/GN), harness side and SJB C2280f-3, circuit CDC33 (VT/GN), harness side.
  ▪ ignition switch C250-7, circuit CDC32 (BN/YE), harness side and SJB C2280f-4, circuit CDC32 (BN/YE), harness side.
  ▪ ignition switch C250-10, circuit CDC35 (BU/WH), harness side and SJB C2280g-32, circuit CDC35 (BU/WH), harness side.
  ▪ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280g-45, circuit CDC34 (WH/OG), harness side.
  ▪ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and run/start relay cavity 1, circuit CDC34 (WH/OG), harness side.
• **Are any of the resistances greater than 10,000 ohms?**
	Yes
	REPAIR the affected circuit(s). TEST the system for normal operation.
	
	No
	GO to G7 .

G7 CHECK THE SJB CONNECTORS	

• Check SJB connectors C2280g and C2280f for:
  ▪ corrosion.
  ▪ pushed-out pins.
  ▪ spread terminal.
• Connect: SJB C2280g.
• Connect: SJB C2280f.
• Make sure the connectors are seated correctly, then operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Key Release Interlock Actuator is Inoperative

Refer to Wiring Diagrams Cell 37 , Shift Interlock for schematic and connector information.

Normal Operation

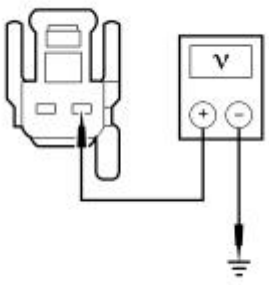
The key release interlock actuator receives fused battery voltage from smart junction box (SJB) fuse 27 (20A) along circuit SBP27 (BU/RD). Ground for the actuator is provided along circuit CDC41 (WH/BN), through the park detection switch and then along circuit GD143 (BK/VT). When the transmission selector lever is placed in PARK, the park detection switch closes and circuit CDC41 (WH/BN) is connected to circuit GD143 (BK/VT), this grounds the key release actuator and prevents the key from being removed.

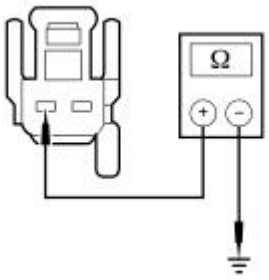
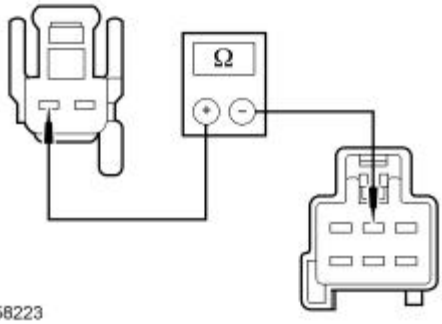
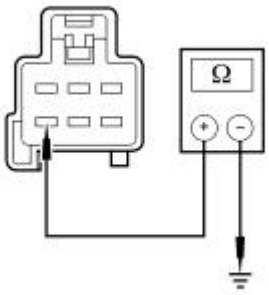
Possible Causes

- Circuit open
- Circuit shorted
- Key release interlock actuator
- Park detection switch (part of the transmission selector lever assembly)

PINPOINT TEST H: THE KEY RELEASE INTERLOCK ACTUATOR IS INOPERATIVE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

Test Step	Result / Action to Take
H1 CHECK CIRCUIT SBP27 (BU/RD) FOR VOLTAGE	
NOTE: Battery voltage must be greater than 10 volts. • Key in OFF position. • Disconnect: Key Release Interlock Actuator C2139. • Measure the voltage between key release interlock actuator C2139-1, circuit SBP27 (BU/RD), harness side and ground.  N0058221 • **Is the voltage greater than 10 volts?**	**Yes** GO to H2 . **No** VERIFY SJB fuse 27 (20A) is OK. If OK, REPAIR circuit SBP27 (BU/RD). TEST the system for normal operation.
H2 CHECK CIRCUIT CDC41 (WH/BN) FOR A SHORT	
• Disconnect: Floor Shifter C2096. • Measure the resistance between key release interlock actuator C2139-2, circuit CDC41 (WH/BN), harness side and ground.	**Yes** REPAIR circuit CDC41 (WH/BN). TEST the system for normal operation. **No** GO to H3 .

 N0058222 • **Is the resistance less than 5 ohms?**	
H3 CHECK CIRCUIT CDC41 (WH/BN) FOR AN OPEN	
• Measure the resistance between key release interlock actuator C2139-2, circuit CDC41 (WH/BN), harness side and floor shifter C2096-2, circuit CDC41 (WH/BN), harness side.  N0058223 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CDC41 (WH/BN). TEST the system for normal operation. **No** GO to H4 .
H4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Measure the resistance between floor shifter C2096-4, circuit GD143 (BK/VT), harness side and ground.  N0058224 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit GD143 (BK/VT). TEST the system for normal operation. **No** GO to H5 .
H5 CHECK THE KEY RELEASE INTERLOCK ACTUATOR FOR AN OPEN	
NOTE: At room temperature, the resistance across the solenoid should be 50 ± 10 ohms. • Measure the resistance between key release interlock actuator C2139, pin-1 and pin-2, component side. • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new key release interlock actuator. REFER to Key Release Interlock Actuator in this section. TEST the system for normal operation. **No** GO to H6 .
H6 CHECK THE KEY RELEASE INTERLOCK ACTUATOR FOR A SHORT	

NOTE: At room temperature, the resistance across the solenoid should be 50 ± 10 ohms. • Measure the resistance between key release interlock actuator C2139 pin-1 and pin-2, component side. • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new key release interlock actuator. REFER to Key Release Interlock Actuator in this section. TEST the system for normal operation. **No** GO to H7 .
H7 CHECK THE PARK DETECTION SWITCH FOR AN OPEN	
• With the transmission selector lever in PARK, measure the resistance between floor shifter C2096 pin-1 and pin-2, component side. • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new floor shift selector lever assembly. REFER to Section 307-05 . TEST the system for normal operation. **No** GO to H8 .
H8 CHECK THE PARK DETECTION SWITCH FOR A SHORT	
• With the transmission selector lever in NEUTRAL, measure the resistance between floor shifter C2096 pin-1 and pin-2, component side. • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new floor shift selector lever assembly. REFER to Section 307-05 . TEST the system for normal operation. **No** The system is functioning correctly at this time. The concern may have been caused by a loose or corroded connection. INSPECT the electrical connectors, REPAIR as necessary. TEST the system for normal operation.

Component Tests

Ignition Switch Continuity Check

Refer to Wiring Diagrams Cell 149 for schematic and connector information.

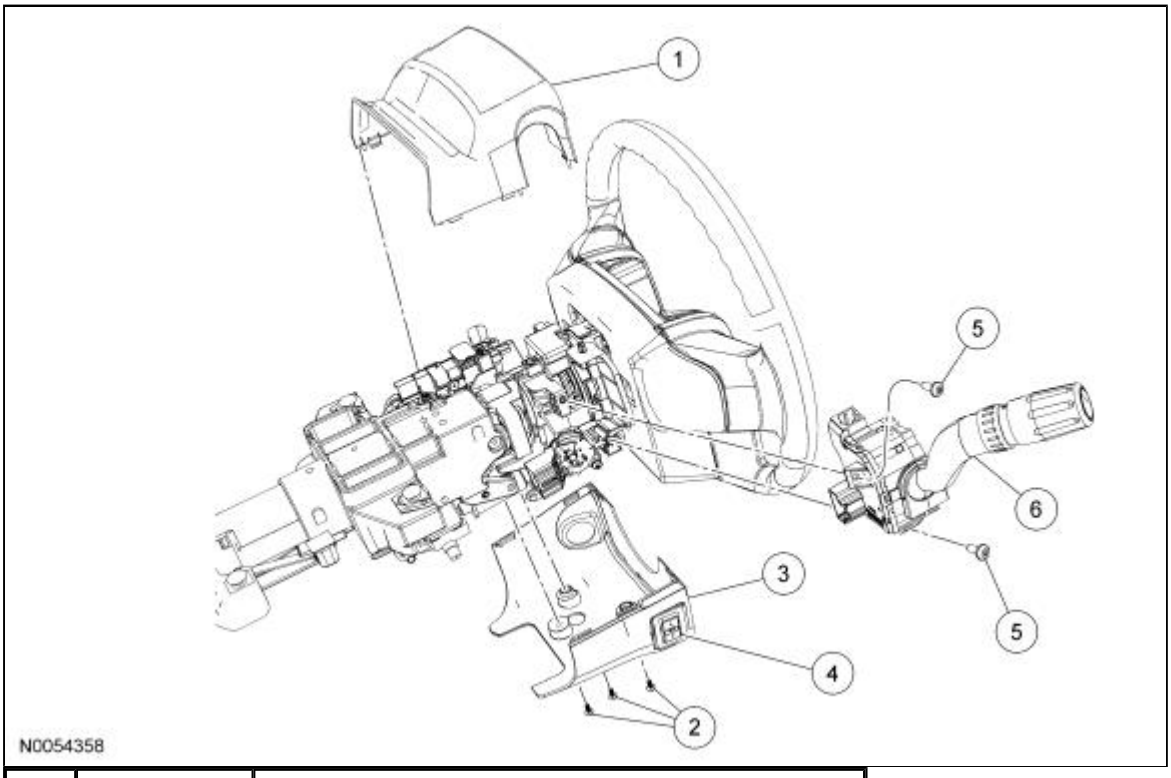
Multi-function Switch

Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Steering Column Multifunction Switch

Printable View (207 KB)

NOTE: Power tilt column shown, manual tilt similar.

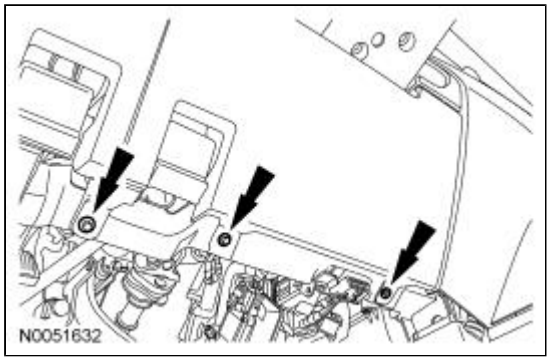


Item	Part Number	Description
1	3530A	Upper steering column shroud
2	W710485	Lower steering column shroud screws (3 required)
3	3530B	Lower steering column shroud
4	3B504	Power tilt switch
5	W506943	Multi-function switch screws (2 required)
6	13K359	Multi-function switch

Removal and Installation

All vehicles

1. Remove the 3 screws, pull out to release the top retaining clips and remove the lower steering column opening cover.



Vehicles with power tilt

2. Remove the 3 screws and the upper and lower steering column shrouds.
    - Disconnect the power tilt electrical connector switch from the lower shroud.

Vehicles with manual tilt

3. If equipped, release the tabs and slide the gear selector cover away from the steering column shrouds.

4. Remove the 3 screws and the upper and lower steering column shrouds.

All vehicles

5. Disconnect the multi-function switch electrical connector.

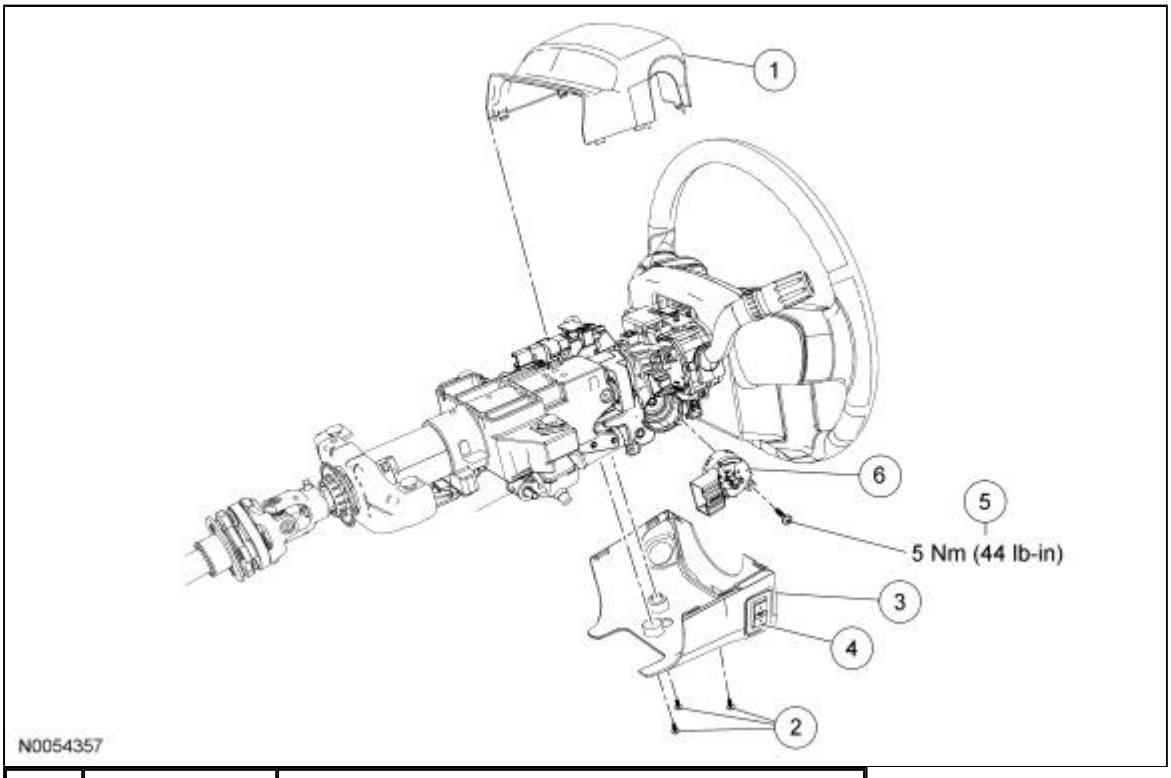
6. Remove the 2 screws and the multi-function switch.

7. To install, reverse the removal procedure.

Ignition Switch

Printable View (298 KB)

NOTE: Power tilt column shown, manual tilt similar.



Item	Part Number	Description
1	3530A	Steering column upper shroud
2	W705314	Steering column shroud screws (3 required)
3	3530B	Steering column lower shroud
4	3B504	Power tilt switch
5	11B572	Ignition switch screw
6	11572	Ignition switch

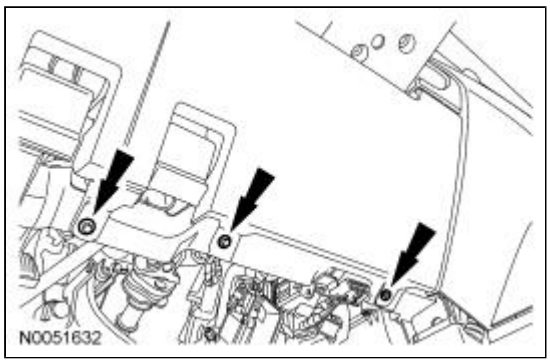
Removal and Installation

All vehicles

1. Depower the supplemental restraints system (SRS). For additional information, refer to Section 501-20B .

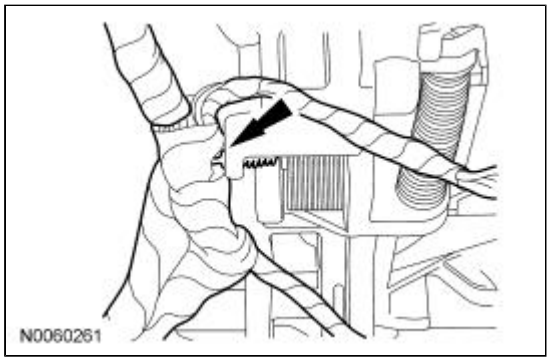
Vehicles with power tilt

2. Remove the 3 screws, pull out to release the top retaining clips and remove the lower steering column opening cover.



3. Remove the 3 screws and the upper and lower steering column shrouds.
    - Disconnect the power tilt electrical connector switch from the lower shroud.

4. Detach the wiring harness retainer from the steering column.



5. Disconnect the following electrical connectors to access the ignition switch.
    - Multi-function switch
    - Clockspring
    - EPATS connector
    - Key release interlock actuator (if equipped)

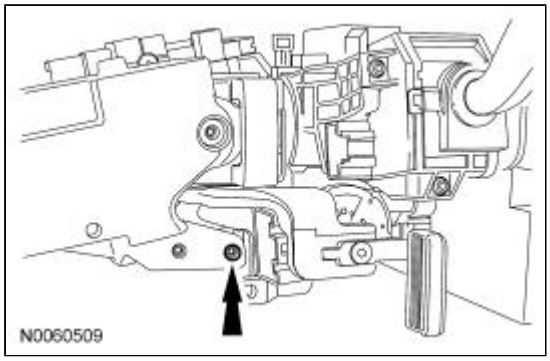
6. Disconnect the ignition switch electrical connector.

Vehicles with manual tilt

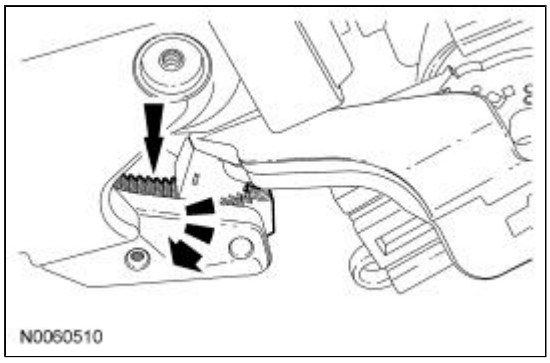
7. Remove the steering column. For additional information, refer to Section 211-04 .
    - Place the steering column on a clean workbench.

8. Position the column in the full up position.

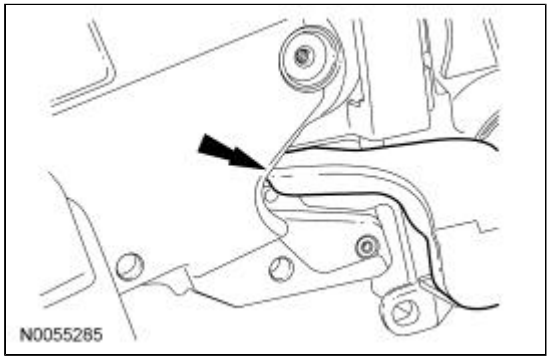
9. Using suitable tools, push the first roll pin out of the fixed shoe.



10. Pivoting on the second roll pin, tilt the fixed shoe down.



11. Position the tilt lever to rest against the steering column housing.



All vehicles

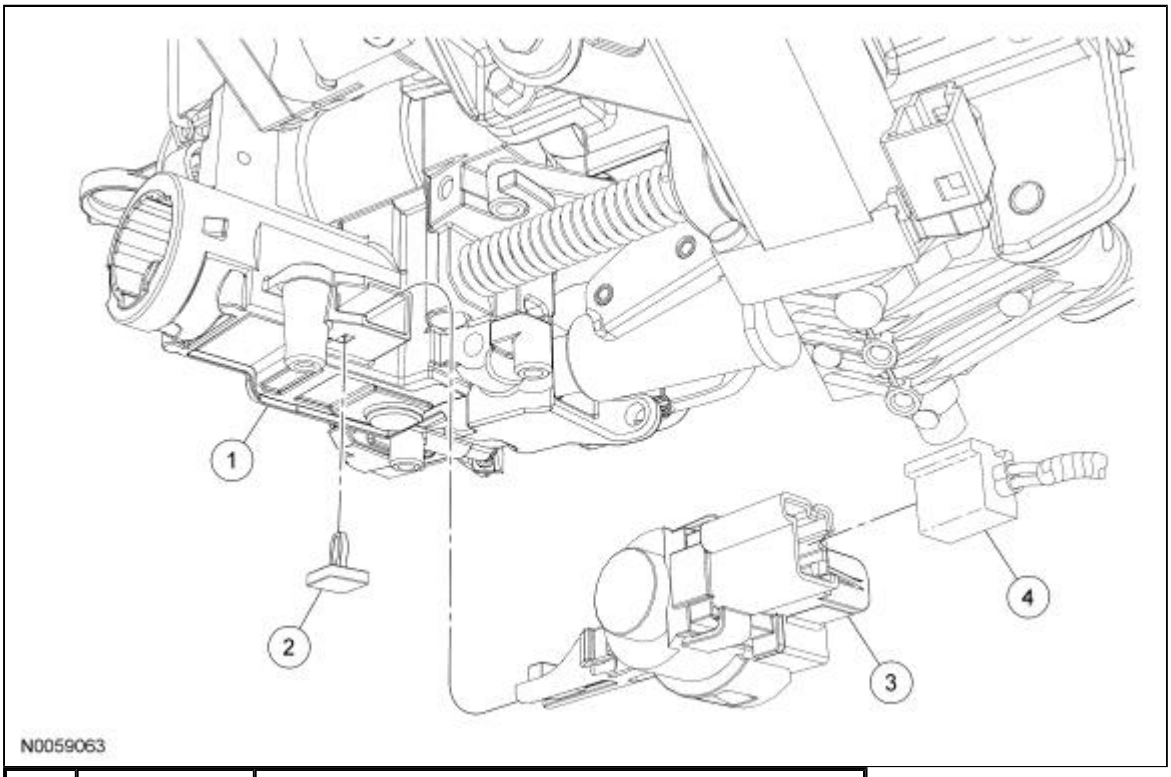
12. Remove the ignition switch screw and ignition switch.
    - To install, tighten to 5 Nm (44 lb-in).

13. **CAUTION: Make sure the electrical wiring harness is routed correctly and secured to the steering column or damage to the wires and/or connectors can occur.**

    To install, reverse the removal procedure.

Key Release Interlock Actuator

Printable View (331 KB)



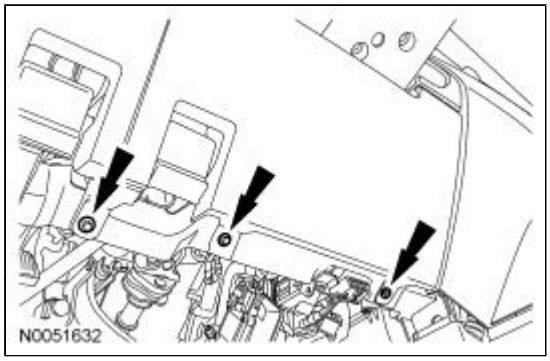
Item	Part Number	Description
1	3C529	Steering column
2	3E636	Locking clip
3	3B658	Key release interlock actuator
4	—	Key release interlock actuator electrical connector

Removal and Installation

All vehicles

1. Place the ignition switch in the off position.
   - Remove key.

2. Remove the lower steering column opening cover.
   - Remove the 3 screws and pull out to release the top retaining clips and remove the lower steering column opening cover.



Vehicle with power tilt

3. Remove the 3 screws and the upper and lower steering column shrouds.
    - Disconnect the power tilt electrical connector switch from the lower shroud.
        - To install, tighten to 2 Nm (18 lb-in).

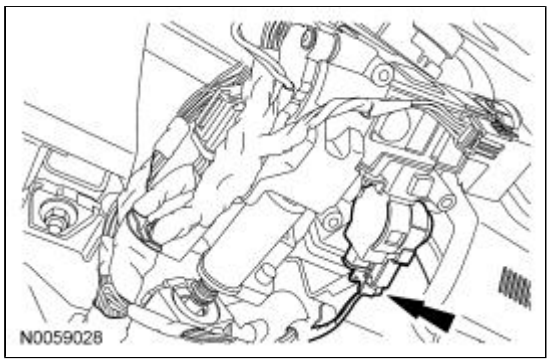
Vehicles with manual tilt

4. If equipped, release the tabs and slide the gear selector cover away from the steering column shrouds.

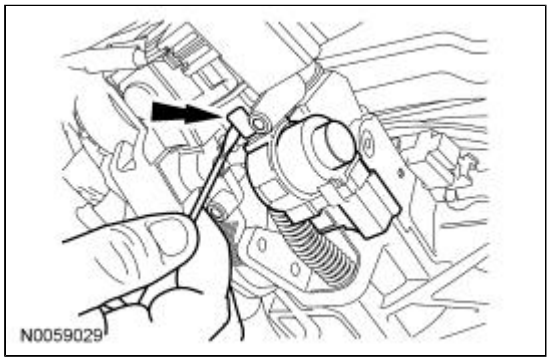
5. Remove the 3 screws and the upper and lower steering column shrouds.
    - To install, tighten to 2 Nm (18 lb-in).

All vehicles

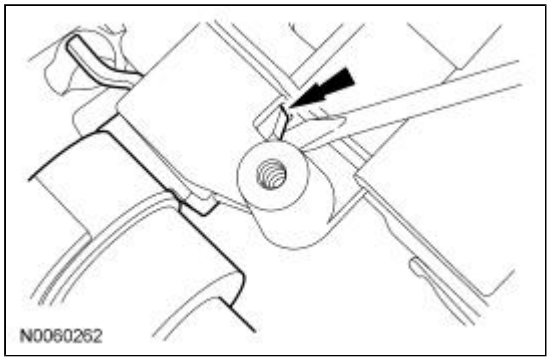
6. Disconnect the key release interlock actuator electrical connector.



7. Remove and discard the locking clip.



8. Using a suitable tool, release the tab and remove the key release interlock actuator.



9. To install, reverse removal procedure.

Printable View (78 KB)

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Gasoline Engine Oil Dye 164-R3705	—
Threadlock 262 TA-26	WSK-M2G351-A6

Engine

Printable View (80 KB)

CAUTION: When repairing engines, all parts must be contamination free. If contamination/foreign material is present when repairing an engine, premature engine failure can occur.

NOTE: This section contains information, steps and procedures that may not be specific to your engine.

This section covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, which are covered in the Powertrain Control/Emissions Diagnosis Manual.

The engine incorporates the following features:

- a closed positive crankcase ventilation (PCV) system. For additional information, refer to Section 303-08 .
- an evaporative emission control system. For additional information, refer to Section 303-13 .

Some engines incorporate a fail-safe cooling system. Refer to the appropriate section in Group 303 for the procedure.

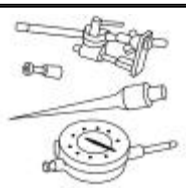
The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the scheduled Maintenance Guide.

Correct engine identification is required to order parts. Refer to the appropriate section in Group 303 for the procedure.

Engine

Printable View (222 KB)

Special Tool(s)

ST1277-A	Commercially Available Leakdown Tester —
ST1299-A	Quick Disconnect Compression Tester 134-R0212 or equivalent
ST1272-A	Dial Indicator Gauge Adapter 303-007 (TOOL-6565-AB) or equivalent
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1298-A	Engine Cylinder Leak Detection/Air Pressurization Kit 014-00708 or equivalent
ST1296-A	Oil Pressure Gauge 303-088 (T73L-6600-A)
ST1300-A	UV Leak Detector Kit 164-R0756 or equivalent
	Vacuum/Pressure Tester 164-R0253 or equivalent

ST1297-A	

Material

Item	Specification
Gasoline Engine Oil Dye 164-R3705	—
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Inspection and Verification

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn parts • Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.
4. If the concerns remain after the inspection, determine the symptoms. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Difficult starting	• Damaged ignition system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Damaged fuel system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

	• Damaged starting system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Damaged charging system/battery	• REFER to Section 414-00 .
	• Burnt valve	• INSTALL a new valve.
	• Worn piston	• INSTALL a new piston.
	• Worn piston rings	• INSTALL new piston rings.
	• Worn cylinder	• REPAIR or INSTALL a new cylinder block.
	• Damaged head gasket	• INSTALL a new head gasket.
	• Damaged cooling system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
• Poor idling	• Vacuum leaks	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged ignition system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged fuel system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Damaged hydraulic lash adjuster	• INSTALL a new hydraulic lash adjuster.
	• Incorrect valve-to-valve seat contact	• REPAIR or INSTALL a new valve or valve seat.
	• Damaged head gasket	• INSTALL a new head gasket.
• Abnormal combustion	• Malfunctioning or damaged fuel system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged ignition system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged air intake system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Damaged hydraulic	• INSTALL a new hydraulic lash

	lash adjuster • Burnt or sticking valve • Weak or broken valve spring • Carbon accumulation in combustion chamber	adjuster. • REPAIR or INSTALL a new valve. • INSTALL a new valve spring. • ELIMINATE carbon buildup.
• Excessive oil consumption	• Leaking oil • Malfunctioning PCV system • Worn valve stem seal • Worn valve stem or valve guide • Sticking piston rings • Worn piston ring groove • Worn piston or cylinder	• REPAIR oil leakage. • REPAIR or INSTALL new necessary components. • INSTALL a new valve stem seal. • INSTALL a new valve and valve guide. • REPAIR or INSTALL new piston rings. • INSTALL a new piston and piston pin. • REPAIR or INSTALL a new piston or cylinder block.
• Engine noise	• Leaking exhaust system • Incorrect drive belt tension • Malfunctioning generator bearing • Malfunctioning water pump bearing • Malfunctioning or damaged cooling system • Malfunctioning or damaged fuel system • Loose timing chain/belt • Damaged timing chain tensioner • Excessive main bearing clearance • Seized or heat damaged crankshaft main	• REPAIR exhaust leakage. • REFER to Section 303-05 . • Refer to the appropriate section in Group 414 for the procedure. • REFER to Section 303-03 . • REFER to Section 303-03 . • Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • ADJUST or INSTALL a new timing chain/belt. • INSTALL a new timing chain tensioner. • **CAUTION: Remove the cylinder heads before removing the crankshaft. Failure to do so can result in engine damage.** INSTALL a new crankshaft main bearing. • INSTALL a new crankshaft main bearing.

	bearing	
	• Excessive crankshaft end play	• INSTALL a new thrust bearing or crankshaft.
	• Excessive connecting rod bearing clearance	• INSTALL a new connecting rod bearing or connecting rod.
	• Heat damaged connecting rod bearing	• INSTALL a new connecting rod bearing.
	• Damaged connecting rod bushing	• INSTALL a new connecting rod bushing.
	• Worn cylinder	• REPAIR or INSTALL a new cylinder block.
	• Worn piston or piston pin	• INSTALL a new piston or piston pin.
	• Damaged piston rings	• INSTALL new piston rings.
	• Bent connecting rod	• INSTALL a new connecting rod.
	• Malfunctioning hydraulic lash adjuster	• INSTALL a new hydraulic lash adjuster.
	• Broken valve spring	• INSTALL a new valve spring.
	• Excessive valve guide clearance	• ADJUST clearance or INSTALL a new valve guide or valve.
• Insufficient power	• Malfunctioning or damaged ignition system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged fuel system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Malfunctioning or damaged air intake system	• Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Damaged or plugged exhaust system	• INSPECT exhaust system.
	• Incorrect tire size	• REFER to Section 204-00 .
	• Dragging brakes	• REFER to Section 206-00 .
	• Slipping transmission	• Refer to the appropriate section in Group 307 for the procedure.
	• Malfunctioning hydraulic lash adjuster	• INSTALL a new hydraulic lash adjuster.
	• Compression leakage at valve seat	• REPAIR or INSTALL a new valve, valve seat or cylinder head.

	• Seized valve stem	• INSTALL a new valve.
	• Weak or broken valve spring	• INSTALL a new valve spring.
	• Worn or damaged camshaft	• INSTALL a new camshaft.
	• Damaged head gasket	• INSTALL a new head gasket.
	• Cracked or distorted cylinder head	• INSTALL a new cylinder head.
	• Damaged, worn or sticking piston ring (s)	• REPAIR or INSTALL a new piston ring(s).
	• Worn or damaged piston	• INSTALL a new piston and piston pin.

Component Tests

Engine Oil Leaks

CAUTION: If an overnight drive is done, the fan air or road air blast can cause erroneous readings.

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to repair.

Prior to carrying out this procedure, clean all sealing surface areas with a suitable solvent to remove all traces of oil.

Engine Oil Leaks — Fluorescent Oil Additive Method

Use the UV Leak Detector Kit to carry out the following procedure for oil leak diagnosis.

1. Add 29.6 ml (1 ounce) of fluorescent additive to a minimum of 0.47L (1/2 qt) and a maximum of 0.95L (1 qt) engine oil and fill through the engine oil fill. If the oil is not premixed, the fluorescent additive will not have enough time to reach the crankcase, oil galleries and seal surfaces during this particular 15 minute test. The additive must be mixed with oil and added through the oil fill. Check the level on the oil level indicator to determine what amount of oil to premix. If it is in the middle of the crosshatch area or below the full mark, use 0.95L (1 qt). If it is at the full mark, use 0.47L (1/2 qt).

2. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the UV Leak Detector Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.

3. At the end of test, make sure the oil level is within the upper and lower oil indicator marks. Remove oil as necessary if it registers above the full mark.

Leakage Points — Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Intake manifold gaskets
- Cylinder head gaskets

- Oil bypass filter
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Oil pressure sensor

Leakage Points — Under Engine — With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets
- Oil pan sealer
- Oil pan rear seal
- Engine front cover gasket
- Crankshaft front seal
- Crankshaft rear seal
- Crankshaft main bearing cap side bolts
- Oil filter adapter and filter body
- Oil cooler, if equipped

Leakage Points — With Transmission and Flywheel Removed

Examine the following areas for oil leakage:

- Crankshaft rear seal
- Rear main bearing cap parting line
- Rear main bearing cap and seals
- Flywheel mounting bolt holes (with flywheel installed)
- Camshaft rear bearing covers or pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when using the dye method.

Compression Test — Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position.

3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder.

4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test — Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1131 kPa (164 psi)	848 kPa (123 psi)	1338 kPa (194 psi)	1000 kPa (145 psi)	1544 kPa (224 psi)	1158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1145 kPa (166 psi)	855 kPa (124 psi)	1351 kPa (196 psi)	1014 kPa (147 psi)	1558 kPa (226 psi)	1165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1158 kPa (168 psi)	869 kPa (126 psi)	1365 kPa (198 psi)	1020 kPa (148 psi)	1572 kPa (228 psi)	1179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (105 psi)	1172 kPa (170 psi)	876 kPa (127 psi)	1379 kPa (200 psi)	1034 kPa (150 psi)	1586 kPa (230 psi)	1186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1186 kPa (172 psi)	889 kPa (129 psi)	1303 kPa (189 psi)	1041 kPa (151 psi)	1600 kPa (232 psi)	1200 kPa (174 psi)
933 kPa (135 psi)	745 kPa (108 psi)	1200 kPa (174 psi)	903 kPa (131 psi)	1407 kPa (204 psi)	1055 kPa (153 psi)	1055 kPa (153 psi)	1207 kPa (175 psi)
1007 kPa (146 psi)	758 kPa (110 psi)	1214 kPa (176 psi)	910 kPa (132 psi)	1420 kPa (206 psi)	1062 kPa (154 psi)	1627 kPa (236 psi)	1220 kPa (177 psi)
1020 kPa (148 psi)	765 kPa (111 psi)	1227 kPa (178 psi)	917 kPa (133 psi)	1434 kPa (208 psi)	1075 kPa (156 psi)	1641 kPa (238 psi)	1227 kPa (178 psi)
1034 kPa (150 psi)	779 kPa (113 psi)	1241 kPa (180 psi)	931 kPa (135 psi)	1448 kPa (210 psi)	1083 kPa (157 psi)	1655 kPa (240 psi)	1241 kPa (180 psi)
1048 kPa (152 psi)	786 kPa (114 psi)	1255 kPa (182 psi)	936 kPa (136 psi)	1462 kPa (212 psi)	1089 kPa (158 psi)	1669 kPa (242 psi)	1248 kPa (181 psi)
1062 kPa (154 psi)	793 kPa (115 psi)	1269 kPa (184 psi)	952 kPa (138 psi)	1476 kPa (214 psi)	1103 kPa (160 psi)	1682 kPa (244 psi)	1262 kPa (183 psi)
1076 kPa (156 psi)	807 kPa (117 psi)	1282 kPa (186 psi)	965 kPa (140 psi)	1489 kPa (216 psi)	1117 kPa (162 psi)	1696 kPa (246 psi)	1269 kPa (184 psi)
1089 kPa (158 psi)	814 kPa (118 psi)	1296 kPa (188 psi)	972 kPa (141 psi)	1503 kPa (218 psi)	1124 kPa (163 psi)	1710 kPa (248 psi)	1202 kPa (174 psi)
1103 kPa (160 psi)	827 kPa (120 psi)	1310 kPa (190 psi)	979 kPa (142 psi)	1517 kPa (220 psi)	1138 kPa (165 psi)	1724 kPa (250 psi)	1289 kPa (187 psi)
1110 kPa (161 psi)	834 kPa (121 psi)	1324 kPa (192 psi)	993 kPa (144 psi)	1631 kPa (237 psi)	1145 kPa (166 psi)	—	—

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test — Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty.

2. If compression does not improve, valves are sticking or seating incorrectly.

3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.
   Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of the Engine Cylinder Leak Detection/Air Pressurization Kit will be helpful in pinpointing the exact cause.

The leakage detector is inserted in the spark plug hole, the piston is brought up to dead center on the compression stroke and compressed air is admitted.

Once the combustion chamber is pressurized, a special gauge included in the kit will read the percentage of leakage. Leakage exceeding 20% is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the throttle body. A leak at the exhaust valve can be heard at the tail pipe. Leakage past the piston rings will be audible at the positive crankcase ventilation (PCV) connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner Guide. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is past the first recommended drain interval, the OEM production filter should have been changed.

2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
    - Extended idling or curbside engine operation
    - Stop-and-go traffic or taxi operation
    - Towing a trailer or vehicle loaded heavily
    - Frequent short trips (engine not up to normal operating temperature)

- Excessive throttling or high engine-rpm driving

3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under Engine Oil Leaks in the Diagnosis and Testing portion of this section.

4. Inspect the crankcase ventilation system for:
   - disconnected hoses at the valve cover or throttle body.
   - loose or missing valve cover fill cap.
   - missing or incorrectly seated engine oil level indicator.
   - incorrect or dirty PCV valve.
   - a PCV valve grommet unseated in the valve cover (if so equipped)

5. Inspect for signs of sludge. Sludge affects PCV performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback capability of piston oil control rings. Sludge can result from either excessive water ingestion in the crankcase or operation at extremely high crankcase temperatures.

6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.

7. If the engine is hot or was recently shut down, wait at least 5 minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming which may cause engine damage.

8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.

2. Verify the spark plugs are not oil saturated. Oil leaking into one or more cylinders will appear as an oil soaked condition on the plug. If a plug is saturated, a compression check may be necessary at the conclusion of the oil consumption test.

Oil Consumption Test

Once all of the previous conditions are met, carry out an oil consumption test.

1. Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure the vehicle is positioned on a level surface. Refill the oil pan to a level **one liter (quart) less** than the specified fill level, using manufacturer-specified oil.

2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 5-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.

3. Add the final 0.95L (1 qt) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.

4. After a 5-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one quart differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the oil level indicator are where

the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.

5. Record the vehicle mileage.

6. Advise the customer that oil level indicator readings must be taken every 320 km (200 miles) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 5-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.

7. When the subsequent indicator readings demonstrate a full quart (liter) has been used, record the vehicle mileage. The mileage driven between the 2 readings should not be less than 1,500 miles. The drive cycle the vehicle has been operated under must be considered when making this calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all spark plugs removed. See the Compression Test Chart in this section for pressure range limits.

2. Compression should be consistent across all cylinders. Refer to the Compression Testing portion of this section. If compression tested within the specifications found in this section, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.

3. A cylinder leak detection test can be carried out using an Engine Cylinder Leak Detection/Air Pressurization Kit. This can help identify valves, piston rings, or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

NOTE: An oil-soaked appearance on the porcelain tips of the spark plugs also indicates excessive oil use. A typical engine with normal oil consumption will exhibit a light tan to brown appearance. See Spark Plug Analysis in this section for details. A single or adjoining, multiple cylinder leak can be traced by viewing the tips.

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.

5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

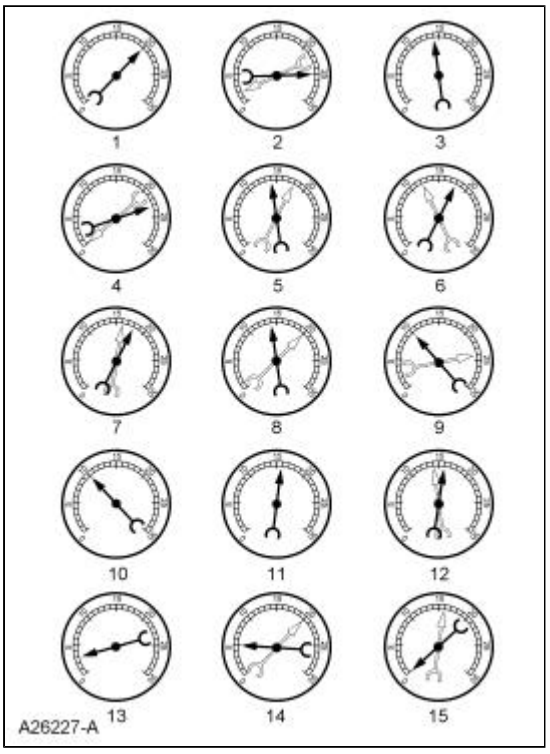
Intake Manifold Vacuum Test — Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas.

Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



1. NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.

2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.

3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.

4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).

5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.

6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient hydraulic lash adjuster or hydraulic lash adjuster (HLA) clearance will also cause this reaction.

7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.

8. WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.

9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The reading at idle could be relatively steady.

10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.

11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.

12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.

13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.

14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.

15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor from the engine.

2. Connect the Oil Pressure Gauge to the oil pressure sender oil galley port.

3. Run the engine until normal operating temperature is reached.

4. Run the engine at the specified rpm and record the gauge reading.

5. The oil pressure should be within specifications; refer to the specification chart in the appropriate engine section.

6. If the pressure is not within specification, check the following possible sources:
    - Insufficient oil
    - Oil leakage
    - Worn or damaged oil pump
    - Oil pump screen cover and tube
    - Excessive main bearing clearance
    - Excessive connecting rod bearing clearance

Valve Train Analysis — Engine Off — Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis — Engine Off, Camshaft Roller Followers and Hydraulic Lash Adjusters, Overhead Camshaft

- Check for loose mounting bolts on camshaft carriers.
- Check for plugged oil feed in the camshaft roller followers, lash adjusters or cylinder heads.

Valve Train Analysis — Engine Off, Camshaft — Engines

- Check for broken or damaged parts.

Valve Train Analysis — Valve Springs

- Check for broken or damaged parts.

Valve Train Analysis — Engine Off, Valve Spring Retainer and Valve Spring Retainer Keys

- Check for correct seating of the valve spring retainer key on the valve stem and in valve spring retainer.
- Check for correct seating on the valve stem.

Valve Train Analysis — Engine Off, Valves and Cylinder Head

- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged guide-mounted valve stem seal.
- Check for damaged hydraulic lash adjuster.
- Check installed valve spring height.
- Check for missing or worn valve spring seats.
- Check for plugged oil metering orifice in cylinder head oil reservoir (if equipped).

Static checks (engine off) are to be made on the engine prior to the dynamic procedure.

Valve Train Analysis — Engine Running, Valves and Cylinder Head

- Check for plugged oil drain back holes.
- Check for missing or damaged valve stem seals or guide mounted valve stem seals.
- Check for a plugged oil metering orifice in the cylinder head oil reservoir (4.6L engine only).

If insufficient oiling is suspected, check oil passages for blockage, then accelerate the engine to 1,200 rpm with the transmission in NEUTRAL and the engine at normal operating temperature. Oil should spurt from the rocker arm oil holes such that valve tips and camshaft roller followers are well oiled. With the valve covers off, some oil splash may overshoot camshaft roller followers.

Valve Train Analysis — Engine Running, Camshaft Lobe Lift

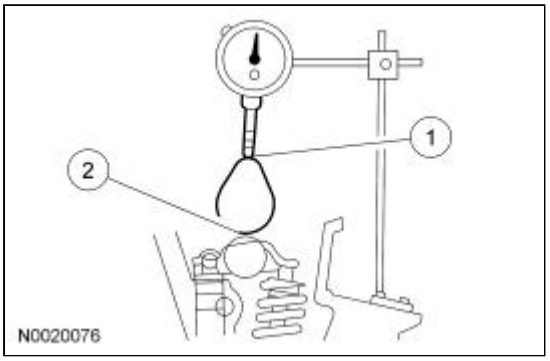
Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the valve covers.

2. Remove the spark plugs.

3. Install the Dial Indicator Gauge with Holding Fixture so the rounded tip of indicator is on top of the camshaft lobe and on the same plane as the hydraulic lash adjuster.

4. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.



5. Zero the dial indicator. Continue to rotate the crankshaft until the (1) high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).

6. To check the accuracy of the original indicator reading, continue to rotate crankshaft until the (2) base circle is reached. The indicator reading should be zero. If zero reading is not obtained, repeat Steps 1 through 6.

7. **NOTE:** If the lift on any lobe is below specified service limits, install a new camshaft, and new camshaft roller followers.

   Remove the Dial Indicator Gauge with Holding Fixture.

8. Install the spark plugs.

9. Install the valve covers.

Sprockets

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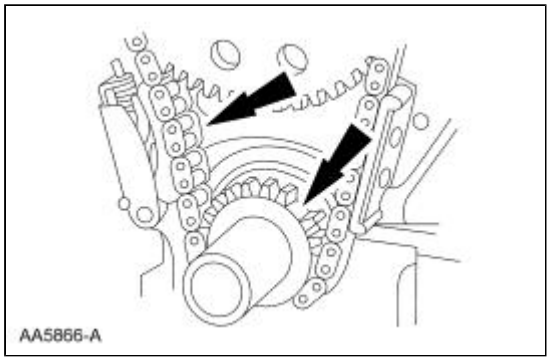
1. **WARNING: To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation.**

   NOTE: Specifications show the expected minimum or maximum condition. Refer to the appropriate section in Group 303 for the procedure.

   NOTE: If a component fails to meet the specifications, it is necessary to install a new component or refinish. If the component can be refinished, wear limits are provided as an aid to making a decision. A new component must be installed for any component that fails to meet specifications and cannot be refinished.

   Inspect the timing chain/belt and the sprockets.
   - Install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Camshaft Bearing Journal Diameter

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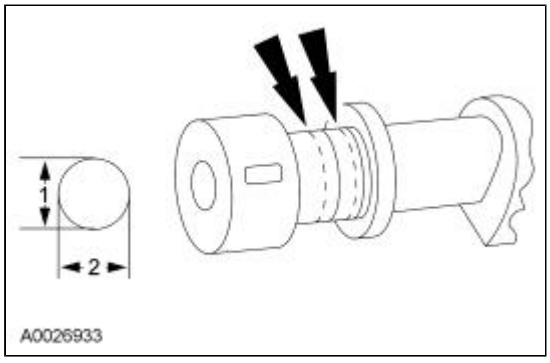
1. Measure each camshaft journal diameter in 2 directions.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Camshaft Journal to Bearing Clearance

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Special Tool(s)

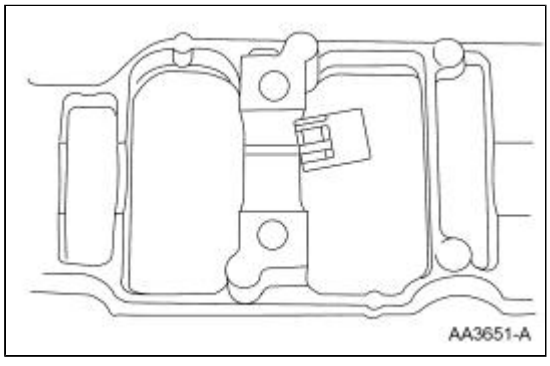
ST1280-A	Plastigage 303-D031 (D81L-6002-B) or equivalent

NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

1. Remove the camshaft bearing cap and lay Plastigage across the surface. Refer to the appropriate section in Group 303 for the procedure.

2. **NOTE:** Do not turn the camshaft while carrying out this procedure.

   Position the camshaft bearing cap and install the bolts. Refer to the appropriate section in Group 303 for the procedure.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3. Use Plastigage to verify the camshaft journal clearance.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.

Camshaft End Play

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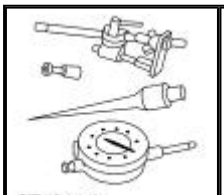
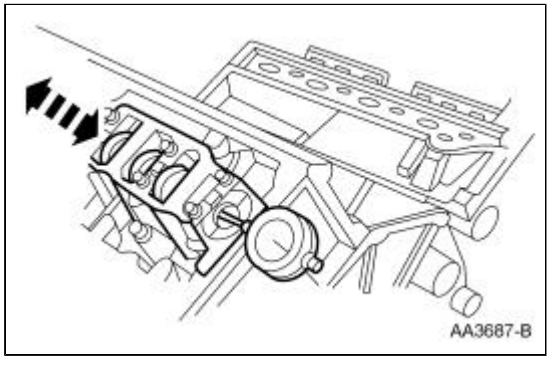
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. Use a Dial Indicator Gauge with Holding Fixture to measure camshaft end play.
2. Position the camshaft to the rear of the cylinder head.
3. Zero the indicator.
4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.
   - If camshaft end play exceeds specifications, install new camshaft and recheck end play. Refer to the appropriate section in Group 303 for the procedure.
   - If camshaft end play exceeds specification after camshaft installation, install a new cylinder head. Refer to the appropriate section in Group 303 for the procedure.



Camshaft Surface Inspection

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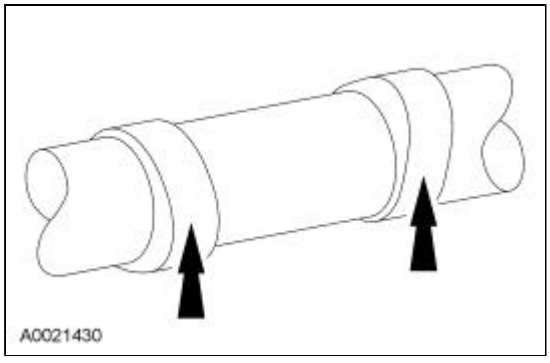
1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.
    - If excessive pitting or damage is present, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Camshaft Lobe Lift

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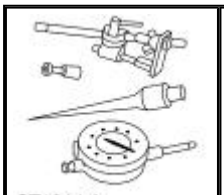
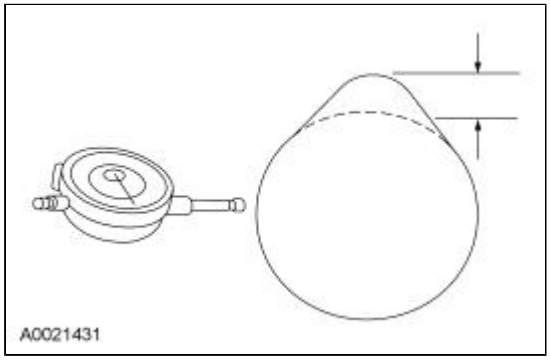
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. Use a Dial Indicator Gauge with Holding Fixture to measure camshaft intake/exhaust lobe lift.
   - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.
   - Refer to the appropriate section in Group 303 for the procedure.



Camshaft Runout

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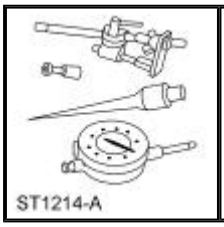
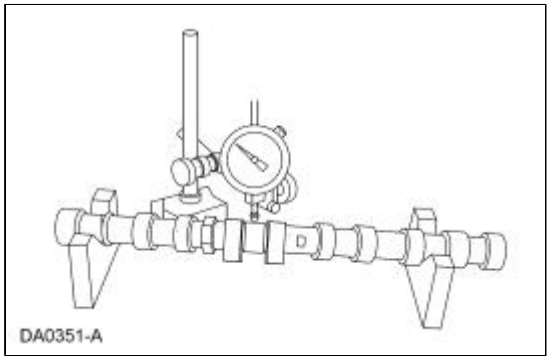
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. **NOTE:** Camshaft journals must be within specifications before checking runout.

   Use a Dial Indicator Gauge with Holding Fixture to measure the camshaft runout.
   - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading.
   - For additional information, refer to the specification chart in the appropriate engine section.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.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Crankshaft Main Bearing Journal Diameter

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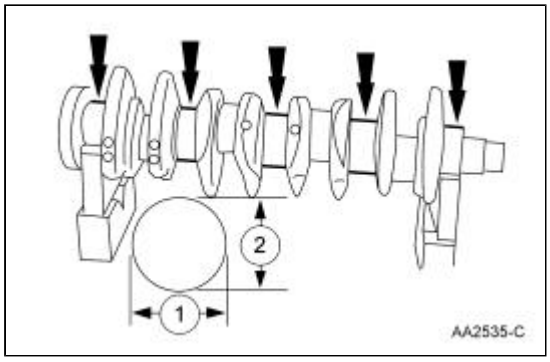
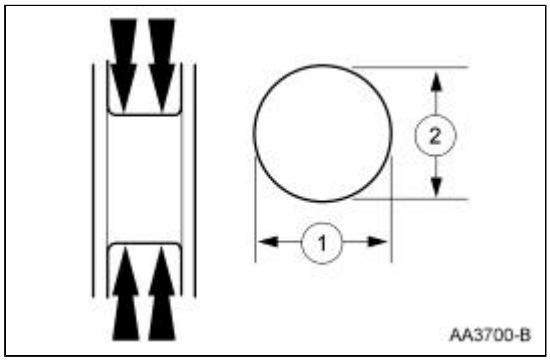
1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Crankshaft Main Bearing Journal Taper and Out-of-Round

Printable View (70 KB)

1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions at each end of the main bearing journal.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Crankshaft Main Bearing Journal-to-Bearing Clearance

Printable View (102 KB)

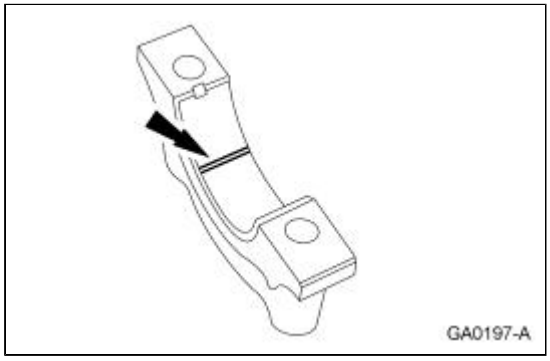
Special Tool(s)

ST1280-A	Plastigage 303-D031 (D81L-6002-B) or equivalent

NOTE: Crankshaft main bearing journals must be within specifications before checking journal clearance.

1. Remove the crankshaft main bearing caps and crankshaft main bearing.

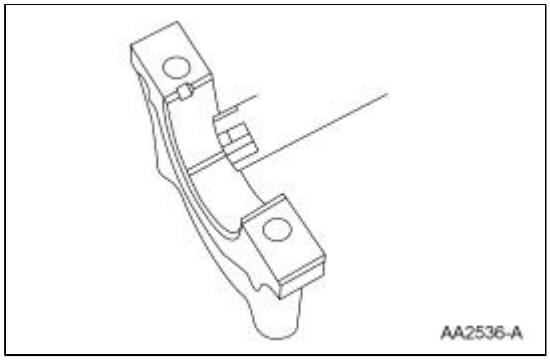
2. Lay a piece of Plastigage across the face of each crankshaft main bearing surface.



3. **NOTE:** Do not turn the crankshaft while carrying out this procedure.

   Install and remove the crankshaft main bearing cap.

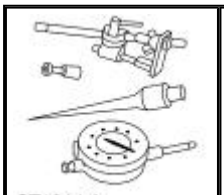
4. Verify the crankshaft journal clearance.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Crankshaft End Play

Printable View (79 KB)

Special Tool(s)

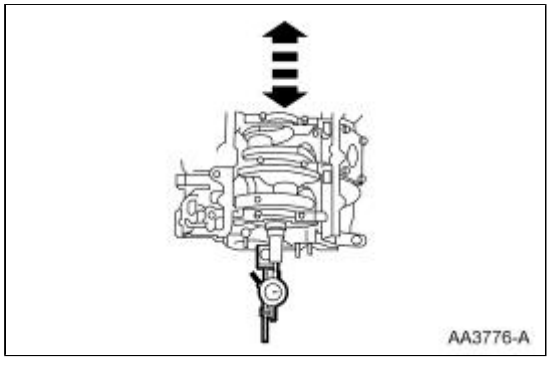
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. Measure the crankshaft end play. Use a Dial Indicator Gauge with Holding Fixture to measure crankshaft end play.

2. Position the crankshaft to the rear of the cylinder block.

3. Zero the indicator.

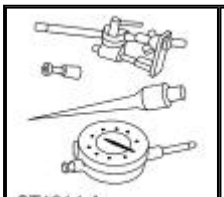
4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
   - If crankshaft end play exceeds specifications, install a new crankshaft thrust washer or crankshaft thrust main bearing. Refer to the appropriate section in Group 303 for the procedure.



Crankshaft Runout

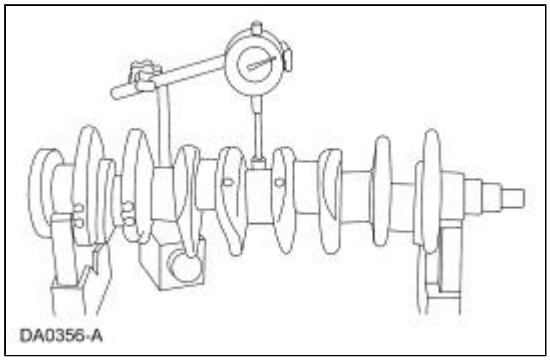
Printable View (103 KB)

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. **NOTE:** Crankshaft main bearing journals must be within specifications before checking runout.

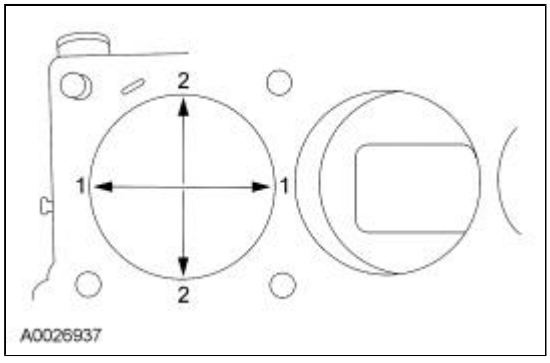
   Use the Dial Indicator Gauge with Holding Fixture to measure the crankshaft runout.
   - Refer to the appropriate section in Group 303 for the procedure.
   - Rotate the crankshaft and subtract the lowest dial indicator reading from the highest dial indicator reading to figure the crankshaft runout. If it is out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.


DA0356-A

Cylinder Bore Taper

Printable View (74 KB)

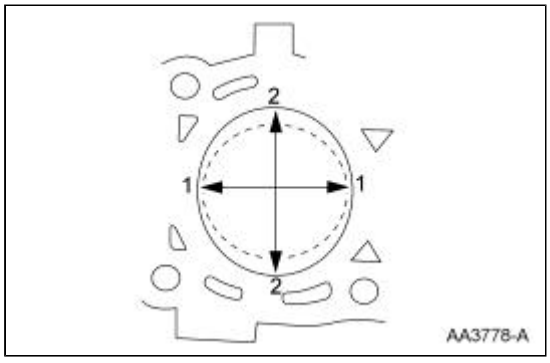
1. Measure the cylinder bore at the top, middle and bottom of piston ring travel in 2 directions as indicated. Verify the cylinder bore is within the wear limit. The difference indicates the cylinder bore taper. Bore the cylinder to the next oversize.
   - Refer to the appropriate section in Group 303 for the procedure.



Cylinder Bore Out-of-Round

Printable View (72 KB)

1. Measure the cylinder bore in 2 directions. The difference is the out-of-round. Verify the out-of-round is within the wear limit and bore the cylinder to the next oversize limit.
   - Refer to the appropriate section in Group 303 for the procedure.



Piston Inspection

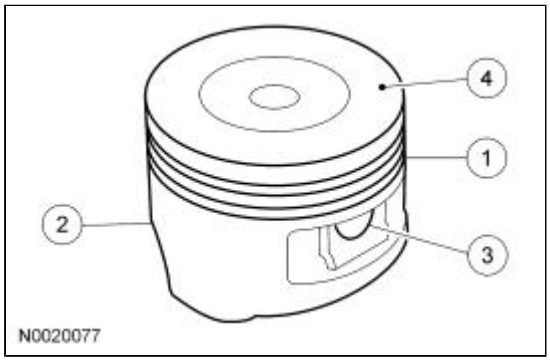
Printable View (111 KB)

Special Tool(s)

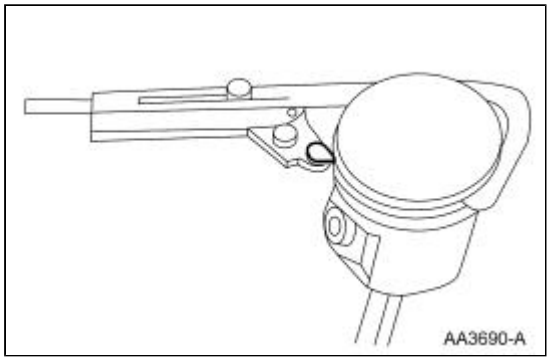
ST1279-A	Scraper, Piston Ring Groove 303-D033 (D81L-6002-D) or equivalent

CAUTION: Do not use a caustic cleaning solution or a wire brush to clean the pistons or damage can occur.

1. Clean and inspect the (1) ring lands, (2) skirts, (3) pin bosses and the (4) tops of the pistons. If wear marks, scores or glazing is found on the piston skirt, check for a bent or twisted connecting rod.



2. Use the Piston Ring Groove Scraper to clean the piston ring grooves.
   - Make sure the oil ring holes are clean.



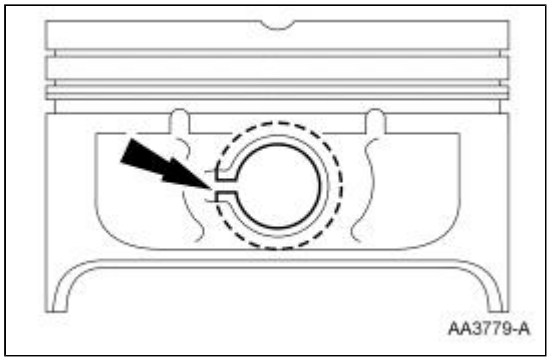
Piston Pin to Bore Diameter

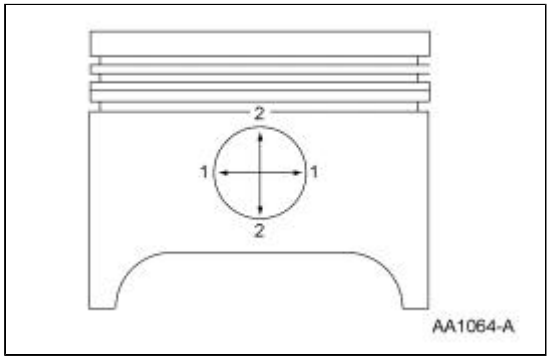
Printable View (95 KB)

1. **WARNING: Cover the end of the pin bore with a hand or shop rag when removing the retainer ring, since it has a tendency to spring out. Wear eye protection.**

   NOTE: Piston and piston pins are a matched set and should not be interchanged.

   Measure the piston pin bore diameter in 2 directions on each side. Verify the diameter is within specification.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.

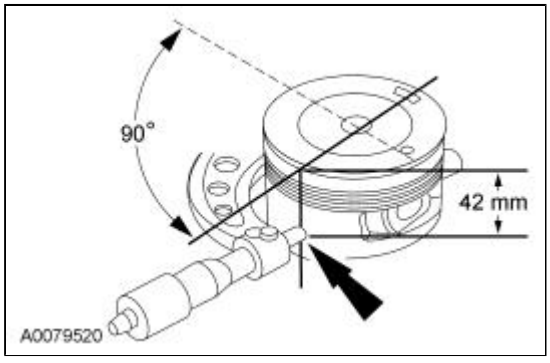




Piston Diameter

Printable View (82 KB)

1. Measure the piston diameter 90 degrees from the piston pin and 42 mm down from the top of the piston at the point indicated. Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Piston To Cylinder Bore Clearance

Printable View (62 KB)

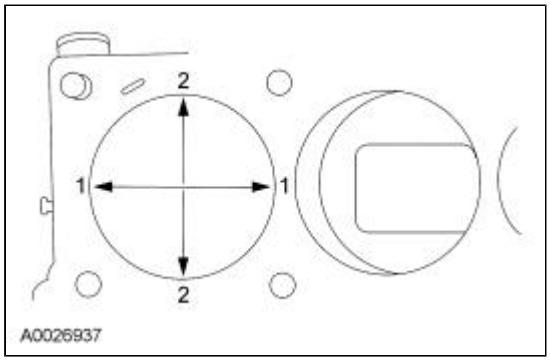
1. Subtract the piston diameter from the cylinder bore diameter to find the piston-to-cylinder bore clearance.

Piston Selection

Printable View (106 KB)

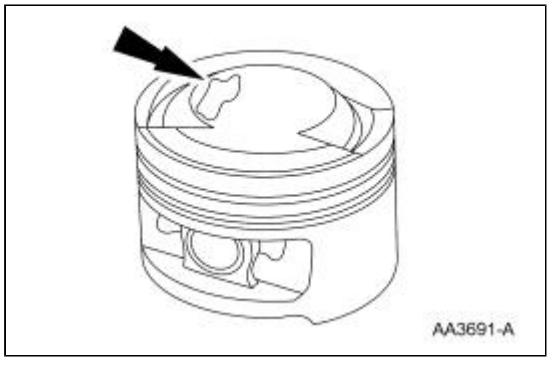
NOTE: The cylinder bore must be within the specifications for taper and out-of-round before fitting a piston.

1. Select a piston size based on the cylinder bore.



2. **NOTE:** For precision fit, new pistons are divided into 3 categories within each size range based on their relative position within the range. A paint spot on the new pistons indicates the position within the size range.

   Choose the piston with the correct paint color.
   - Refer to the appropriate section in Group 303 for the procedure.



Piston Ring End Gap

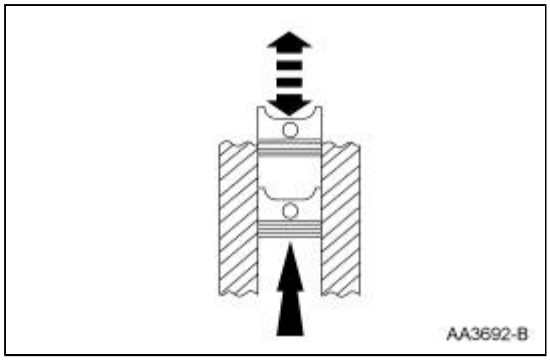
Printable View (107 KB)

CAUTION: Use care when fitting piston rings to avoid possible damage to the piston ring or the cylinder bore.

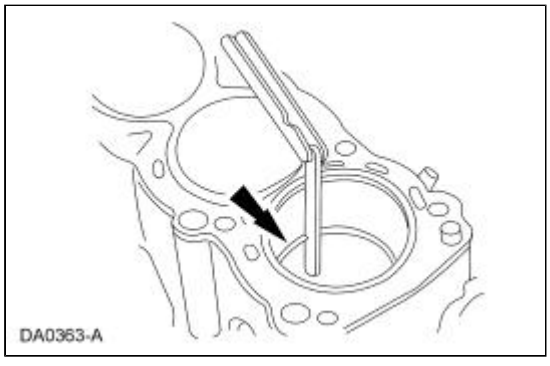
CAUTION: Piston rings should not be transferred from one piston to another.

NOTE: Cylinder bore must be within specification for taper and out-of-round.

1. Use a piston without rings to push a piston ring in a cylinder to the bottom of ring travel.



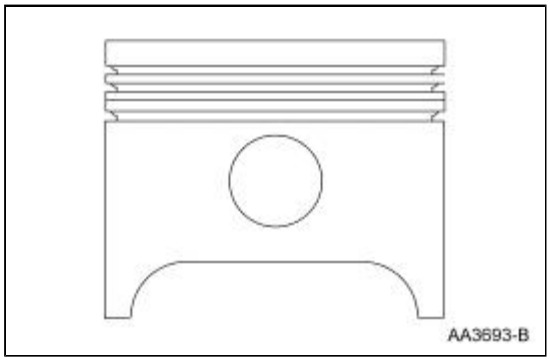
2. Use a feeler gauge to measure the top piston ring end gap and the second piston ring end gap.
   - Refer to the appropriate section in Group 303 for the procedure.



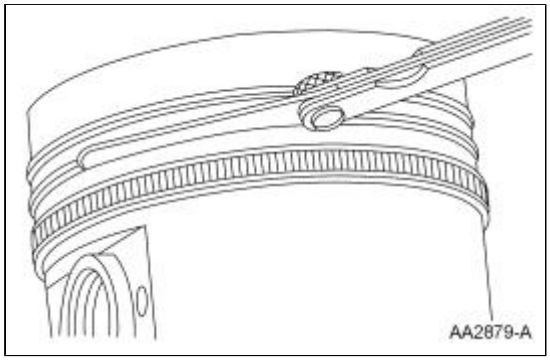
Piston Ring-to-Groove Clearance

Printable View (91 KB)

1. Inspect the piston for ring land damage or accelerated wear.



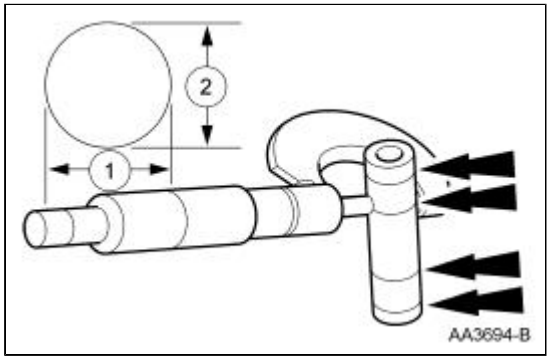
2. Measure the piston ring-to-groove clearance.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Piston Pin Diameter

Printable View (76 KB)

1. Measure the piston pin diameter in 2 directions at the points shown. Verify the diameter is within specification.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



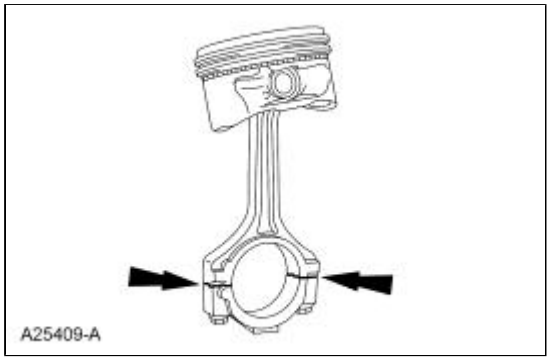
Connecting Rod Cleaning

Printable View (91 KB)

CAUTION: Do not use a caustic cleaning solution or damage to connecting rods can occur.

1. **NOTE:** The connecting rod large end is a matched set. The connecting rod cap must be installed on the original connecting rod in the original position. Do not reverse the cap. Parts are not interchangeable.

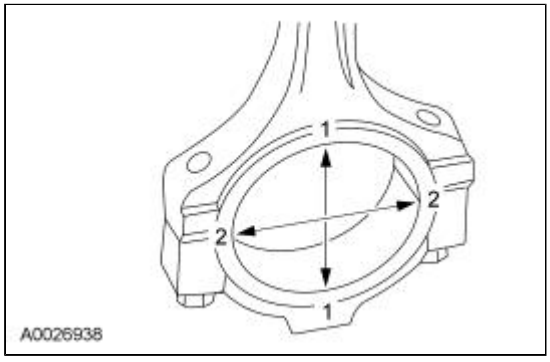
   Mark and separate the parts and clean with solvent. Clean the oil passages.



Connecting Rod Large End Bore

Printable View (78 KB)

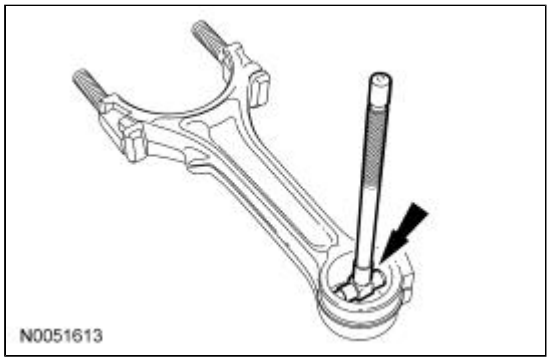
1. Tighten the bolts to specification, then measure the bore in 2 directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.
    - Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



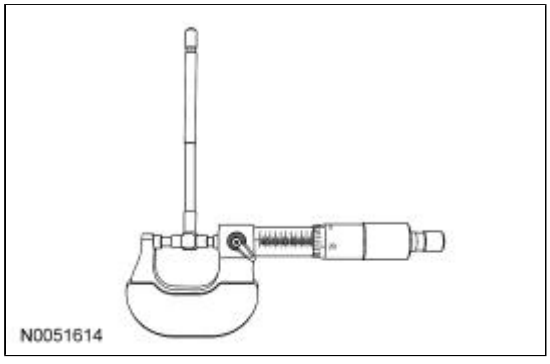
Connecting Rod Bushing Diameter

Printable View (88 KB)

1. Use a telescoping gauge to determine the inner diameter of the connecting rod bushing, if equipped.



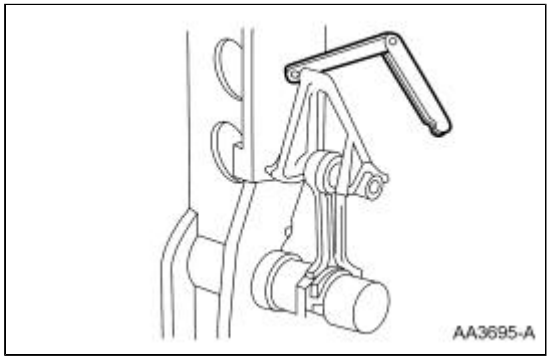
2. Measure the telescoping gauge with a micrometer. Verify the diameter is within specification.
   - Refer to the appropriate section in Group 303 for the specification.
   - If out of specification, install new components as necessary.



Connecting Rod Bend

Printable View (79 KB)

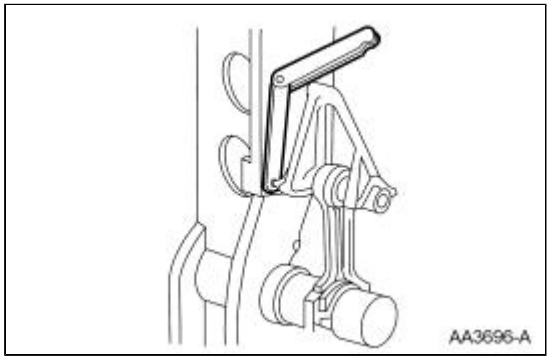
1. Measure the connecting rod bend on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the bend measurement is within specification.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Connecting Rod Twist

Printable View (79 KB)

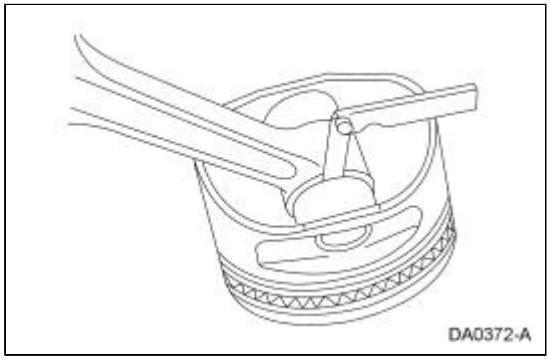
1. Measure the connecting rod twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the measurement is within specification.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Connecting Rod-to-Piston Clearance

Printable View (80 KB)

1. Measure the clearance between the connecting rod and the piston. Verify the measurement is within specification.
    - Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Connecting Rod Bearing Journal-to-Bearing Clearance

Printable View (103 KB)

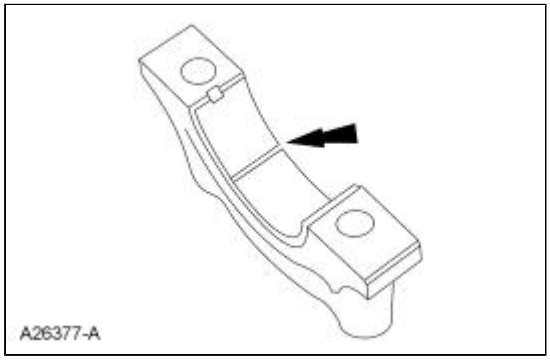
Special Tool(s)

ST1280-A	Plastigage 303-D031 (D81L-6002-B) or equivalent

NOTE: The crankshaft connecting rod journals must be within specifications to check the connecting rod bearing journal clearance.

1. Remove the connecting rod bearing cap.

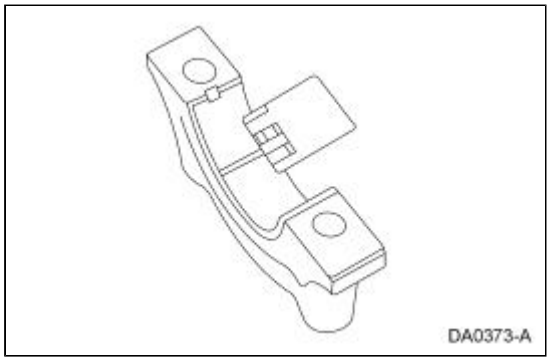
2. Position a piece of Plastigage across the bearing surface.



3. **NOTE:** Do not turn the crankshaft during this step.

   Install and tighten to specifications, then remove the connecting rod bearing cap.

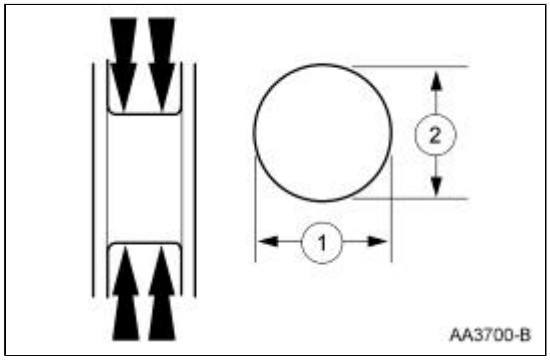
4. Measure the Plastigage to get the connecting rod bearing journal clearance. The Plastigage should be smooth and flat. A changing width indicates a tapered or damaged connecting rod or connecting rod bearing.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Connecting Rod Bearing Journal Taper and Out-of-Round

Printable View (70 KB)

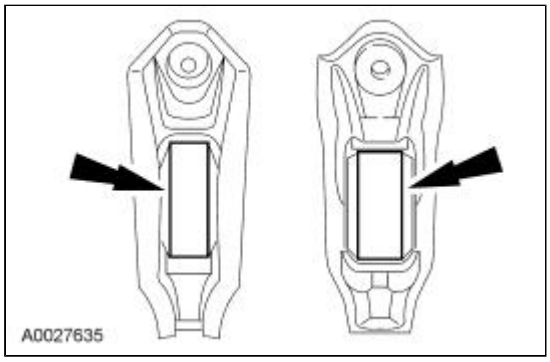
1. Measure the crankshaft connecting rod journal diameters in 2 directions perpendicular to one another at each end of the connecting rod journal. The difference in the measurements from one end to the other is the taper. Verify measurement is within the wear limit.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Roller Follower Inspection

Printable View (80 KB)

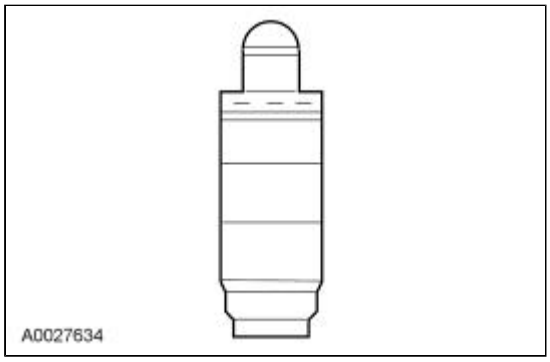
1. Inspect the roller follower for flat spots or scoring. If any damage is found, inspect the camshaft lobes and hydraulic lash adjuster for damage.



Hydraulic Lash Adjuster Inspection

Printable View (65 KB)

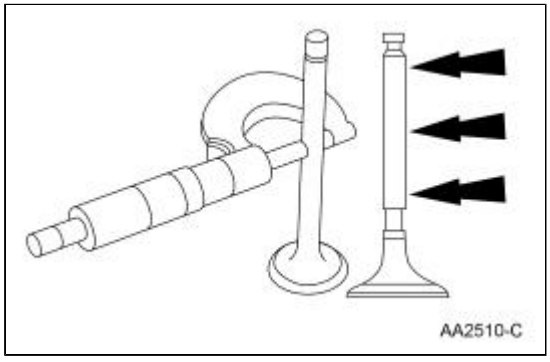
1. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage.



Valve Stem Diameter

Printable View (75 KB)

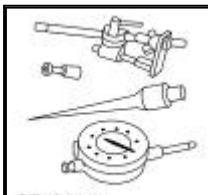
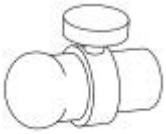
1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.
    - Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Valve Stem to Valve Guide Clearance

Printable View (109 KB)

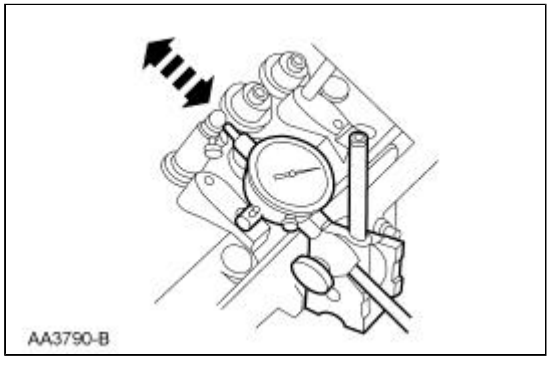
Special Tool(s)

 ST1214-A	Dial Indicator with Bracketry 100-002 (TOOL-4201-C) or equivalent
 ST1251-A	Valve Stem Checking Tool 303-004 (TOOL-6505-E) or equivalent

NOTE: Valve stem diameter must be within specifications before checking valve stem to valve guide clearance.

1. **NOTE:** If necessary, use a magnetic base.

   Install a Valve Stem Clearance Tool on the valve stem and install a Dial Indicator with Bracketry. Lower the valve until the Valve Stem Clearance Tool contacts the upper surface of the valve guide.

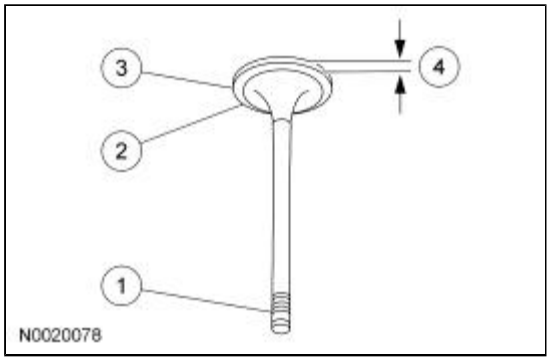
   
   AA3790-B

2. Move the Valve Stem Clearance Tool toward the indicator and zero the indicator. Move the Valve Stem Clearance Tool away from the indicator and note the reading. The reading will be DOUBLE the valve stem-to-valve guide clearance. Valves with oversize stems will need to be installed if out of specification.

Valve Inspection

Printable View (70 KB)

1. Inspect the following valve areas:
    1. the end of the stem for grooves or scoring
    2. the valve face and the edge for pits, grooves or scores
    3. the valve head for signs of burning, erosion, warpage and cracking
    4. the valve margin for wear

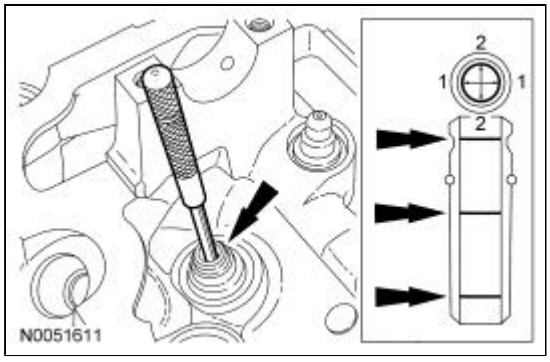


Valve Guide Inner Diameter

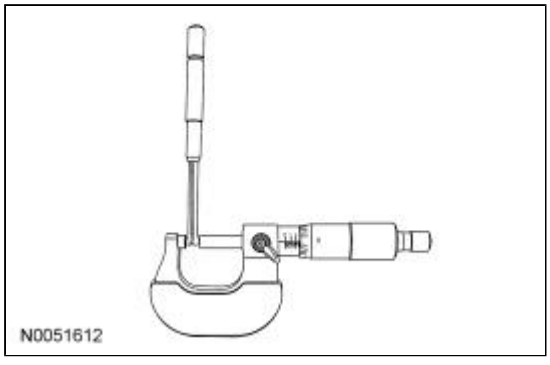
Printable View (115 KB)

1. **NOTE:** Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide if necessary.

   Use a ball gauge to determine the inner diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.



2. Measure the ball gauge with a micrometer.
   - Refer to the appropriate section in Group 303 for the specification.

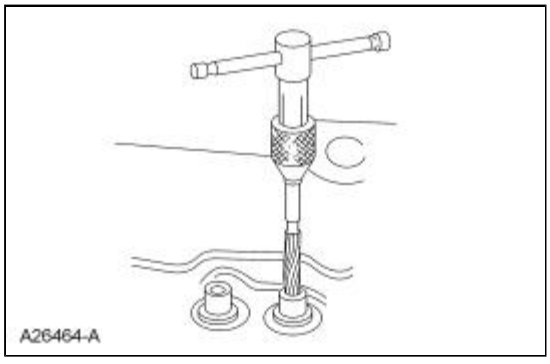


3. If the valve guide is not within specifications, ream the valve guide and install a valve with an oversize stem or remove the valve guide and install a new valve guide.

Valve Guide Reaming

Printable View (73 KB)

1. Use a hand-reaming kit to ream the valve guide.

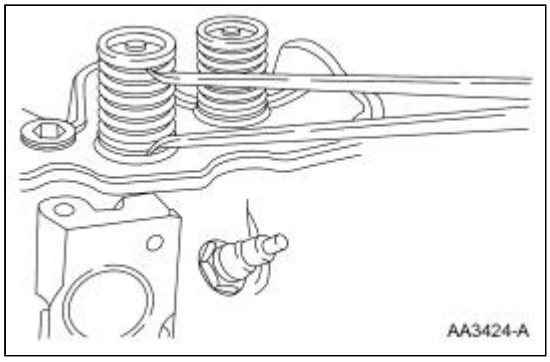


2. Reface the valve seat.
3. Clean the sharp edges left by reaming.

Valve Spring Installed Length

Printable View (84 KB)

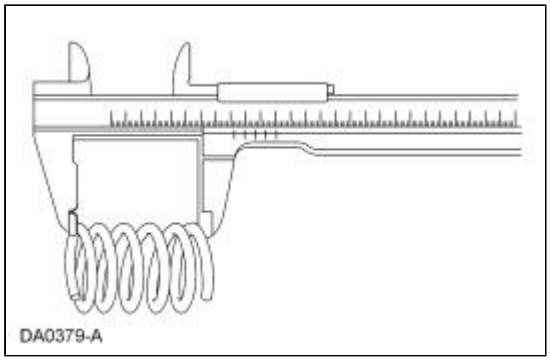
1. Measure the installed length of each valve spring.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components. Refer to the appropriate section in Group 303 for the procedure.



Valve Spring Free Length

Printable View (72 KB)

1. Measure the free length of each valve spring.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.

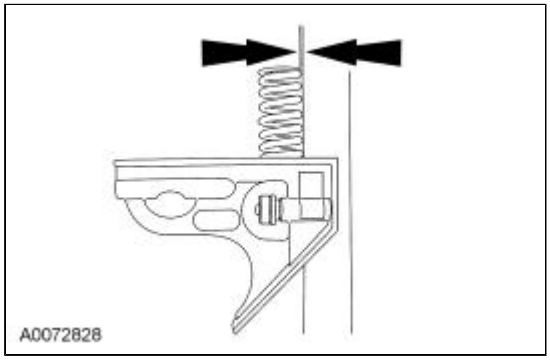


Valve Spring Squareness

Printable View (88 KB)

1. **NOTE:** This procedure only applies to cylindrical valve springs.

   Measure the out-of-square on each valve spring.
   - Turn the valve spring and observe the space between the top of the valve spring and the square. Install a new valve spring if out of square. Refer to the appropriate section in Group 303 for the procedure.



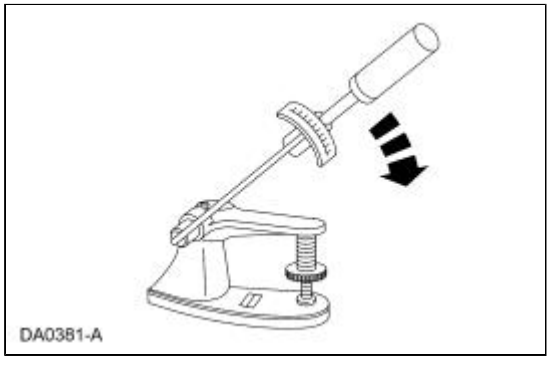
Valve Spring Strength

Printable View (78 KB)

Special Tool(s)

ST1278-A	Pressure Gauge, Valve/Clutch Spring 303-006 (TOOL-6513-DD) or equivalent

1. Use a Valve/Clutch Spring Pressure Gauge to check the valve spring for correct strength at the specified valve spring length.
   - Refer to the appropriate section in Group 303 for the procedure.
   - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



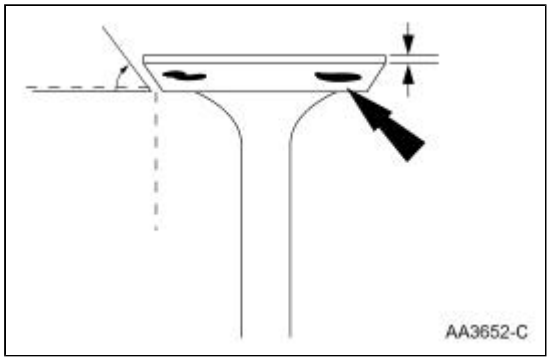
Valve Seat Inspection

Printable View (85 KB)

Valve and Seat Refacing Measurements

CAUTION: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.
   - Check valve angles.
   - Check margin width.
   - Refer to the appropriate section in Group 303 for the procedure.
   - Be sure margin width is within specification.

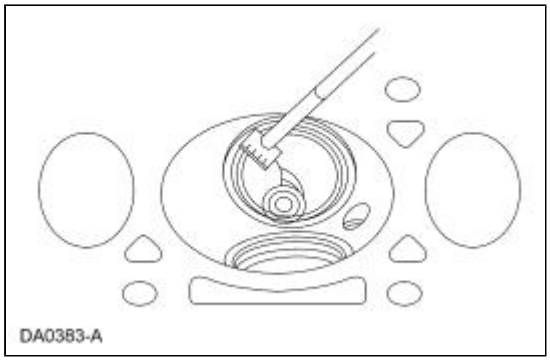


2. Inspect for abnormalities on the valve face and seat.

Valve Seat Width

Printable View (78 KB)

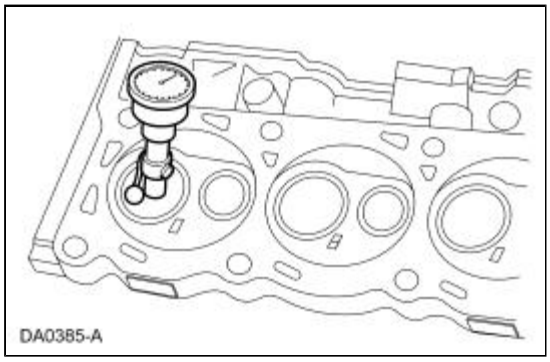
1. Measure the valve seat width. If necessary, grind the valve seat to specification.
    - Measure the intake valve seat width.
    - Measure the exhaust valve seat width.
    - Recheck the valve spring installed length after the seats have been ground, and shim the valve springs as necessary to achieve the correct installed spring length.
    - Refer to the appropriate section in Group 303 for the procedure.



Valve Seat Runout

Printable View (89 KB)

1. Use the Valve Seat Runout Gauge to check valve seat runout.



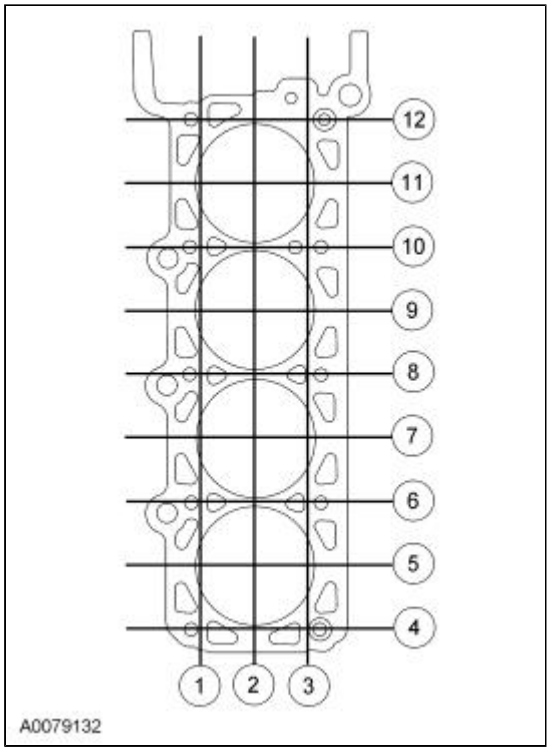
Cylinder Head Distortion

Printable View (107 KB)

1. **NOTE:** Make sure all cylinder head surfaces are clear of any gasket material, RTV, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

   NOTE: Use a straightedge that is calibrated by the manufacturer to be flat with 0.0002 in (0.005 mm) per running foot length. For example, if the straightedge is 24 inches (61 cm) long, the machined edge must be flat with 0.0004 in (0.010 mm) from end to end.

   Using a straightedge and a feeler gauge, inspect the cylinder head for flatness in the sequence shown. If the cylinder head is distorted, install a new cylinder head.



Cylinder Bore Cleaning

Printable View (79 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

1. **CAUTION: If these procedures are not followed, rusting of the cylinder bores may occur.**

   Clean the cylinder bores with soap or detergent and water.

2. Thoroughly rinse with clean water and wipe dry with a clean, lint-free cloth.

3. Use a clean, lint-free cloth and lubricate the cylinder bores.
   - Use clean engine oil meeting Ford specification.

Cylinder Block Core Plug Replacement

Printable View (122 KB)

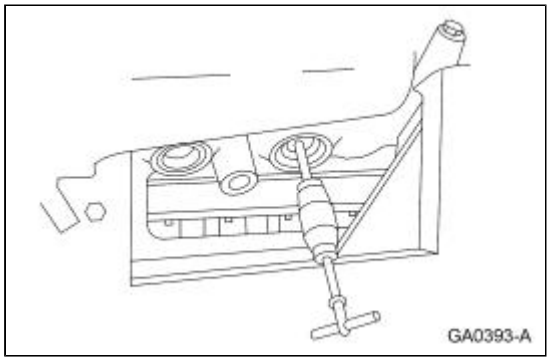
Special Tool(s)

ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Threadlock 262 TA-26 or equivalent	WSK-M2G351-A6

1. Use a slide hammer or tools suitable to remove the cylinder block core plug.



2. Inspect the cylinder block plug bore for any damage that would interfere with the correct sealing of the plug. If the cylinder block plug bore is damaged, bore for the next oversize plug.

3. **NOTE:** Oversize plugs are identified by the OS stamped in the flat located on the cup side of the plug.

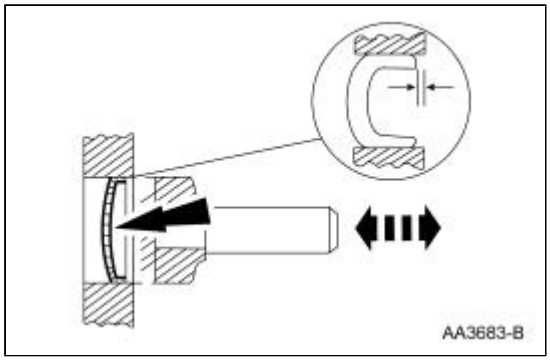
   Coat the cylinder block core plug and bore lightly with threadlock and install the cylinder block core plug.

Cup-Type

1. **CAUTION: Use care during this procedure so as not to disturb or distort the cup sealing surface.**

   CAUTION: When installed, the flanged edge must be below the chamfered edge of the bore to effectively seal the bore.

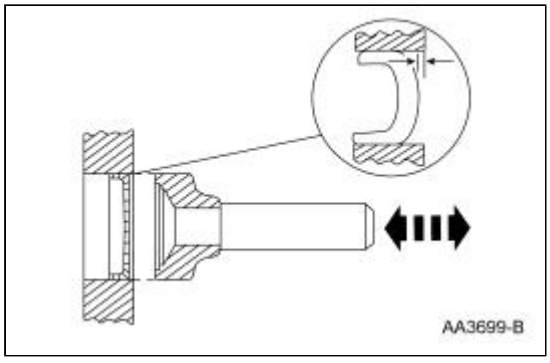
   Use a tool suitable to seat the cup-type cylinder block core plug.



Expansion-Type

1. **CAUTION: Do not contact the crown when installing an expansion-type cylinder block core plug. This could expand the plug before seating and result in leakage.**

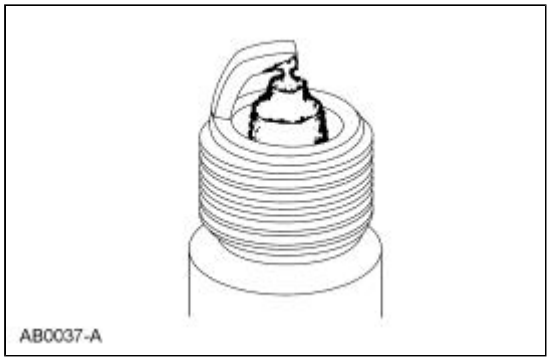
   Use a tool suitable to seat the expansion-type cylinder block core plug.



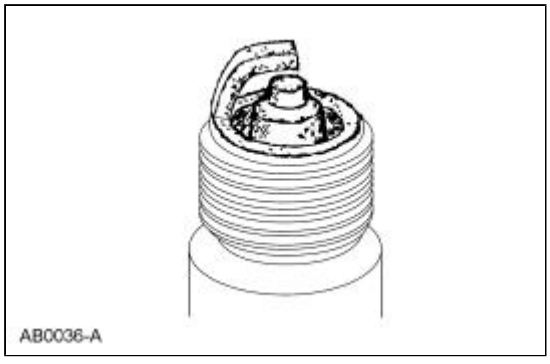
Spark Plug Inspection

Printable View (160 KB)

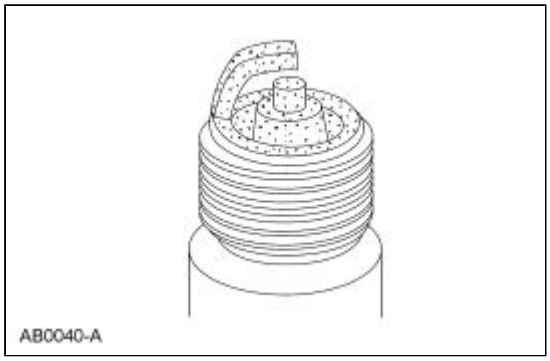
1. Inspect the spark plug for a bridged gap.
   - Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.
   - Clean the spark plug.



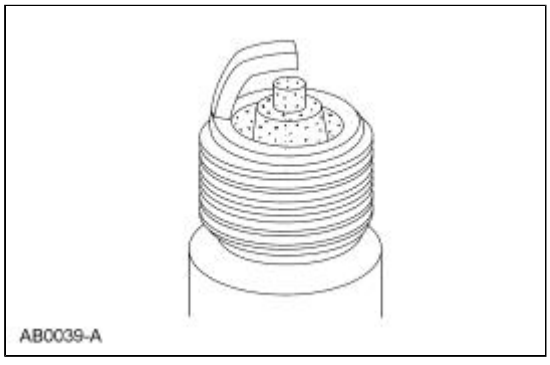
2. Check for oil fouling.
   - Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
   - Correct the oil leak concern.
   - Install a new spark plug.



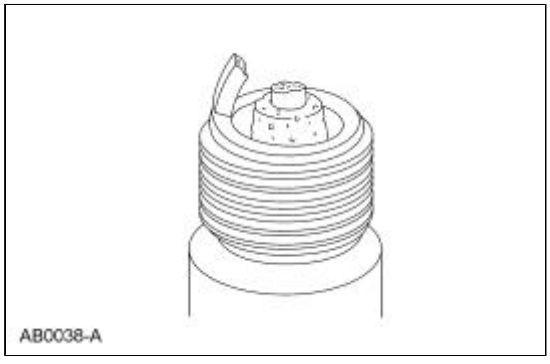
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
   - Clean the spark plug.



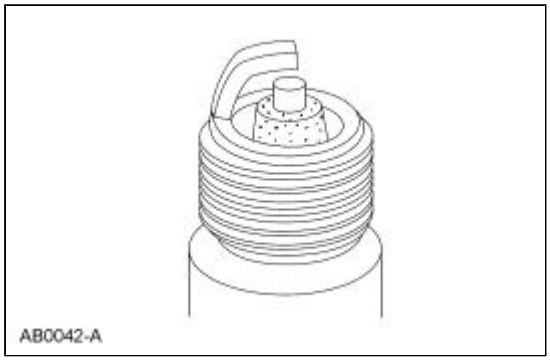
4. Inspect for normal burning.
    - Check for light tan or gray deposits on the firing tip.



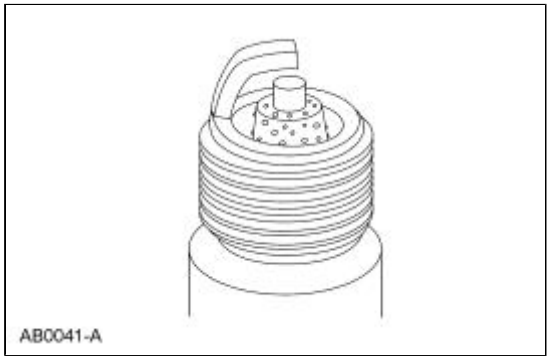
5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a heli-coil insert in place of the spark plug threads.
    - Install a new spark plug.



6. Inspect for overheating, identified by a white or light gray spots and with bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.
    - Install a new spark plug.



7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.
    - Clean the spark plug.



Exhaust Manifold Cleaning and Inspection

Printable View (91 KB)

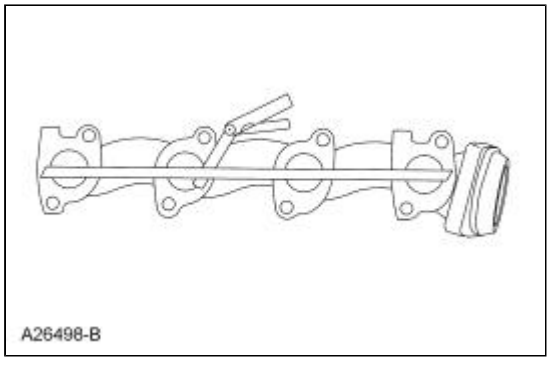
Special Tool(s)

ST1246-A	Straight Edge 303-D039 (D83L-4201-A) or equivalent

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

2. **NOTE:** New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

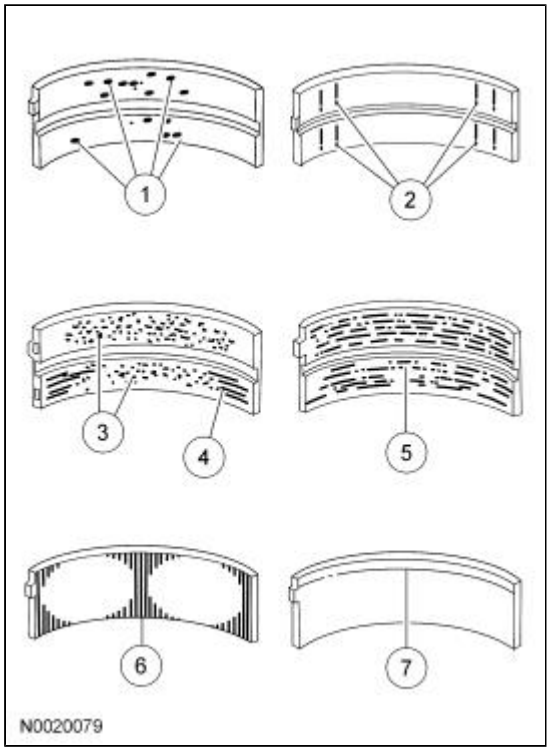
   Using the special tool (or a precision straight edge) and a feeler gauge, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 in), install a new exhaust manifold.



Bearing Inspection

Printable View (97 KB)

1. Inspect bearings for the following defects. Possible causes are shown:
    1. Cratering — fatigue failure.
    2. Spot polishing — incorrect seating.
    3. Imbedded dirt engine oil.
    4. Scratching — dirty engine oil.
    5. Base exposed — poor lubrication.
    6. Both edges worn — journal damaged.
    7. One edge worn — journal tapered or bearing not seated.



Printable View (93 KB)

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft Metal Surface Prep ZC-31	—
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	—
Engine	
Displacement	5.4L (330 CID)
Number of cylinders	8
Bore	90.2 mm (3.55 in)
Stroke	105.8 mm (4.17 in)
Firing order	1-3-7-2-6-5-4-8
Oil pressure minimum at 2,000 rpm (engine at normal operating temperature)	517 kPa (75 psi)
Oil capacity	6.6L (7.0 qt) with filter
Compression ratio	9.8:1
Cylinder Head and Valve Train	
Combustion chamber volume	48.1-51.1 cc (2.94-3.12 cu in)
Valve arrangement (front to rear) — LH	I-E-I-I-E-I-I-E-I-I-E-I
Valve arrangement (front to rear) — RH	I-E-I-I-E-I-I-E-I-I-E-I
Valve guide bore diameter	6.015-6.044 mm (0.237-0.238 in)
Valve stem diameter — intake	5.975-5.995 mm (0.235-0.236 in)
Valve stem diameter — exhaust	5.95-5.97 mm (0.234-0.235 in)
Valve stem-to-guide clearance — intake	0.020-0.045 mm (0.001-0.002 in)
Valve stem-to-guide clearance — exhaust	0.069-0.094 mm (0.003-0.004 in)
Valve head diameter — intake	33.62-33.98 mm (1.324-1.338 in)
Valve head diameter — exhaust	37.32-37.68 mm (1.469-1.483 in)

Valve face runout	0.05 mm (0.002 in)
Valve face angle	45.5 degrees
Valve seat width — intake	1.2-1.4 mm (0.047-0.055 in)
Valve seat width — exhaust	1.4-1.6 mm (0.055-0.063 in)
Valve seat angle	44.5-45.0 degrees
Valve spring free length	55.7 mm (2.19 in)
Valve spring compression pressure	350 N (79 lbs) ± 17.5 N (4 lbs) @ 42.04 mm (1.66 in)
Valve spring installed height	42.04 mm (1.66 in)
Valve spring installed pressure	350 N (79 lbs) ± 17.5 N (4 lbs) @ 42.04 mm (1.66 in)
Roller follower ratio	—
Hydraulic Lash Adjuster	
Diameter	15.988-16.000 mm (0.6294-0.6299 in)
Clearance-to-bore	0.018-0.069 mm (0.0007-0.0027 in)
Service limit	—
Hydraulic leakdown rate	5-25 seconds [a]
Collapsed lash adjuster gap	0.45-0.85 mm (0.018-0.033 in)
Camshaft	
Theoretical valve lift @ 0 lash — intake	11.1 mm (0.437 in)
Theoretical valve lift @ 0 lash — exhaust	11.0 mm (0.433 in)
Lobe lift — intake	5.520 mm (0.217 in)
Lobe lift — exhaust	5.506 mm (0.217 in)
Allowable lobe lift loss	0.127 mm (0.005 in)
Journal diameter	28.607-28.633 mm (1.126-1.127 in)
Camshaft journal bore inside diameter	28.657-28.682 mm (1.128-1.129 in)
Camshaft journal-to-bearing clearance	0.024-0.075 mm (0.001-0.003 in)
Runout	0.03 mm (0.001 in)
End play	0.075-0.185 mm (0.003-0.007 in)
Cylinder Block	
Cylinder bore diameter — Grade 1	90.200-90.210 mm (3.5512-3.5516 in)
Cylinder bore diameter — Grade 2	90.210-90.220 mm (3.5516-3.5520 in)
Cylinder bore diameter — Grade 3	0.220-90.230 mm (3.5520-3.5524 in)
Cylinder bore maximum taper	0.006 mm (0.0002 in)

Cylinder bore maximum out-of-round	0.020 mm (0.0008 in)
Main bearing bore inside diameter	72.400-72.424 mm (2.850-2.851 in)
Crankshaft	
Main bearing journal diameter	67.481-67.505 mm (2.6567-2.6576 in)
Main bearing journal maximum taper	0.004 mm (0.0002 in)
Main bearing journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Main bearing journal-to-cylinder block clearance	0.048-0.024 mm (0.0019-0.0009 in)
Connecting rod journal diameter	53.003-52.983 mm (2.0867-2.0859 in)
Connecting rod journal maximum taper	0.004 mm (0.0002 in)
Connecting rod journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Crankshaft maximum end play	0.075-0.377 mm (0.0030-0.0148 in)
Piston and Connecting Rod	
Piston diameter — Grade 1 (at right angle to pin bore)	90.175-90.165 mm (3.5502-3.5498 in)
Piston diameter — Grade 2 (at right angle to pin bore)	90.185-90.175 mm (3.5506-3.5502 in)
Piston diameter — Grade 3 (at right angle to pin bore)	90.195-90.185 mm (3.5510-3.5506 in)
Piston-to-cylinder bore clearance (at grade size)	0.025-0.045 mm (0.0010-0.0018 in)
Piston ring end gap — top	0.15-0.30 mm (0.006-0.012 in)
Piston ring end gap — intermediate	0.25-0.50 mm (0.0098-0.0197 in)
Piston ring end gap — oil control	0.15-0.65 mm (0.0059-0.0256 in)
Piston ring groove width — top	1.52-1.55 mm (0.0598-0.0610 in)
Piston ring groove width — intermediate	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width — oil control	3.030-3.050 mm (0.1193-0.1201 in)
Piston ring width — top and intermediate	1.50-1.47 mm (0.0590-0.0578 in)
Piston ring-to-groove clearance — top	0.020-0.080 mm (0.0008-0.0031 in)
Piston ring-to-groove clearance — intermediate	0.030-0.070 mm (0.0012-0.0028 in)
Piston pin bore diameter	22.008-22.014 mm (0.8665-0.8667 in)
Piston pin diameter	22.0010-22.0030 mm (0.8662-0.8663 in)

Piston pin length	61.8 mm (2.433 in)
Piston pin-to-piston fit	0.005-0.013 mm (0.0002-0.0005 in)
Connecting rod-to-pin clearance	0.009-0.0235 mm (0.0004-0.0093 in)
Connecting rod pin bore diameter	22.012-22.024 mm (0.8666-0.8671 in)
Connecting rod length (center-to-center)	169.1 mm (6.6575 in)
Connecting rod maximum allowed bend	± 0.038 mm (0.0015 in)
Connecting rod maximum allowed twist [b]	± 0.05 mm (0.0020 in)
Connecting rod bearing bore diameter (with assembled liners)	53.049-53.027 mm (2.0885-2.0877 in)
Connecting rod bearing-to-crankshaft clearance	0.064-0.026 mm (0.0025-0.0010 in)
Connecting rod side clearance	0.475-0.125 mm (0.0187-0.0049 in)

[a] The time required for the plunger to leak down 1.6 mm (0.062 in) of travel with 222 N force and leak-down fluid in the lash adjuster.
[b] The pin bore and crank bearing bore must be parallel and in the same vertical plane within the specified total difference when measured at the ends of a 203 mm bar, 105.5 mm on each side of rod centerline.

Torque Specifications

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner bolt	25	18	—
Air cleaner outlet pipe-to-throttle body (TB) adapter bolt	10	—	89
Axle housing mounting bolts	89	66	—
Camshaft bearing cap bolts [a]	—	—	—
Camshaft position (CMP) sensor bolt	10	—	89
Charge motion control valve (CMCV) bolts	10	—	89
Coolant pump bolts	25	18	—
Coolant pump pulley bolts	25	18	—
Connecting rod bolts [a]	—	—	—
Cooling fan shroud bolts	10	—	89
Crankshaft position (CKP) sensor bolt	10	—	89
Crankshaft damper pulley bolt [a]	—	—	—
Crankshaft main bearing bolts (cross-mounted) [a]	—	—	—
Crankshaft main bearing bolts (vertical) [a]	—	—	—
Cylinder head temperature sensor (CHT)	26	19	—
Cylinder heads bolts [a]	—	—	—
Drive belt idler pulley bolt	25	18	—
Engine front cover bolts [a]	—	—	—
Exhaust manifold heat shield bolts	10	—	89
Exhaust manifold nuts	25	18	—

Exhaust manifold studs	12	9	—
Exhaust manifold-to-Y-pipe nuts	40	30	—
Engine oil pressure (EOP) switch	18	13	—
Engine support insulator-to-cylinder block bolts	63	46	—
Engine support insulator through bolt	350	258	—
Engine support insulator-to-frame bolts	175	129	—
Engine support insulator-to-frame nuts	175	129	—
Flexplate bolts [a]	—	—	—
Frame crossmember bolts	102	75	—
Fuel rail bracket bolts	10	—	89
Generator upper mounting bracket bolts	10	—	89
Generator lower mounting bolts	25	18	—
Ignition coil	6	—	53
Intake manifold-to-cylinder head bolts [a]	—	—	—
Intake manifold vacuum tube support bracket nut	10	—	89
Knock sensor (KS) bolts	20	15	—
Oil filter	15	11	—
Oil filter adapter bolts	25	18	—
Oil level indicator tube bolt	10	—	89
Oil pan bolts [a]	—	—	—
Oil pan drain plug	14	10	—
Oil pump bolts	10	—	89
Oil pump screen and pickup tube bolts	10	—	89
Oil pump screen and pickup tube spacer	25	18	—
Oil pump screen and pickup tube spacer bolt	25	18	—
Positive crankcase ventilation (PCV) heater element bolts	6	—	53
Power steering pressure hose support bracket nut	10	—	89
Power steering pump bolts	25	18	—
Radiator ignition interference capacitor nut	25	18	—
Radiator support bolts	25	18	—
Rear seal retainer plate bolts [a]	—	—	—
Spark plugs	34	25	—
Thermostat housing bolts	10	—	89
Timing chain guide bolts	10	—	89
Timing chain hydraulic tensioner bolts	25	18	—
Torque converter-to-flexplate nuts	35	26	—
Transmission cooler tube support bracket nut	25	18	—
Transmission fluid cooler tube support bracket nut	10	—	89
Transmission-to-engine bolts	48	35	—
Transmission mount-to-crossmember nuts	103	76	—
Valve cover bolts	10	—	89

Variable camshaft timing (VCT) sprocket assembly bolts [a]	—	—	—

[a] Refer to the procedure in this section.

Engine

Printable View (85 KB)

NOTE: Refer to the exploded view under the assembly procedure in this section.

The 5.4L (3V) is a V-8 engine with the following features:

- Single overhead camshafts
- Three valves per cylinder
- Sequential multi-port fuel injection (SFI)
- Aluminum cylinder heads
- Cast iron, 60-degree V cylinder block
- Variable camshaft timing (VCT)
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Distributorless ignition system

Identification

Always refer to these labels when installation of new parts is necessary, or when checking engine calibrations. The engine parts often differ within a CID family. Verification of the identification codes will make sure that the correct parts are obtained. These codes contain all the pertinent information relating to the dates, optional equipment and revisions. The Ford Master Parts Catalog contains a complete listing of the codes and their application.

Code Information

The engine code information label, located on the side of the valve cover and the front side of the valve cover, contains the following:

- Engine build date
- Engine plant code
- Engine code

Exhaust Emission Control System

Operation and necessary maintenance of the exhaust emission control devices used on this engine are covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The sequential multi-port fuel injection (SFI) provides the fuel/air mixture needed for combustion in the cylinders. The 8 solenoid-operated fuel injectors:

- are mounted in the intake manifold.
- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.
- supply fuel from the fuel tank with a fuel pump mounted in the fuel tank.

Valve Train

The valve train operates as follows:

- Ball-tip hydraulic lash adjusters provide automatic lash adjustment.
- Roller followers ride on the camshaft lobe, transferring the up-and-down motion of the camshafts to the valves in the cylinder heads.

Positive Crankcase Ventilation System

All engines are equipped with a closed-type positive crankcase ventilation system recycling the crankcase vapors to the upper intake manifold.

Lubrication System

The engine lubrication system operates as follows:

- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the left front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to both cylinder heads.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.
- The left cylinder head is fed from a drilling into the supply passage feeding the main gallery at the front of the cylinder block. The right cylinder head is fed from a drilling into the rear of the main gallery. Main gallery pressure is reduced as it enters the cylinder head galleries through fixed serviceable orifices, located at the upper part of the feed passages. It is this reduced pressure in the cylinder head galleries which feeds the camshaft journals, the hydraulic lash adjusters and the primary and secondary timing chain tensioners.
- The camshaft lobe and roller followers are lubricated by splash created through valve train operation.

Oil Pump

The lubrication system of the 5.4L (3V) engine is designed to provide optimum oil flow to critical components of the engine through its entire operating range. The heart of the system is a positive displacement internal gear oil pump using top seal rotors. Generically this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure, both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

Engine

Printable View (63 KB)

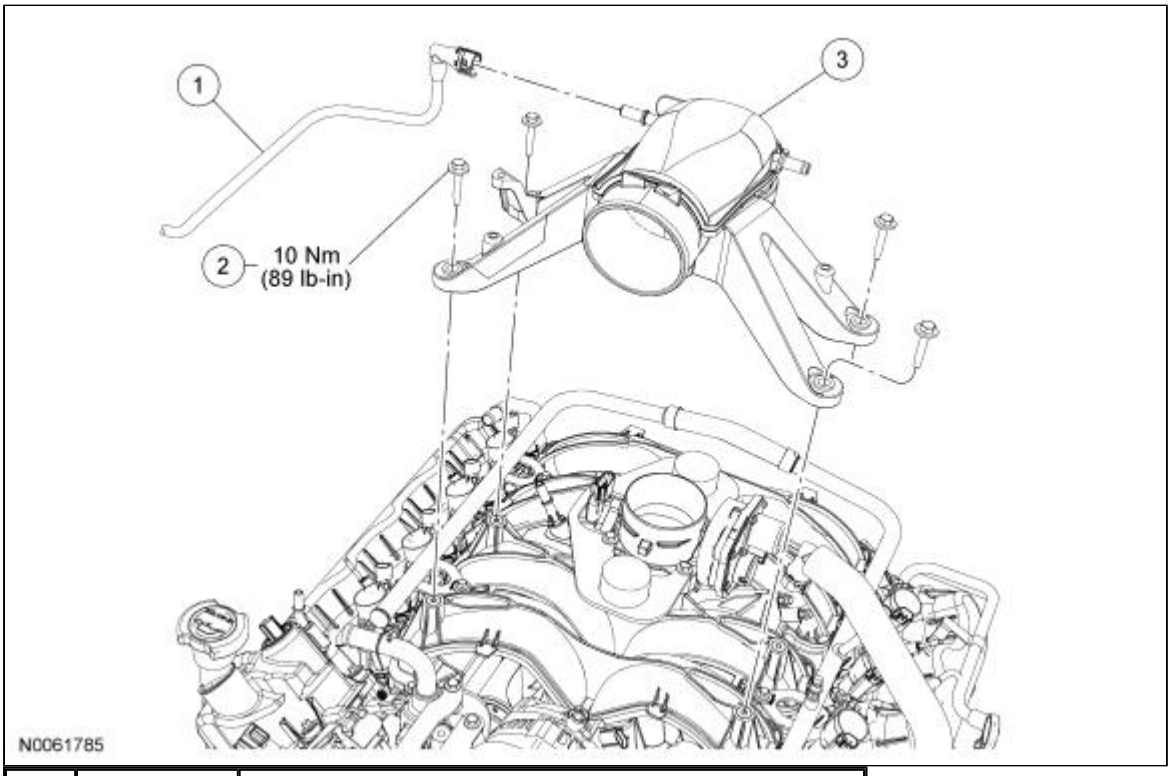
For basic engine mechanical concerns, refer to Section 303-00 . For driveability concerns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Intake Manifold

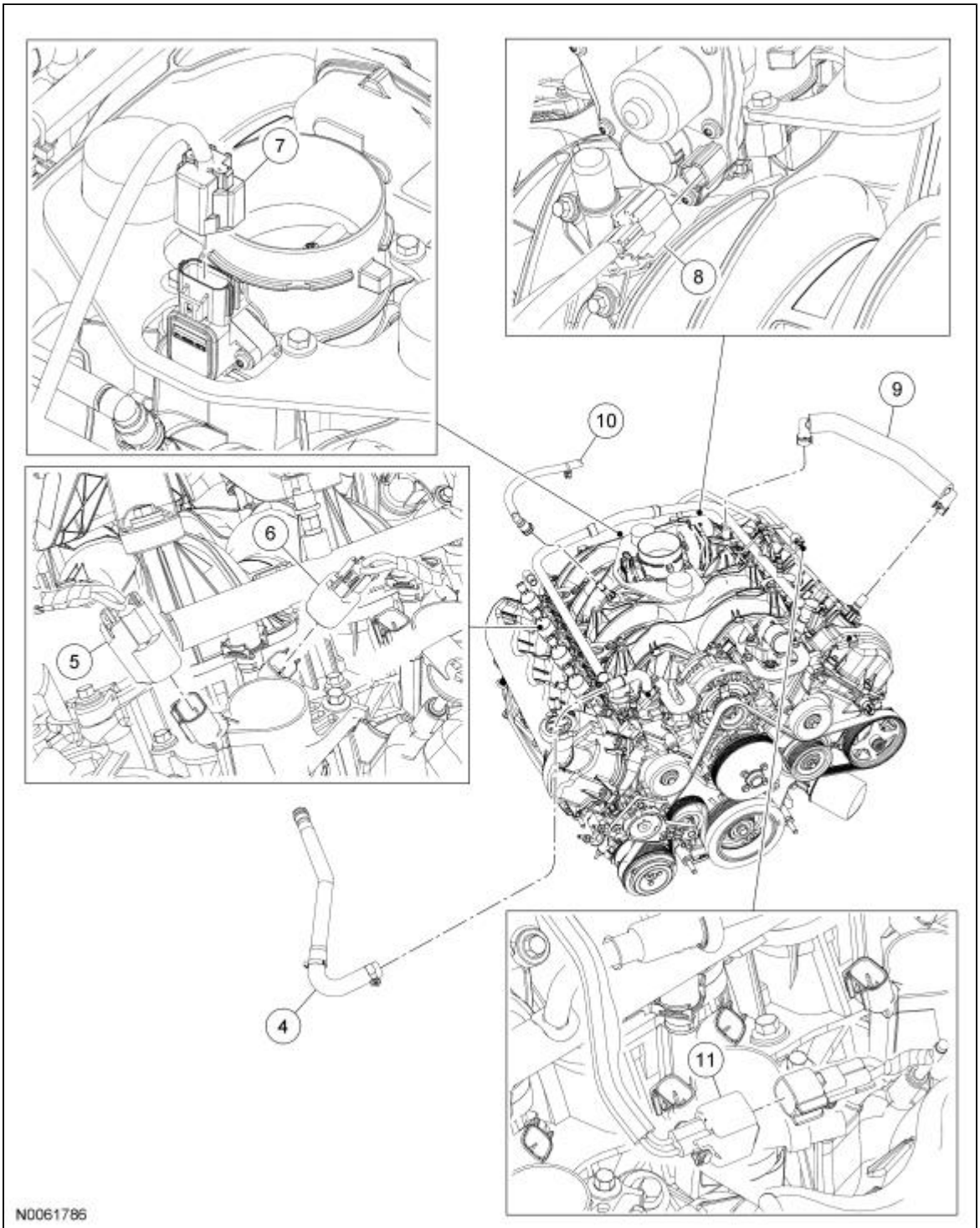
Printable View (942 KB)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—

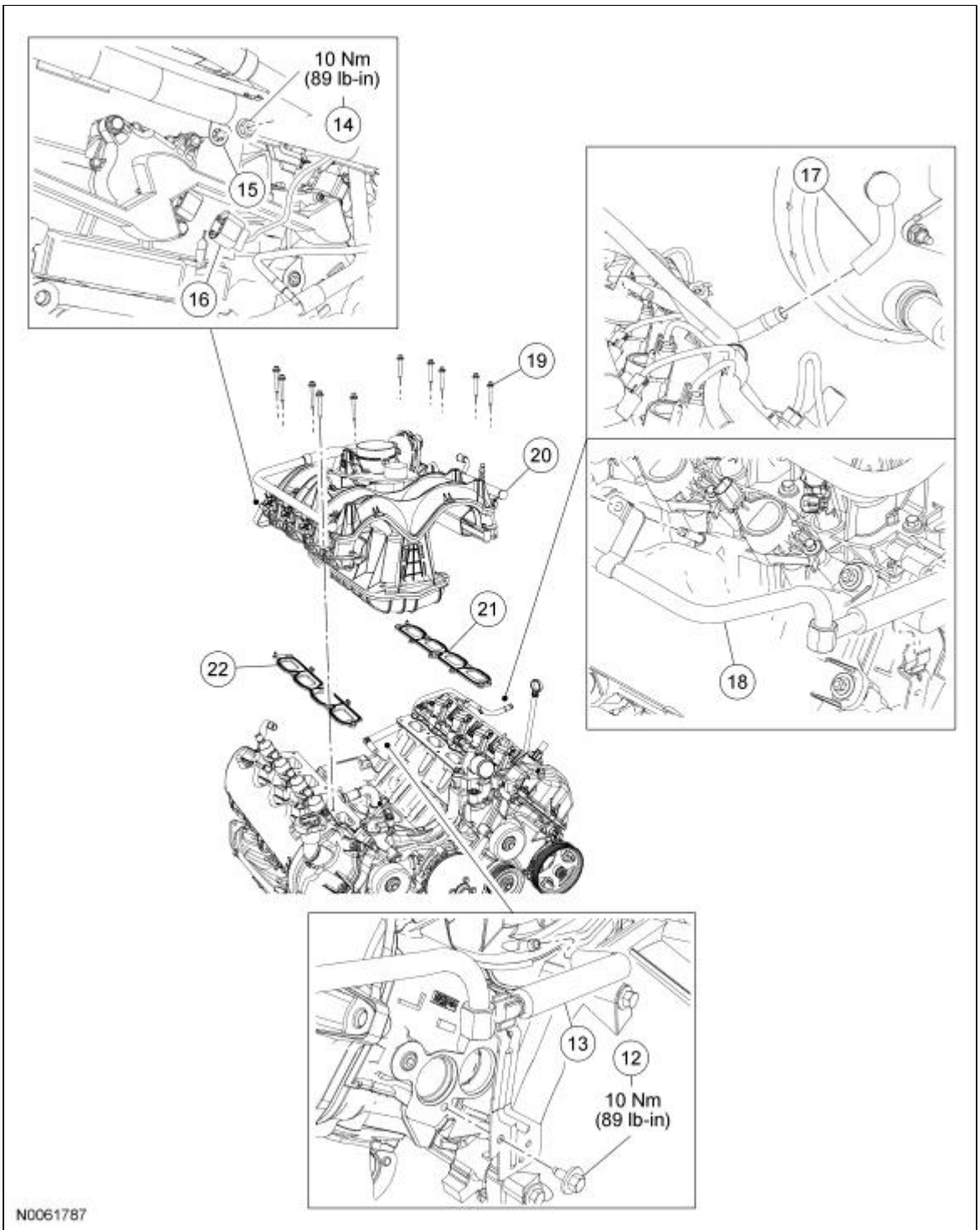


Item	Part Number	Description
1	6758	Crankcase ventilation tube
2	W505426	Air cleaner outlet pipe-to-throttle body (TB) adapter bolt (4 required)
3	9A589	Air cleaner outlet pipe-to-TB adapter



Item	Part Number	Description
4	9229	Heater coolant hose
5	—	Ignition coil electrical connector (8 required) (part of 12B637)
6	—	Fuel injector electrical connector (8 required) (part of 12B637)
7	—	Throttle position (TP) sensor electrical connector (part of 12B637)
8	—	Electronic acceleration control electrical connector (part of 12B637)9

9	6K817	Positive crankcase ventilation (PCV) tube
10	—	Evaporative emissions (EVAP) system tube quick connect coupling
11	—	Heated PCV intake fitting electrical connector (part of 12B637)



Item	Part Number	Description
12	—	Intake manifold vacuum tube support bracket bolt
13	—	Intake manifold vacuum tube-to-intake manifold

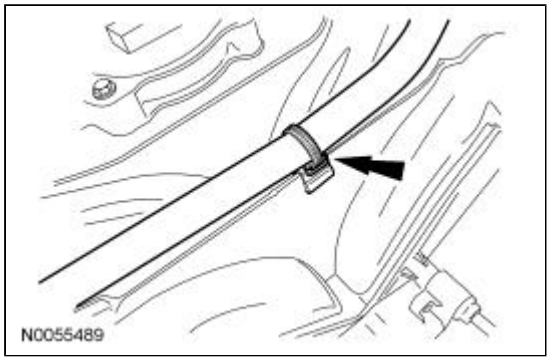
		hose (part of 9A474)
14	N621903	Engine wiring harness retainer nut
15	—	Engine wiring harness retainer (part of 12B637)
16	—	Charge motion control valve (CMCV) electrical connector (part of 12B637)
17	—	Intake manifold vacuum tube-to-brake booster hose (part of 9A474)
18	9D446	Intake manifold vacuum tube
19	W710758	Intake manifold bolt (10 required)
20	9Y451	Intake manifold assembly
21	9441	LH intake manifold gasket
22	9439	RH intake manifold gasket

Removal

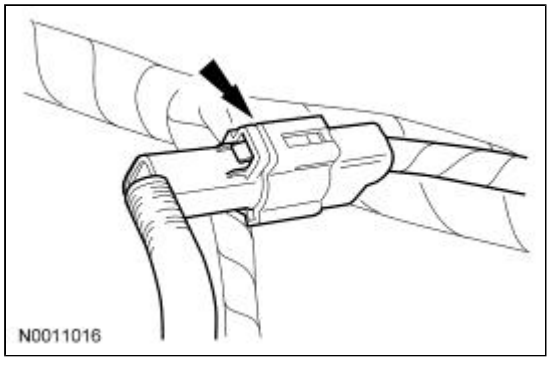
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel. Failure to follow these instructions may result in personal injury.

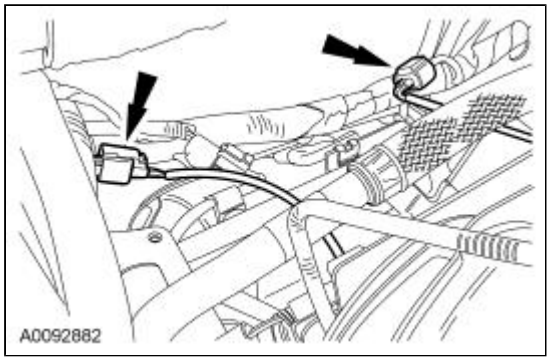
1. Drain the cooling system. For additional information, refer to Section 303-03 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the fuel supply hose spring lock coupling from the fuel rail. For additional information, refer to Section 310-00 .
4. Remove the generator. For additional information, refer to Section 414-02 .
5. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .
6. Disconnect the crankcase ventilation tube quick connect coupling from the intake manifold. For additional information, refer to Section 310-00 .
7. Disconnect the quick connect coupling and remove the evaporative emissions system (EVAP) hose from the intake manifold. For additional information, refer to Section 310-00 .
8. Disconnect the EVAP hose position retainer from the intake manifold.



9. Remove the 4 bolts and the air cleaner outlet pipe-to-TB adapter.
10. Disconnect the heater coolant hose from the coolant bypass tube.
11. Disconnect the quick connect couplings and remove the positive crankcase ventilation (PCV) tube. For additional information, refer to Section 310-00 .
12. Disconnect the 8 fuel injector electrical connectors.
13. Disconnect the 8 ignition coil electrical connectors.
14. Disconnect the throttle position (TP) sensor and electronic acceleration control electrical connectors.
15. Disconnect the heated PCV intake fitting electrical connector.
16. Remove the intake manifold vacuum tube support bracket bolt and disconnect the intake manifold vacuum tube-to-intake manifold hose.
17. Disconnect the brake booster vacuum hose from the intake manifold vacuum tube.
18. Disconnect the intake manifold vacuum tube support retainer from the valve cover and position the intake manifold vacuum tube aside.
19. Remove the 10 intake manifold bolts.
20. Disconnect the charge motion control valve (CMCV) electrical connector.
21. Disconnect the cylinder head temperature (CHT) sensor jumper harness electrical connector.



22. Disconnect the LH and RH knock sensor (KS) electrical connectors.



23. Remove the nut and disconnect the engine wiring harness retainer from the CMCV stud.

24. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Remove the intake manifold and discard the gaskets.
    - Inspect and clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

Installation

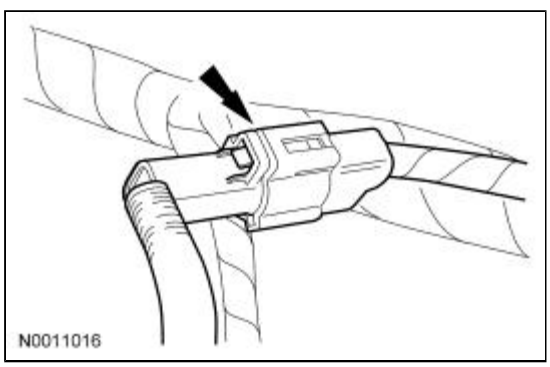
1. **NOTE:** Electrical and vacuum harnesses must not restrict movement of the CMCV control rods at rear of the intake manifold. Use extreme care on installation of the intake manifold to prevent any pinching of electrical and vacuum harnesses.

   Using new intake manifold gaskets, position the intake manifold.

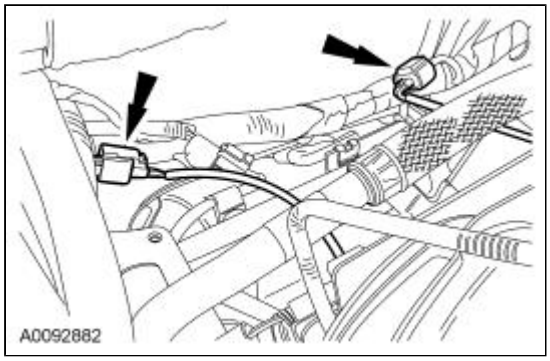
2. Connect the engine wiring harness retainer to the CMCV stud and install the nut.
   - Tighten to 10 Nm (89 lb-in).

3. Connect the CMCV electrical connector.

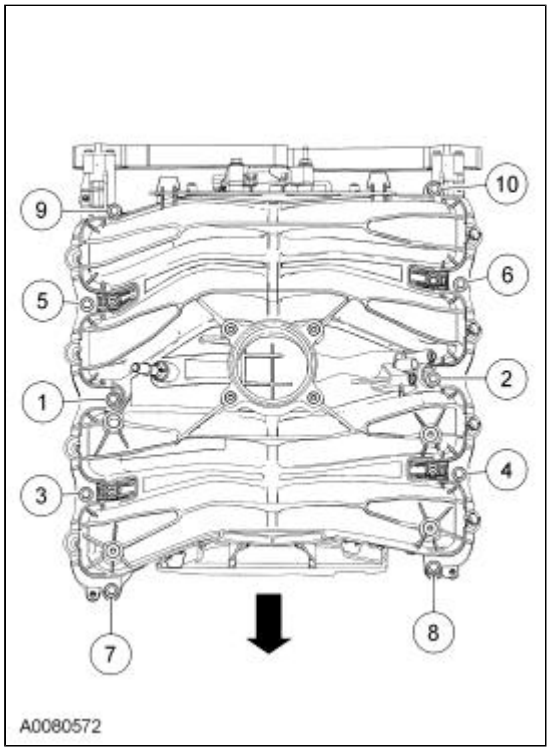
4. Connect the CHT sensor jumper harness electrical connector.



5. Connect the LH and RH KS electrical connectors.



6. Install the intake manifold bolts and tighten in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 2 Nm (18 lb-in).
    - Stage 2: Tighten to 10 Nm (89 lb-in).



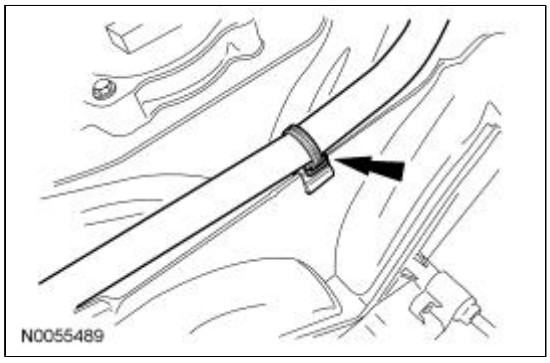
7. Install the intake manifold vacuum tube support bracket bolt and connect the intake manifold vacuum tube-to-intake manifold hose.
    - Tighten to 10 Nm (89 lb-in).
8. Connect the intake manifold vacuum tube support retainer to the valve cover and position the intake manifold vacuum tube aside.
9. Connect the brake booster vacuum hose to the intake manifold vacuum tube.
10. Connect the heated PCV intake fitting electrical connector.
11. Connect the TP sensor and electronic acceleration control electrical connectors.
12. Connect the 8 fuel injector electrical connectors.
13. Connect the 8 ignition coil electrical connectors.
14. Position the air cleaner outlet pipe-to-TB adapter and install the 4 bolts.

- Tighten to 10 Nm (89 lb-in).

15. Connect the crankcase ventilation tube quick connect coupling to the intake manifold. For additional information, refer to Section 310-00 .

16. Position the EVAP hose and connect the quick connect coupling to the intake manifold. For additional information, refer to Section 310-00 .

17. Connect the EVAP hose position retainer to the intake manifold.



18. Position the PCV tube and connect the quick connect couplings. For additional information, refer to Section 310-00 .

19. Connect the heater coolant hose to the coolant bypass.

20. Connect the fuel supply spring lock coupling to the fuel rail. For additional information, refer to Section 310-00 .

21. Install the generator. For additional information, refer to Section 414-02 .

22. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

23. Connect the battery ground cable. For additional information, refer to Section 414-01 .

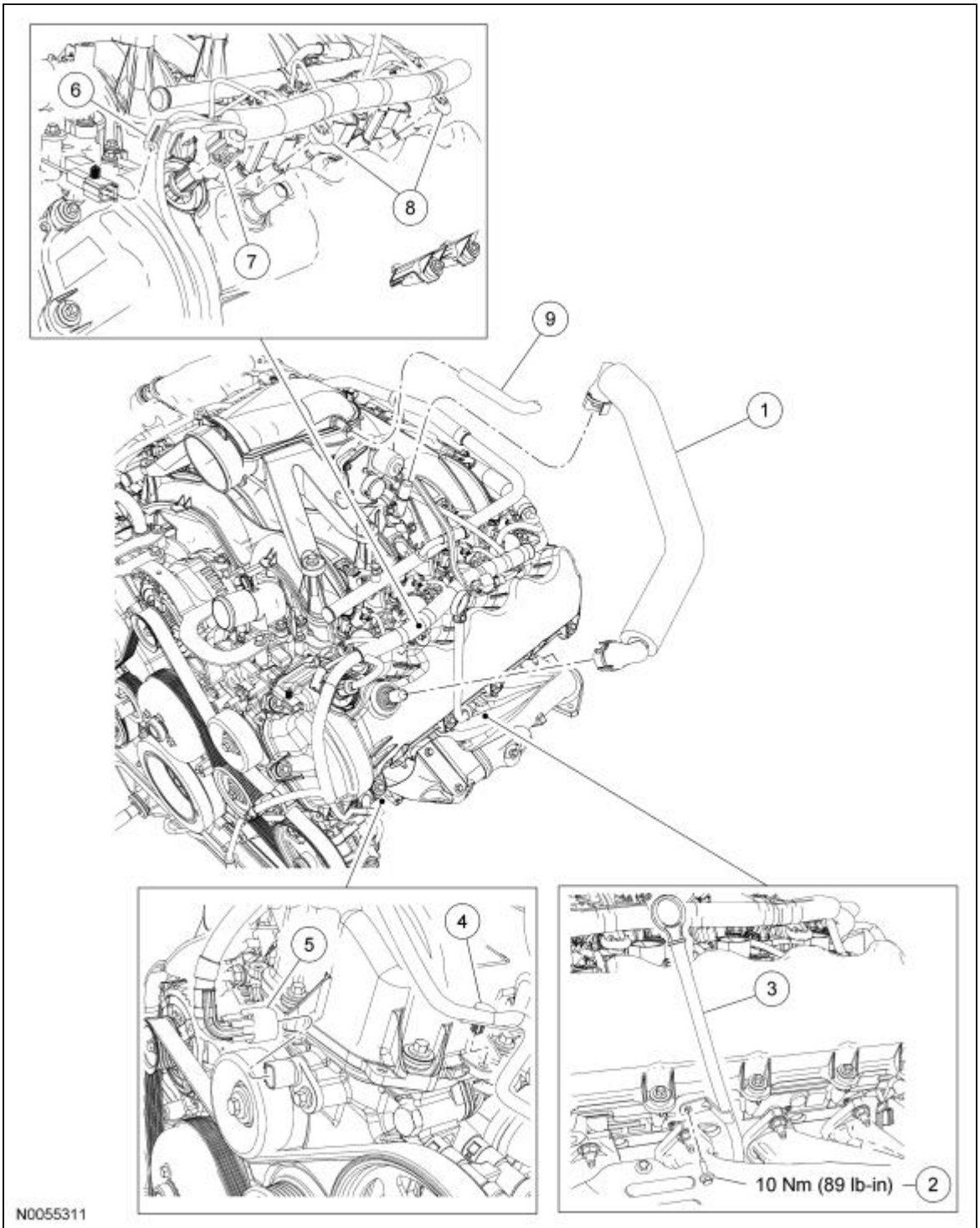
24. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

Valve Cover — LH

Printable View (700 KB)

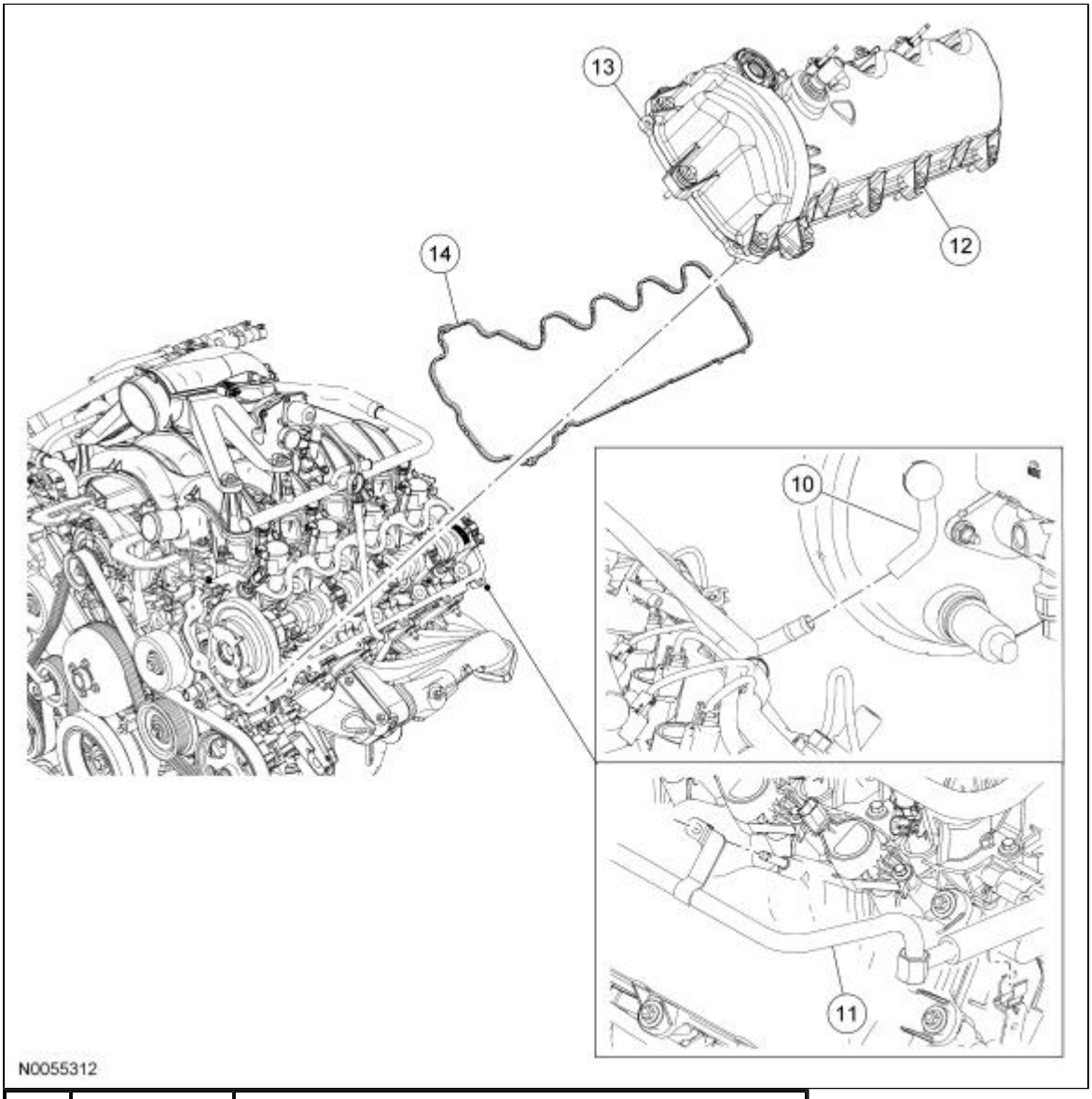
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	6K817	Positive crankcase ventilation (PCV) tube
2	N605892	Oil level indicator and tube bolt
3	6K873	Oil level indicator and tube
4	—	Engine wiring harness retainer (part of 12B637)
5	—	LH camshaft position (CMP) sensor electrical connector (part of 12B637)
6	—	LH radio ignition interference capacitor electrical connector (part of 12B637)

7	—	LH variable camshaft timing (VCT) solenoid electrical connector (part of 12B637)
8	—	Engine wiring harness retainers (part of 12B637)
9	—	Vacuum hose



Item	Part Number	Description
10	—	Intake manifold vacuum tube-to-brake booster hose
11	9D446	Intake manifold vacuum tube
12	—	LH valve cover bolt (15 required) (part of 6582)
13	6A505	LH valve cover
14	6A559	LH valve cover gasket

Removal

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

2. Remove the degas bottle. For additional information, refer to Section 303-03 .

3. Remove the LH ignition coils. For additional information, refer to Section 303-07 .

4. Disconnect the quick connect couplings and remove the positive crankcase ventilation (PCV) tube. For additional information, refer to Section 310-00 .

5. Remove the bolt and position the oil level indicator tube aside.

6. Disconnect the LH radio ignition interference capacitor electrical connector.

7. Disconnect the LH variable camshaft timing (VCT) solenoid electrical connector and the wiring harness retainers.

8. Disconnect the intake manifold vacuum tube hose from the brake booster.

9. Disconnect the intake manifold vacuum tube assembly from the support bracket and the valve cover stud and position aside.

10. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    CAUTION: When removing the valve cover, make sure to avoid damaging the VCT solenoid.

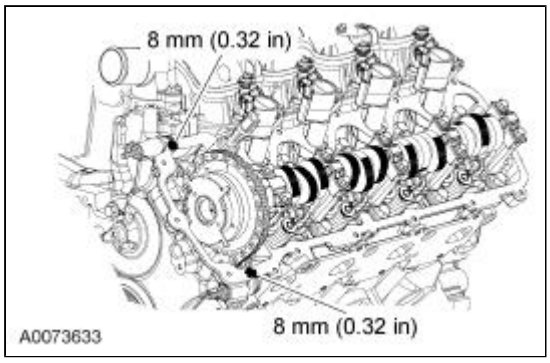
    NOTE: The fasteners are part of the valve cover and should not be removed.

    Fully loosen the 15 fasteners and remove the LH valve cover and gasket.
    - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Discard the valve cover gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.

Installation

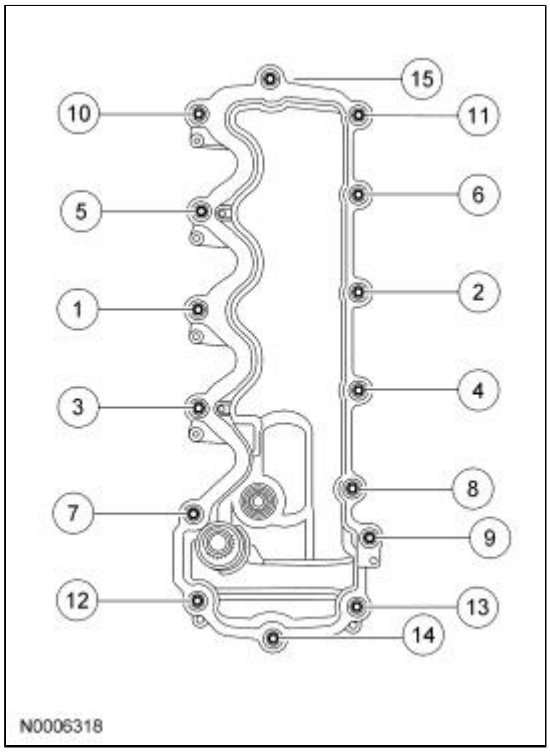
1. **NOTE:** If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

   Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



2. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT solenoid.**

   Position the LH valve cover and new gasket on the cylinder head and tighten the fasteners in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).



3. Position the intake manifold vacuum tube assembly onto the support bracket and the valve cover stud.

4. Connect the intake manifold vacuum tube hose to the brake booster.

5. Connect the VCT solenoid electrical connector and the wiring harness retainers.

6. Connect the radio ignition interference capacitor electrical connector.

7. Position the oil level indicator tube and install the bolt.
   - Tighten to 10 Nm (89 lb-in).

8. Position the PCV tube and connect the quick connect couplings. For additional information, refer to Section 310-00 .

9. Install the LH ignition coils. For additional information, refer to Section 303-07 .

10. Install the degas bottle. For additional information, refer to Section 303-03 .

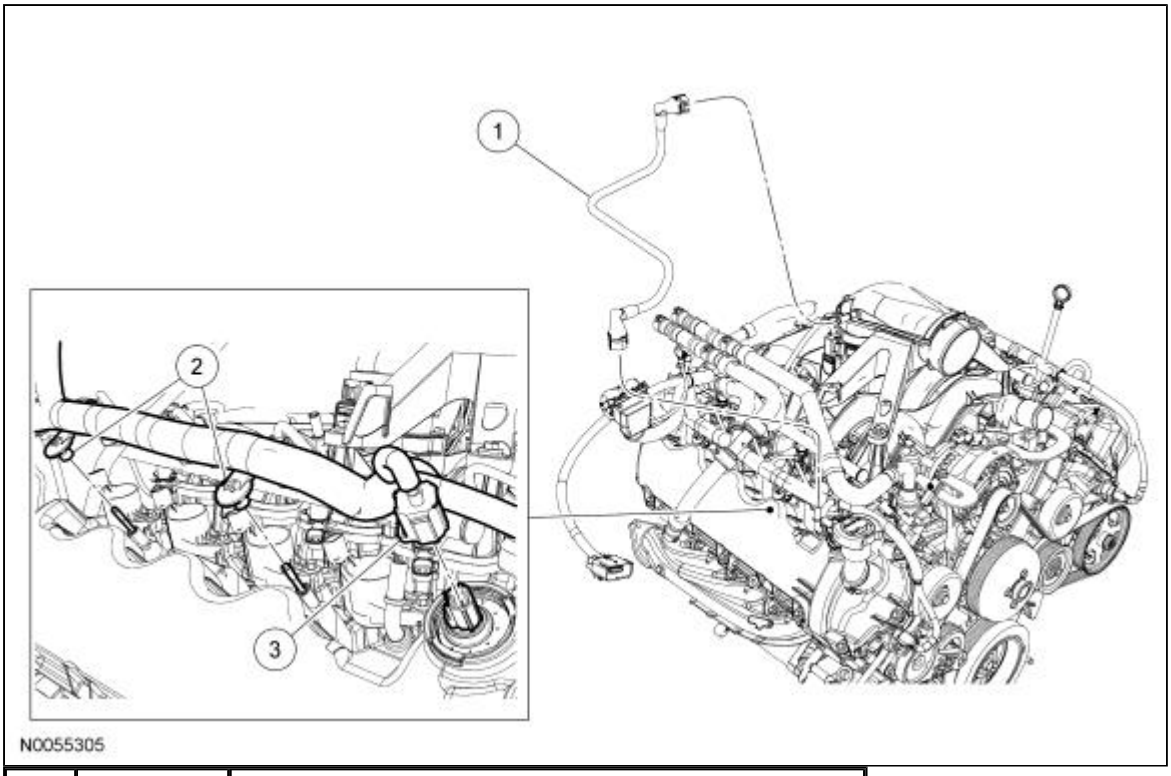
11. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

Valve Cover — RH

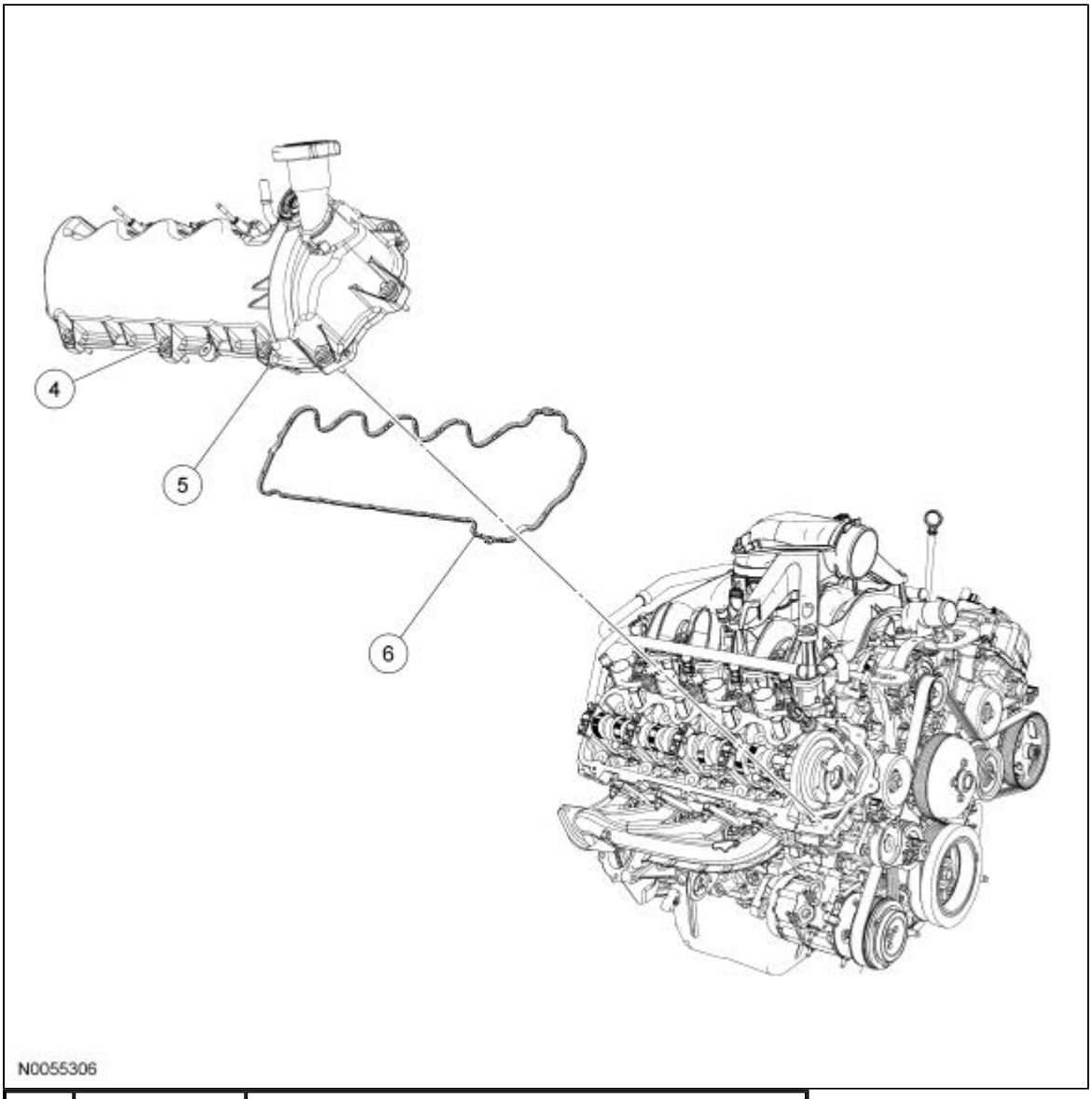
Printable View (786 KB)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	6758	Crankcase vent tube
2	—	Engine wiring harness retainers (part of 12B637)
3	—	Variable camshaft timing (VCT) solenoid electrical connector (part of 12B637)



Item	Part Number	Description
4	—	RH valve cover bolt (15 required) (part of 6582)
5	6582	RH valve cover
6	6584	RH valve cover gasket

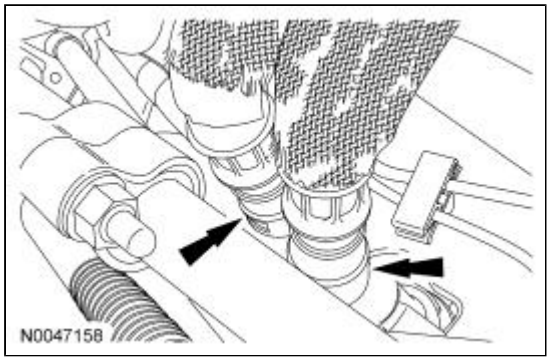
Removal

All vehicles

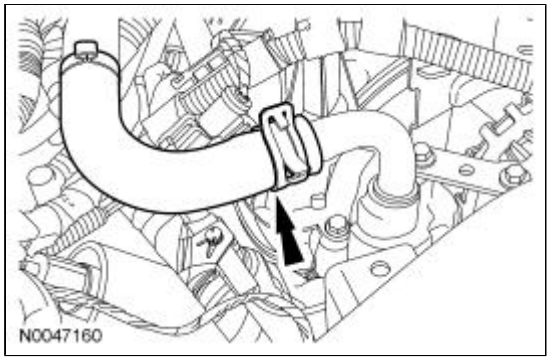
1. Recover the refrigerant. For additional information, refer to Section 412-00 .

Vehicles with auxiliary heat

2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Disconnect the 2 auxiliary heat coolant hoses.



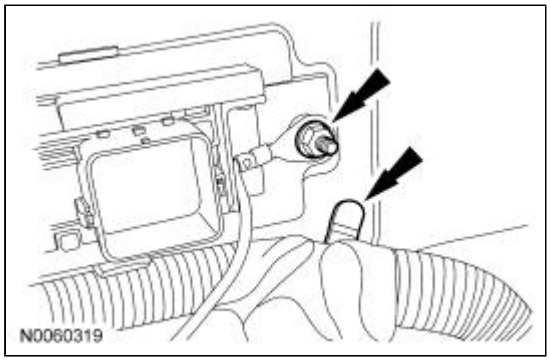
4. Disconnect the coolant hose from the intake manifold and position the coolant hose assembly aside.



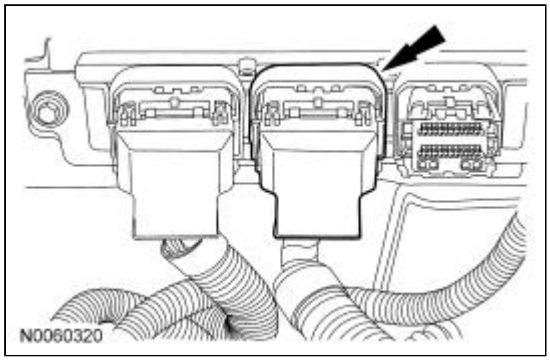
All vehicles

5. Disconnect the quick connect couplings and remove the crankcase vent tube. For additional information, refer to Section 310-00 .

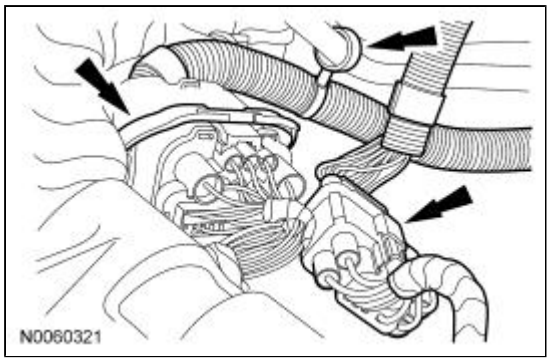
6. Remove the nut and the ground cable and disconnect the wiring harness retainer.



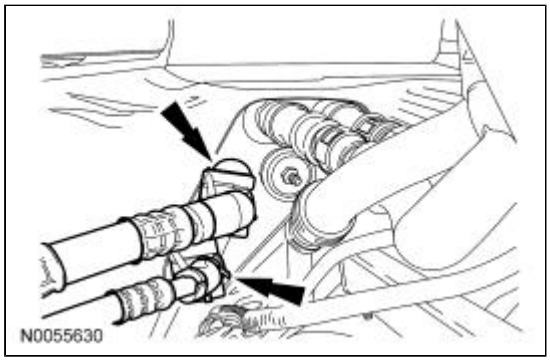
7. Disconnect the powertrain control module (PCM) electrical connector.



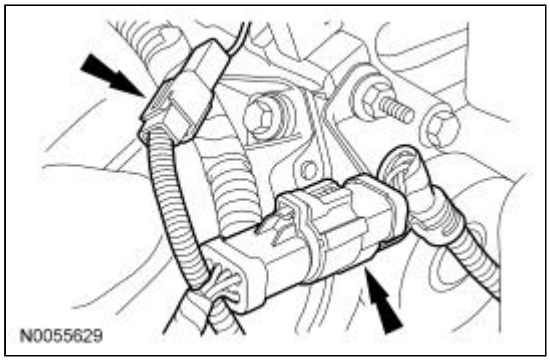
8. Disconnect the 2 electrical connectors and the wiring harness retainer.



9. Disconnect the evaporator outlet and inlet fittings.
    - Discard the O-ring seals.



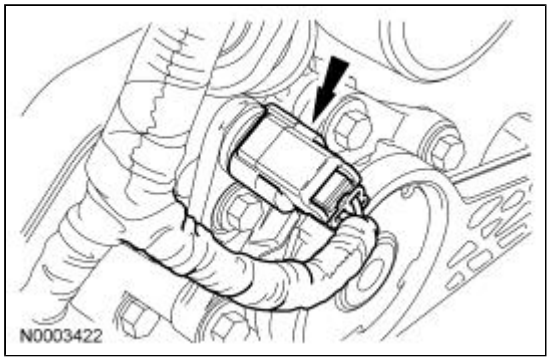
10. Disconnect the RH radio ignition interference capacitor and engine cooling fan clutch electrical connectors.



11. Remove the RH ignition coils. For additional information, refer to Section 303-07 .

12. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

13. Disconnect the RH camshaft position (CMP) sensor electrical connector.



14. Disconnect the 2 engine wiring harness retainers from the RH valve cover studs.

15. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    CAUTION: When removing the valve cover, make sure to avoid damaging the VCT solenoid.

    NOTE: The fasteners are part of the valve cover and should not be removed.

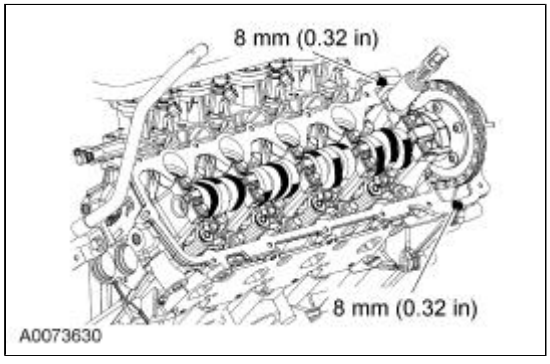
    Fully loosen the 15 fasteners and remove the RH valve cover and gasket.
    - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Discard the valve cover gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.

Installation

All vehicles

1. **NOTE:** If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

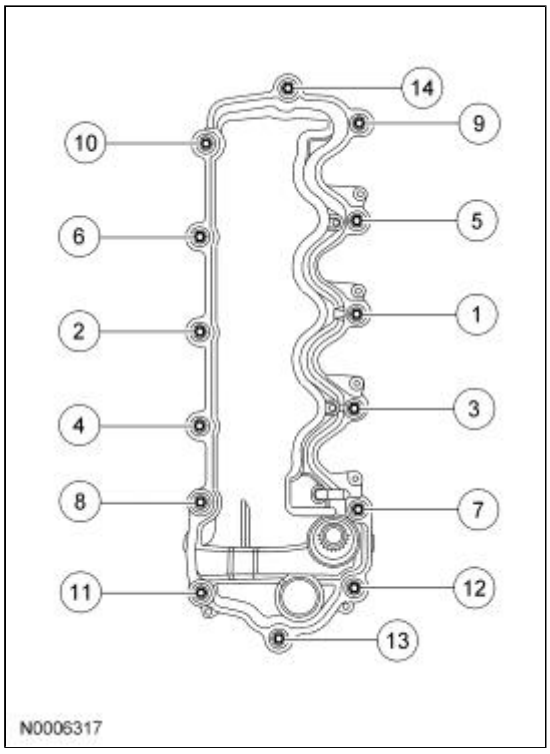
   Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



2. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT solenoid.**

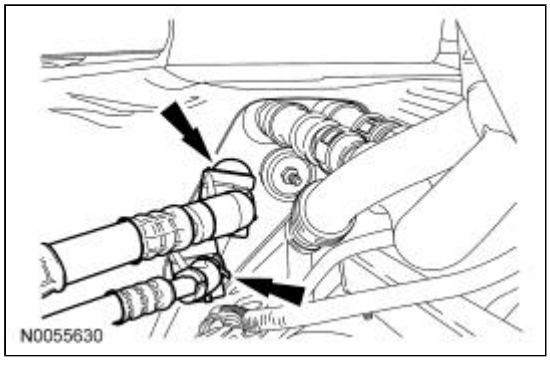
Position the LH valve cover and new gasket on the cylinder head and tighten the fasteners in the sequence shown.

- Tighten to 10 Nm (89 lb-in).

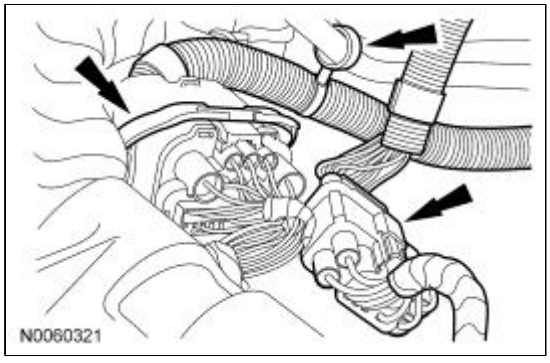


3. Install the RH ignition coils. For additional information, refer to Section 303-07 .

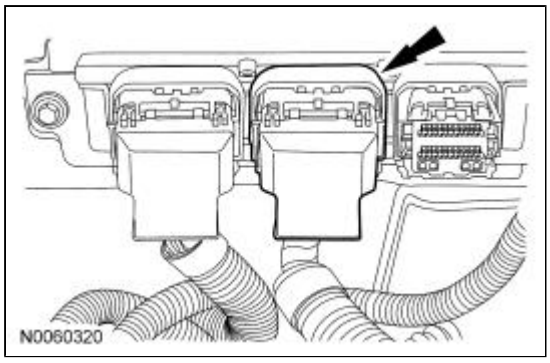
4. Using new O-ring seals, connect the evaporator outlet and inlet fittings.
   - Lubricate the O-ring seals with PAG oil prior to installation.



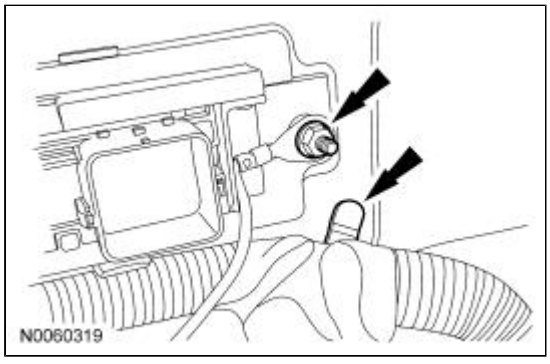
5. Connect the 2 electrical connectors and the wiring harness retainer.



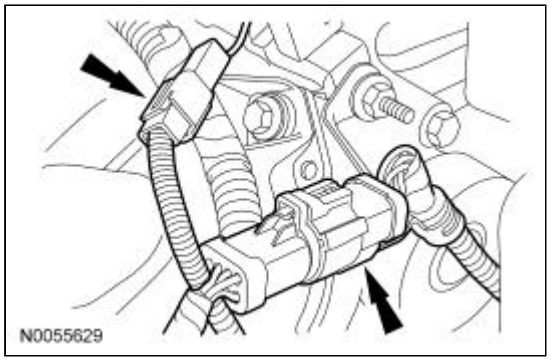
6. Connect the PCM electrical connector.



7. Connect the wiring harness retainer and ground cable and install the nut.
    - tighten to 10 Nm (89 lb-in).



8. Connect the RH radio ignition interference capacitor and engine cooling fan clutch electrical connectors.



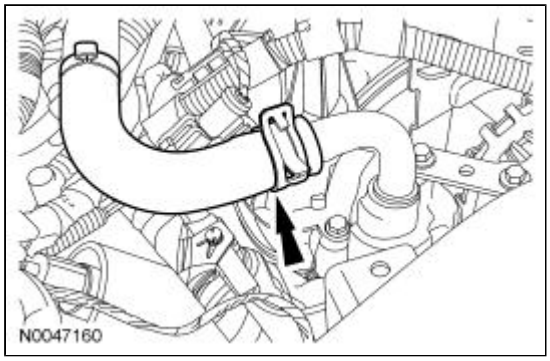
9. Connect the RH VCT solenoid electrical connector.

10. Connect the wiring harness retainers to the valve cover.

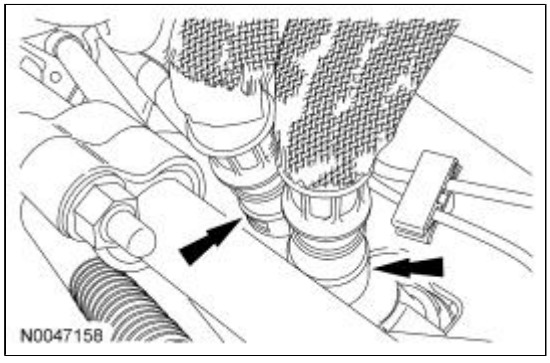
11. Position the crankcase vent tube and connect the quick connect couplings. For additional information, refer to Section 310-00 .

Vehicles with auxiliary heat

12. Position the coolant hose assembly and connect the coolant hose to the intake manifold.



13. Connect the 2 auxiliary heat coolant hoses.



14. Fill and bleed the coolant system. For additional information, refer to Section 303-03 .

All vehicles

15. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Crankshaft Pulley

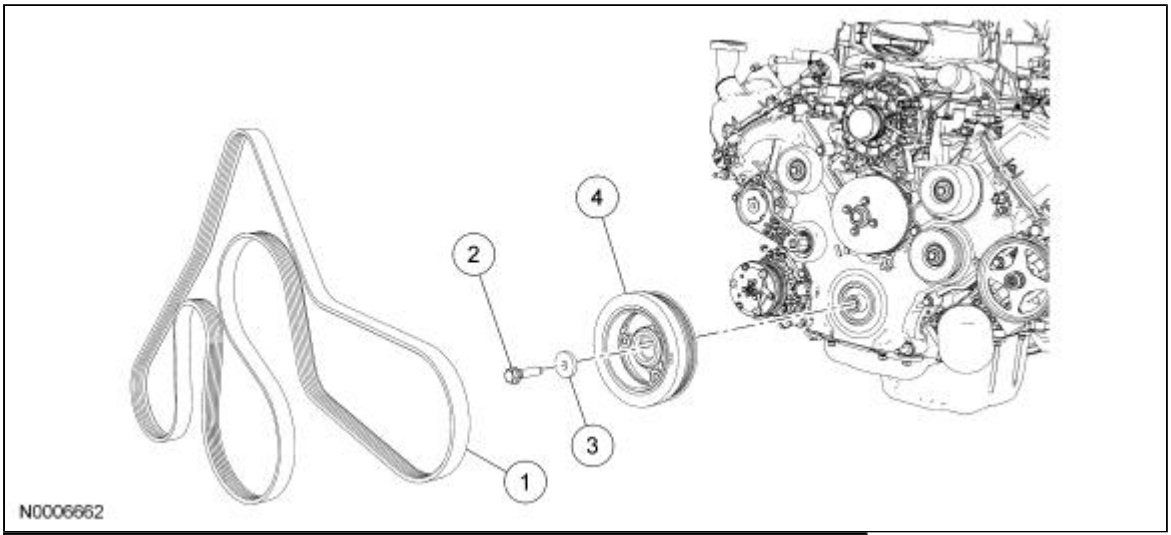
Printable View (385 KB)

Special Tool(s)

ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



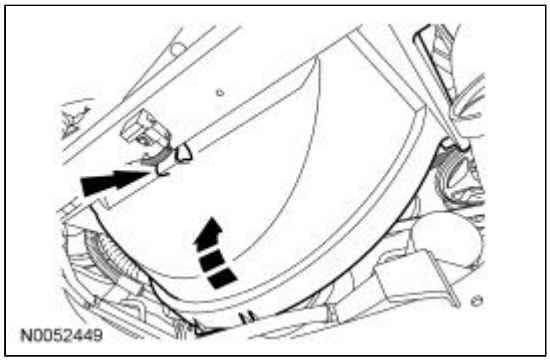
Item	Part Number	Description

1	8620	Accessory drive belt
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley bolt washer
4	6316	Crankshaft pulley

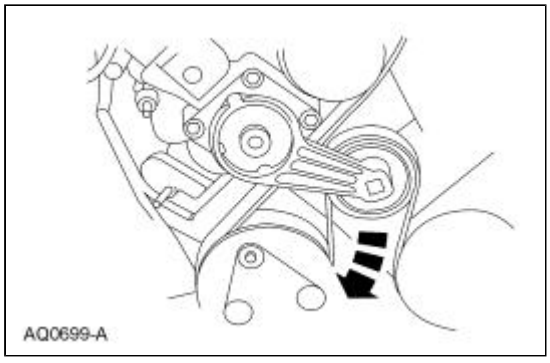
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the cooling fan shroud position tab and rotate the shroud upward until the lower tab locks into position.

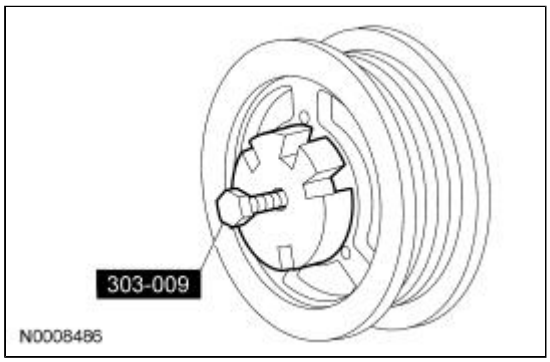


3. Rotate the tensioner clockwise and remove the accessory drive belt from the crankshaft pulley.



4. Remove the crankshaft pulley bolt and washer.
   - Discard the crankshaft pulley bolt.

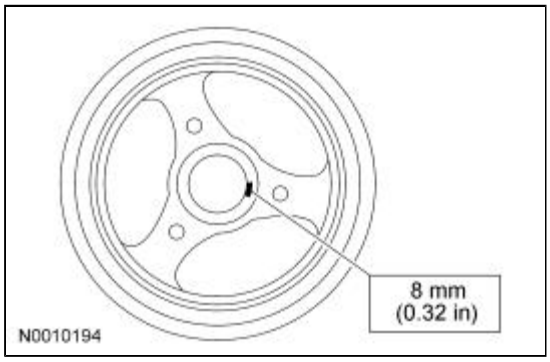
5. Using the special tool, remove the crankshaft pulley.



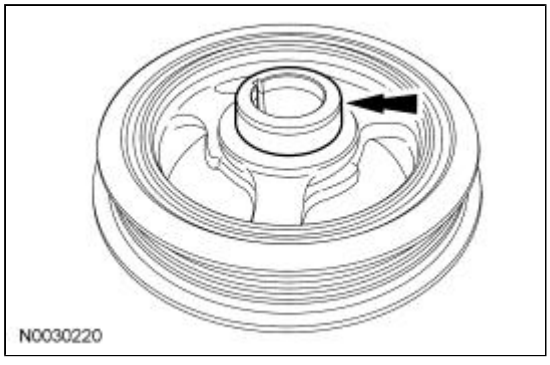
Installation

1. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

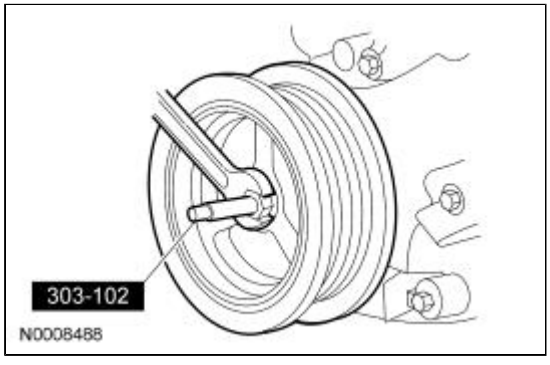
   Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



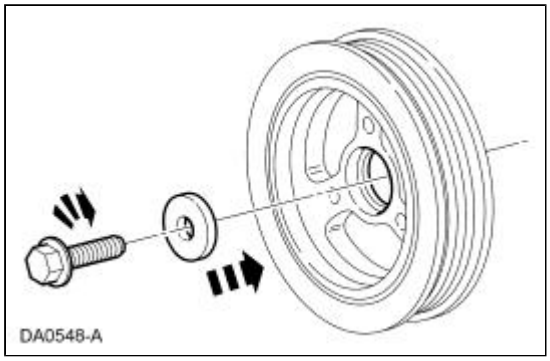
2. Lubricate the crankshaft pulley sealing area with clean engine oil prior to installation.



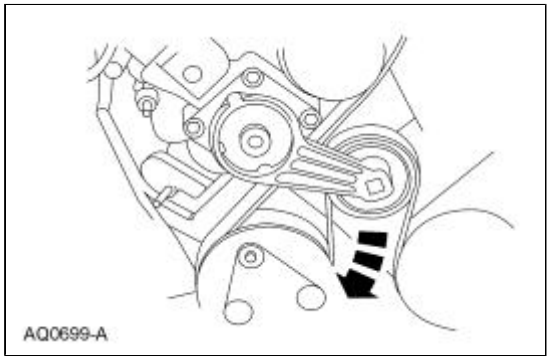
3. Using the special tool, install the crankshaft pulley.



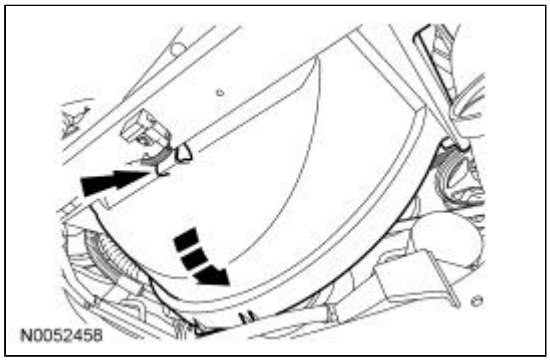
4. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
   - Stage 1: Tighten to 90 Nm (66 lb-ft).
   - Stage 2: Loosen 360 degrees.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.



5. Rotate the tensioner clockwise and install the accessory drive belt onto the crankshaft pulley.



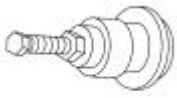
6. Release the cooling fan shroud position tab and rotate the shroud downward until the tab locks into position.



Crankshaft Front Seal

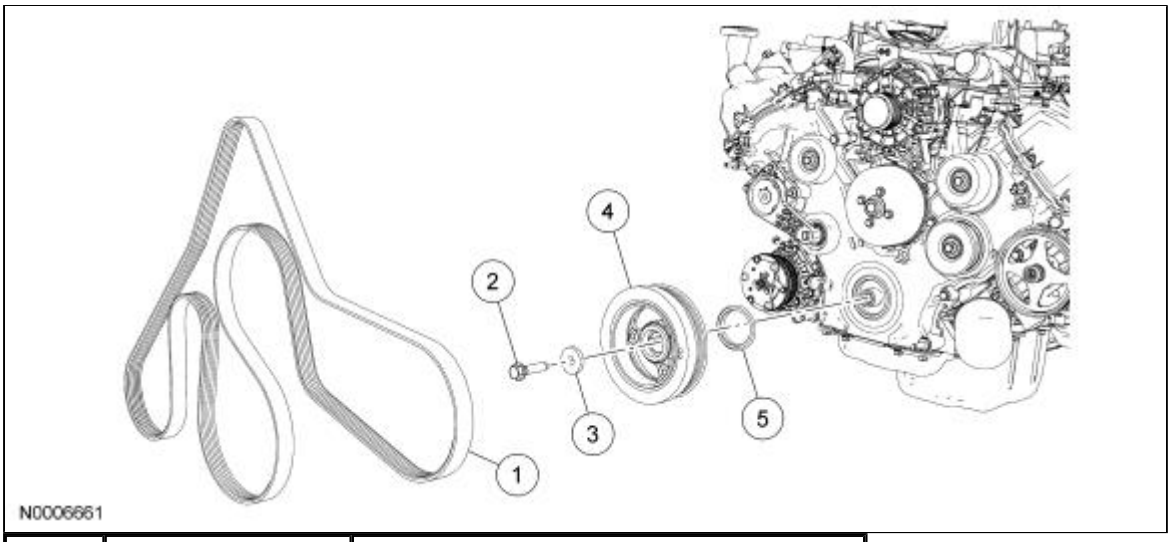
Printable View (431 KB)

Special Tool(s)

ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
ST1288-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant	WSE-

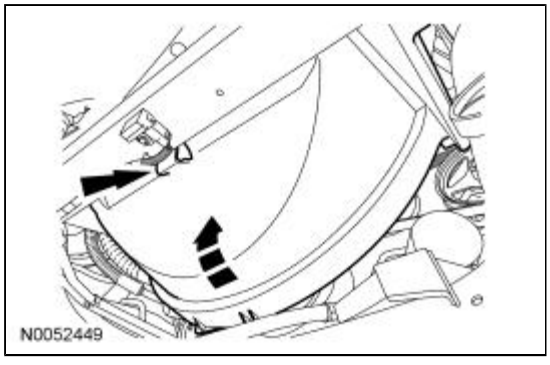


Item	Part Number	Description
1	8620	Accessory drive belt
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley bolt washer
4	6316	Crankshaft pulley
5	6700	Crankshaft front seal

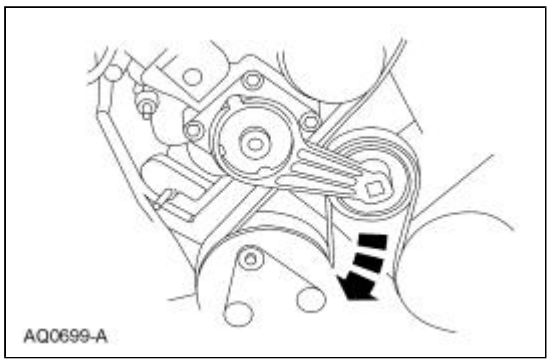
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the cooling fan shroud position tab and rotate the shroud upward until the lower tab locks into position.

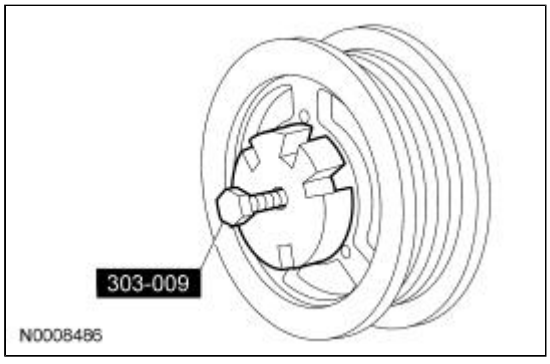


3. Rotate the tensioner clockwise and remove the accessory drive belt from the crankshaft pulley.

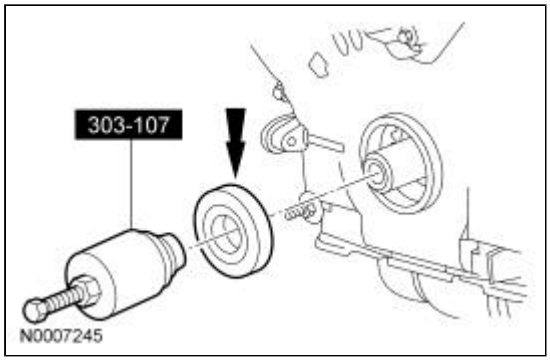


4. Remove the crankshaft pulley bolt and washer.
    - Discard the crankshaft pulley bolt.

5. Using the special tool, remove the crankshaft pulley.

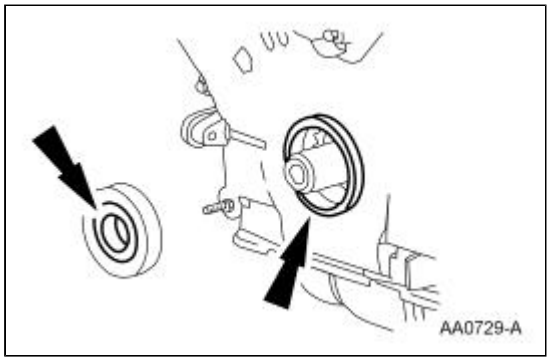


6. Using the special tool, remove and discard the crankshaft front seal.

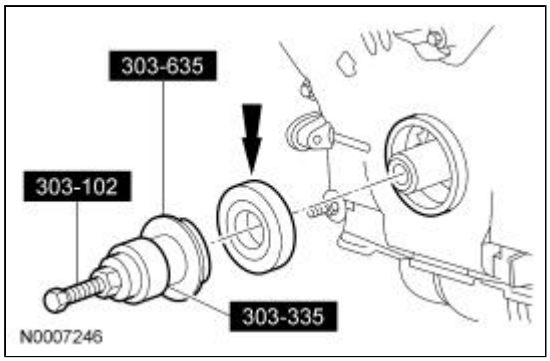


Installation

1. Lubricate the engine front cover and the new crankshaft front seal inner lip with clean engine oil.

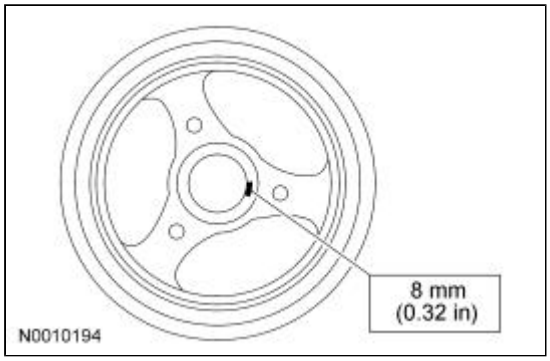


2. Using the special tools, install the new crankshaft front seal.

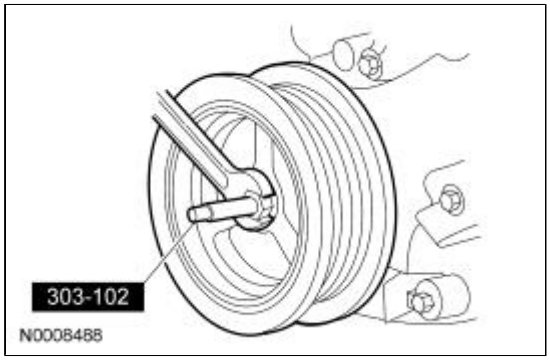


3. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

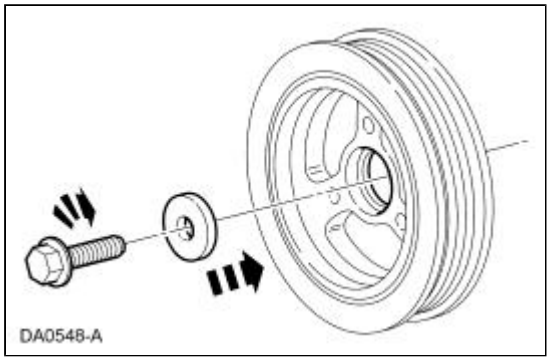
   Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



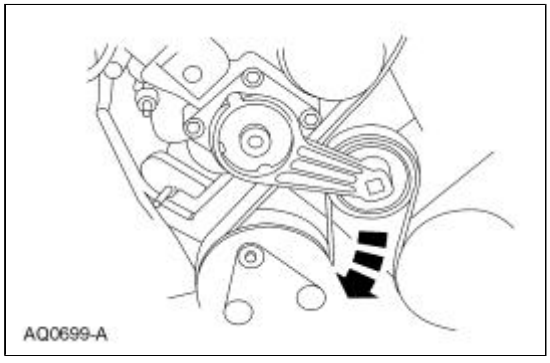
4. Using the special tool, install the crankshaft pulley.



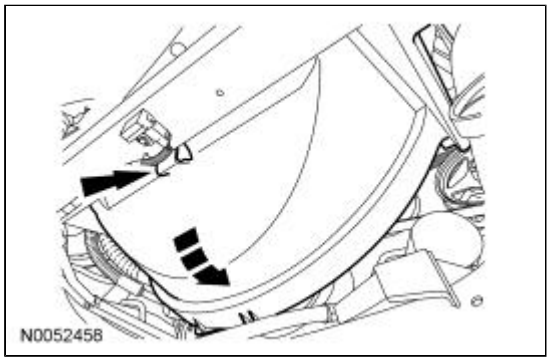
5. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
   - Stage 1: Tighten to 90 Nm (66 lb-ft).
   - Stage 2: Loosen 360 degrees.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.



6. Rotate the tensioner clockwise and install the accessory drive belt onto the crankshaft pulley.



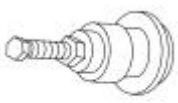
7. Release the cooling fan shroud position tab and rotate the shroud downward until the tab locks into position.



Engine Front Cover

Printable View (1514 KB)

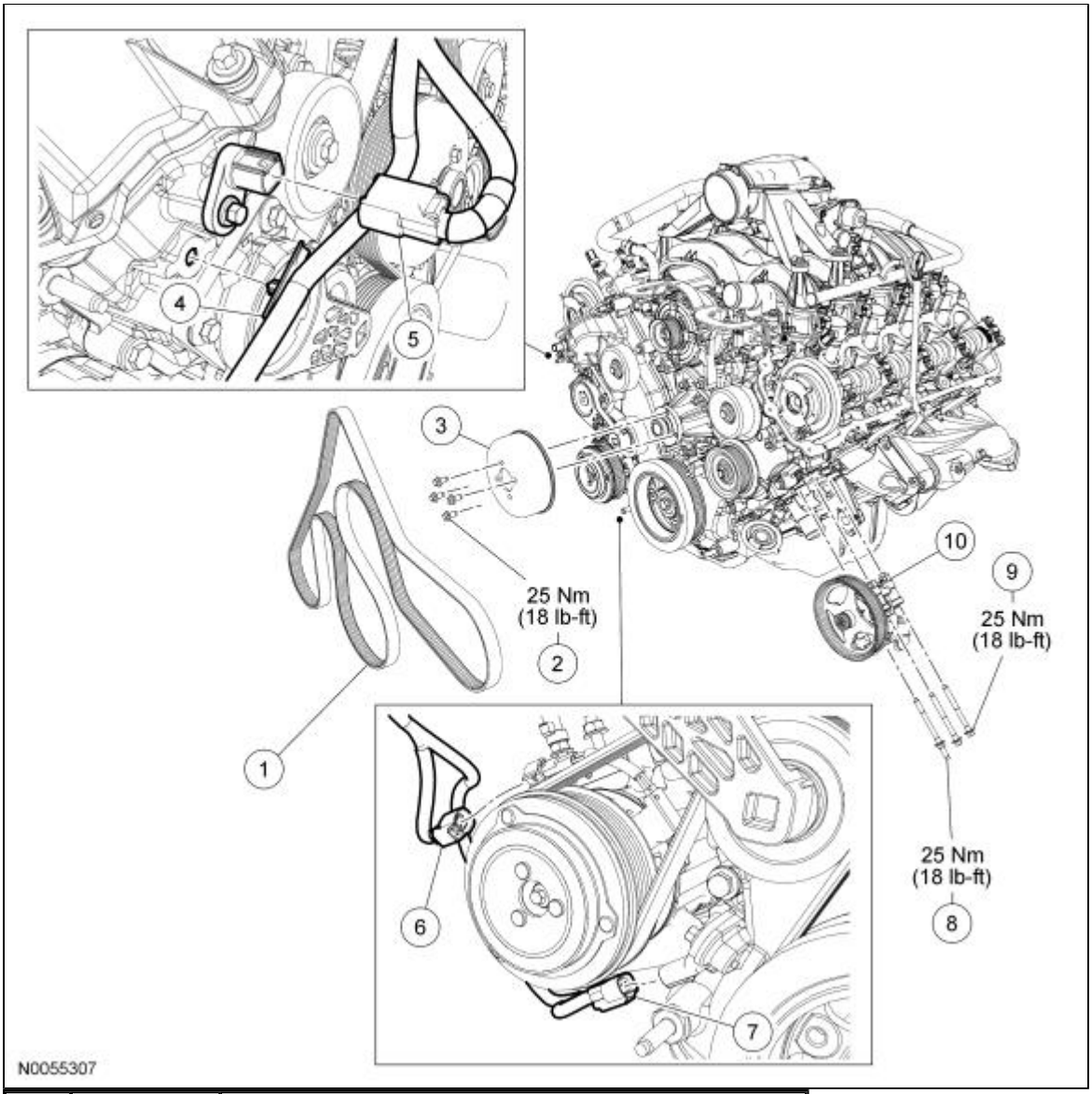
Special Tool(s)

 ST1328-A	Installer, Crankshaft Front Seal 303-335 (T88T-6701-A)
ST1288-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
ST2197-A	Installer, Crankshaft Front Seal 303-635
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

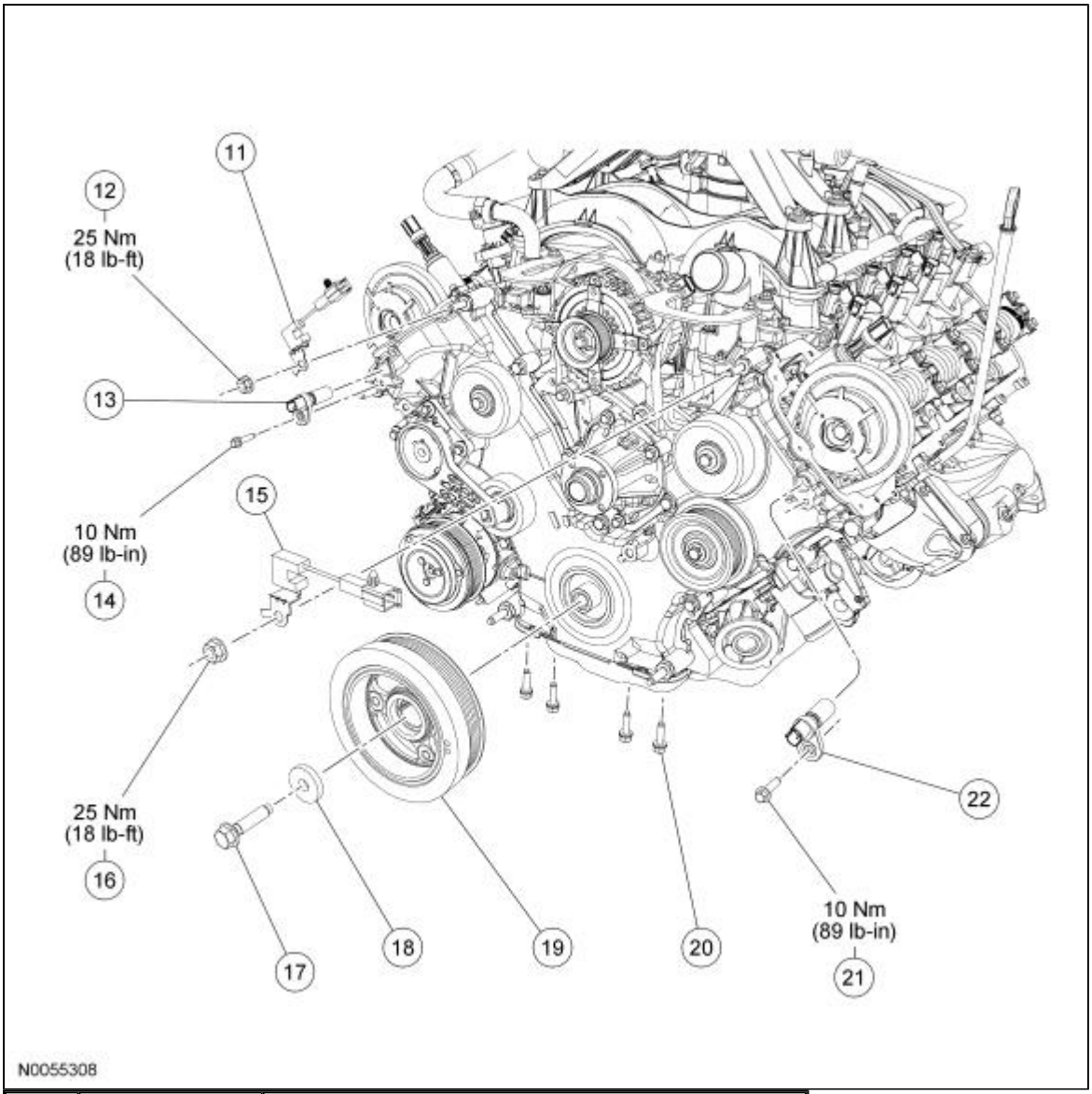
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover	

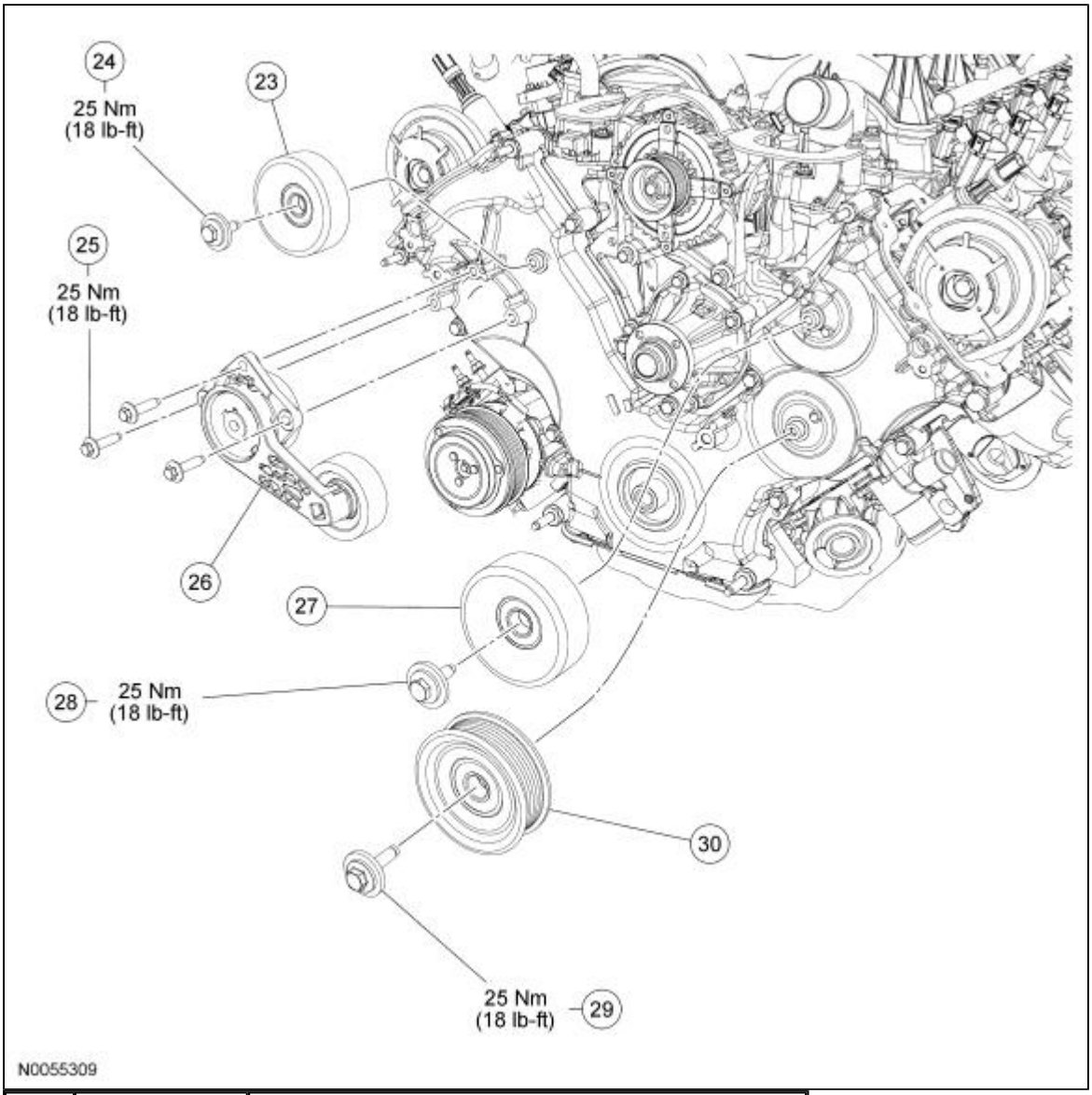
ZC-30	—



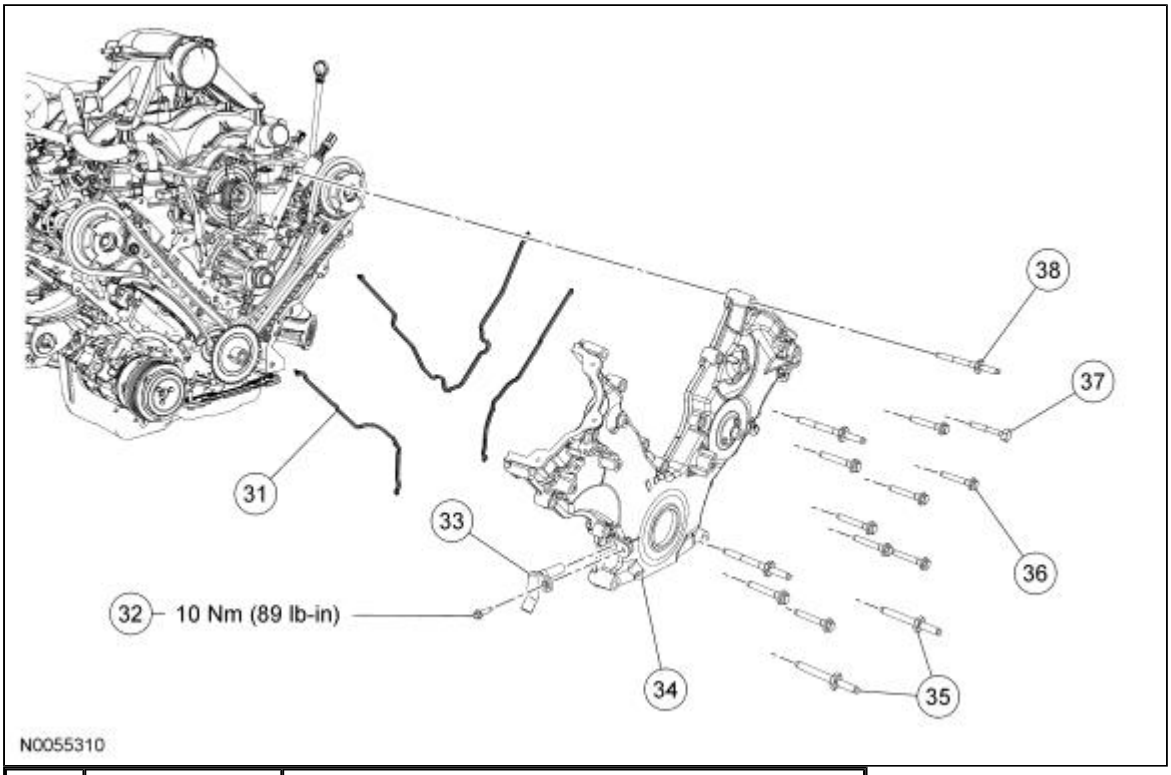
Item	Part Number	Description
1	8620	Accessory drive belt
2	N806282	Coolant pump pulley bolt (4 required)
3	8A528	Coolant pump pulley
4	—	Wiring harness retainer (part of 12B637)
5	—	RH camshaft position (CMP) sensor electrical connector (part of 12B637)
6	—	A/C compressor electrical connector (part of 12B637)
7	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
8	W710927	Power steering pump stud bolt
9	W706447	Power steering pump bolt (2 required)
10	3A696	Power steering pump



Item	Part Number	Description
11	18801	RH radio ignition interference capacitor
12	N804758	RH radio ignition interference capacitor nut
13	6B288	RH CMP sensor
14	N806155	RH CMP sensor bolt
15	18801	LH radio ignition interference capacitor
16	N804758	LH radio ignition interference capacitor nut
17	W701512	Crankshaft pulley bolt
18	N806165	Crankshaft pulley bolt washer
19	6316	Crankshaft pulley
20	W701605	Oil pan bolt (4 required)
21	N806155	LH CMP sensor bolt
22	6B288	LH CMP sensor



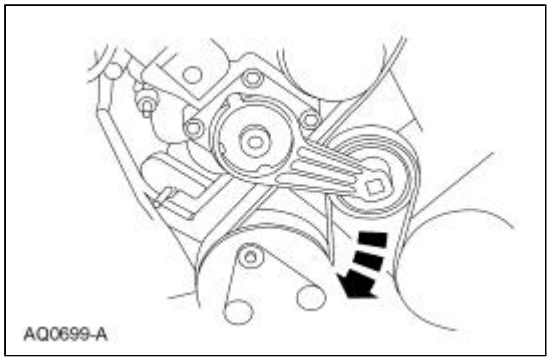
Item	Part Number	Description
23	19A216	RH accessory drive belt idler pulley
24	N808102	RH accessory drive belt idler pulley bolt
25	N808920	Accessory drive belt tensioner bolt (3 required)
26	6B209	Accessory drive belt tensioner
27	19A216	LH accessory drive belt idler pulley
28	N808102	LH accessory drive belt idler pulley bolt
29	N808102	LH lower accessory drive belt idler pulley bolt
30	6C348	LH lower accessory drive belt idler pulley



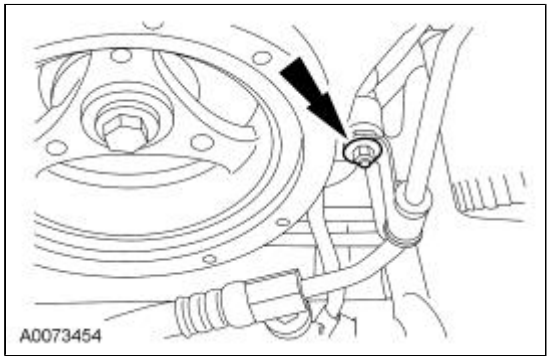
Item	Part Number	Description
31	6D081	Engine front cover gasket (3 required)
32	N806155	CKP sensor bolt
33	6C315	CKP sensor
34	6C086	Engine front cover
35	N808529	Engine front cover lower studs (2 required)
36	N806177	Engine front cover bolt (9 required)
37	W706605	Engine front cover bolt
38	W709573	Engine front cover upper stud (3 required)

Removal

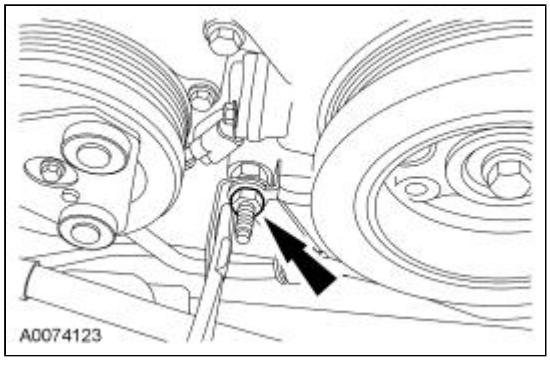
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the engine oil.
3. Remove the engine cooling fan. For additional information, refer to Section 303-03 .
4. Remove the cooling fan shroud. For additional information, refer to Section 303-03 .
5. Remove the RH valve cover. For additional information, refer to Valve Cover — RH in this section.
6. Remove the LH valve cover. For additional information, refer to Valve Cover — LH in this section.
7. Rotate the tensioner clockwise and remove the accessory drive belt.



8. Remove the nut and the power steering pressure hose support bracket.

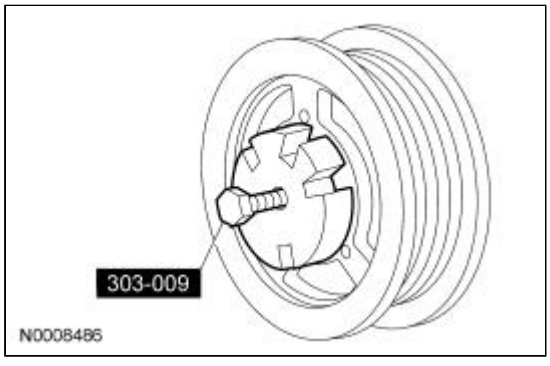


9. Remove the nut and the battery wiring harness and transmission cooler tube support brackets.

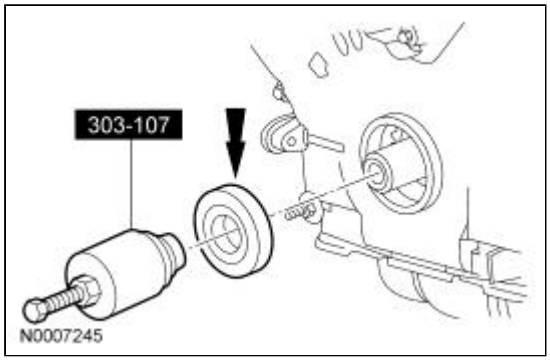


10. Remove the crankshaft pulley bolt and washer.
    - Discard the crankshaft pulley bolt.

11. Using the special tool, remove the crankshaft pulley.



12. Using the special tool, remove and discard the crankshaft front seal.



13. Remove the 3 bolts and the 3 accessory drive idler pulleys.

14. Remove the 4 bolts and the coolant pump pulley.

15. Remove the 3 bolts and the accessory drive belt tensioner.

16. Disconnect the RH camshaft position (CMP) sensor wiring harness retainer from the cylinder head.

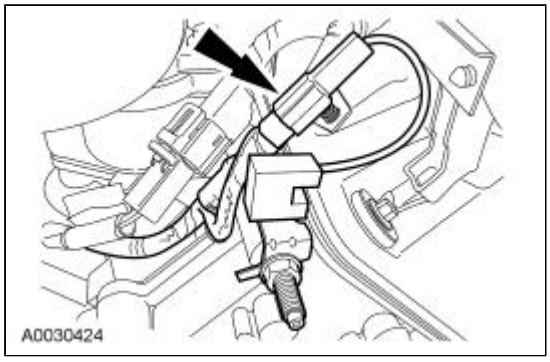
17. Disconnect the A/C compressor electrical connector.

18. Disconnect the crankshaft position (CKP) sensor electrical connector.

19. Remove the bolt and the RH CMP sensor.

20. **NOTE:** LH shown, RH similar.

    Disconnect the radio ignition interference capacitor electrical connectors.

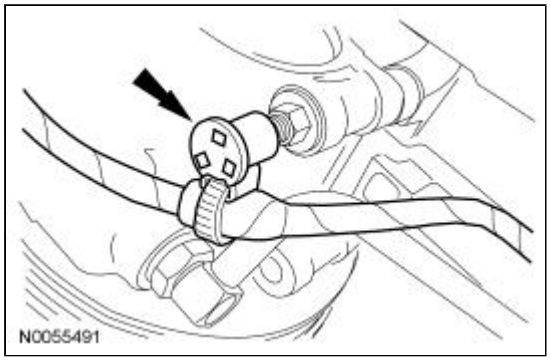


21. Remove the nut and the RH radio ignition interference capacitor.

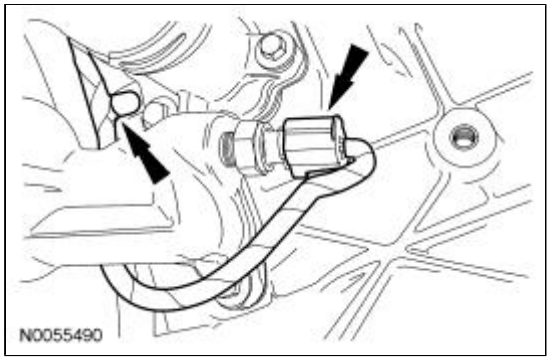
22. Remove the nut and the LH radio ignition interference capacitor.

23. Remove the bolt and the LH CMP sensor.
    - Discard the O-ring seal.

24. Disconnect the wiring harness position retainer from the power steering pump stud bolt.



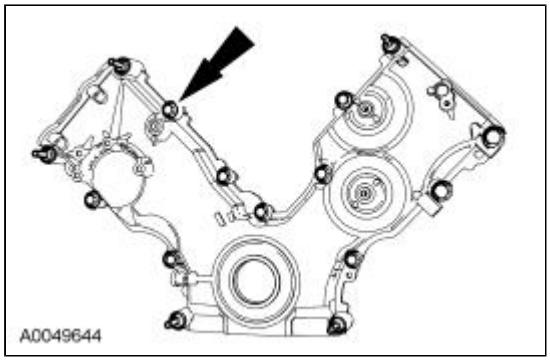
25. Disconnect the wiring harness position retainer and the engine oil pressure (EOP) switch electrical connector and position the wiring harness aside.



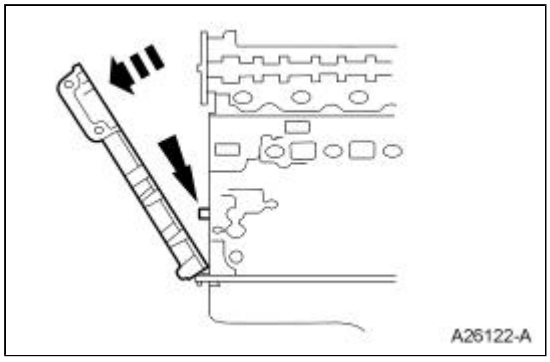
26. Remove the 2 bolts, the stud bolt and position the power steering pump assembly aside.

27. Remove the 4 front oil pan bolts.

28. Remove the bolts and the studs.



29. Remove the engine front cover from the front cover to cylinder block dowel.



30. Remove the bolt and the CKP sensor.
    - Discard the O-ring seal.

31. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Remove and discard the engine front cover gaskets.
    - Clean the mating surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Inspect the mating surfaces.

Installation

1. **NOTE:** Lubricate the O-ring with clean engine oil prior to installation.

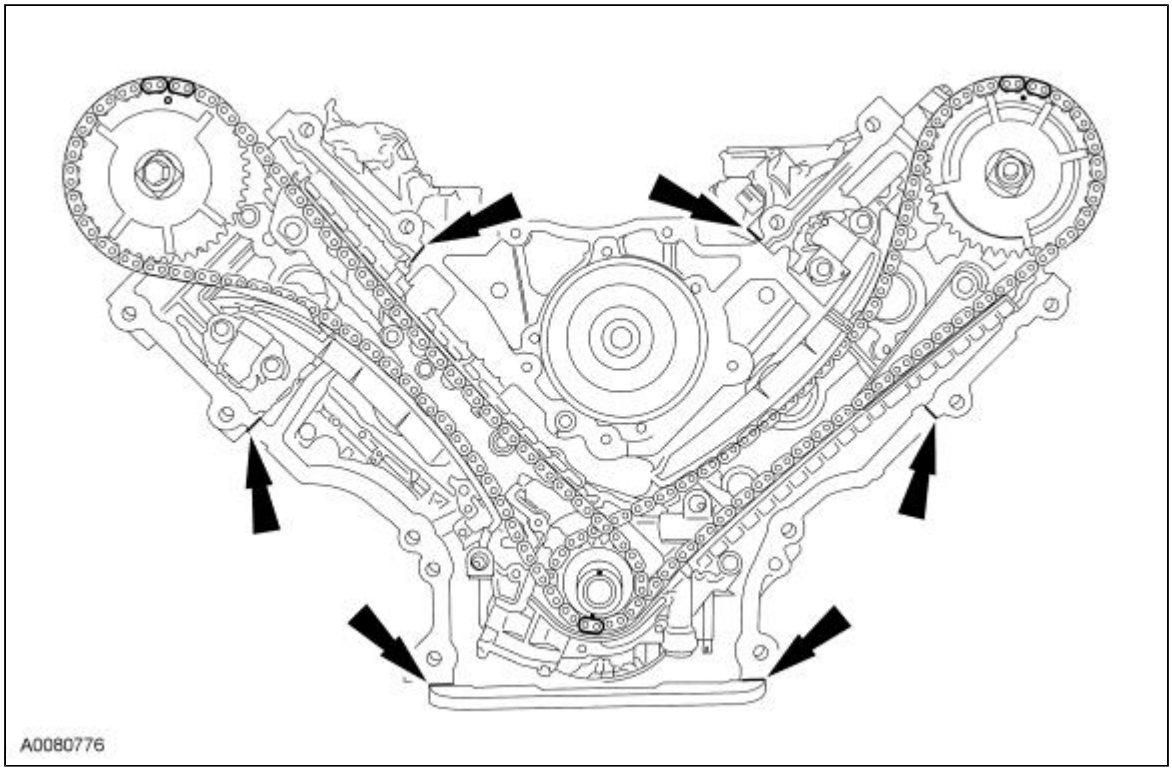
   Install the CKP sensor and the bolt.
   - Tighten to 10 Nm (89 lb-in).

2. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

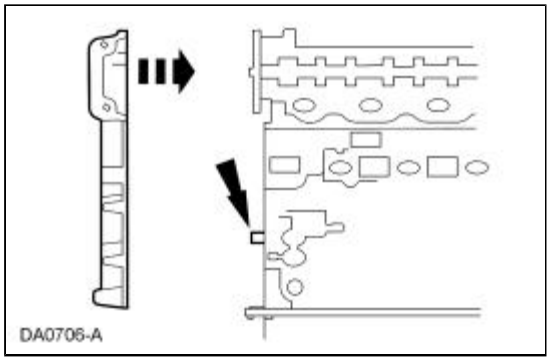
   NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

   NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

   Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface and the oil pan-to-cylinder block surface, at the locations shown.



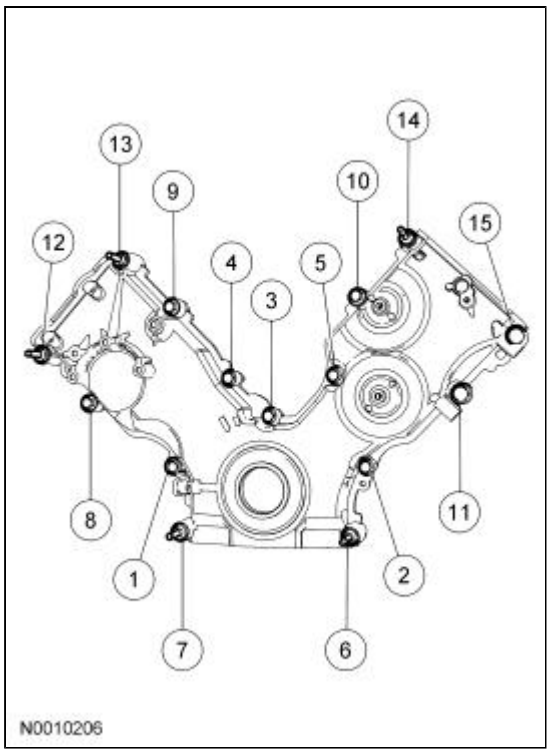
3. Install new engine front cover gaskets on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger tight.



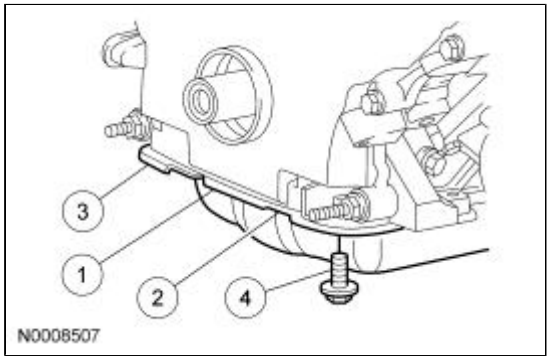
4. Tighten the engine front cover fasteners in 2 stages, in the sequence shown.
   Stage 1: Tighten fasteners 1 through 15 to 25 Nm (18 lb-ft).
   Stage 2: Tighten fasteners 6 and 7 to 48 Nm (35 lb-ft).

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
5	N806177	Bolts, Hex Flange Head Pilot, M8 x 1.25 x 50
6	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
7	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50

11	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
12	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
13	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
14	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
15	W706605	Bolt, Hex Head Pilot, M8 x 1.25 x 56

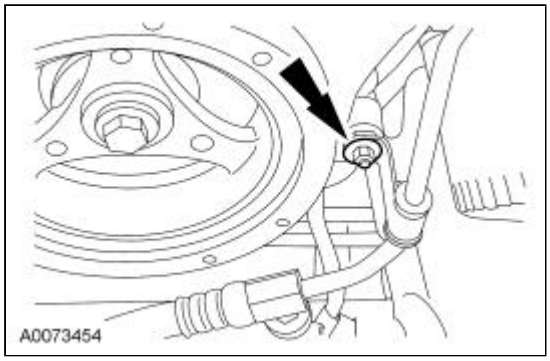


5. Loosely install the bolts, then tighten the bolts in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten an additional 60 degrees.

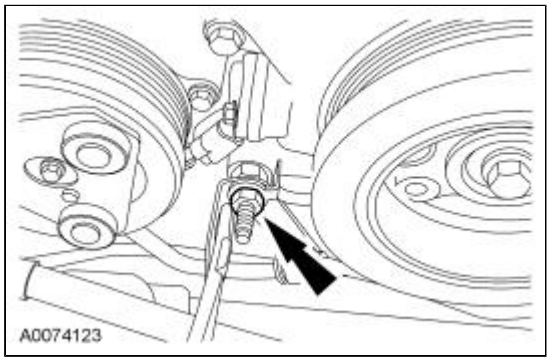


6. Position the power steering pump assembly and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).

7. Position the power steering pressure hose support bracket and install the nut.
    - Tighten to 10 Nm (89 lb-in).



8. Position the transmission cooler tube support bracket and install the nut.
    - Tighten to 10 Nm (89 lb-in).



9. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

    Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

10. Connect the RH CMP sensor electrical connector.

11. Connect the wiring harness retainer from the cylinder head.

12. Connect the A/C compressor electrical connector.

13. Connect the CKP sensor electrical connector.

14. Install the LH radio ignition interference capacitor and the nut.
    - Tighten to 25 Nm (18 lb-ft).

15. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

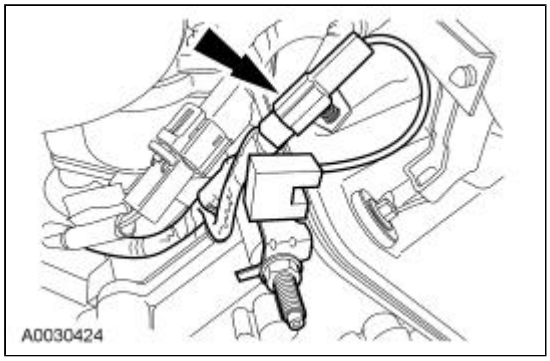
    Install the LH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

16. Connect the LH CMP sensor electrical connector.

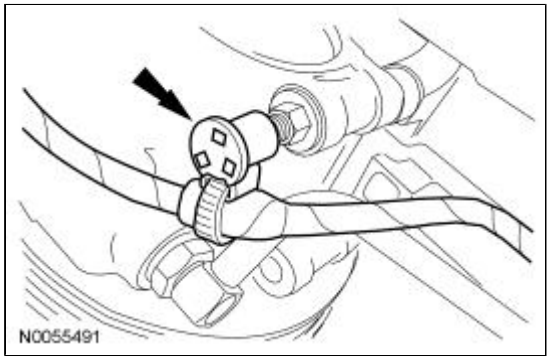
17. Install the RH radio ignition interference capacitor and the nut.
    - Tighten to 25 Nm (18 lb-ft).

18. **NOTE:** LH shown, RH similar.

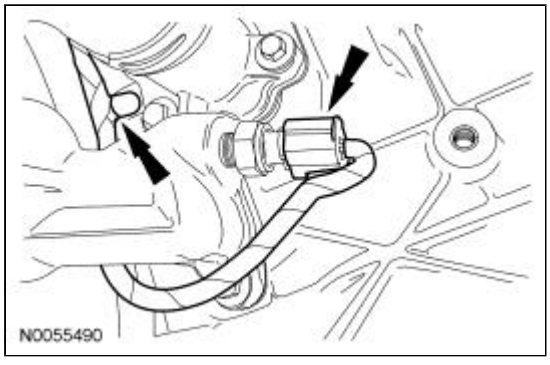
    Connect the radio ignition interference capacitor electrical connectors.



19. Connect the wiring harness position retainer to the power steering pump stud bolt.



20. Connect the wiring harness position retainer and the EOP switch electrical connector.

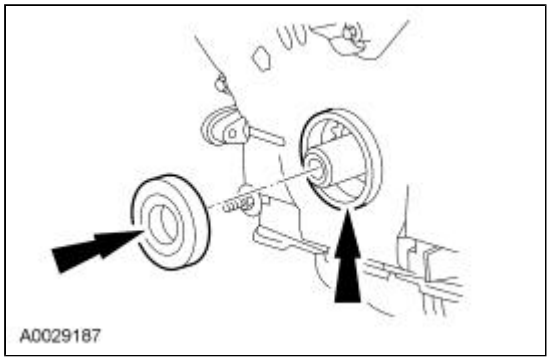


21. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

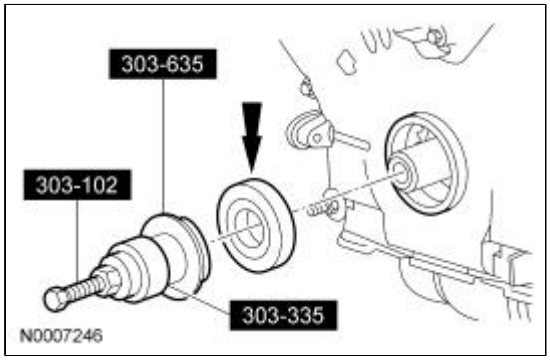
22. Install the coolant pump pulley and the 4 bolts.
    - Tighten to 25 Nm (18 lb-ft).

23. Install the 3 accessory drive idler pulleys and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

24. Lubricate the engine front cover and the crankshaft front seal inner lip with clean engine oil.

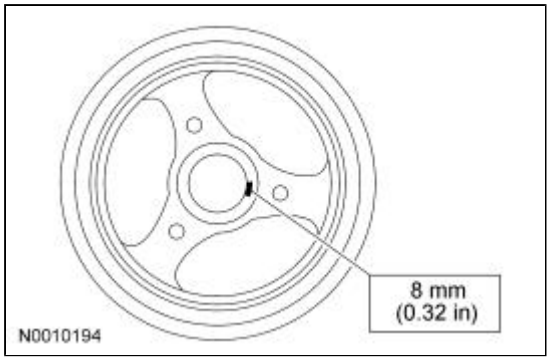


25. Using the special tools, install the crankshaft front seal into the engine front cover.

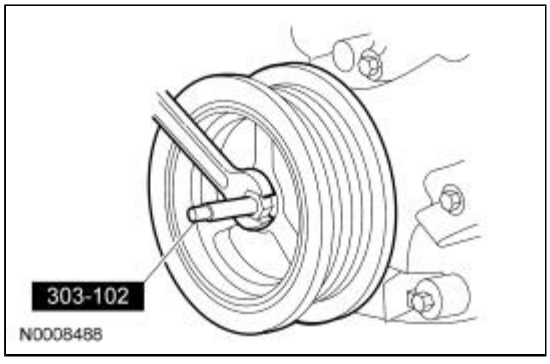


26. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

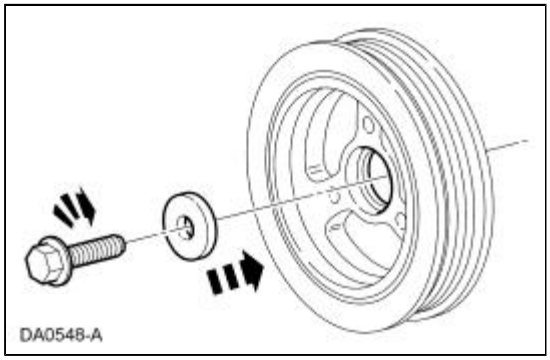
    Apply silicone gasket and sealant to the Woodruff key slot on the crankshaft pulley.



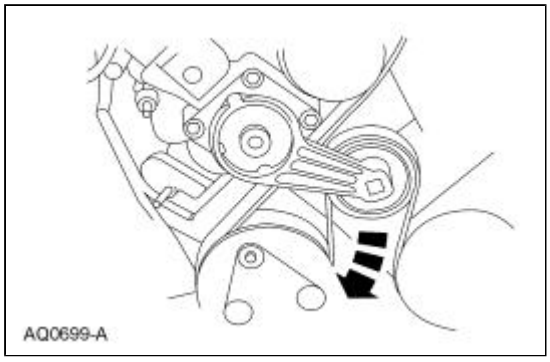
27. Use the special tool to install the crankshaft pulley.



28. Tighten the new crankshaft pulley bolt in 4 stages.
    - Stage 1: Tighten to 90 Nm (66 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.



29. Rotate the tensioner clockwise and install the accessory drive belt.

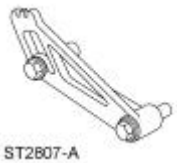


30. Install the RH valve cover. For additional information, refer to Valve Cover — RH in this section.
31. Install the LH valve cover. For additional information, refer to Valve Cover — LH in this section.
32. Install the cooling fan shroud. For additional information, refer to Section 303-03 .
33. Install the engine cooling fan. For additional information, refer to Section 303-03 .
34. Fill the crankcase with clean engine oil.

Timing Drive Components

Printable View (1133 KB)

Special Tool(s)

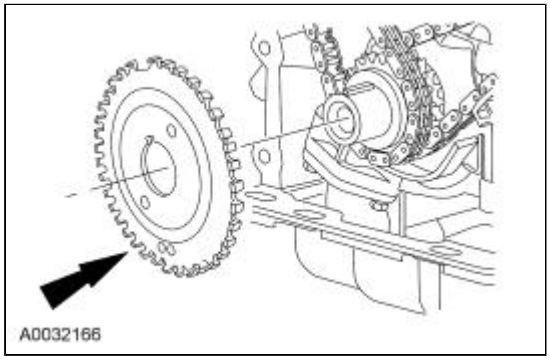
ST2804-A	Compressor, Valve Spring 303-1039
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046

Material

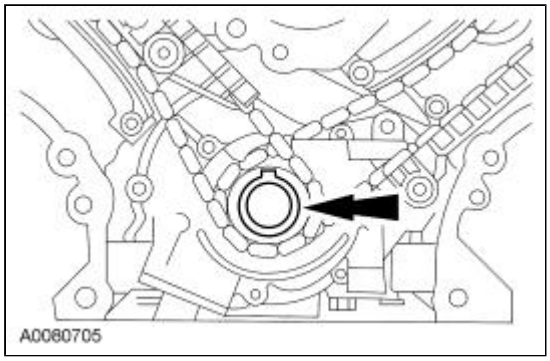
Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	—

Removal

1. Remove the engine front cover. For additional information, refer to Engine Front Cover in this section.
2. Remove the crankshaft sensor ring from the crankshaft.

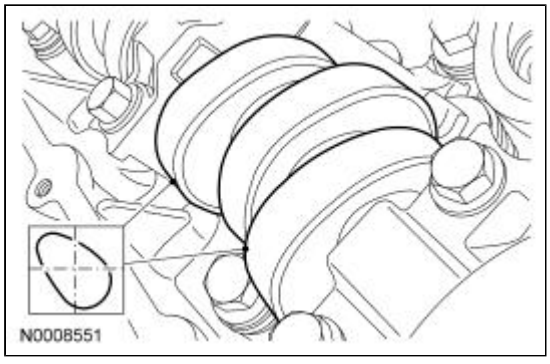


3. Position the crankshaft keyway at the 12 o'clock position.



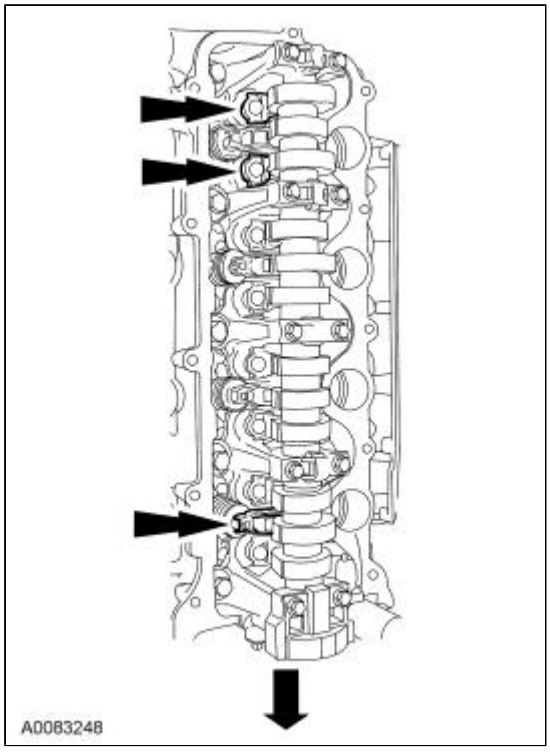
4. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

   The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.



5. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

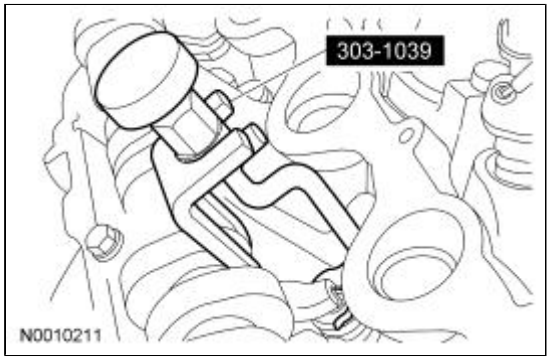
   Remove only the 3 camshaft roller followers shown in the illustration from the RH cylinder head.



6. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

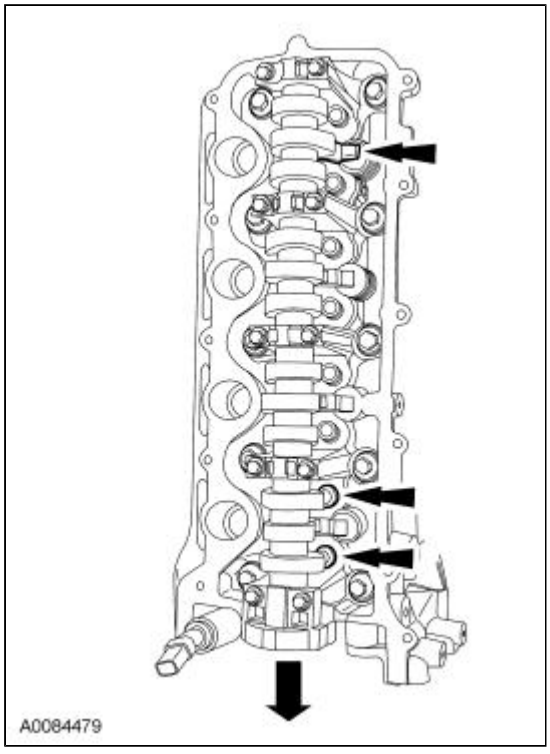
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the RH cylinder head.



7. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

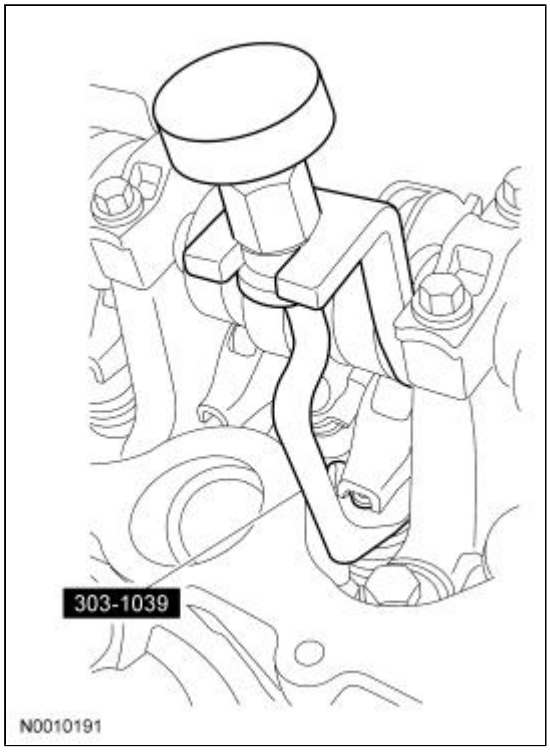
   Remove only the 3 camshaft roller followers shown in the illustration from the LH cylinder head.



8. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

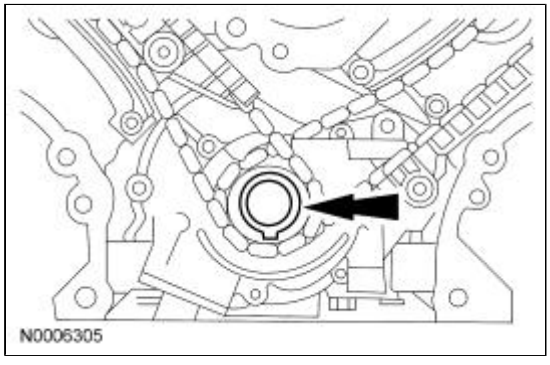
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the LH cylinder head.



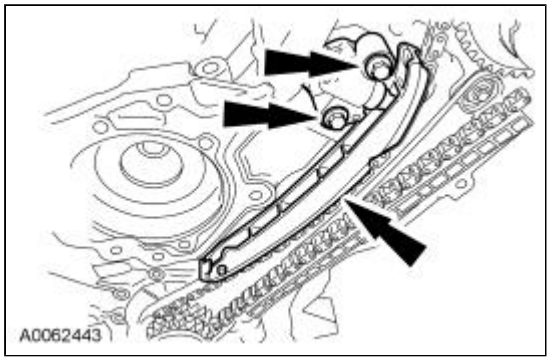
9. **CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.**

   Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



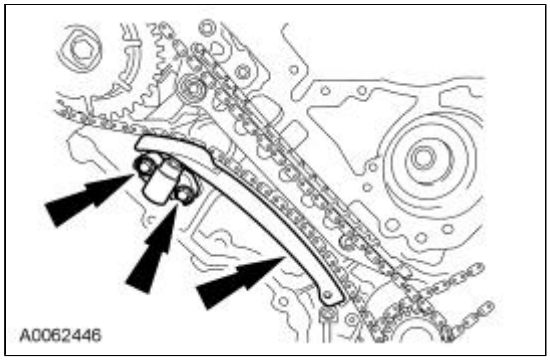
10. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the LH timing chain tensioner and tensioner arm.

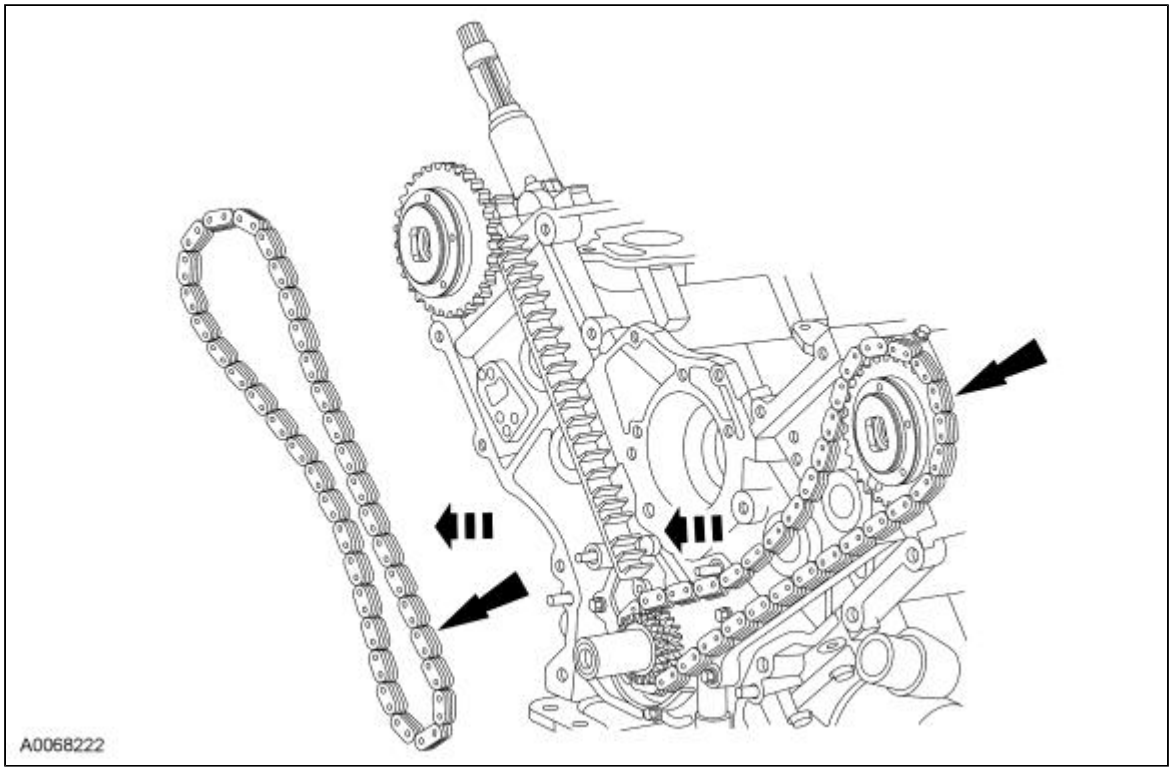


11. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the RH timing chain tensioner and tensioner arm.



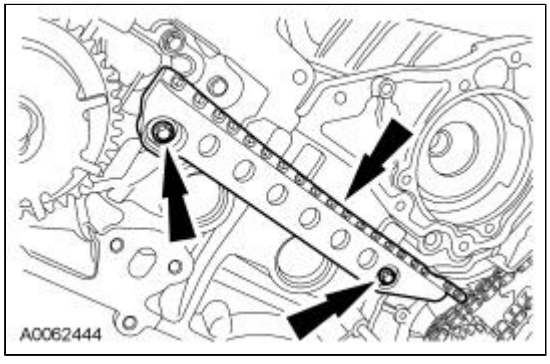
12. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



13. **NOTE:** RH shown, LH similar.

Remove the LH and RH timing chain guides.

- Remove the bolts.
- Remove both timing chain guides.

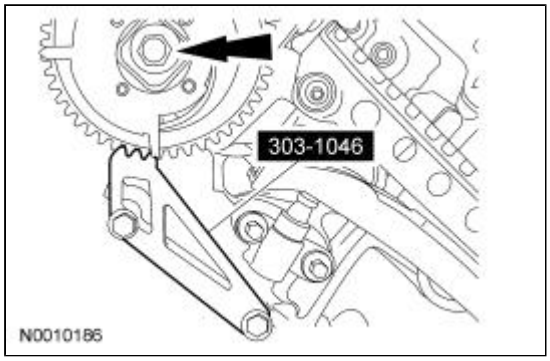


14. **CAUTION: Damage to the variable camshaft timing (VCT) phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

Using the special tool, remove the bolt and the RH VCT phaser sprocket assembly.

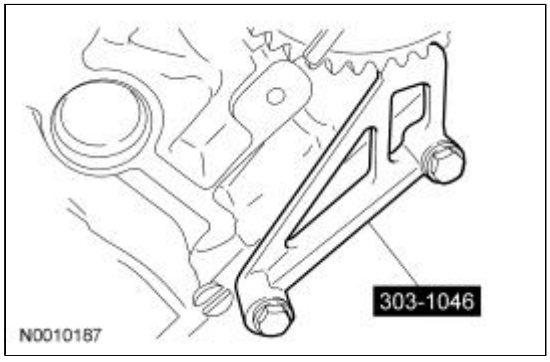
- Discard the VCT phaser sprocket bolt.



15. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

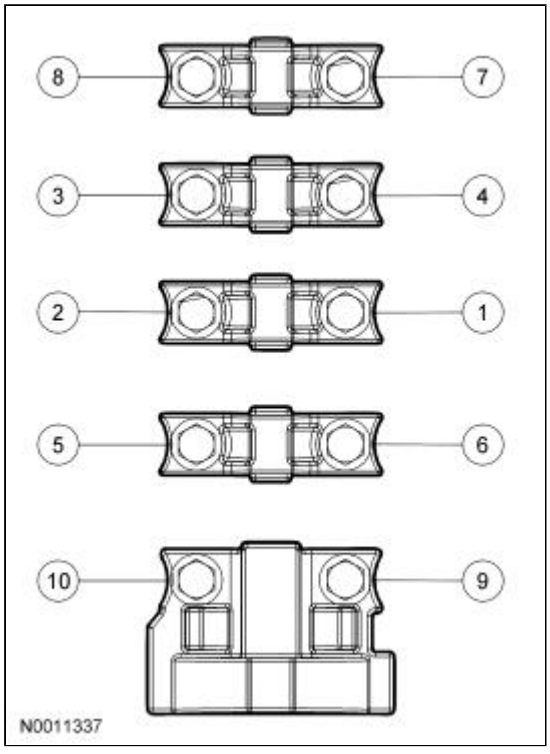
    Using the special tool, remove the bolt and the LH VCT phaser sprocket assembly.
    - Discard the VCT phaser sprocket bolt.



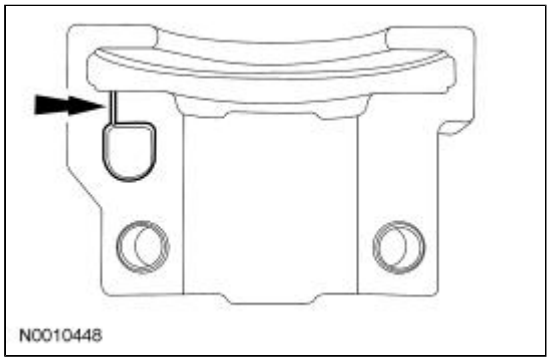
16. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the RH cylinder head front camshaft bearing cap and then the remaining bearing caps.



17. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.

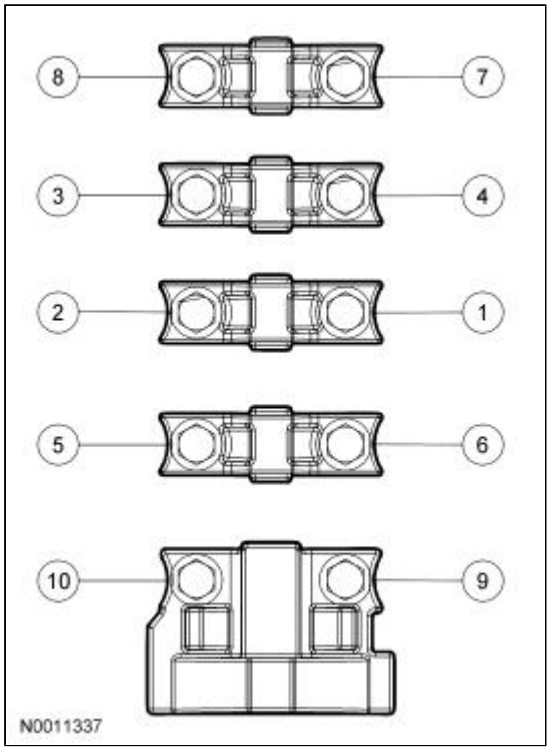


18. Remove the RH camshaft.

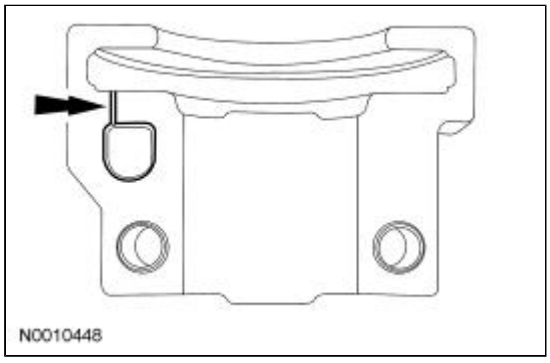
19. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the LH cylinder head front camshaft bearing cap and then the remaining bearing caps.



20. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



21. Remove the LH camshaft.

22. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove all of the remaining camshaft roller followers from the cylinder heads.

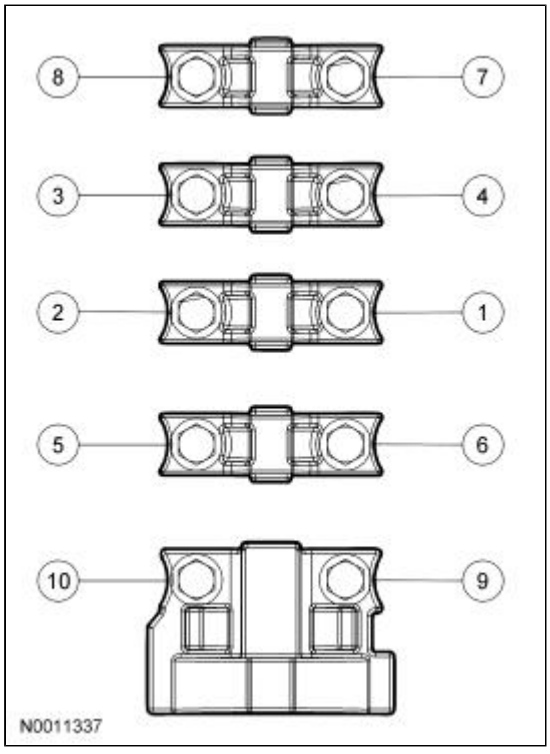
Installation

1. Install the LH and RH camshafts.
    - Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

2. **NOTE:** LH shown, RH similar.

    Install the LH and RH camshaft bearing caps in their original locations.
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.

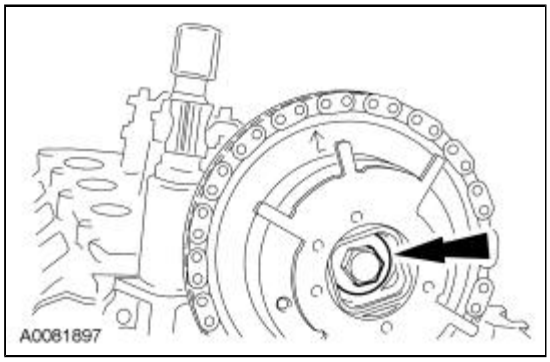
- Position the remaining camshaft bearing caps.
- Install the bolts loosely.
- Tighten to 10 Nm (89 lb-in) in the sequence shown.



3. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   NOTE: LH shown, RH similar.

   Install the VCT phaser sprockets and new VCT phaser sprocket bolts finger tight.



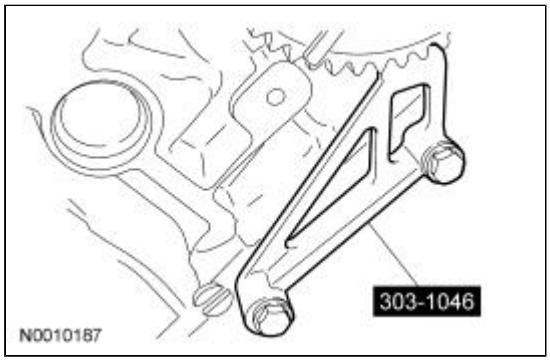
4. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

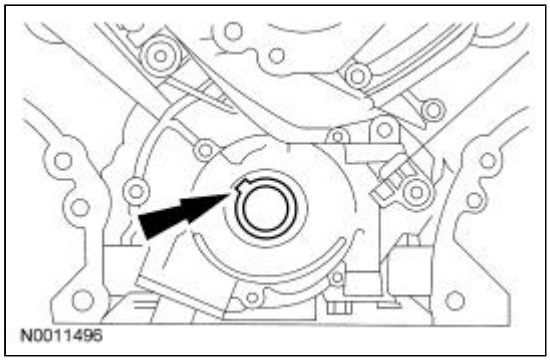
   NOTE: LH shown, RH similar.

   Using the special tool, tighten the LH and RH VCT phaser sprocket bolts in 2 stages.

- Stage 1: Tighten to 40 Nm (30 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



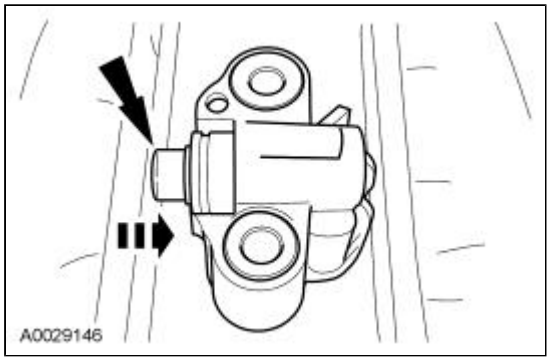
5. Position the crankshaft keyway at the 11 o'clock position.



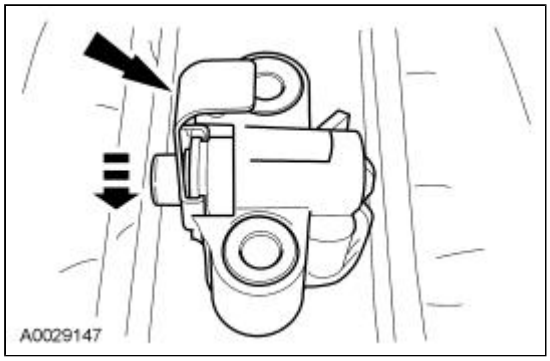
6. **CAUTION: Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

   CAUTION: Prior to installation, inspect the tensioner-sealing bead for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.

   Compress the tensioner plunger, using a vise.

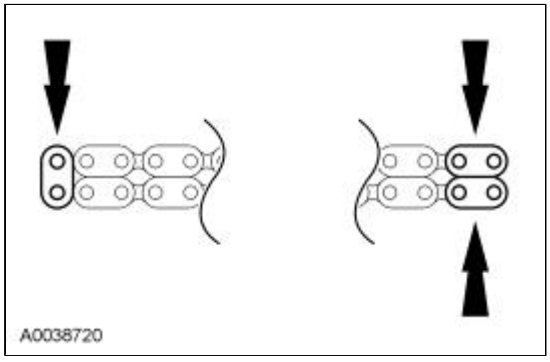


7. Install a retaining clip on the tensioner to hold the plunger in during installation.

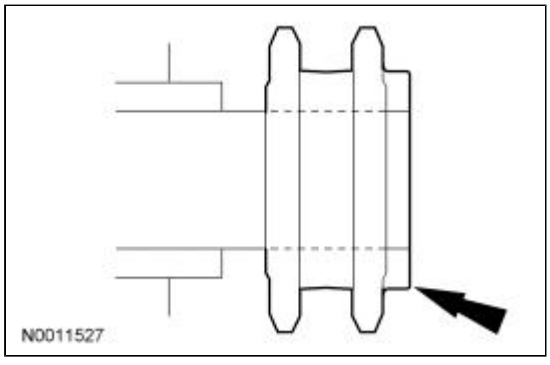


8. Remove the tensioner from the vise.

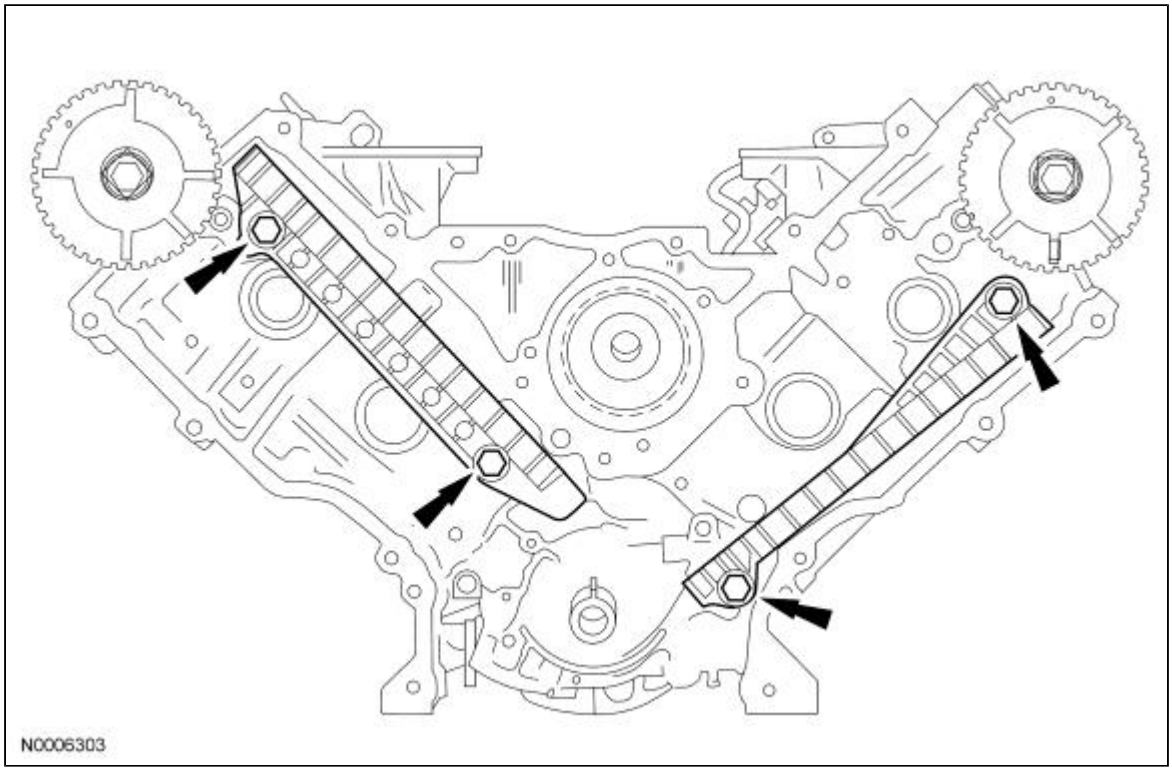
9. If the copper links are not visible, mark 2 links on one end and 1 link on the other end, and use as timing marks.



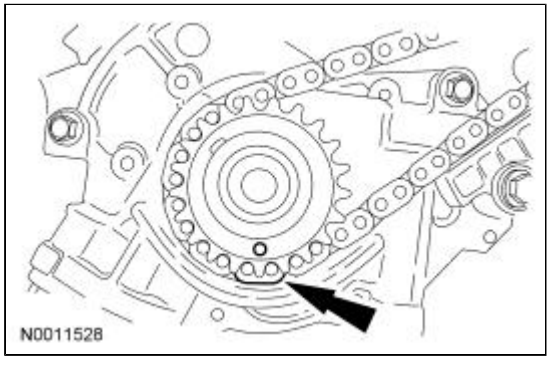
10. Install the crankshaft sprocket, making sure the flange faces forward.



11. Install the 4 bolts and the LH and RH timing chain guides.
    - Tighten to 10 Nm (89 lb-in).

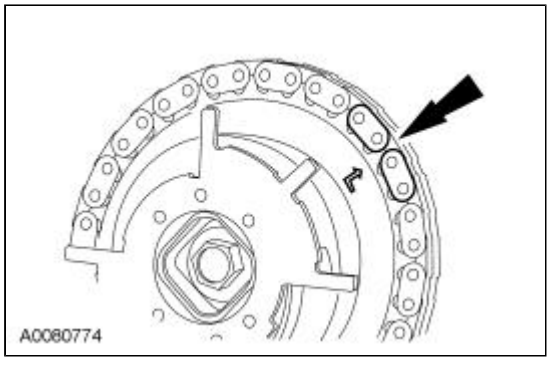


12. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



13. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

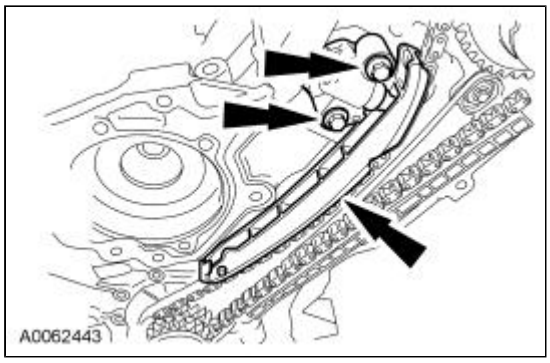
    Position the timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.



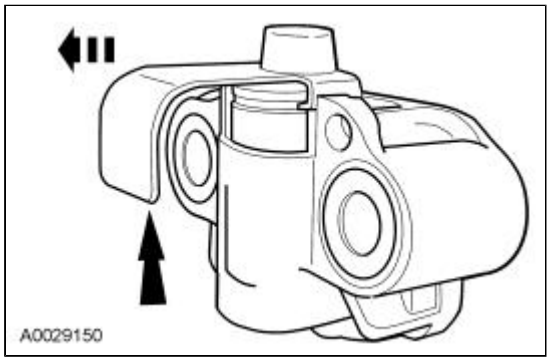
14. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and bolts.

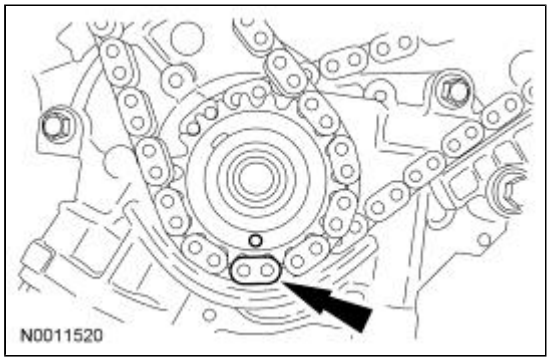
- Tighten to 25 Nm (18 lb-ft).



15. Remove the retaining clip from the LH timing chain tensioner.

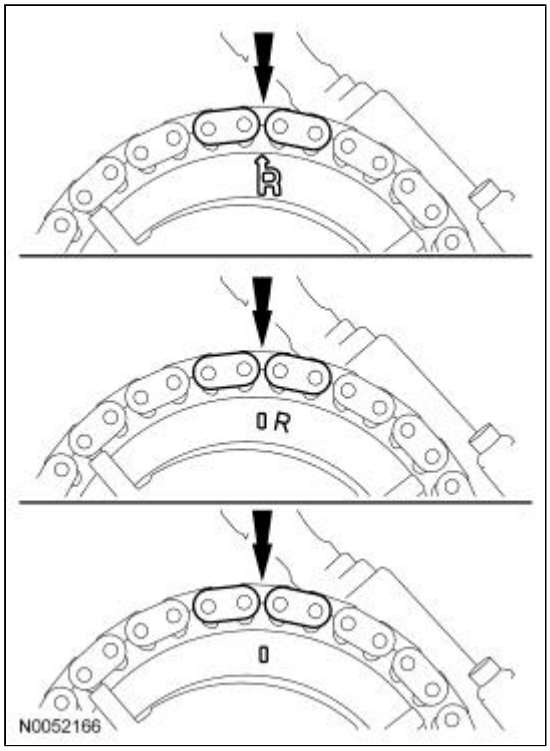


16. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.

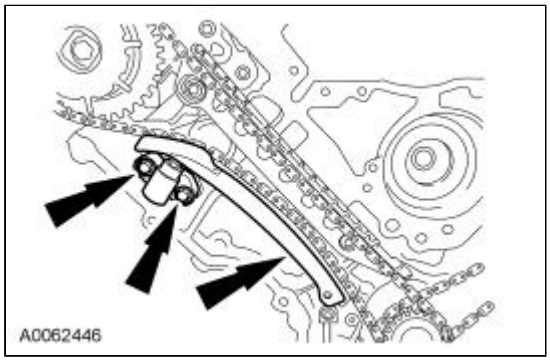


17. **NOTE:** The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

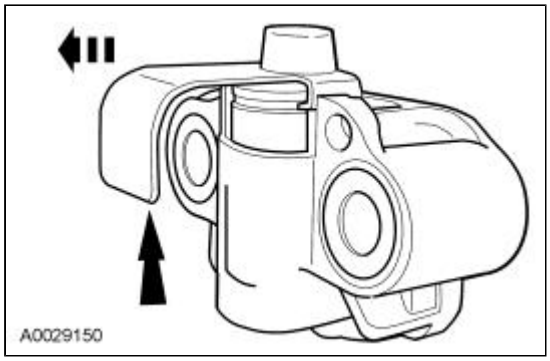
    Position the RH timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.



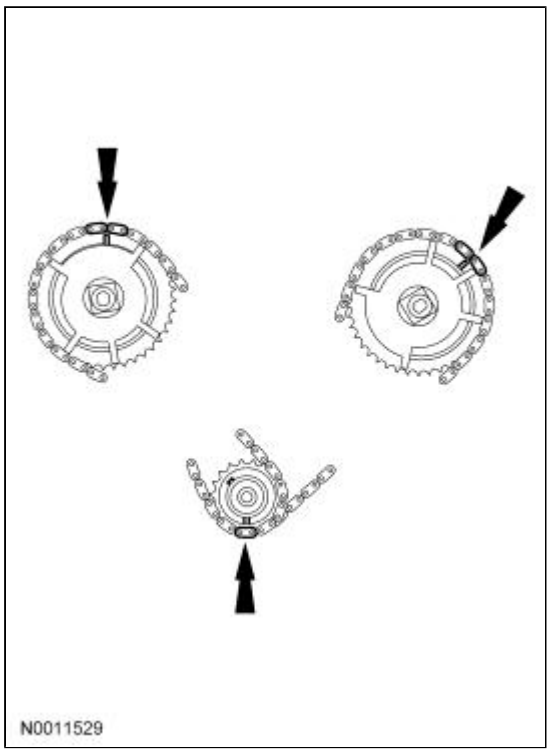
18. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and bolts.
    - Tighten to 25 Nm (18 lb-ft).



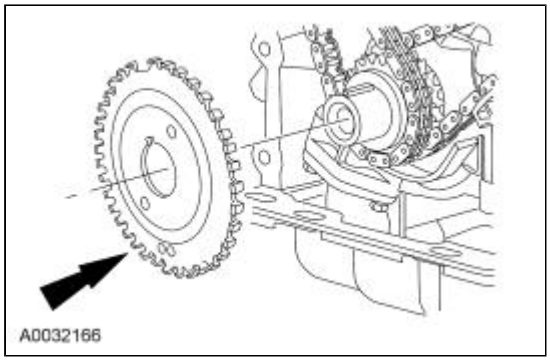
19. Remove the retaining clip from the RH timing chain tensioner.



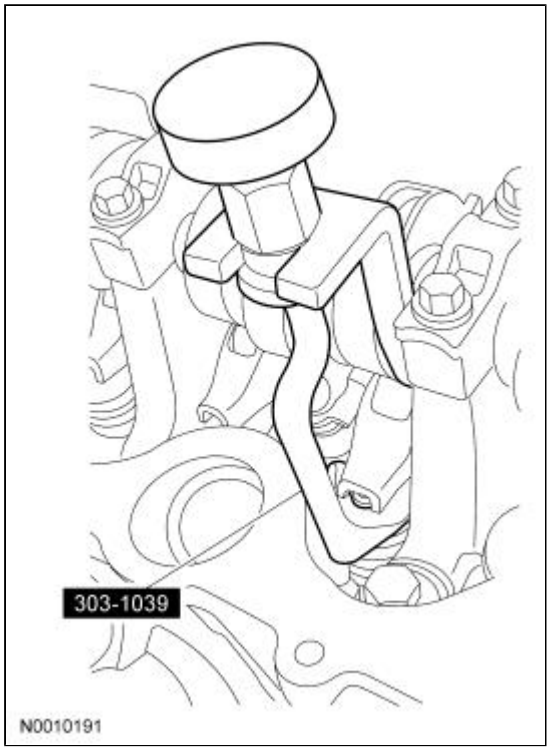
20. As a post-check, verify correct alignment of all timing marks.



21. Install the crankshaft sensor ring on the crankshaft.



22. Using the special tool, install all of the camshaft roller followers.
    - Lubricate the camshaft roller followers with clean engine oil prior to installation.

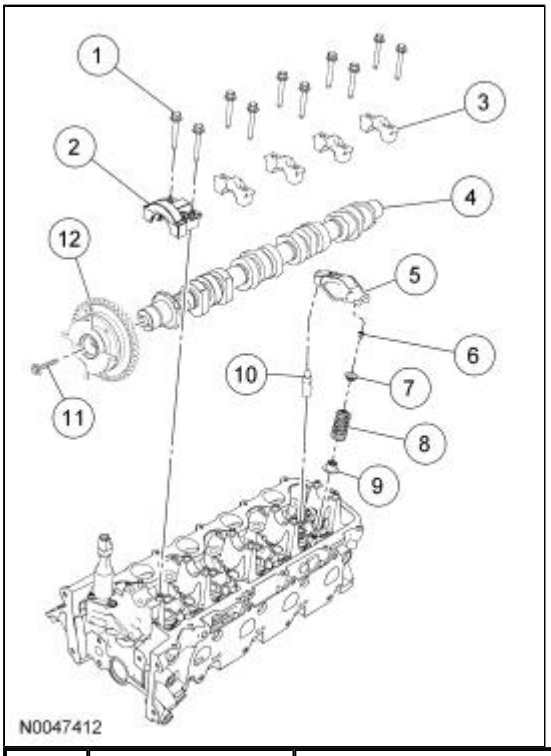


23. Install the engine front cover. For additional information, refer to Engine Front Cover in this section.

Valve Train Components — Exploded View

Printable View (135 KB)

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	N807834	Camshaft bearing cap bolt (10 required)
2	6B284	Camshaft front bearing cap
3	6B280	Camshaft bearing cap (4 required)
4	6C255	Camshaft
5	6529	Camshaft roller follower (12 required)
6	6518	Valve spring retainer key (24 required)
7	6514	Valve spring retainer (12 required)
8	6513	Valve spring (12 required)
9	6A517	Valve seal (12 required)
10	6C501	Hydraulic lash adjuster (12 required)
11	6279	Camshaft phaser and sprocket bolt
12	6C524	Camshaft phaser and sprocket

1. For additional information, refer to the procedures in this section.

Camshaft — LH

Printable View (567 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039
ST2969-A	Wedge, Timing Chain 303-1175

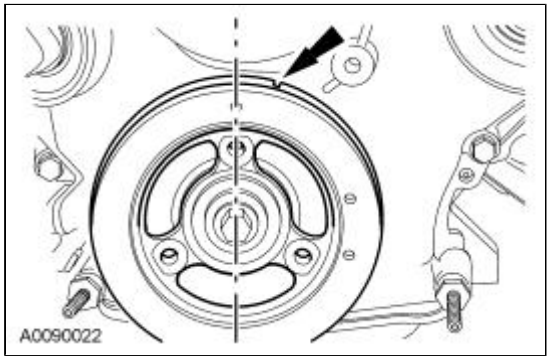
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

CAUTION: The camshaft procedure must be followed exactly or damage to the valves and pistons will result.

1. Position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.



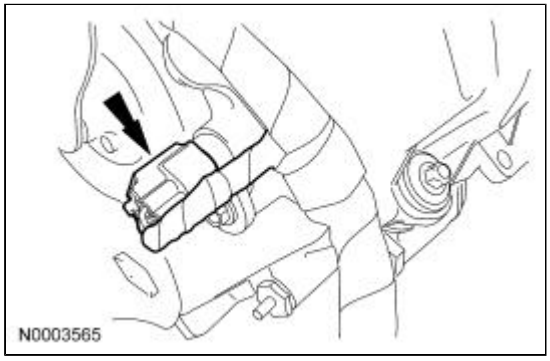
2. Remove the LH valve cover. For additional information, refer to Valve Cover — LH in this section.

3. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if**

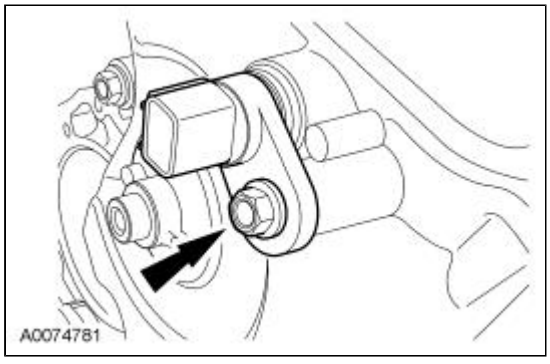
mishandled or used as a lifting or leveraging device.

Loosen and back off the LH camshaft phaser and sprocket bolt one full turn.

4. Disconnect the LH camshaft position (CMP) sensor electrical connector.

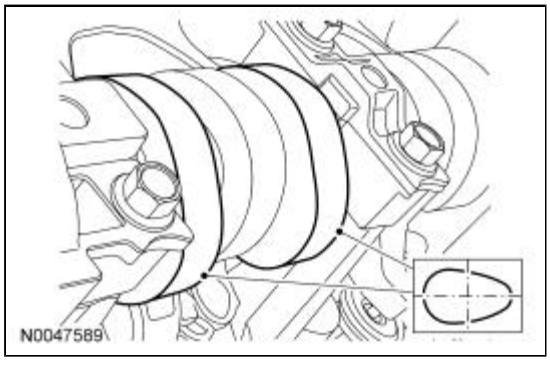


5. Remove the LH CMP sensor and the bolt.

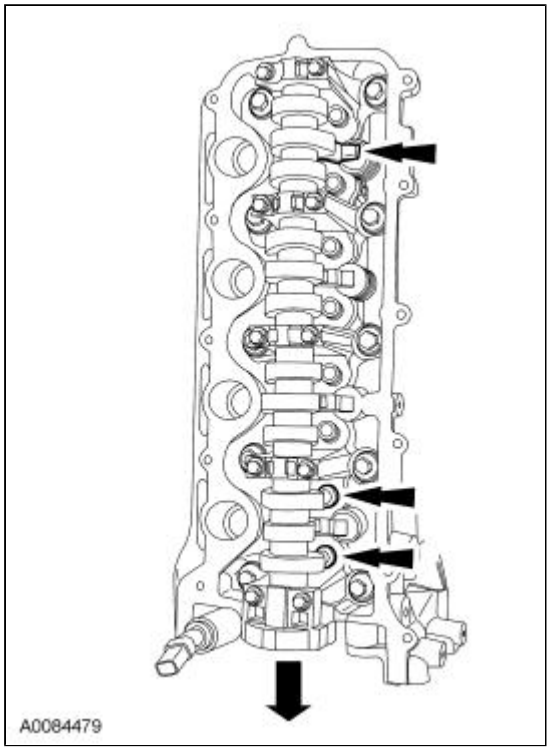


6. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft keyway will require one full additional rotation to 12 o'clock.

   The No. 5 cylinder camshaft lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 5 cylinder.



7. Remove only the 3 camshaft roller followers shown in the illustration.

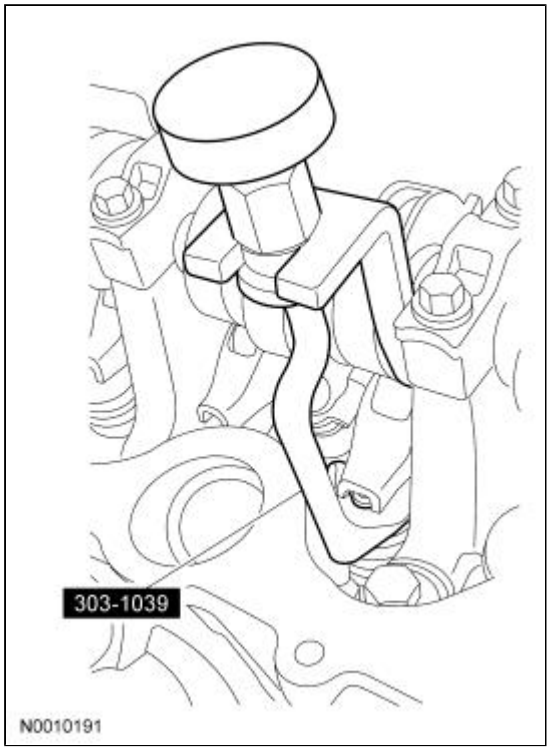


8. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

   NOTE: The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations.

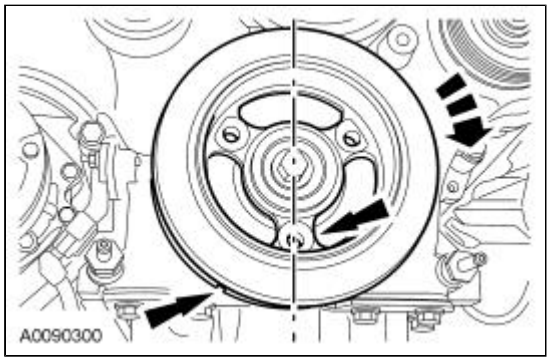
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the special tool, remove only the 3 designated camshaft roller followers from the previous step.



9. **CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.**

   Rotate the crankshaft clockwise, as viewed from the front, positioning the crankshaft damper spoke at the 6 o'clock position and the timing mark indentation at the 7 o'clock position.

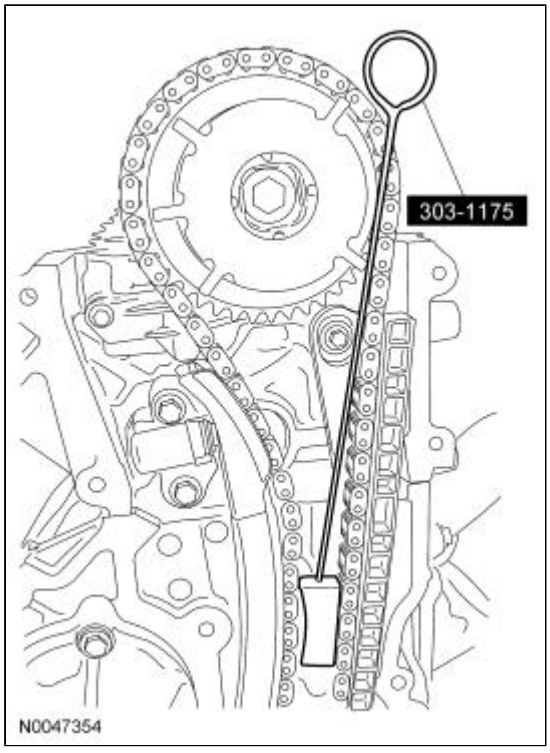


10. **CAUTION: Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.**

    CAUTION: The Timing Chain Wedge tool must be installed square to the timing chain and the engine block.

    NOTE: Engine front cover removed for clarity.

    Install the special tool in the LH timing chain as shown.

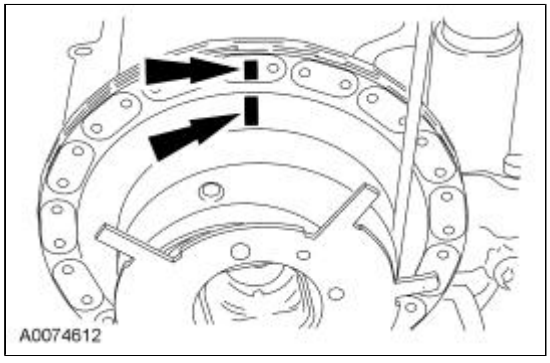


11. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

CAUTION: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

NOTE: RH shown, LH similar.

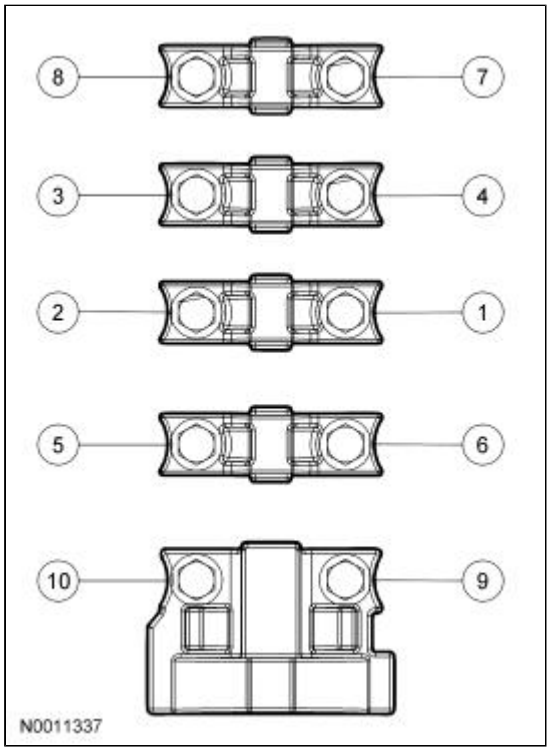
Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



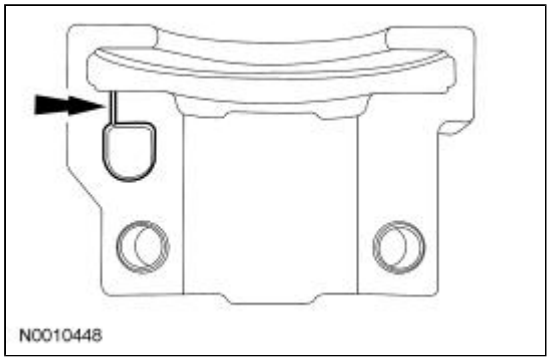
12. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from side loading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the front camshaft bearing cap and then the remaining bearing caps.



13. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.

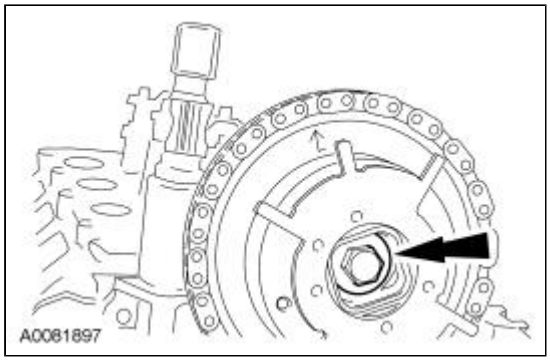


14. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.

    CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.

    Remove the bolt and withdraw the camshaft from the camshaft phaser and sprocket assembly, leaving the camshaft phaser and sprocket assembly in place.
    - Discard the bolt and washer.



15. Inspect the camshaft phaser and sprocket for damage. For additional information, refer to Camshaft Phaser and Sprocket in this section.

Installation

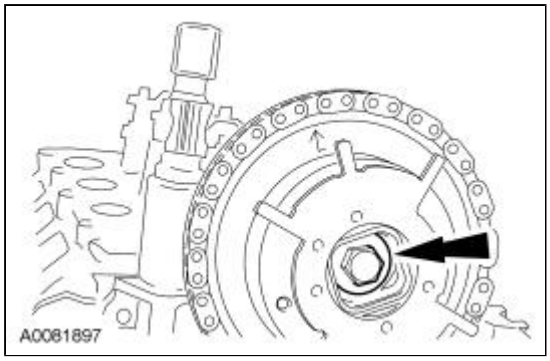
1. Lubricate the camshaft and camshaft journals with clean engine oil.

2. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

   CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

Install the camshaft into the camshaft phaser and sprocket assembly and onto the head. Install a new camshaft phaser and sprocket bolt finger tight.

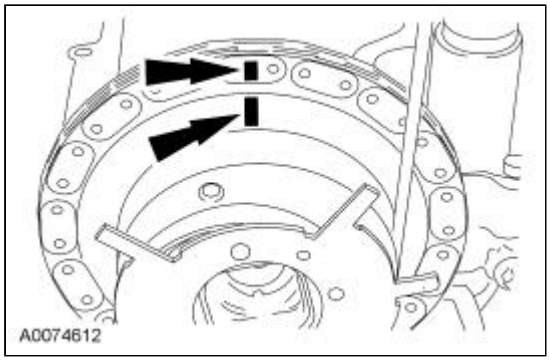


3. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

CAUTION: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

NOTE: RH shown, LH similar.

Verify the camshaft phaser and sprocket and timing chain scribe marks are still in alignment.

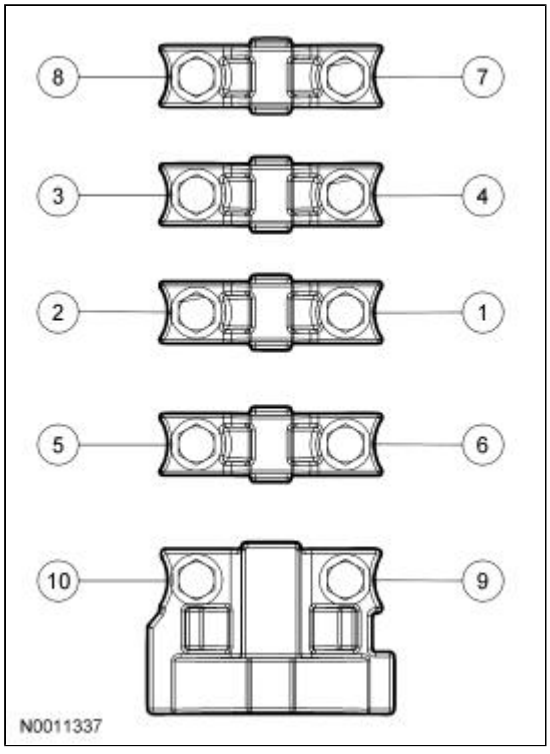


4. **CAUTION: Do not allow the camshaft roller followers to move out of position when installing the camshaft.**

Install the camshaft bearing caps in their original locations.

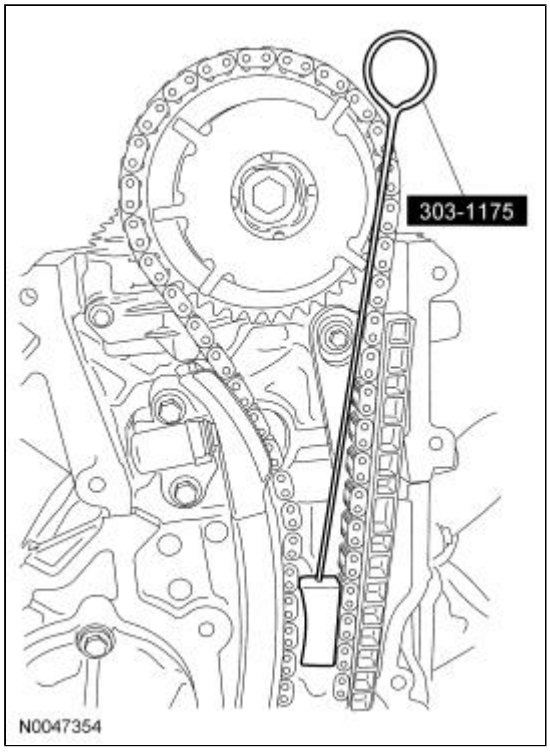
- Lubricate the camshaft bearing caps with clean engine oil.
- Position the front camshaft bearing cap.
- Position the remaining camshaft bearing caps.
- Install the bolts loosely.

5. Tighten the bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).

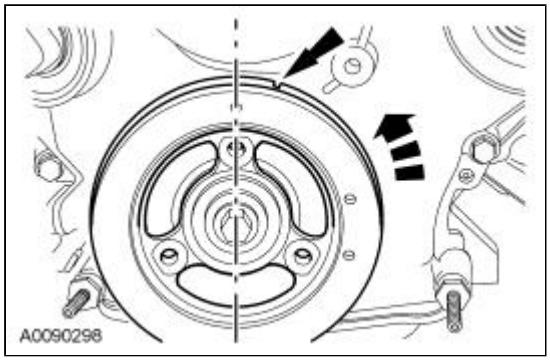


6. **NOTE:** Engine front cover removed for clarity.

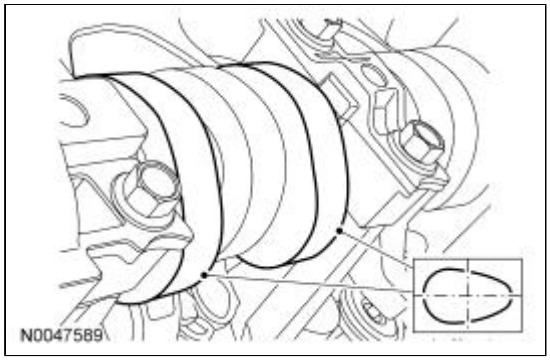
   Remove the special tools.



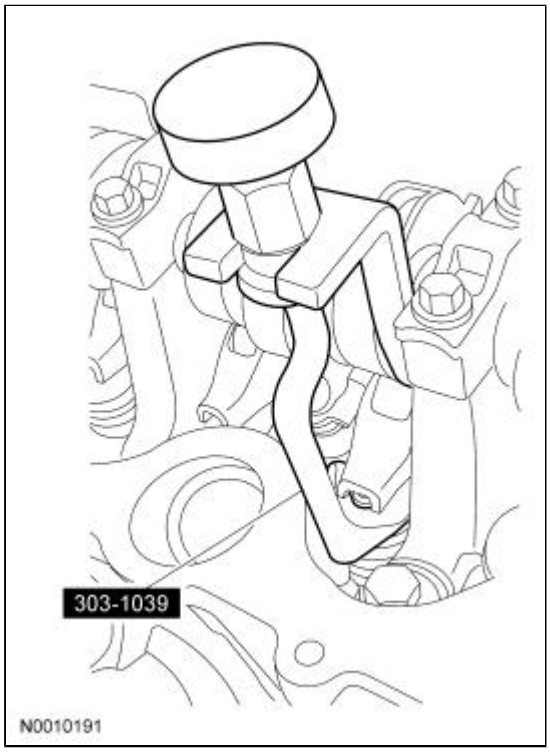
7. Rotate the crankshaft a half turn counterclockwise and position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.



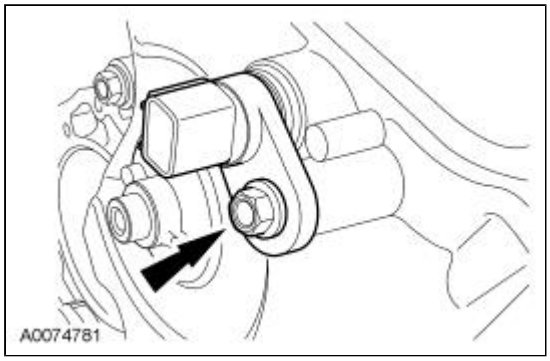
8. Verify correct camshaft position by noting the position of the No. 5 cylinder intake and exhaust camshaft lobes.



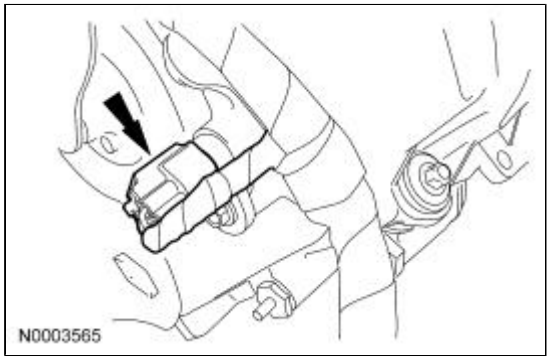
9. Using the special tool, install the 3 originally removed camshaft roller followers.



10. Install the CMP sensor and the bolt.



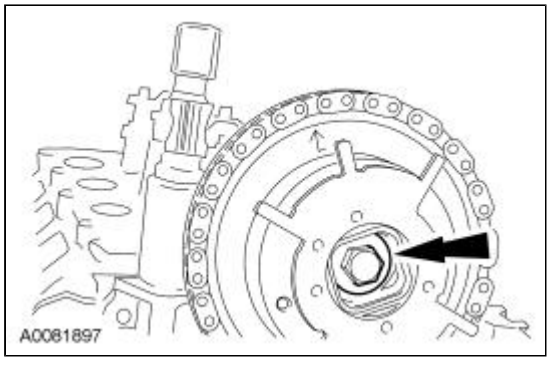
11. Connect the CMP electrical connector.



12. **CAUTION: Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

    CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

    Tighten the camshaft phaser and sprocket bolt in 2 stages:
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



13. Install the LH valve cover. For additional information, refer to Valve Cover — LH in this section.

Camshaft — RH

Printable View (566 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039
ST2969-A	Wedge, Timing Chain 303-1175

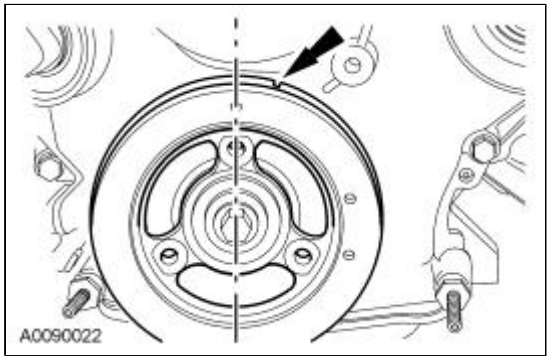
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

CAUTION: The camshaft procedure must be followed exactly or damage to the valves and pistons will result.

1. Position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

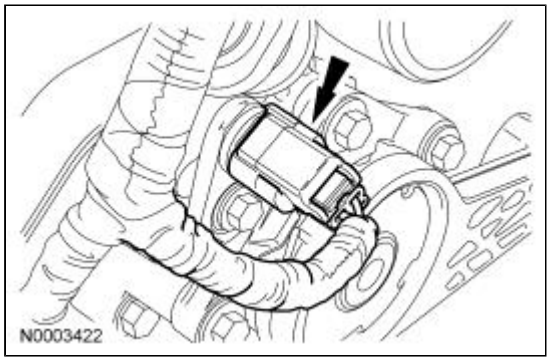


2. Remove the RH valve cover. For additional information, refer to Valve Cover — RH in this section.

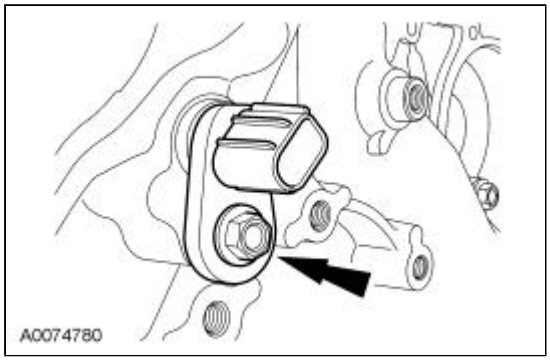
3. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   Loosen and backoff the RH camshaft phaser and sprocket bolt one full turn.

4. Disconnect the RH camshaft position (CMP) sensor electrical connector.

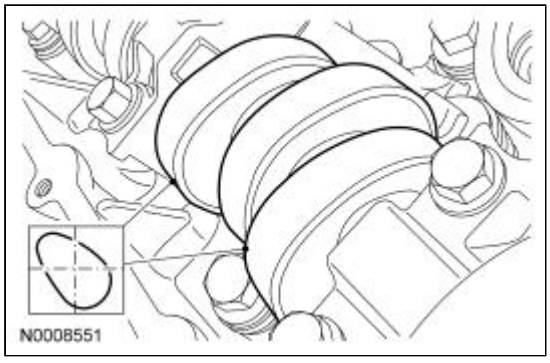


5. Remove the bolt and the RH CMP sensor.

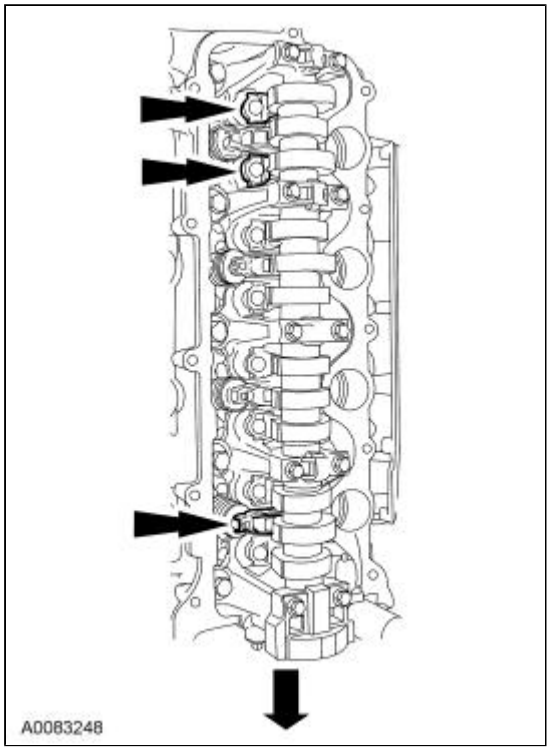


6. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

   The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.



7. Remove only the 3 camshaft roller followers shown in the illustration.

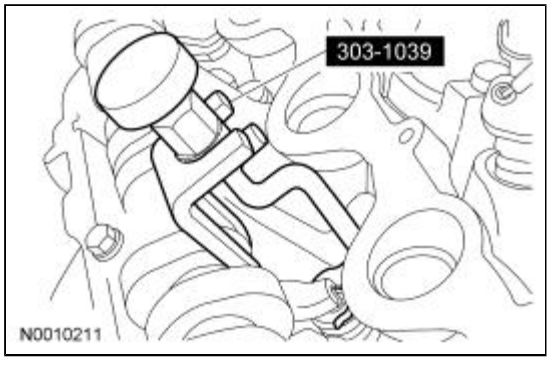


8. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

   NOTE: The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations.

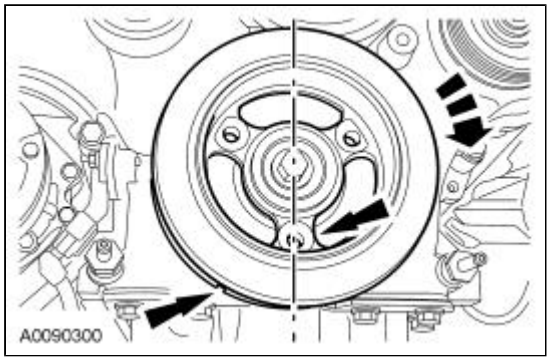
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the special tool, remove only the 3 designated camshaft roller followers from the previous step.



9. **CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.**

   Rotate the crankshaft clockwise, as viewed from the front, positioning the crankshaft damper spoke at the 6 o'clock position and the timing mark indentation at the 7 o'clock position.

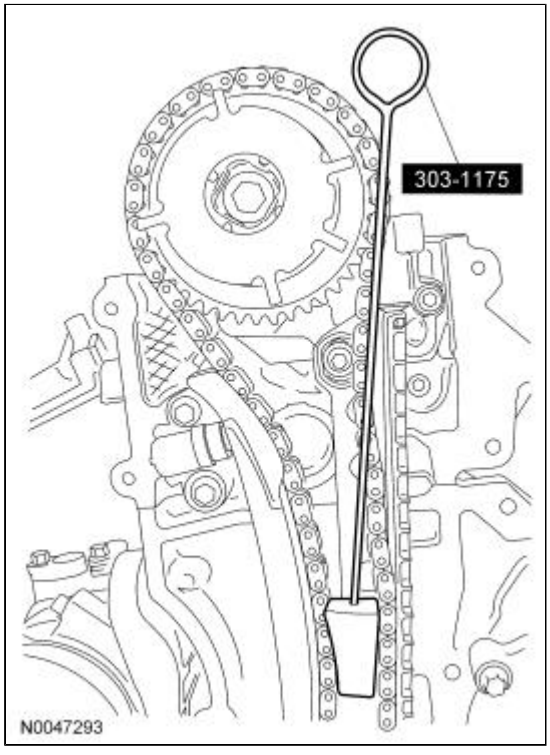


10. **CAUTION: Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.**

    CAUTION: The Timing Chain Wedge tool must be installed square to the timing chain and the engine block.

    NOTE: Engine front cover removed for clarity.

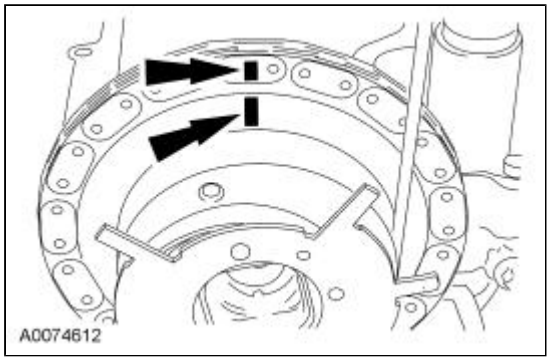
    Install the special tool in the RH timing chain as shown.



11. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

    CAUTION: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

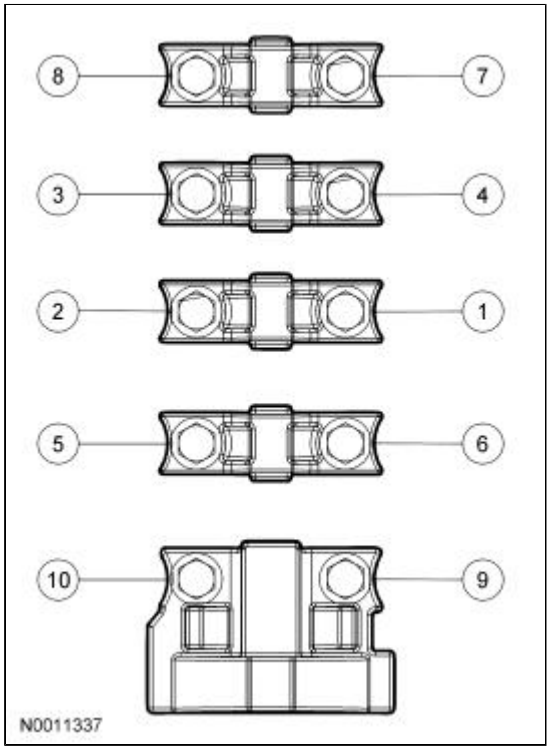
    Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



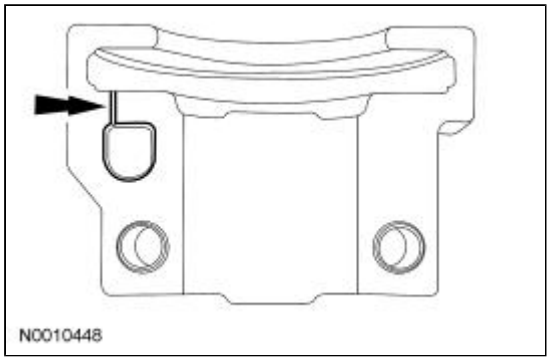
12. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the front camshaft bearing cap and then the remaining bearing caps.



13. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.

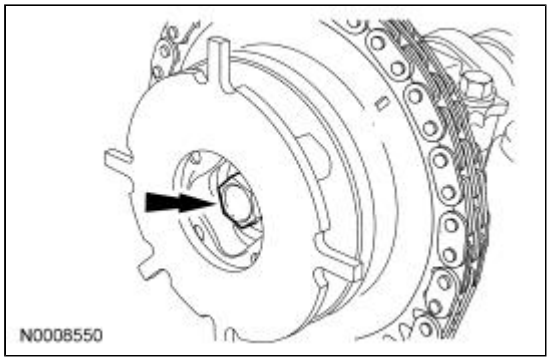


14. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.

    CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.

    Remove the bolt and withdraw the camshaft from the camshaft phaser and sprocket assembly, leaving the camshaft phaser and sprocket assembly in place.
    - Discard the bolt and washer.



15. Inspect the camshaft phaser and sprocket for damage. For additional information, refer to Camshaft Phaser and Sprocket in this section.

Installation

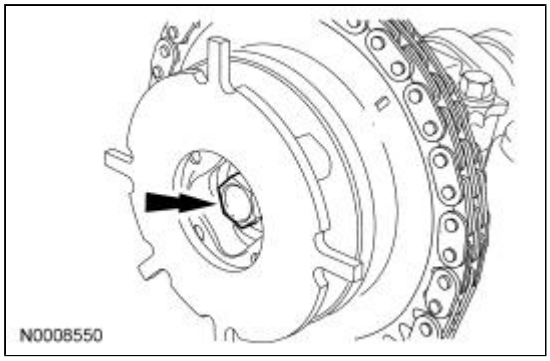
1. Lubricate the camshaft and camshaft journals with clean engine oil.

2. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

   CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

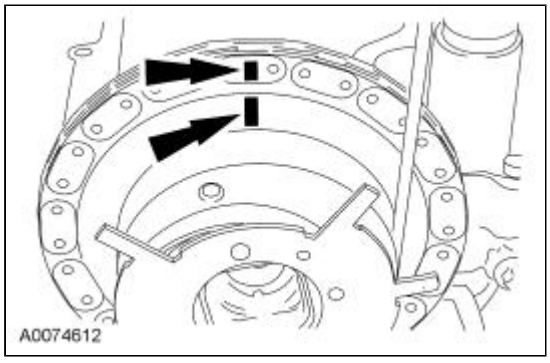
Install the camshaft into the camshaft phaser and sprocket assembly and onto the head. Install a new camshaft phaser and sprocket bolt finger tight.



3. **CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

   CAUTION: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

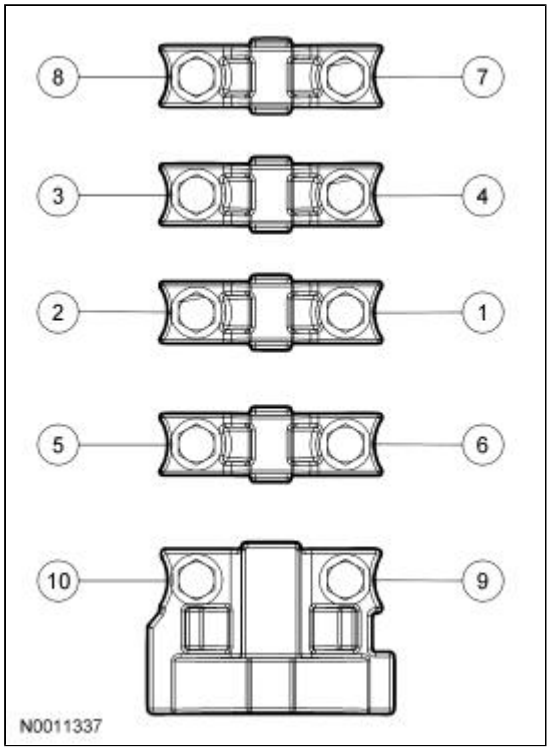
   Verify the camshaft phaser and sprocket and timing chain scribe marks are still in alignment.



4. **CAUTION: Do not allow the camshaft roller followers to move out of position when installing the camshaft.**

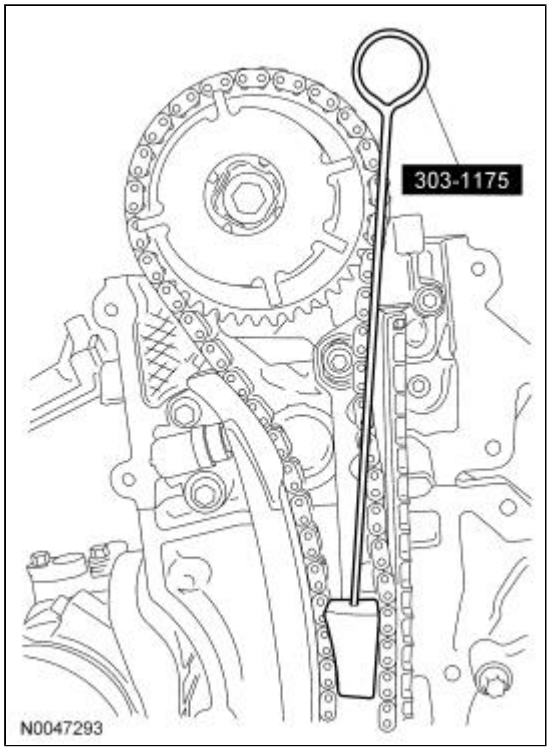
   Install the camshaft bearing caps in their original locations.
   - Lubricate the camshaft bearing caps with clean engine oil.
   - Position the front camshaft bearing cap.
   - Position the remaining camshaft bearing caps.
   - Install the bolts loosely.

5. Tighten the bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).

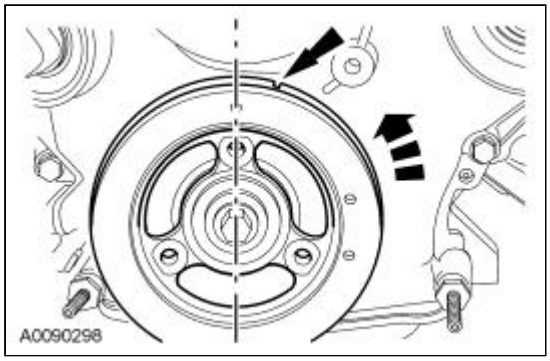


6. **NOTE:** Engine front cover removed for clarity.

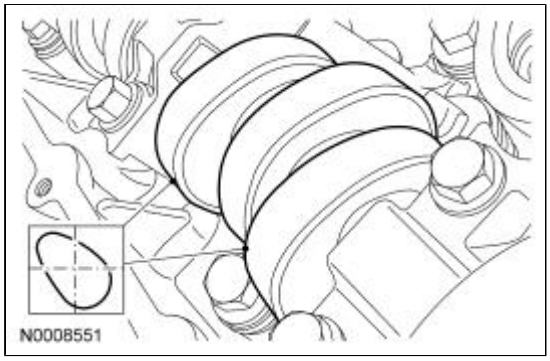
   Remove the special tool.



7. Rotate the crankshaft a half turn counterclockwise and position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

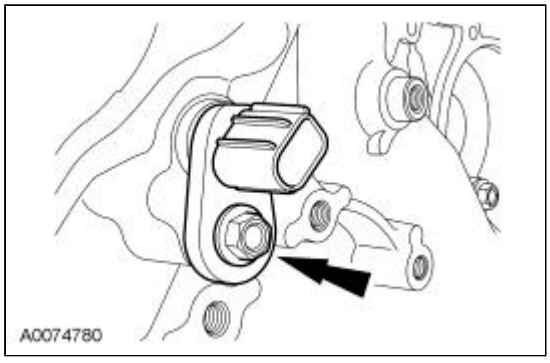


8. Verify correct camshaft position by noting the position of the No. 1 cylinder intake and exhaust camshaft lobes.

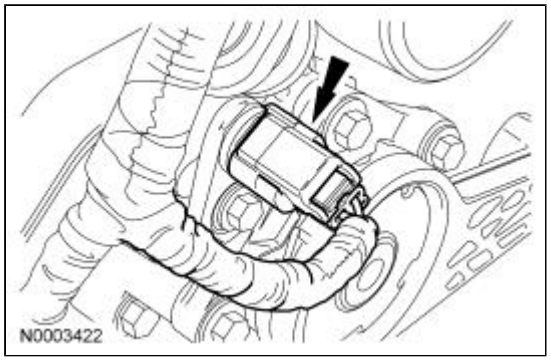


9. Using the special tool, install the 3 originally removed camshaft roller followers.

10. Install the CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



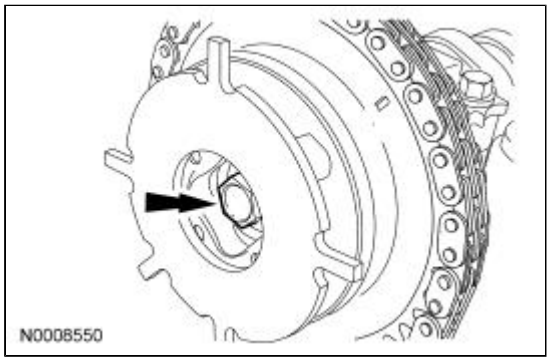
11. Connect the CMP electrical connector.



12. **CAUTION: Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

    CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

    Tighten the new camshaft phaser and sprocket bolt in 2 stages:
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



13. Install the RH valve cover. For additional information, refer to Valve Cover — RH in this section.

Camshaft Phaser and Sprocket

Printable View (184 KB)

Special Tool(s)

ST2969-A	Wedge, Timing Chain 303-1175

Removal

1. If servicing the RH camshaft phaser and sprocket, remove the RH camshaft. For additional information, refer to Camshaft — RH in this section.

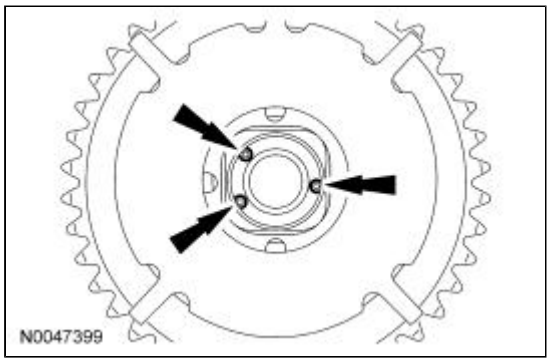
2. If servicing the LH camshaft phaser and sprocket, remove the LH camshaft. For additional information, refer to Camshaft — LH in this section.

3. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

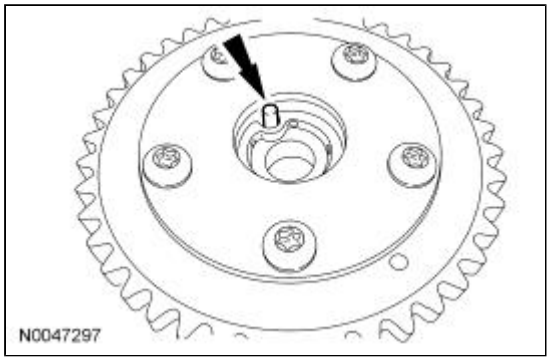
   CAUTION: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.

   Remove the camshaft phaser and sprocket from the timing chain.

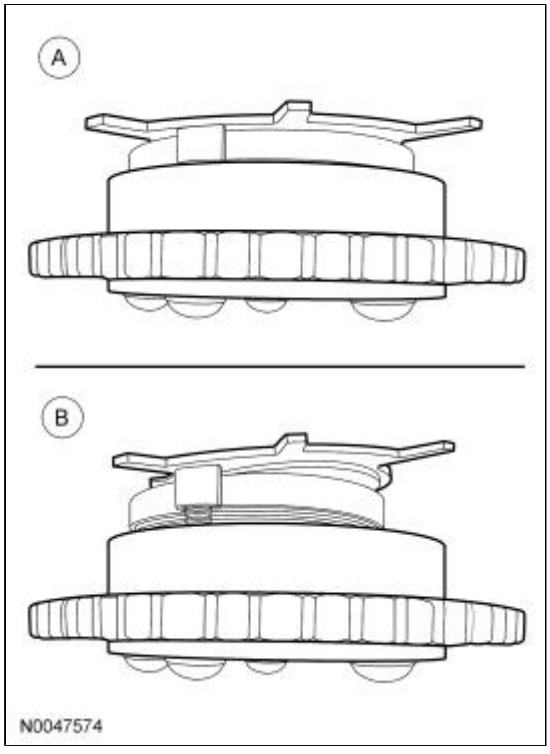
4. Inspect the front of the camshaft phaser and sprocket for missing or damaged roll pins.
   - If the roll pins are missing or damaged, a new camshaft phaser and sprocket must be installed.



5. Inspect the rear of the camshaft phaser and sprocket for a deformed or damaged location pin.
   - If the location pin is deformed or damaged a new camshaft phaser and sprocket must be installed.



6. Visually inspect the camshaft phaser and sprocket for squareness (A). If the trigger wheel or spring is deformed or damaged (B), install a new camshaft phaser and sprocket.



Installation

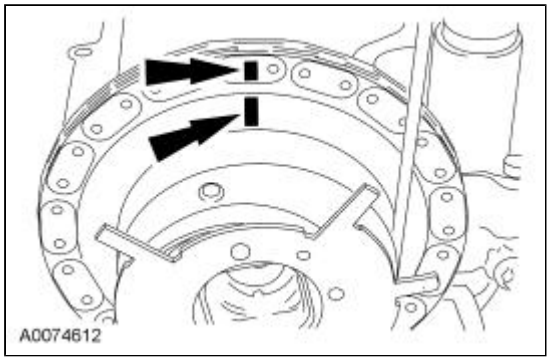
1. **CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   If installing a new camshaft phaser and sprocket, transfer the original scribe mark to the new camshaft phaser and sprocket.

2. **CAUTION: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

   CAUTION: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

   Align the scribe marks and position the camshaft phaser and sprocket into the timing chain.



3. If servicing the RH camshaft phaser and sprocket, install the RH camshaft. For additional information, refer to Camshaft — RH in this section.

4. If servicing the LH camshaft phaser and sprocket, install the LH camshaft. For additional information, refer to Camshaft — LH in this section.

Camshaft Roller Follower

Printable View (119 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039

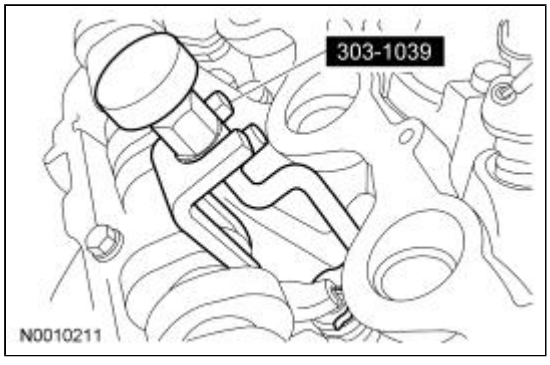
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Depending on the camshaft roller follower being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.
3. **CAUTION: If the components are to be reinstalled, they must be installed in the same position. Mark the components for installation into the original location.**

   Using the special tool, compress the valve spring and remove the camshaft roller follower.



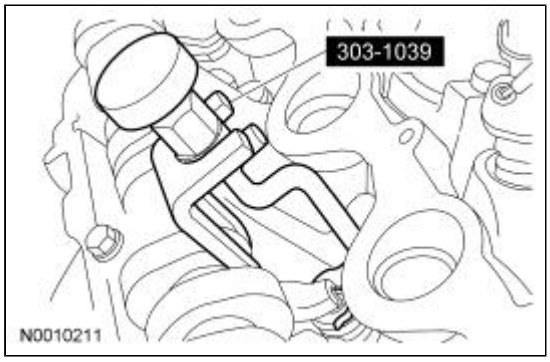
4. Repeat the previous 2 steps for each camshaft roller follower being serviced.
5. Inspect the camshaft roller follower. For additional information, refer to Section 303-00 .

Installation

1. **CAUTION: If the components are to be reinstalled, they must be installed in the same position. Mark the components for installation into the original locations.**

   NOTE: Lubricate the camshaft roller followers with clean engine oil prior to installation.

   Using the special tool, compress the valve spring and install the camshaft roller follower.



2. Repeat the previous step for each camshaft roller follower being serviced.

3. Depending on the camshaft roller follower being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

Valve Springs

Printable View (154 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

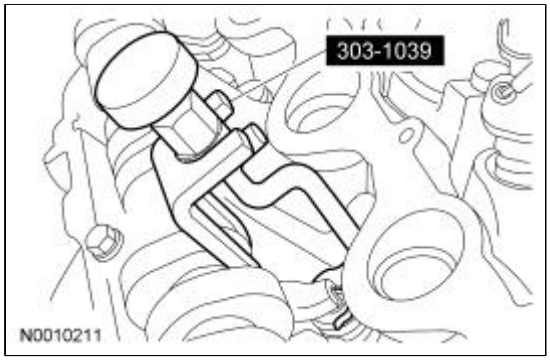
1. Depending on the valve spring being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

2. Remove the spark plug. For additional information, refer to Section 303-07 .

3. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

4. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

   Using the special tool, compress the valve spring and remove the camshaft roller follower.



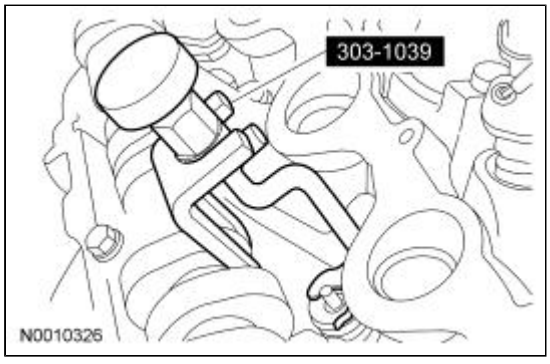
5. Use compressed air in the cylinder to hold both valves in position.
   - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

6. **CAUTION: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal.**

   CAUTION: If the components are to be reinstalled, they must be installed in the same position. Mark the components for location.

   NOTE: If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head in this section.

   Using the special tool, compress the valve spring and remove the valve spring retainer keys.

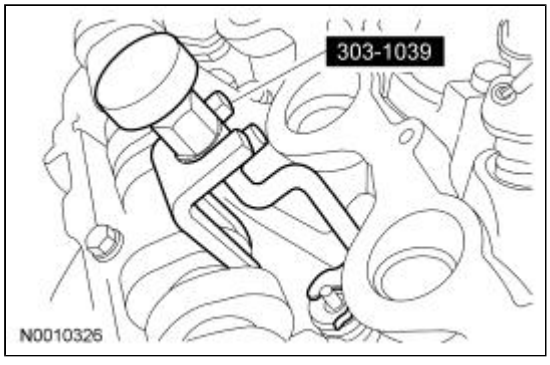


7. Remove the valve spring retainer and the valve spring.

8. Inspect the valve spring. For additional information, refer to Section 303-00 .

Installation

1. Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.

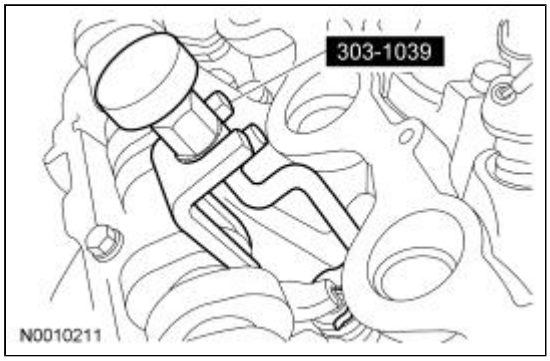


2. Relieve the air pressure from the cylinder.

3. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

   NOTE: Lubricate the camshaft roller follower with clean engine oil prior to installation.

   Using the special tool, compress the valve spring and install the camshaft roller follower.



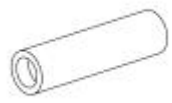
4. Install the spark plug. For additional information, refer to Section 303-07 .

5. Depending on the valve spring being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

Valve Seals

Printable View (190 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039
 ST1332-A	Installer, Valve Stem Oil Seal 303-383 (T91P-6571-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

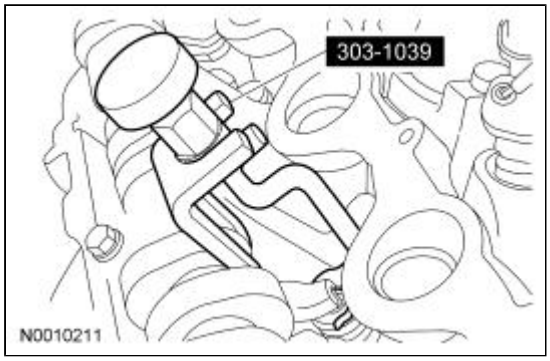
1. Depending on the valve being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

2. Remove the spark plug. For additional information, refer to Section 303-07 .

3. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

4. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

   Using the special tool, compress the valve spring and remove the camshaft roller follower.



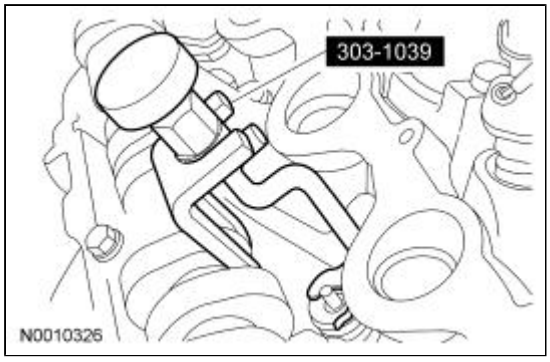
5. Use compressed air in the cylinder to hold both valves in position.
   - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

6. **CAUTION: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal.**

   CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for locations.

   NOTE: If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head in this section.

   Using the special tool, compress the valve spring and remove the valve spring retainer keys.



7. Remove the valve spring retainer, the valve spring and the valve seal.
   - Discard the valve seal.

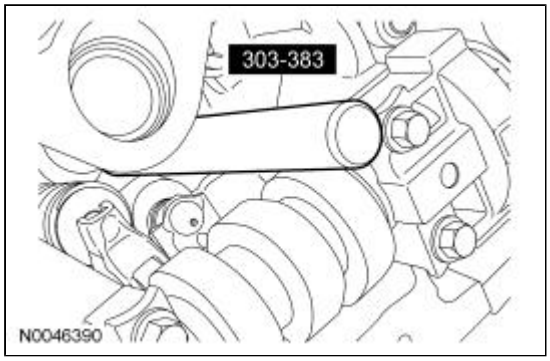
8. Inspect the components. For additional information, refer to Section 303-00 .

Installation

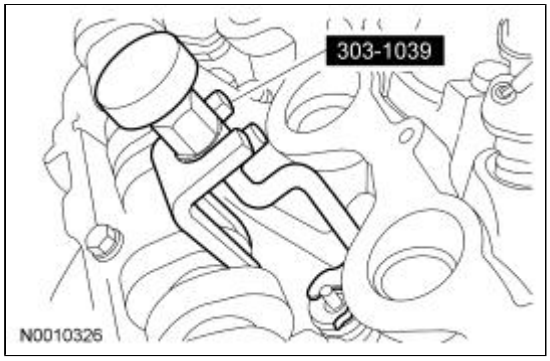
1. **NOTE:** Lubricate the valve seal and valve stem with clean engine oil prior to installation.

   Position a new valve seal onto the valve stem.

2. Using the special tool, install the new valve seal.



3. Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.



4. Relieve the air pressure from the cylinder.

5. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

   NOTE: Lubricate the camshaft roller follower with clean engine oil prior to installation.

   Using the special tool, compress the valve spring and install the camshaft roller follower.

6. Install the spark plug. For additional information, refer to Section 303-07 .

7. Depending on the valve being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

Hydraulic Lash Adjuster

Printable View (80 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal and Installation

1. Remove the camshafts. For additional information, refer to Camshaft — LH or Camshaft — RH in this section.

2. Remove the remaining camshaft roller followers from the cylinder head being serviced.

3. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

   Remove the hydraulic lash adjusters that are being serviced.

4. Inspect the hydraulic lash adjusters. For additional information, refer to Section 303-00 .

5. **NOTE:** Lubricate each of the hydraulic lash adjusters with clean engine oil prior to installation.

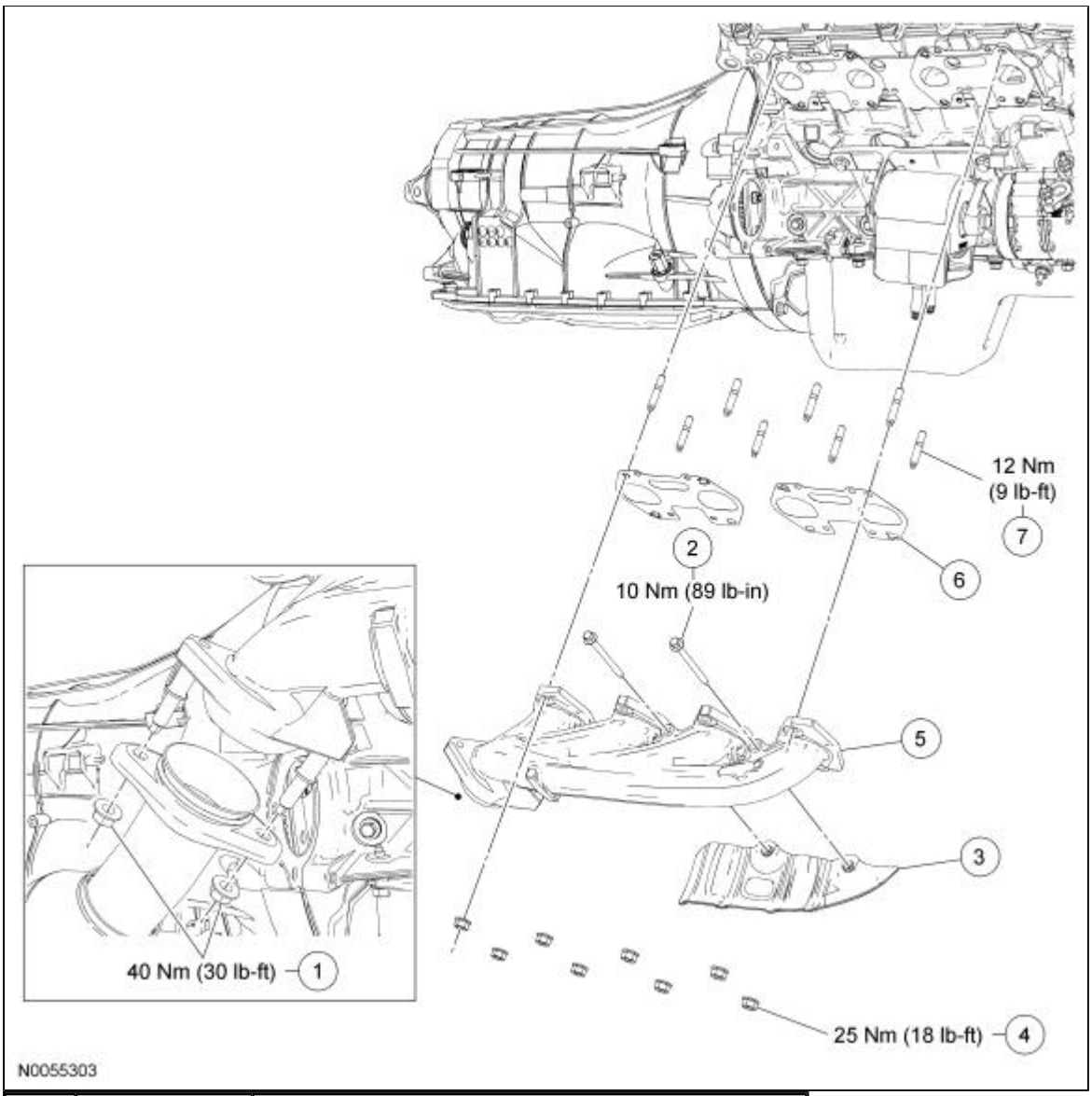
   To install, reverse the removal procedure.

Exhaust Manifold — RH

Printable View (256 KB)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—



Item	Part Number	Description
1	W705443	Exhaust Y-pipe flange nuts (2 required)
2	—	Exhaust manifold heat shield bolt (2 required)
3	—	Exhaust manifold heat shield
4	W701706	Exhaust manifold nut (8 required)
5	9430	Exhaust manifold

6	9Y431	Exhaust manifold gasket (2 required)
7	W707747	Exhaust manifold stud (8 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the RH inner fenderwell. For additional information, refer to Section 501-02 .

3. Remove the RH engine support insulator. For additional information, refer to Engine Support Insulators .

4. Remove the 2 bolts and the exhaust manifold heat shield.

5. Remove the 8 exhaust manifold nuts, studs and the exhaust manifold.
   - Discard the exhaust manifold nuts and studs.

6. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

   NOTE: Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging.

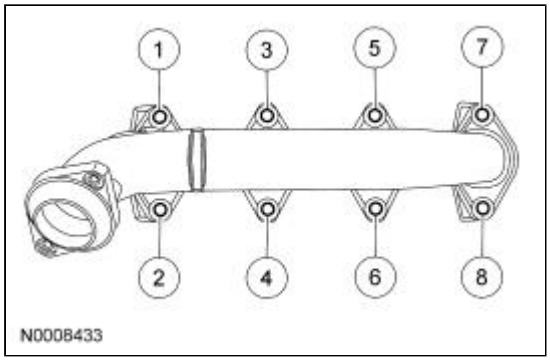
   Remove and discard the exhaust manifold gaskets. Clean the sealing surfaces with metal surface prep.

7. Inspect the exhaust manifold. For additional information, refer to Section 303-00 .

Installation

1. Using new exhaust manifold gaskets and studs, position the 2 gaskets and exhaust manifold and install the 8 studs.
   - Tighten to 12 Nm (9 lb-ft).

2. Using new exhaust manifold nuts, install the 8 nuts.
   - Tighten to 25 Nm (18 lb-ft) in the sequence shown.



3. Position the exhaust manifold heat shield and install the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

4. Install the RH engine support insulator. For additional information, refer to Engine Support Insulators .

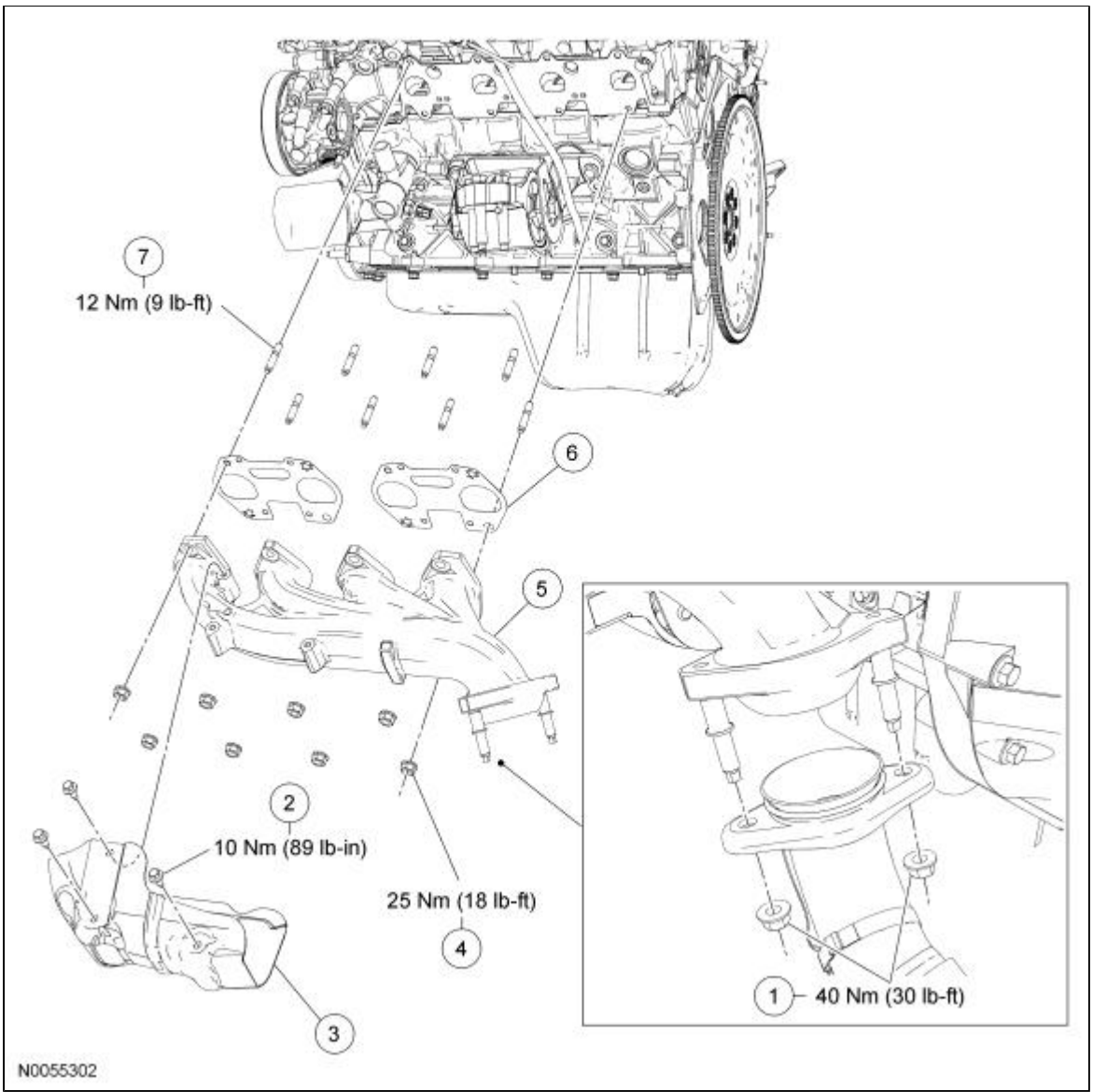
5. Install the RH inner fenderwell. For additional information, refer to Section 501-02 .

Exhaust Manifold — LH

Printable View (314 KB)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC31	—



Item	Part Number	Description
1	W705443	Exhaust Y-pipe flange nuts (2 required)
2	W707130	Exhaust manifold heat shield bolt (3 required)
3	9Y427	Exhaust manifold heat shield
4	W701706	Exhaust manifold nut (8 required)
5	9431	Exhaust manifold

6	9Y431	Exhaust manifold gasket (2 required)
7	W707747	Exhaust manifold stud (8 required)

Removal

All vehicles

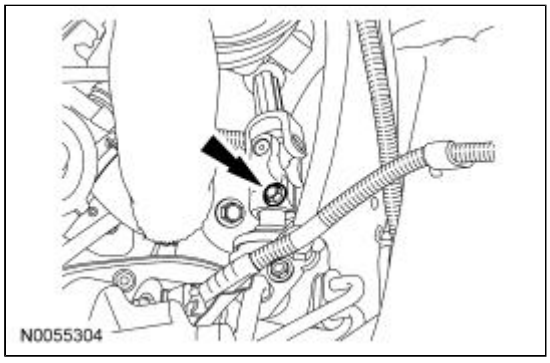
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the air cleaner outlet tube. For additional information, refer to Section 303-12 .

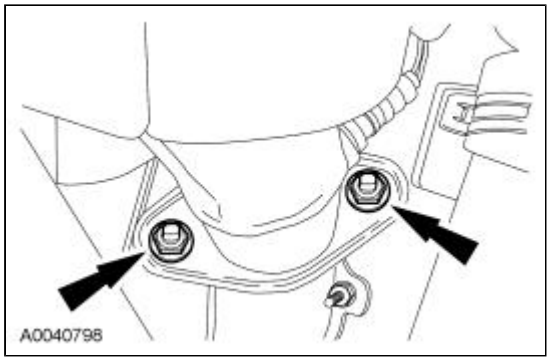
3. Remove the degas bottle. For additional information, refer to Section 303-03 .

4. **CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Remove the bolt and disconnect the steering shaft and position aside.



5. Remove the 4 (2 LH and 2 RH) exhaust manifold-to-catalytic converter nuts.



6. Remove the 3 bolts and the exhaust manifold heat shield.

Four wheel drive (4WD) vehicles

7. Remove the front driveshaft. For additional information, refer to Section 205-01 .

All vehicles

8. Remove the 8 exhaust manifold nuts, studs and the exhaust manifold.

- Discard the exhaust manifold nuts and studs.

9. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

   NOTE: Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging.

   Remove and discard the exhaust manifold gaskets. Clean the sealing surfaces with metal surface prep.

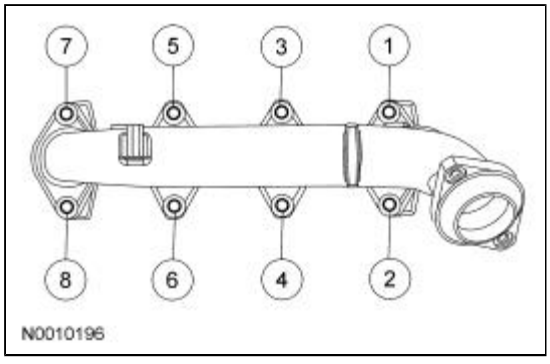
10. Inspect the exhaust manifold. For additional information, refer to Section 303-00 .

Installation

All vehicles

1. Using new exhaust manifold gaskets and studs, position the 2 gaskets and exhaust manifold and install the 8 studs.
   - Tighten to 12 Nm (9 lb-ft).

2. Using new exhaust manifold nuts, install the 8 nuts.
   - Tighten to 25 Nm (18 lb-ft) in the sequence shown.



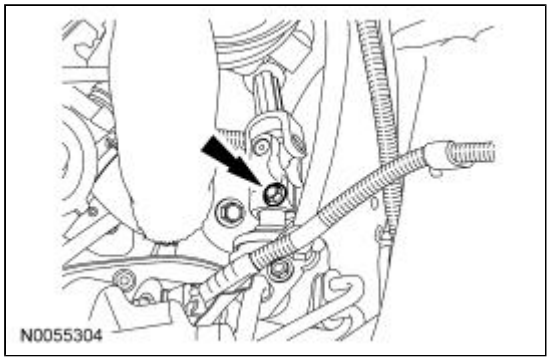
4WD vehicles

3. Install the front driveshaft. For additional information, refer to Section 205-01 .

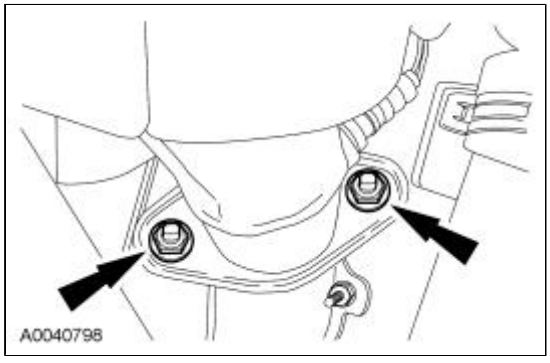
All vehicles

4. **CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Connect the steering shaft and install the bolt.
   - To install, tighten to 30 Nm (22 lb-ft).



5. Install the 4 exhaust manifold-to-catalytic converter nuts.



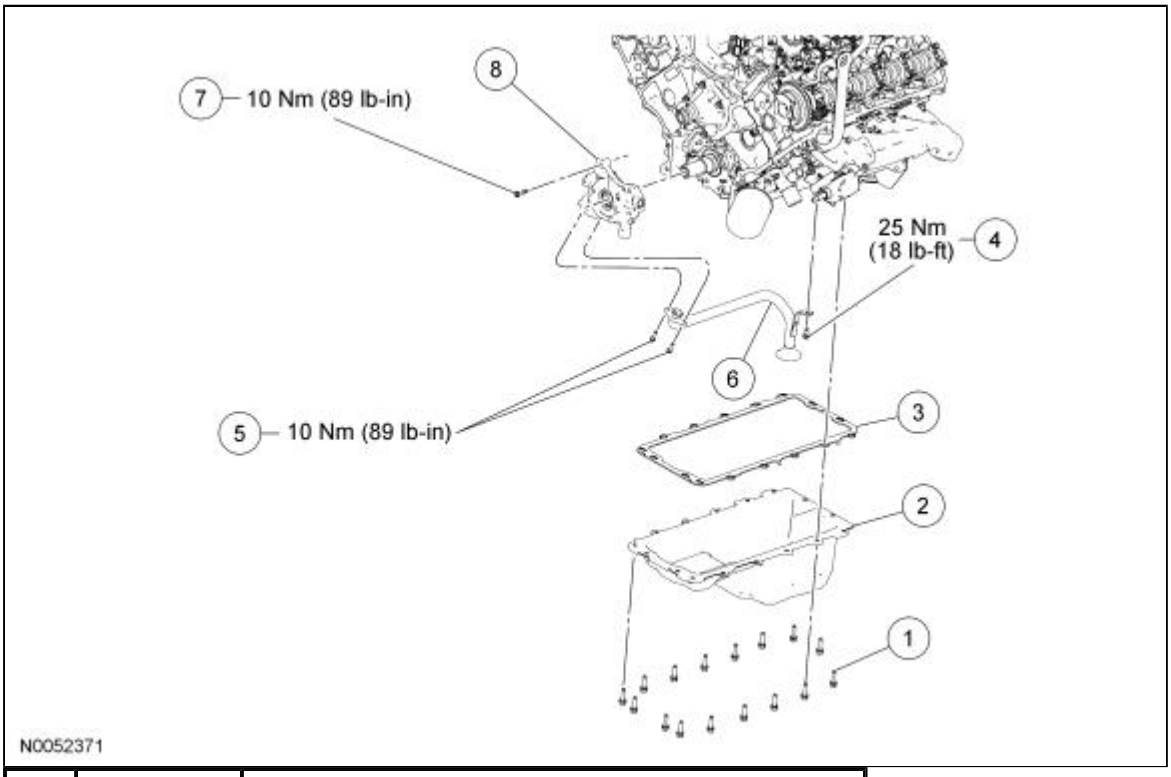
6. Position the exhaust manifold heat shield and install the 3 bolts.
    - To install, tighten to 10 Nm (89 lb-in).

7. Install the degas bottle. For additional information, refer to Section 303-03 .

8. Install the air cleaner outlet tube. For additional information, refer to Section 303-12 .

Engine Lubrication Components — Exploded View

Printable View (125 KB)



Item	Part Number	Description
1	W701605	Oil pan bolt (16 required)
2	6675	Oil pan
3	6710	Oil pan gasket
4	N605904	Oil pump screen and pickup tube-to-spacer bolt
5	N806155	Oil pump screen and pickup tube-to-oil pump bolts (2 required)
6	6622	Oil pump screen and pickup tube
7	N806183	Oil pump bolt (3 required)
8	6621	Oil pump

1. For additional information, refer to the procedures in this section.

Oil Pan

Printable View (429 KB)

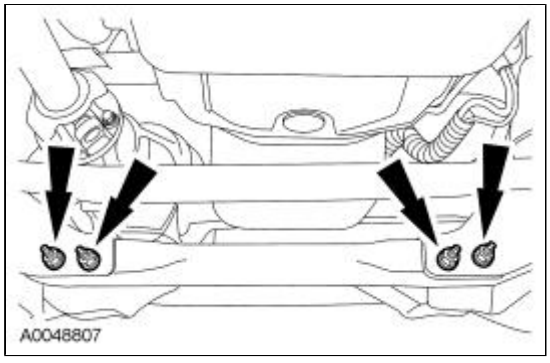
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

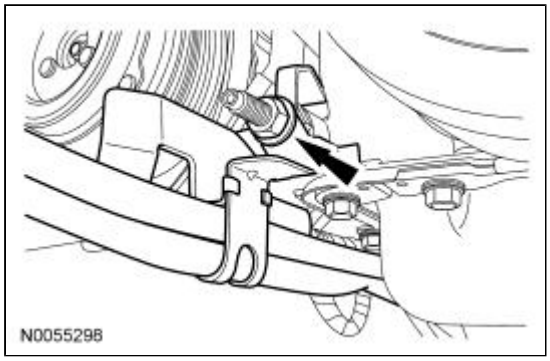
Removal

All vehicles

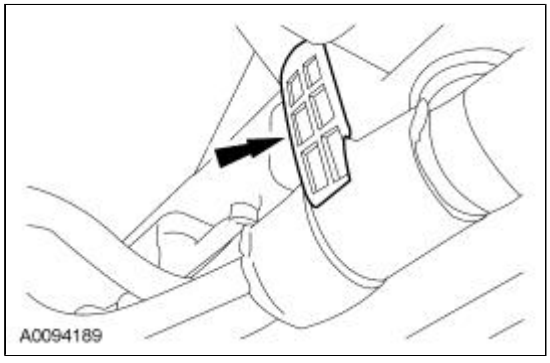
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the engine oil.
3. Remove the 4 bolts and the frame crossmember.



4. Remove the nut and remove the starter wiring harness and transmission fluid cooler tube support brackets from the stud bolt.

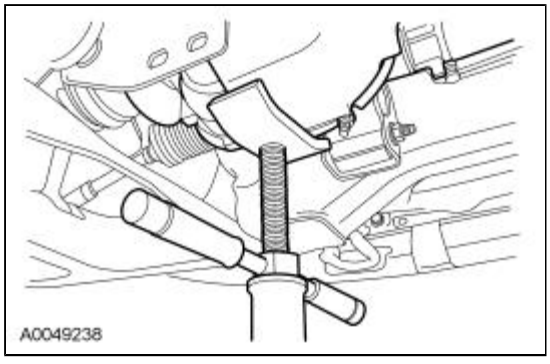


5. Disconnect the starter wiring harness retainer.



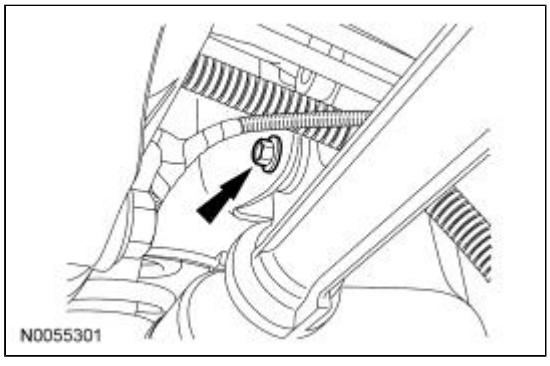
Four wheel drive (4WD) vehicles

6. Support the front axle housing with a jack stand.



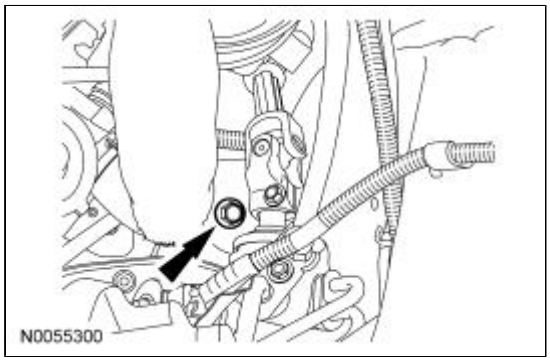
7. **NOTE:** Mark the bolt and bracket so that alignment can be maintained on installation.

   Remove the front axle housing RH mounting bolt.



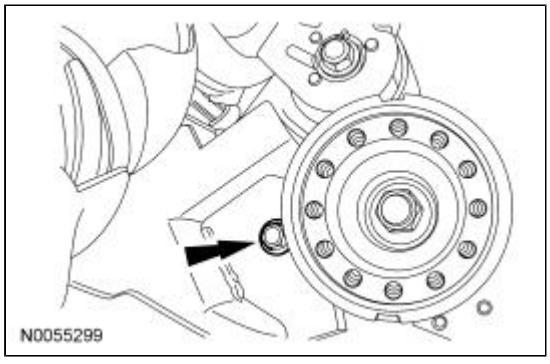
8. **NOTE:** Mark the bolt and bracket so that alignment can be maintained on installation.

   Remove the front axle housing LH front mounting bolt.



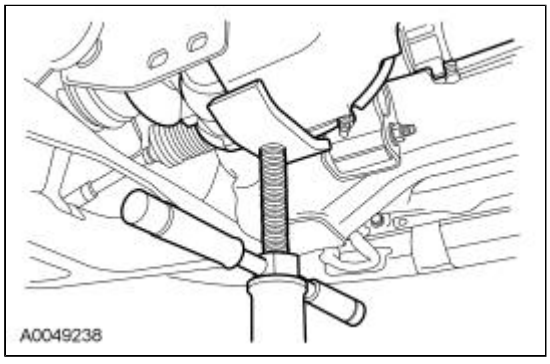
9. **NOTE:** Mark the bolt and bracket so that alignment can be maintained on installation.

   Remove the front axle housing LH rear mounting bolt.



10. **CAUTION: Use care when lowering the front axle housing, or the vacuum lines to the axle solenoid may become disconnected or damaged.**

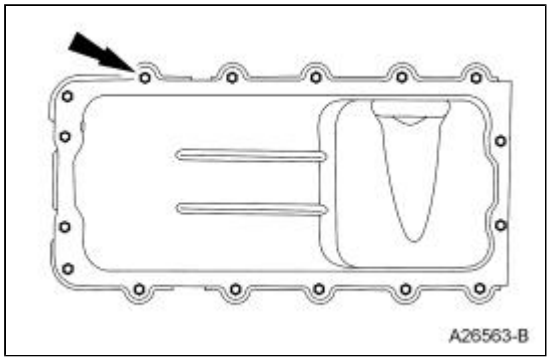
    Lower the axle to allow clearance for the oil pan to be removed.



All vehicles

11. **NOTE:** Be careful when removing the oil pan gasket. It is reusable.

    Remove the 16 bolts, the oil pan and the gaskets.
    - Inspect the oil pan gasket for damage.
    - If damaged, discard the oil pan gasket and the oil pan-to-oil pump gaskets.



Installation

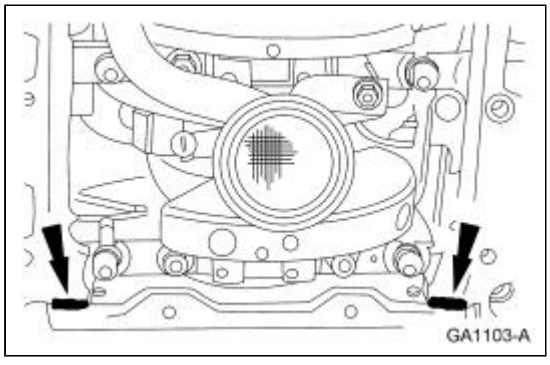
All vehicles

1. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   Inspect the oil pan. Clean the mating surface for the oil pan with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

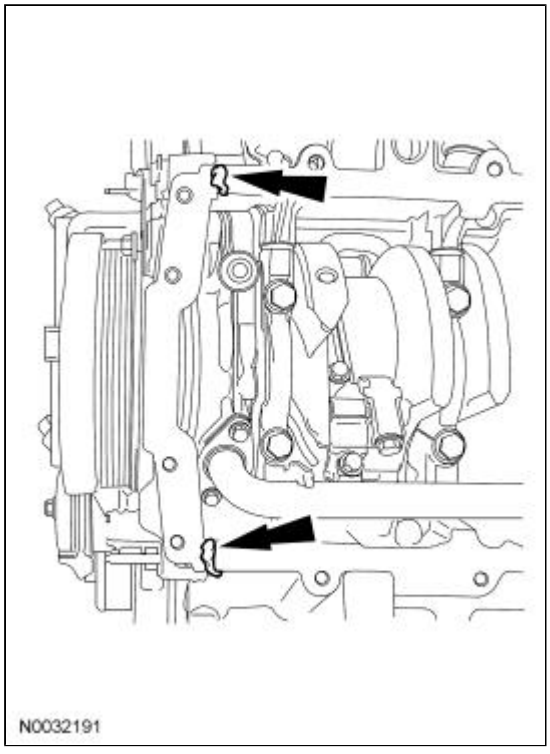
2. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

   Apply silicone gasket and sealant at the crankshaft rear seal retainer plate-to-cylinder block sealing surface.

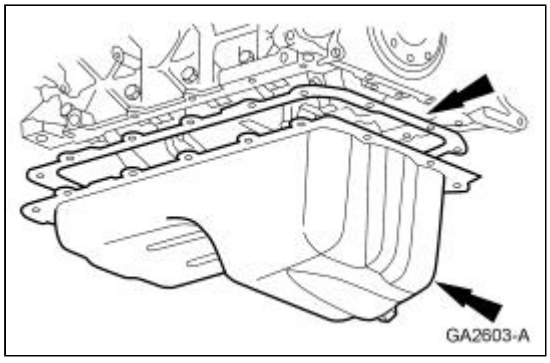


3. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

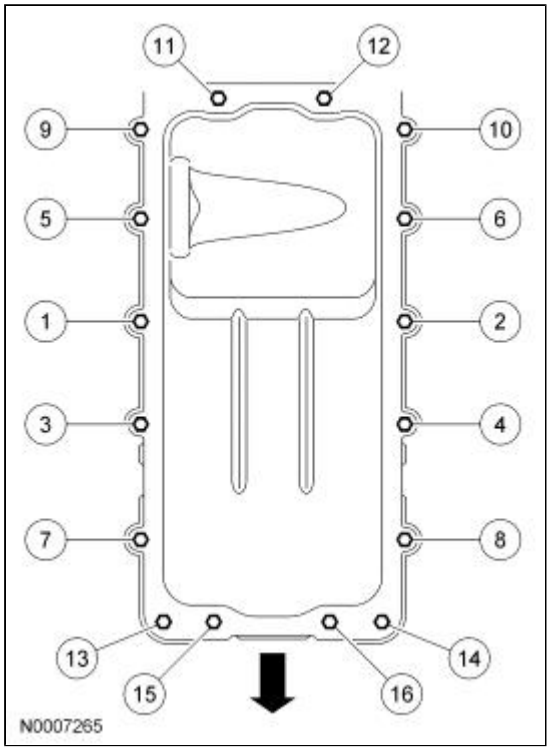
   Apply silicone gasket and sealant at the engine front cover-to-cylinder block sealing surface.



4. Install the oil pan gasket and the oil pan and loosely install the 16 bolts.



5. Tighten the bolts in 3 stages, in the sequence shown.
    - Stage 1: Tighten to 2 Nm (18 lb-in).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).
    - Stage 3: Tighten an additional 60 degrees.

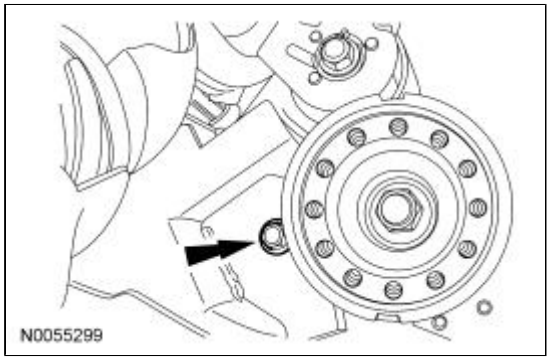


4WD vehicles

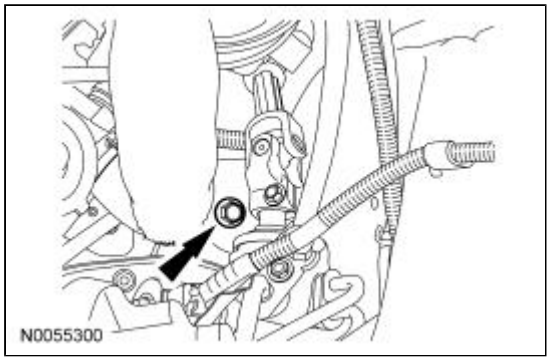
6. **CAUTION: Use care when positioning the front axle housing, or the vacuum lines to the axle solenoid may become disconnected or damaged.**

   Position the front axle housing and loosely install the 3 bolts, aligning the bolt location marks made during removal.

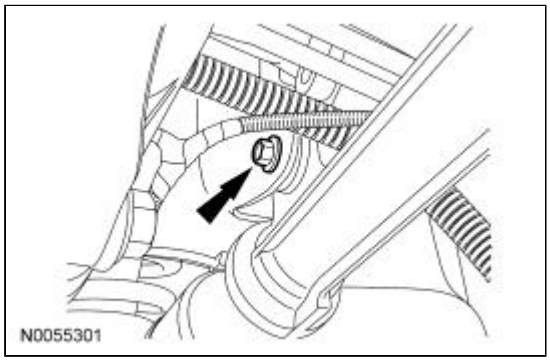
7. Install the front axle housing RH mounting bolt.
   - Tighten to 89 Nm (66 lb-ft).



8. Install the front axle housing LH front mounting bolt.
   - Tighten to 89 Nm (66 lb-ft).

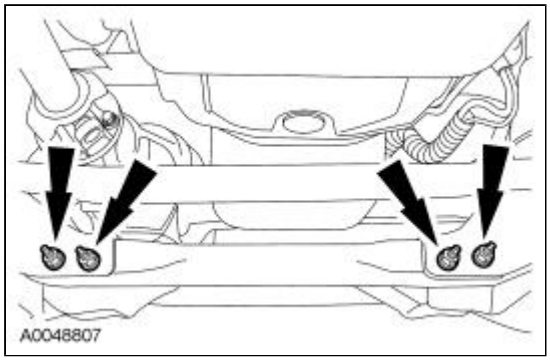


9. Install the front axle housing LH rear mounting bolt.
    - Tighten to 89 Nm (66 lb-ft).

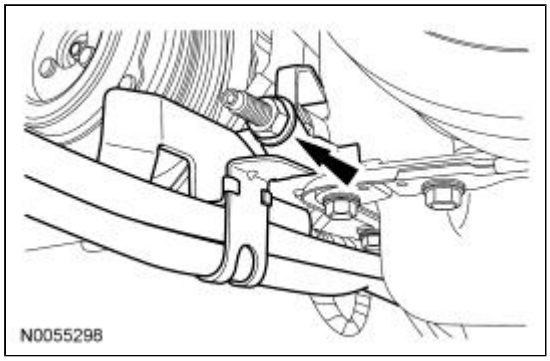


All vehicles

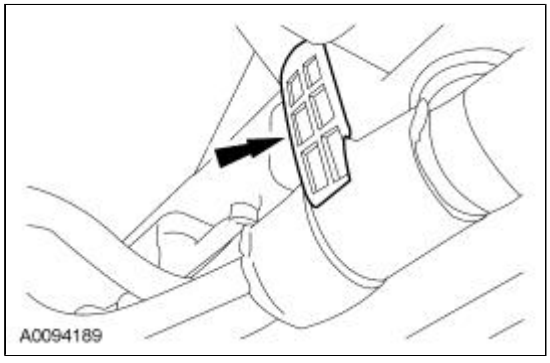
10. Position the frame crossmember and the 4 bolts.
    - Tighten to 102 Nm (75 lb-ft).



11. Position the starter wiring harness and transmission fluid cooler tube support brackets and install the nut.
    - Tighten to 10 Nm (89 lb-in).



12. Connect the starter wiring harness retainer to the cylinder block.



13. Fill the crankcase with clean engine oil.

Oil Pump

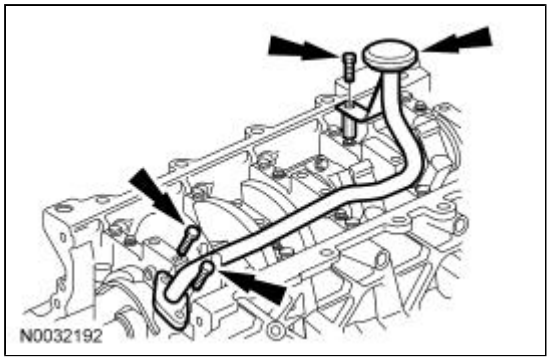
Printable View (141 KB)

Material

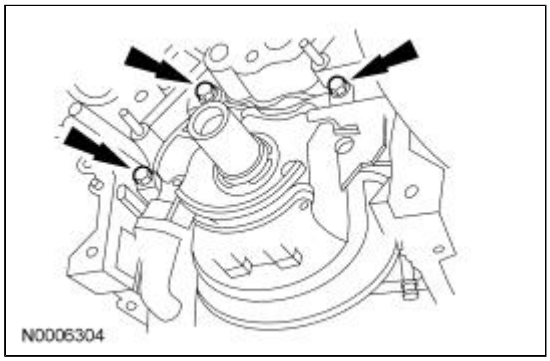
Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Remove the timing drive components. For additional information, refer to Timing Drive Components in this section.
2. Remove the oil pan. For additional information, refer to Oil Pan in this section.
3. Remove the 3 bolts and the oil pump screen and pickup tube.



4. Remove the 3 bolts and the oil pump.

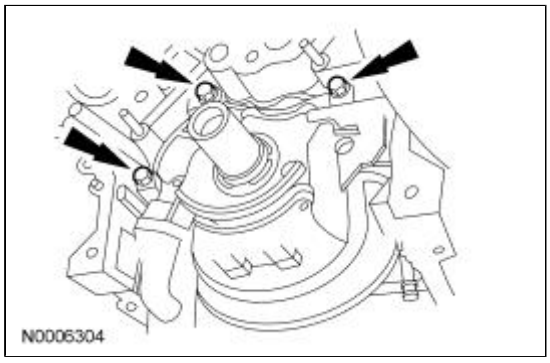


Installation

1. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging. Inspect the mating surfaces.

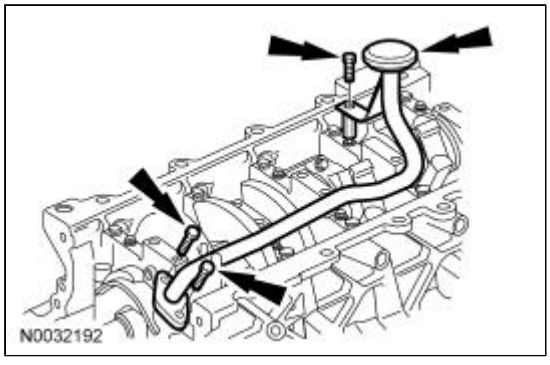
2. Position the oil pump and install the bolts.
   - Tighten to 10 Nm (89 lb-in).



3. **CAUTION: Make sure the O-ring is in place and not damaged. A missing or damaged O-ring can cause foam in the lubrication system, low oil pressure and severe engine damage.**

   NOTE: Clean and inspect the mating surfaces and install a new O-ring. Lubricate the O-ring with clean engine oil prior to installation.

   Position the oil pump screen and pickup tube and install the 3 bolts.
   - Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
   - Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).



4. Install the oil pan. For additional information, refer to Oil Pan in this section.

5. Install the timing drive components. For additional information, refer to Timing Drive Components in this section.

Oil Pump Screen and Pickup Tube

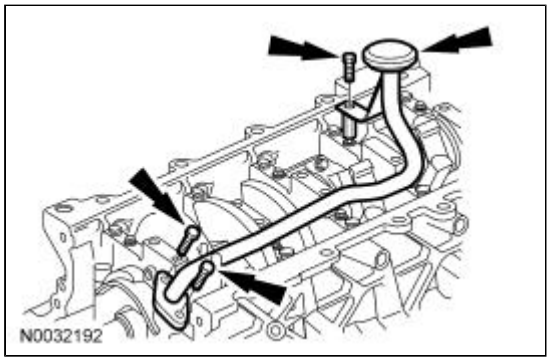
Printable View (112 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Remove the oil pan. For additional information, refer to Oil Pan in this section.
2. Remove the 3 bolts and the oil pump screen and pickup tube.

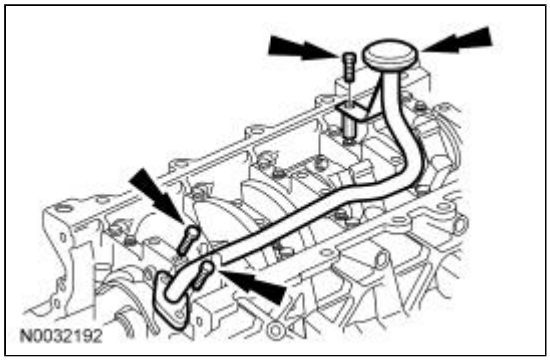


Installation

1. **CAUTION: Make sure the O-ring is in place and not damaged. A missing or damaged O-ring can cause foam in the lubrication system, low oil pressure and severe engine damage.**

   NOTE: Clean and inspect the mating surfaces and install a new O-ring. Lubricate the O-ring with clean engine oil prior to installation.

   Position the oil pump screen and pickup tube and install the bolts.
   - Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
   - Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).



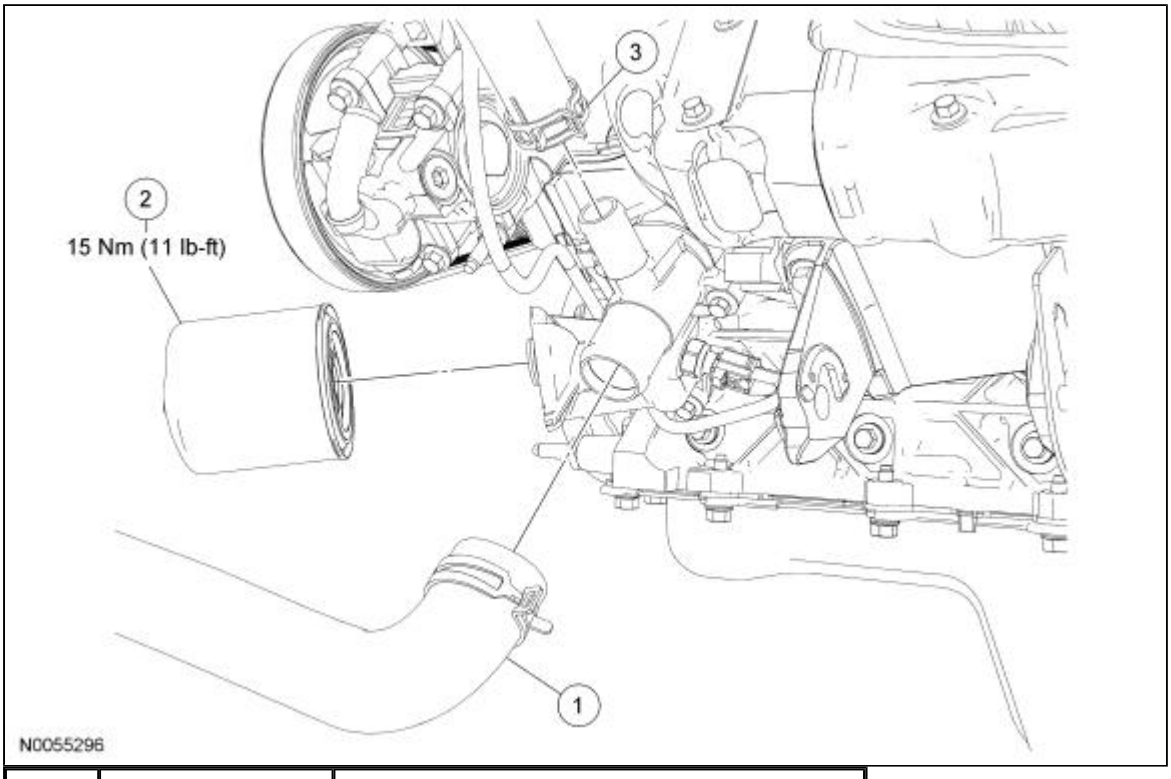
2. Install the oil pan. For additional information, refer to Oil Pan in this section.

Oil Filter Adapter

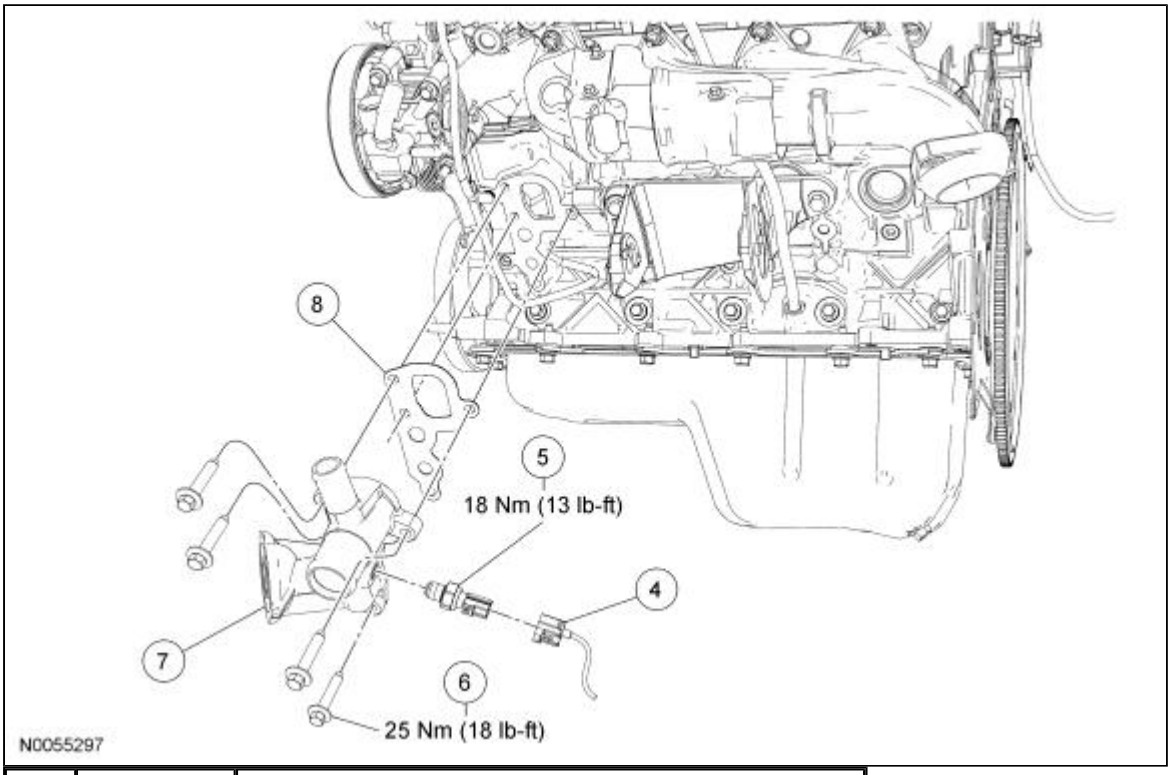
Printable View (309 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—



Item	Part Number	Description
1	8B273	Lower radiator hose
2	6714	Oil filter
3	8C351	Lower degas bottle coolant hose



Item	Part Number	Description
4	—	Engine oil pressure (EOP) switch electrical connector (part of 12B637)
5	9278	EOP switch
6	N806156	Oil filter adapter bolt (4 required)
7	6881	Oil filter adapter
8	6A636	Oil filter adapter gasket

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the engine cooling system. For additional information, refer to Section 303-03 .

3. Disconnect the lower radiator hose from the oil filter adapter and position it aside.

4. Disconnect the degas bottle coolant hose from the oil filter adapter and position it aside.

5. Remove and discard the engine oil filter.
   - To install, tighten to 15 Nm (11 lb-ft).

6. Disconnect the engine oil pressure (EOP) switch electrical connector.

7. Remove the EOP switch.
   - To install, tighten to 18 Nm (13 lb-ft).

8. Remove the 4 bolts and the oil filter adapter.
   - To install, tighten to 25 Nm (18 lb-ft).

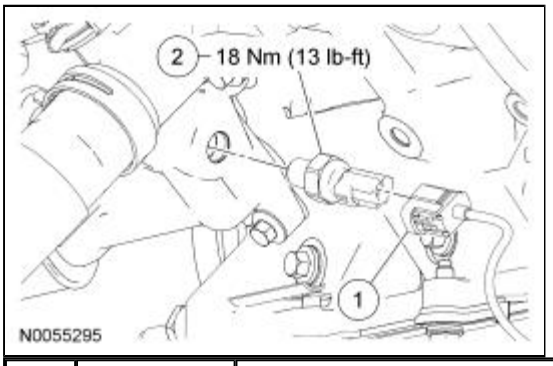
9. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

   Remove and discard the oil filter adapter gasket. Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Inspect the mating surfaces.

10. To install, reverse the removal procedure.
    - Install a new oil filter.
    - Check the engine oil level and fill as necessary with clean engine oil.

Engine Oil Pressure (EOP) Switch

Printable View (94 KB)



Item	Part Number	Description
1	—	Engine oil pressure (EOP) switch electrical connector (part 12B637)
2	9278	EOP switch

Removal and Installation

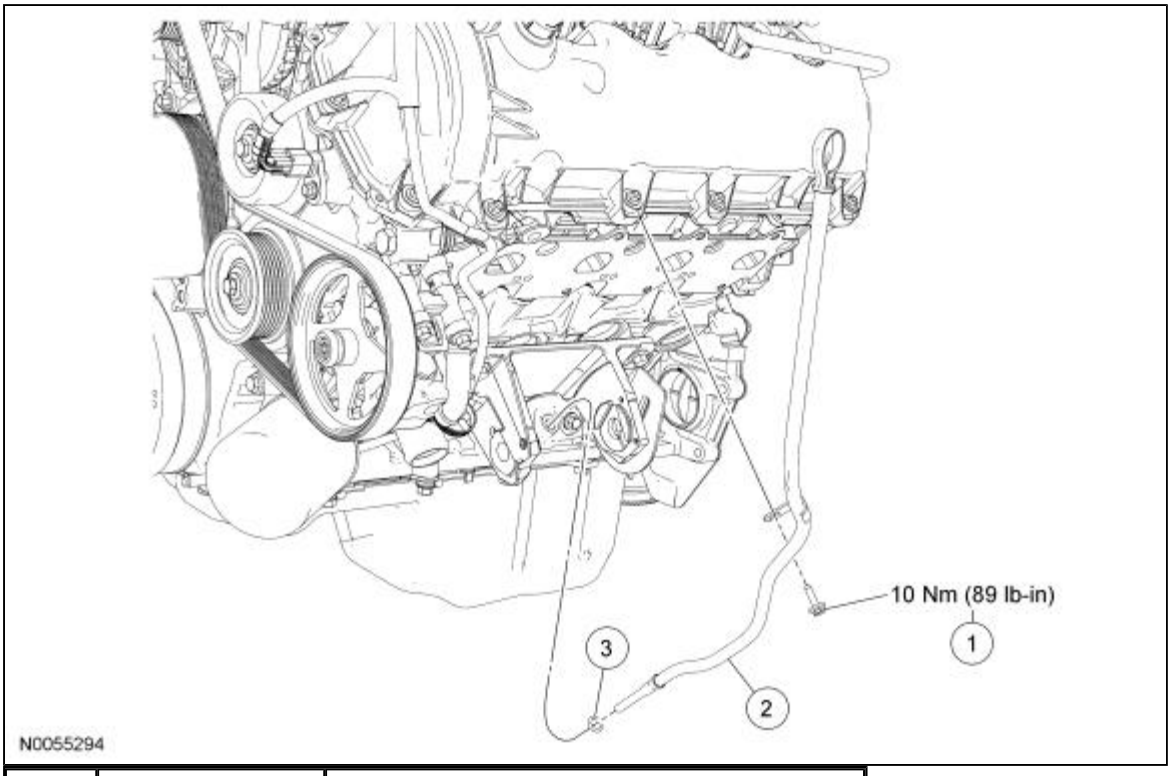
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the engine oil pressure (EOP) switch electrical connector.
   - To install, tighten to 18 Nm (13 lb-ft).
3. Remove the EOP switch.
   - To install, tighten to 18 Nm (13 lb-ft).
4. To install, reverse the removal procedure.

Oil Level Indicator and Tube

Printable View (205 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	N605892	Oil level indicator and tube bolt
2	6K873	Oil level indicator and tube
3	—	Oil level indicator tube O-ring seal

Removal and Installation

1. Remove the LH exhaust manifold. For additional information, refer to Exhaust Manifold — LH in this section.

2. Remove the oil level indicator and tube bolt.
   - To install, tighten to 10 Nm (89 lb-in).

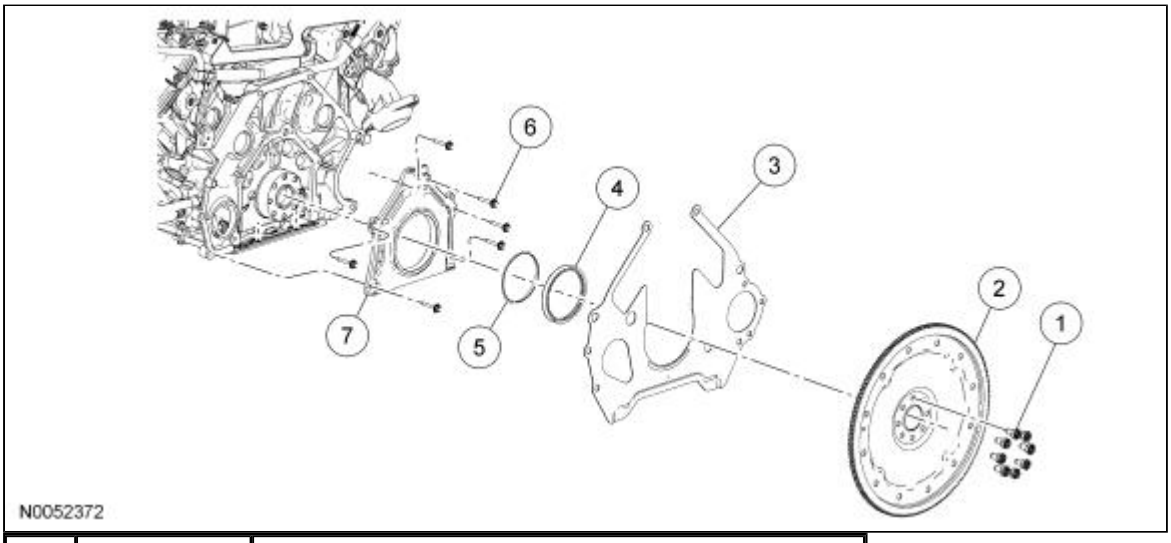
3. Remove the oil level indicator and tube from the cylinder block.
   - Discard the O-ring seal.

4. **NOTE:** Lubricate the new oil level indicator tube O-ring seal with clean engine oil prior to installation.

   To install, reverse the removal procedure.
   - Install a new O-ring seal.

Flexplate or Flywheel and Crankshaft Rear Seal — Exploded View

Printable
View (128 KB)



Item	Part Number	Description
1	N806168	Flexplate bolt (8 required)
2	6375	Flexplate
3	6A373	Rear cover plate
4	6310	Crankshaft oil slinger
5	6701	Crankshaft rear seal
6	N806155	Crankshaft rear seal retainer plate bolt (6 required)
7	6K318	Crankshaft rear seal retainer plate

1. For additional information, refer to the procedures in this section.

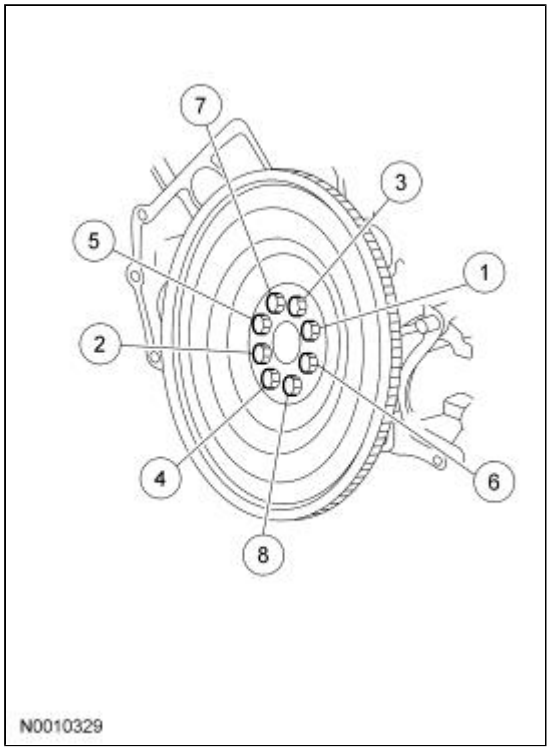
Flexplate

Printable View (97 KB)

Removal and Installation

1. Remove the transmission. For additional information, refer to Section 307-01A or Section 307-01B .

2. Remove the 8 bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft) in the sequence shown.

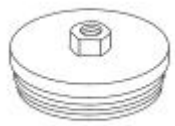
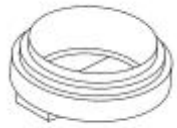


3. To install, reverse the removal procedure.

Crankshaft Rear Seal

Printable View (208 KB)

Special Tool(s)

ST1480-A	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-BH)
ST1481-A	Remover, Crankshaft Rear Oil Slinger 303-514 (T95P-6701-AH)
ST1482-A	Installer, Crankshaft Rear Oil Slinger 303-517 (T95P-6701-CH)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada);	WSS-M2C930-A

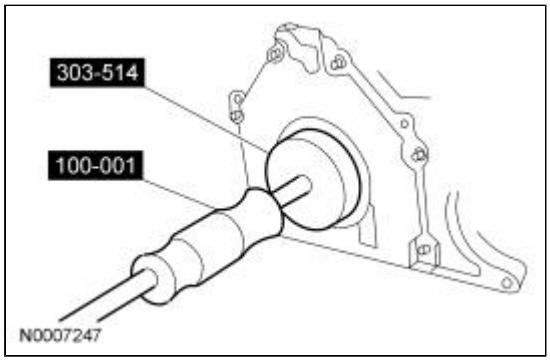
or equivalent	

Removal

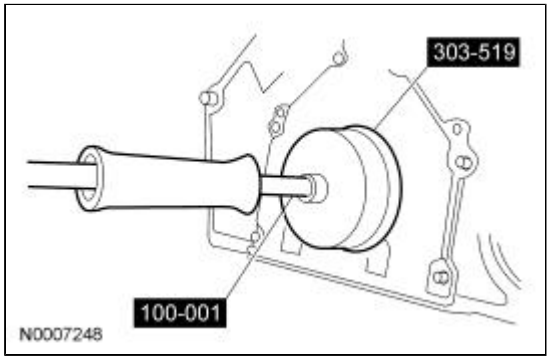
1. Remove the transmission. For additional information, refer to Section 307-01A or Section 307-01B .

2. Remove the 8 bolts and the flexplate.

3. Using the special tools, remove the crankshaft oil slinger.
   - Discard the crankshaft oil slinger.



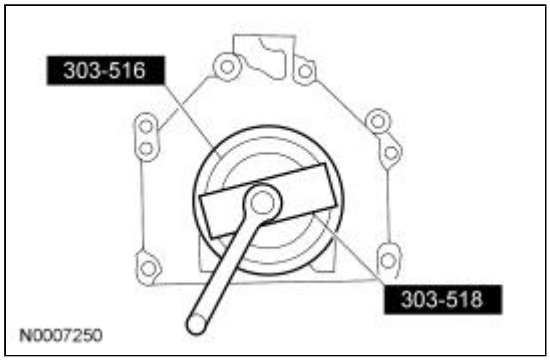
4. Using the special tools, remove the crankshaft rear seal.
   - Discard the crankshaft rear seal.



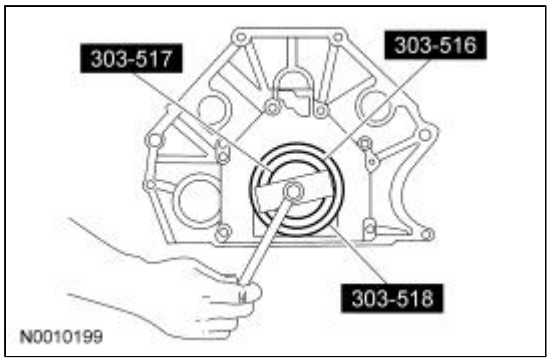
Installation

1. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

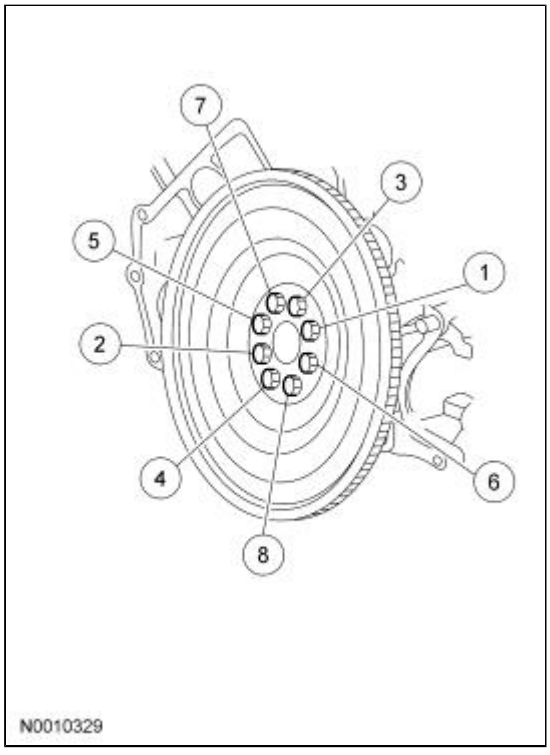
   Using the special tools, install a new crankshaft rear seal.



2. Using the special tools, install a new crankshaft rear oil slinger.



3. Install the flexplate and tighten the 8 bolts in the sequence shown.
    - Tighten to 80 Nm (59 lb-ft).

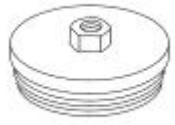
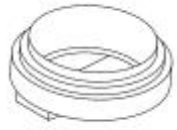


4. Install the transmission. For additional information, refer to Section 307-01A or Section 307-01B .

Crankshaft Rear Seal with Retainer Plate

Printable View (253 KB)

Special Tool(s)

ST1480-A	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-BH)
ST1481-A	Remover, Crankshaft Rear Oil Slinger 303-514 (T95P-6701-AH)
ST1482-A	Installer, Crankshaft Rear Oil Slinger 303-517 (T95P-6701-CH)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—

Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

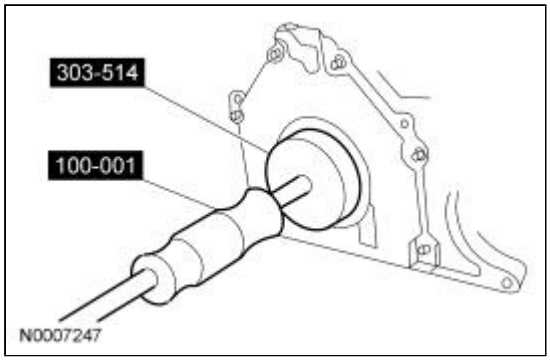
Removal

1. Remove the transmission. For additional information, refer to Section 307-01A or Section 307-01B .

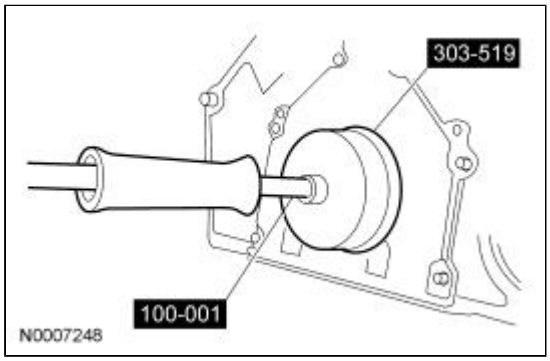
2. Remove the oil pan. For additional information, refer to Oil Pan in this section.

3. Remove the 8 bolts and the flexplate.

4. Using the special tools, remove the crankshaft oil slinger.
   - Discard the crankshaft oil slinger.



5. Using the special tools, remove the crankshaft rear seal.
   - Discard the crankshaft rear seal.



6. Remove the 6 bolts and the crankshaft rear seal retainer plate.

Installation

1. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   NOTE: Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow

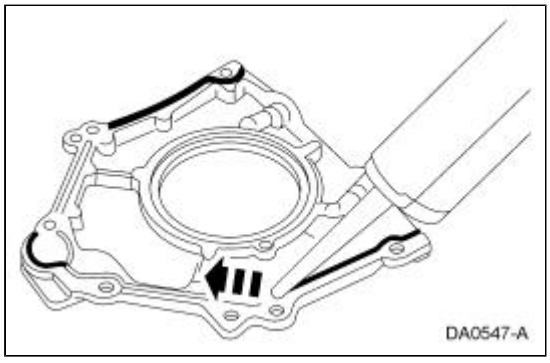
the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

Clean and inspect the mating surface.

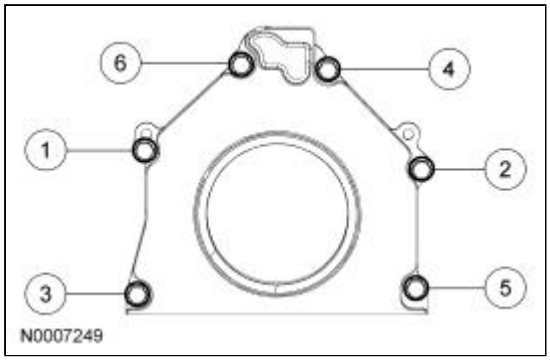
2. **NOTE:** If the rear crankshaft seal retaining plate is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leaks.

   NOTE: The silicone must be applied on the groove along the retainer plate.

   Apply a 4.06 mm (0.16 in) bead of silicone gasket and sealant around the crankshaft rear seal retainer plate sealing surface.

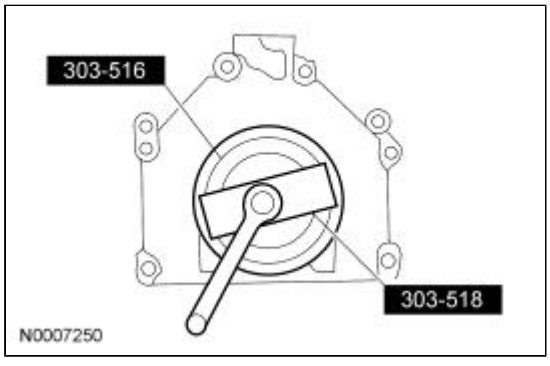


3. Install the crankshaft rear seal retainer plate and the 6 bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).

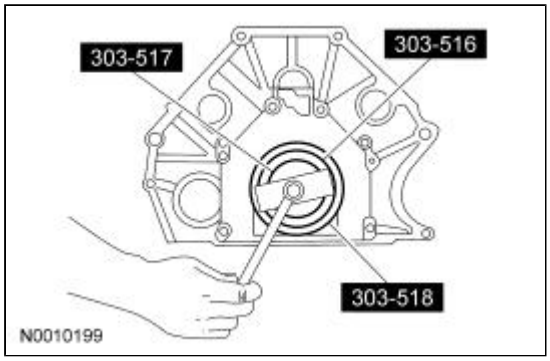


4. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

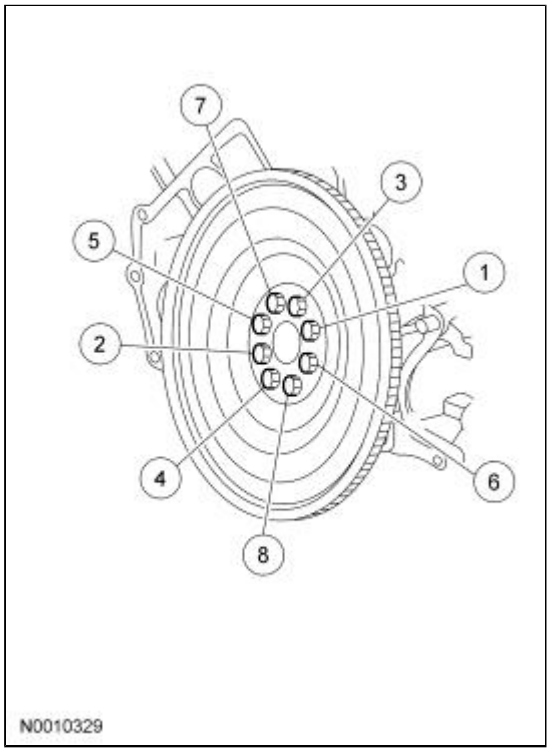
   Using the special tools, install a new crankshaft rear seal.



5. Using the special tools, install a new crankshaft rear oil slinger.



6. Install the flexplate and tighten the 8 bolts in the sequence shown.
    - Tighten to 80 Nm (59 lb-ft).



7. Install the oil pan. For additional information, refer to Oil Pan in this section.

8. Install the transmission. For additional information, refer to Section 307-01A or Section 307-01B .

Engine Support Insulators

Printable View (543 KB)

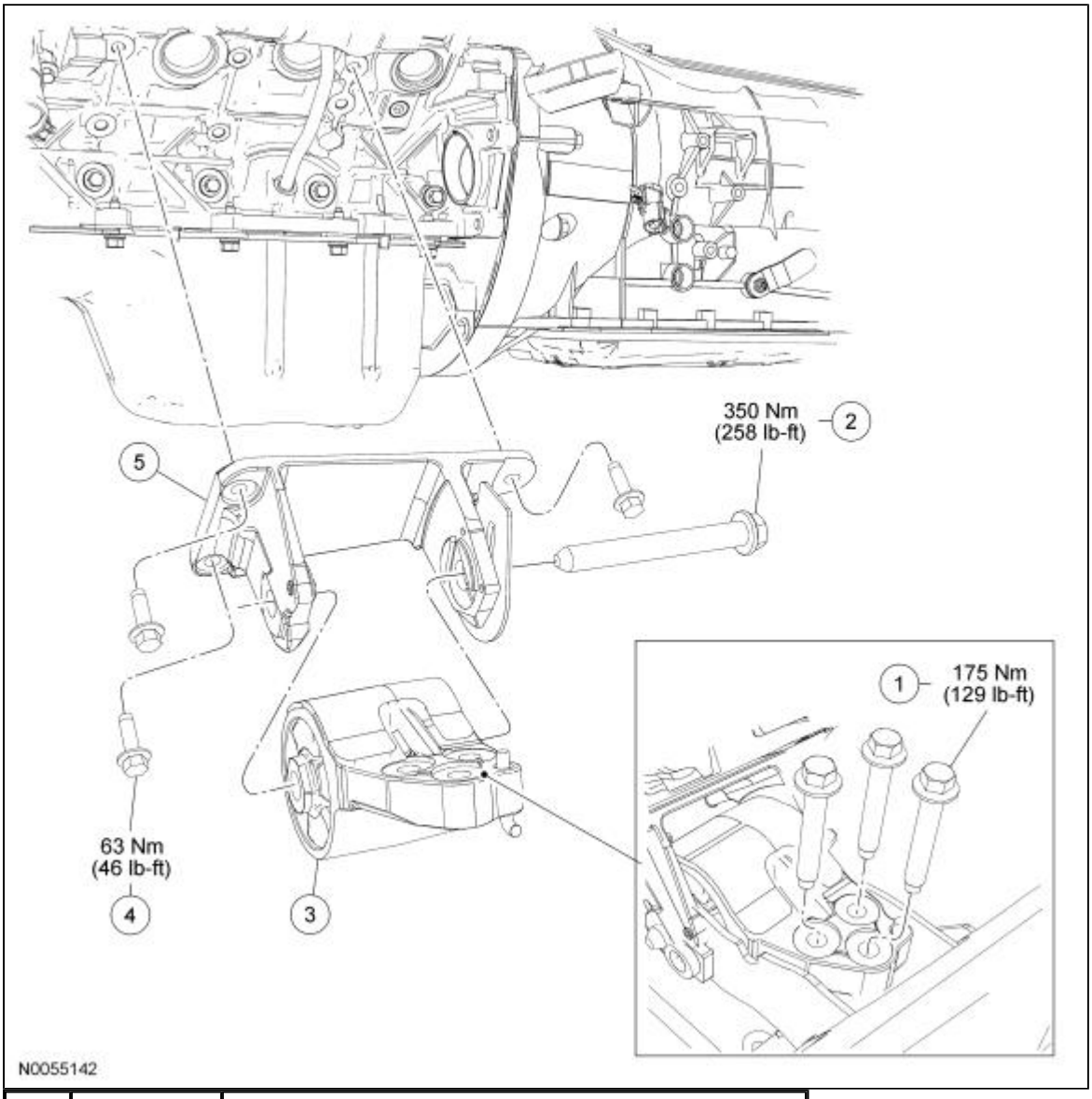
Special Tool(s)

ST2176-B	Engine Support Bar, Heavy Duty 303-F070
ST2970-A	Support Hook 303-F071
ST2592-A	Engine Support Bracket 303-639

Material

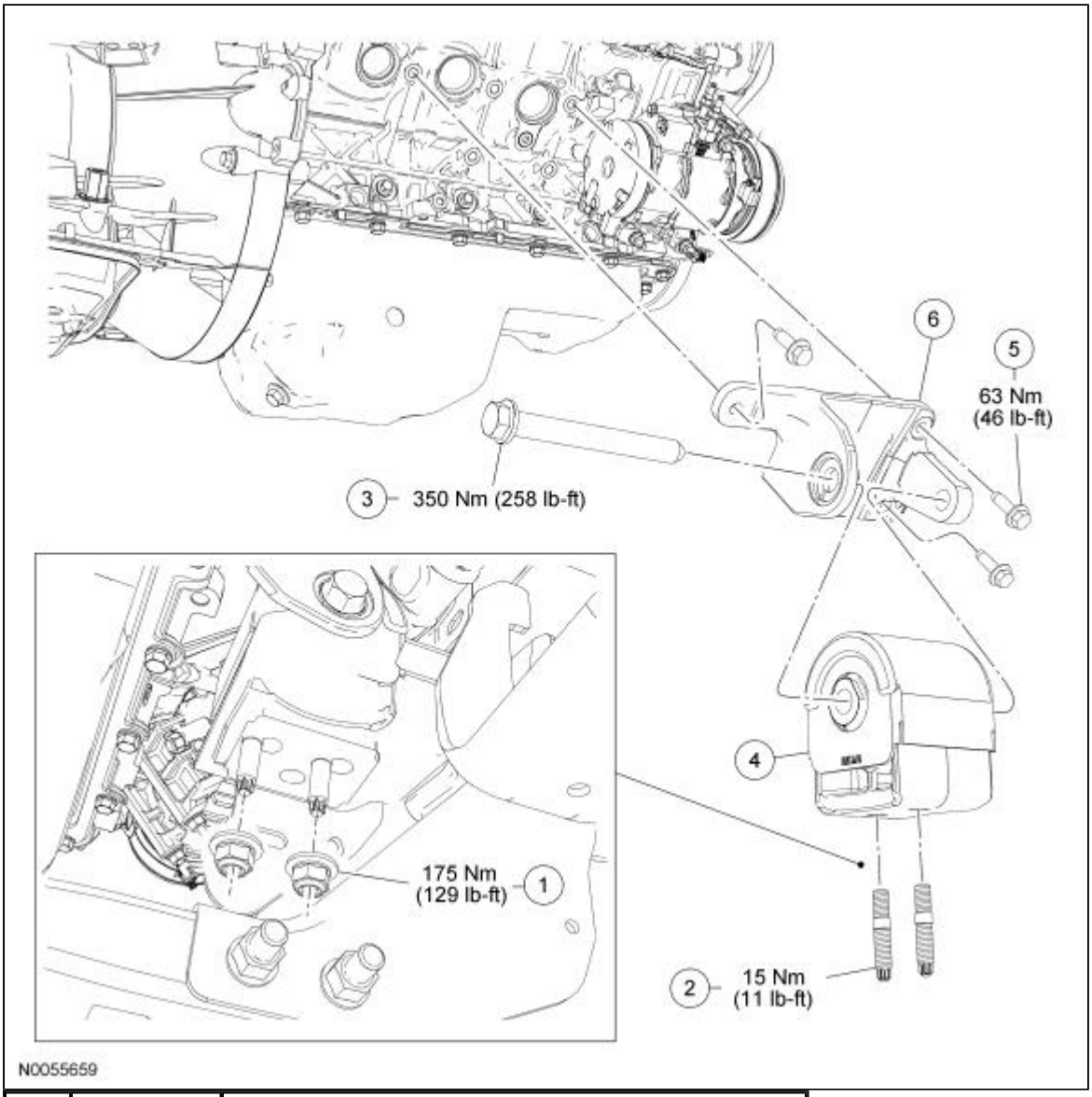
Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6

LH Engine Support Insulator



Item	Part Number	Description
1	W712805	LH engine support insulator-to-frame bolt (3 required)
2	W711142	LH engine support insulator through bolt
3	6B032	LH engine support insulator
4	W711141	LH engine support insulator-to-cylinder block bracket bolt (3 required)
5	6061	LH engine support insulator-to-cylinder block bracket

RH Engine Support Insulator



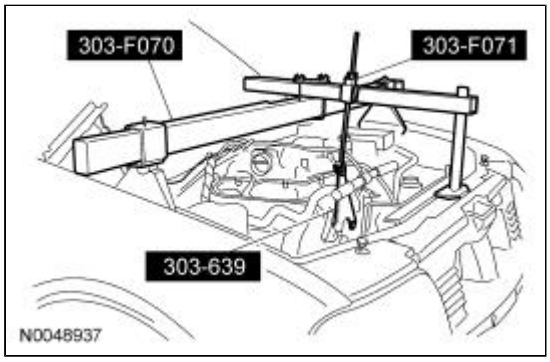
Item	Part Number	Description
1	W707251	RH engine support insulator-to-frame nut (2 required)
2	W711144	RH engine support insulator-to-frame stud bolt (2 required)
3	W711142	RH engine support insulator through bolt
4	6H028	RH engine support insulator
5	W711141	RH engine support insulator-to-cylinder block bracket bolt (3 required)
6	—	RH engine support insulator-to-cylinder block bracket

Removal

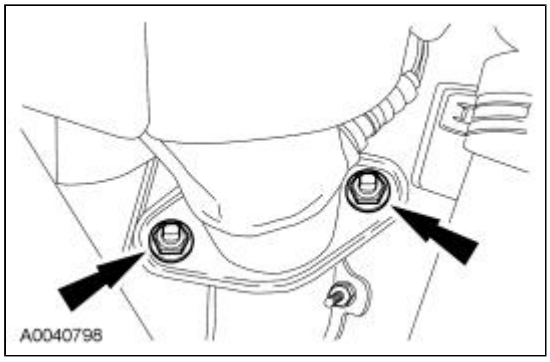
All engine support insulators

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the throttle body (TB). For additional information, refer to Section 303-04 .
4. Remove the cooling fan. For additional information, refer to Section 303-03 .
5. Remove the generator. For additional information, refer to Section 414-02 .
6. Remove the starter. For additional information, refer to Section 303-06 .
7. If servicing the engine support insulators on a four wheel drive (4WD) vehicle, remove the front drive shaft. For additional information, refer to Section 205-01 .
8. Install the special tools.

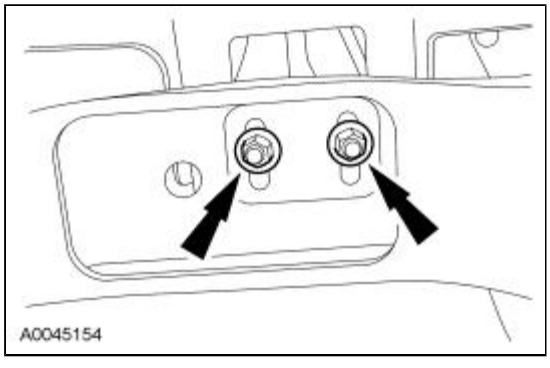


9. Remove the 4 exhaust manifold-to-catalytic converter nuts.



10. **CAUTION: Only use hand tools when removing the transmission mount-to-crossmember nuts or damage to the transmission mount can occur.**

    Loosen the transmission mount-to-crossmember nuts.



RH engine support insulator

11. **CAUTION: Only use hand tools when loosening the engine support insulator through bolts or damage to the engine support insulator-to-cylinder block bracket can occur.**

    Loosen the LH engine support insulator through bolt.

12. **CAUTION: Only use hand tools when removing the engine support insulator through bolts or damage to the engine support insulator-to-cylinder block bracket can occur.**

    Remove the RH engine support insulator through bolt.

13. **CAUTION: Only use hand tools when removing the engine support insulator nuts or damage to the engine support insulator can occur.**

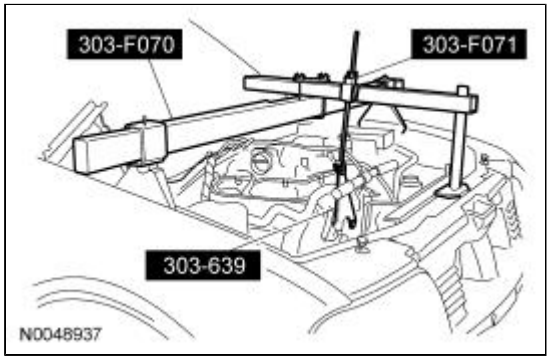
    NOTE: If during nut removal the stud bolt is extracted from the engine support insulator, separate the nut from the stud bolt prior to stud bolt installation.

    Remove the 2 RH engine support insulator nuts.

14. **CAUTION: Only use hand tools when removing the engine support insulator stud bolts or damage to the engine support insulator can occur.**

    Remove the 2 RH engine support insulator stud bolts.

15. Using the special tools, raise the engine.



16. Remove the 3 bolts and the RH engine support insulator-to-cylinder block bracket.

17. Remove the RH engine support insulator.

LH engine support insulator

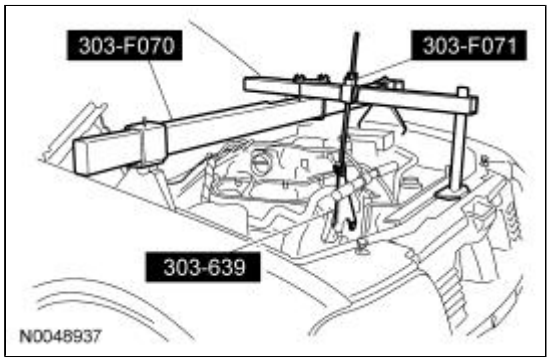
18. **CAUTION: Only use hand tools when loosening the engine support insulator through bolts or damage to the engine support insulator-to-cylinder block bracket can occur.**

    Loosen the RH engine support insulator through bolt.

19. **CAUTION: Only use hand tools when removing the engine support insulator through bolts or damage to the engine support insulator-to-cylinder block bracket can occur.**

Remove the LH engine support insulator through bolt.

20. Using the special tools, raise the engine.



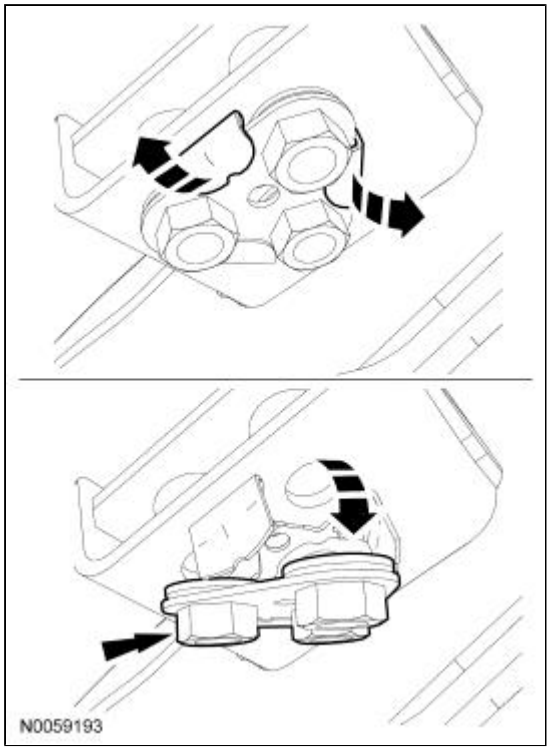
21. **CAUTION: Only use hand tools when removing the engine support insulator-to-frame bolts or damage to the engine support insulator-to-frame nut plate can occur.**

Remove the 3 engine support insulator-to-frame bolts.
- Discard the 3 bolts.

22. Remove the 3 bolts and the LH engine support insulator-to-cylinder block bracket.

23. Remove the LH engine support insulator.

24. Inspect the engine support insulator-to-frame nut plate for thread damage. If the nut plate is damaged, bend 2 tabs back and remove the nut plate. Replace the nut plate with service part number 56190 and bend the 2 tabs back to the original position.



Installation

RH engine support insulator

1. Clean the engine support insulator-to-cylinder block and engine support insulator-to-frame mating surfaces of any dirt or foreign material prior to installation.

2. **CAUTION: Only use hand tools when installing the engine support insulator stud bolts or damage to the engine support insulator can occur.**

   Position the RH engine support insulator into the vehicle and install the 2 stud bolts.
   - Tighten to 15 Nm (11 lb-ft).

3. Position the RH engine support insulator-to-cylinder block bracket and install the 3 bolts.
   - Tighten to 63 Nm (46 lb-ft).

4. **CAUTION: Only use hand tools when installing the RH engine support insulator nuts or damage to the engine support insulator can occur.**

   Install the 2 RH engine support insulator nuts.
   - Tighten to 175 Nm (129 lb-ft).

LH engine support insulator

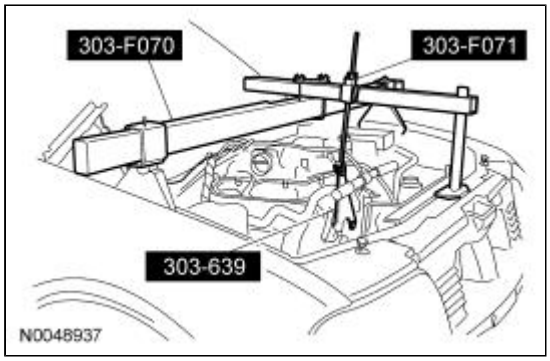
5. Clean the engine support insulator-to-cylinder block and engine support insulator-to-frame mating surfaces of any dirt or foreign material prior to installation.

6. Position the LH engine support insulator and hand start the 3 new engine support insulator-to-frame bolts.
   - Tighten to 175 Nm (129 lb-ft).

7. Position the LH engine support insulator-to-cylinder block bracket and install the 3 bolts.
   - Tighten to 63 Nm (46 lb-ft).

All engine support insulator

8. Using the special tools, lower the engine into position.



9. **CAUTION: Only use hand tools when installing the engine support insulator through bolt or damage to the engine support insulator-to-cylinder block bracket can occur.**

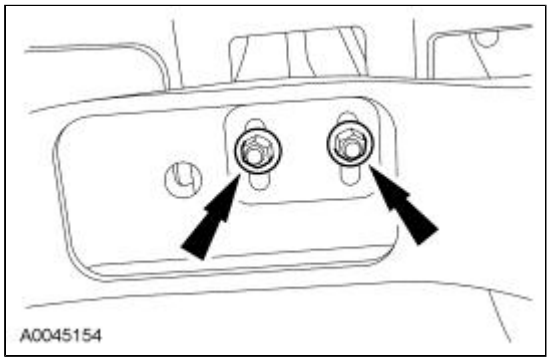
   Install the LH and RH engine support insulator bolts.
   - Apply Threadlock 262 to the bolt threads prior to installation.
   - Tighten to 350 Nm (258 lb-ft).

10. **CAUTION: Only use hand tools when installing the transmission mount-to-**

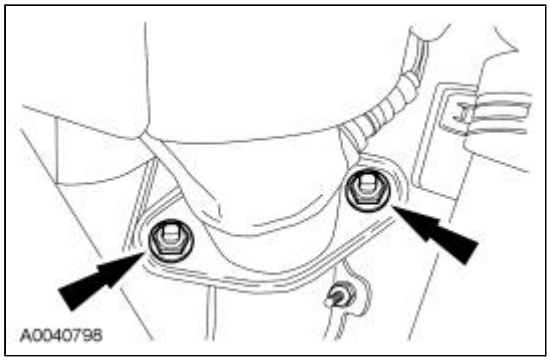
crossmember nuts or damage to the transmission mount can occur.

Install the transmission mount-to-crossmember nuts.

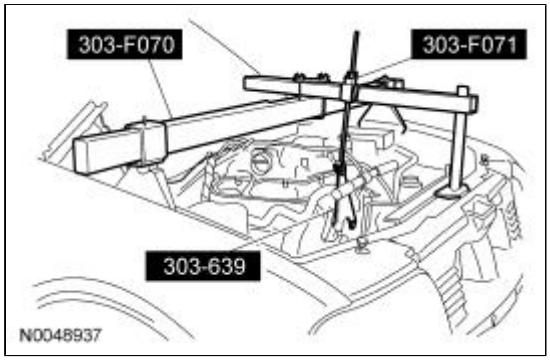
- Tighten to 103 Nm (76 lb-ft).



11. Position the Y-pipe and install the 4 nuts.
    - Tighten to 40 Nm (30 lb-ft).



12. Remove the special tools.



13. Install the starter. For additional information, refer to Section 303-06 .
14. If servicing the engine support insulator on a 4WD vehicle, install the front driveshaft. For additional information, refer to Section 205-01 .
15. Install the generator. For additional information, refer to Section 414-02 .
16. Install the cooling fan. For additional information, refer to Section 303-03 .
17. Install the TB. For additional information, refer to Section 303-04 .
18. Connect the battery ground cable. For additional information, refer to Section 414-01 .

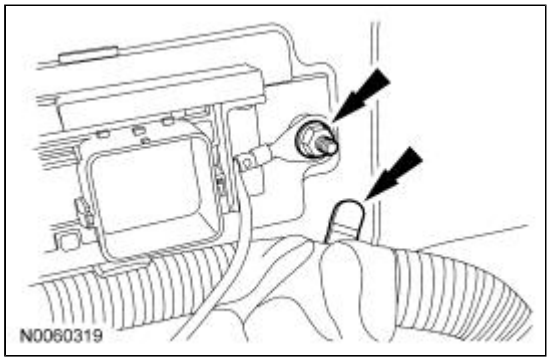
Engine

Printable View (837 KB)

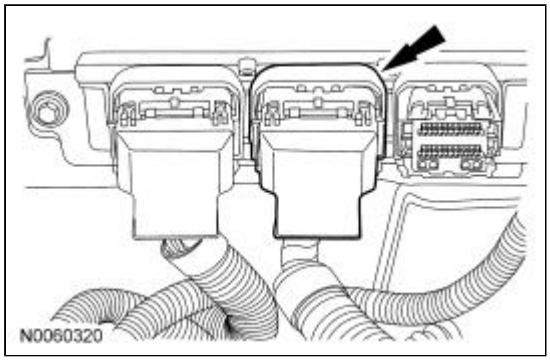
Special Tool(s)

ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073)

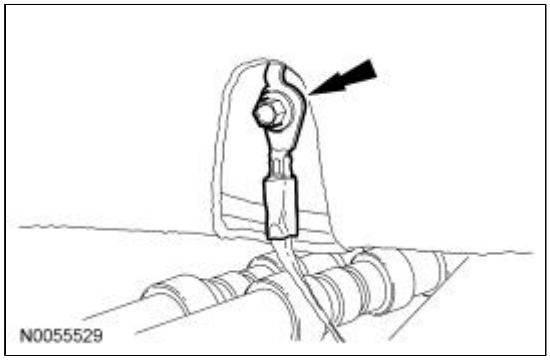
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the hood.
3. Remove the cooling module. For additional information, refer to Section 303-03 .
4. Remove the bypass tube. For additional information, refer to Section 303-03 .
5. If servicing the engine on a four wheel drive (4WD) vehicle, remove the front drive shaft. For additional information, refer to Section 205-01 .
6. Remove the starter. For additional information, refer to Section 303-06 .
7. Remove the accessory drive belt.
8. Remove the nut and the ground cable and disconnect the wiring harness retainer.



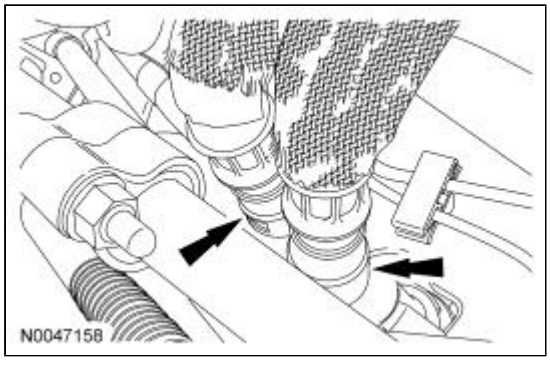
9. Disconnect the powertrain control module (PCM) electrical connector.



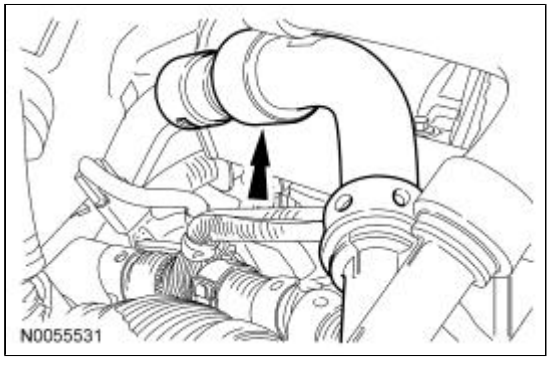
10. Remove the bolt and the ground cable.



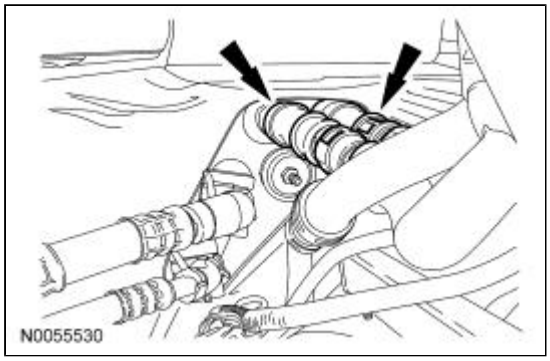
11. If equipped, disconnect the 2 auxiliary heat coolant hose quick connect couplings.



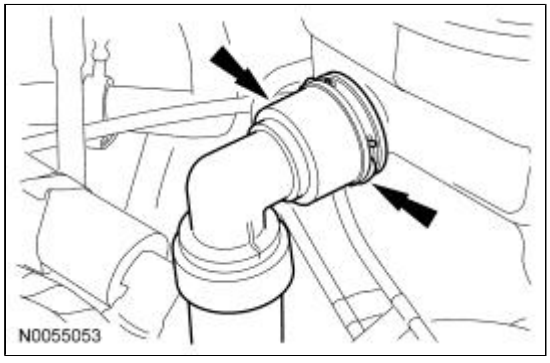
12. Disconnect the heater coolant hose quick connect coupling.



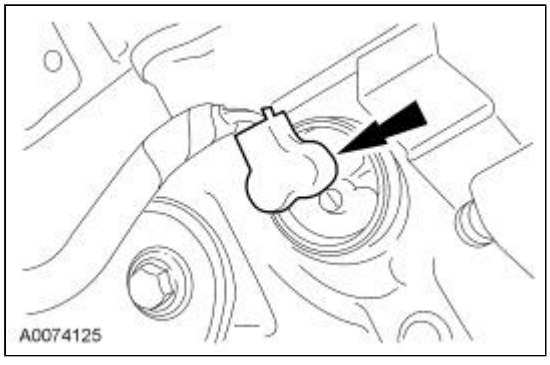
13. Disconnect and remove the 2 heater coolant hose quick connect couplings.



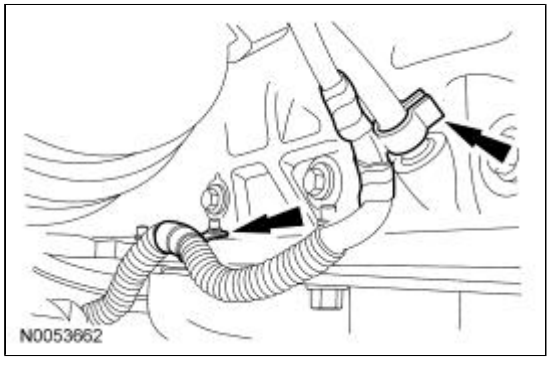
14. Remove the clip and disconnect the degas bottle coolant outlet hose quick connect coupling.



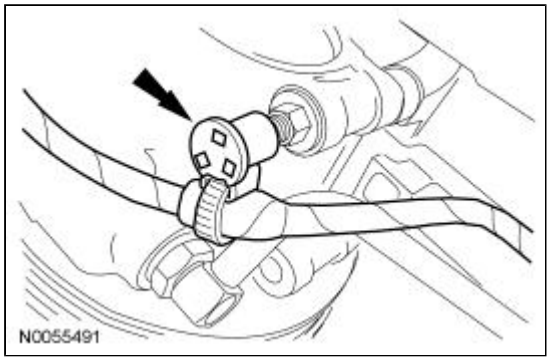
15. If equipped, disconnect the block heater electrical connector.



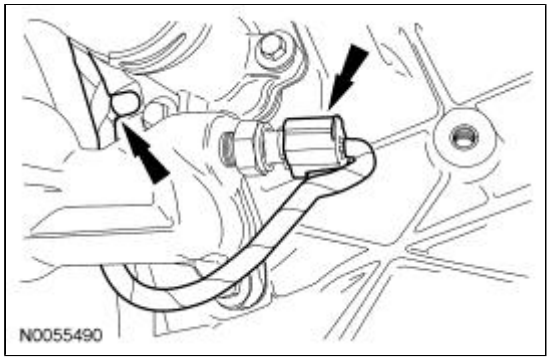
16. If equipped, disconnect the block heater wiring harness retainers.



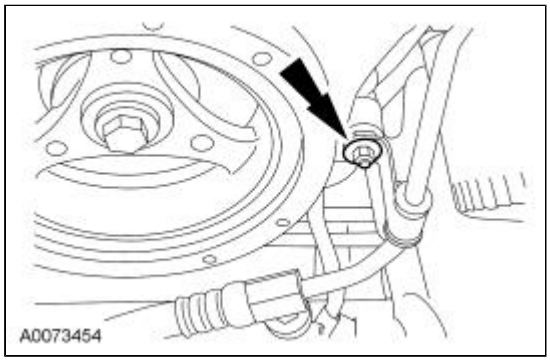
17. Disconnect the wiring harness position retainer from the power steering pump stud bolt.



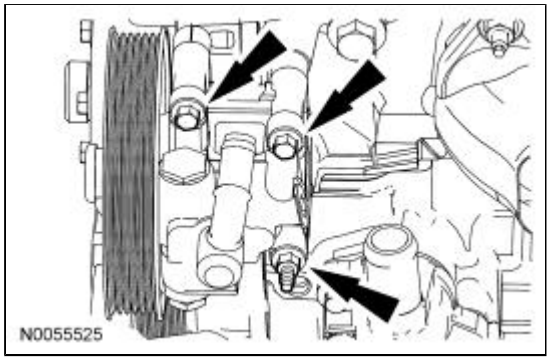
18. Disconnect the wiring harness position retainer and the engine oil pressure (EOP) switch electrical connector and position the wiring harness aside.



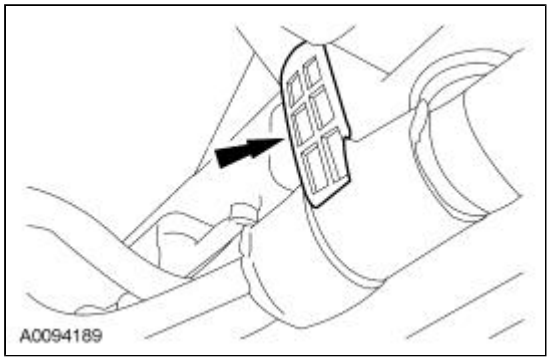
19. Remove the nut and the power steering pressure tube support bracket.



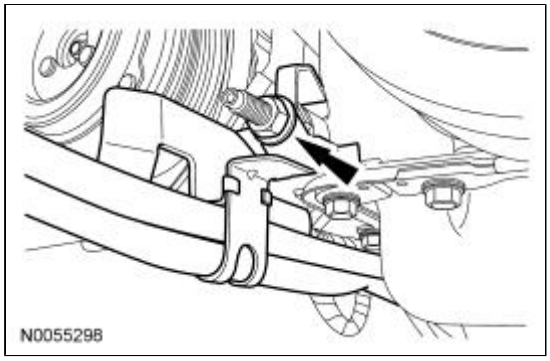
20. Remove the 2 bolts, the stud bolt and position the power steering pump aside.



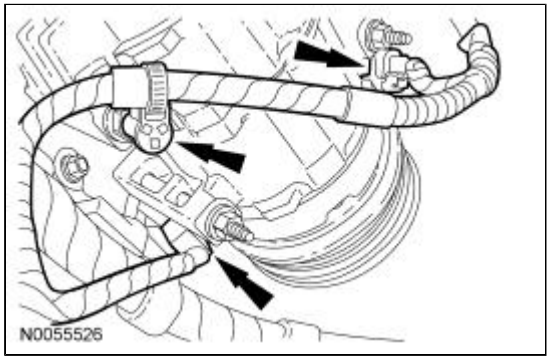
21. Disconnect the starter wiring harness retainer.



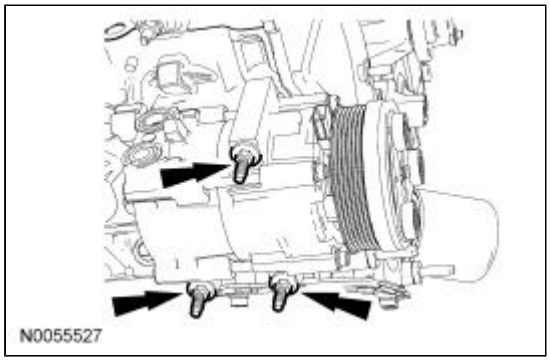
22. Remove the nut and remove the starter wiring harness and transmission fluid cooler tube support brackets from the nut.



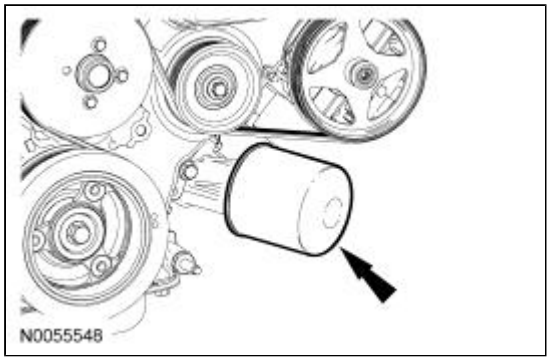
23. Disconnect the wiring harness position retainer and the crankshaft position (CKP) sensor and A/C compressor electrical connectors.



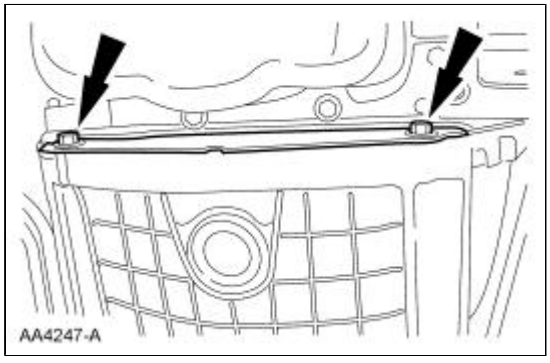
24. Remove the 3 stud bolts and position the A/C compressor aside.



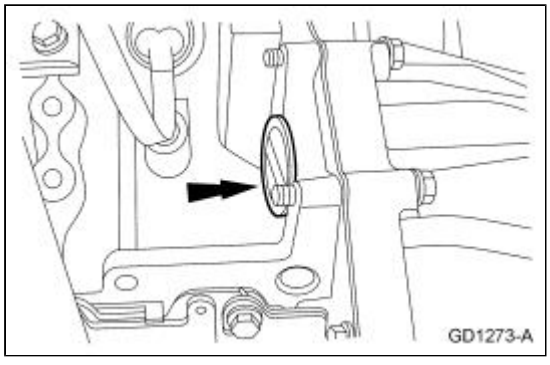
25. Remove and discard the oil filter.



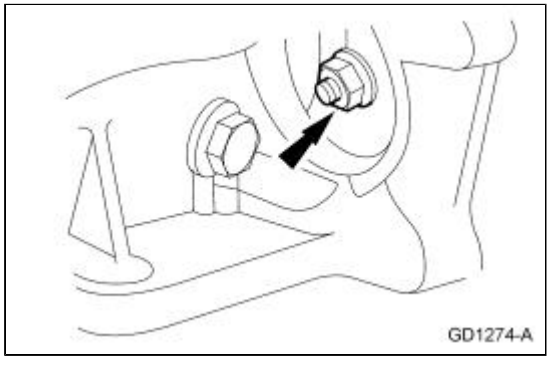
26. Remove the bolts and the flexplate inspection cover.



27. Remove the cylinder block opening cover.

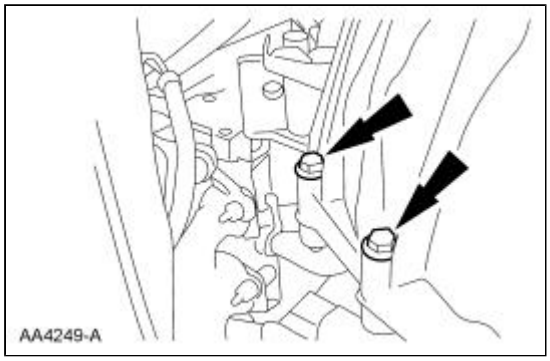


28. Remove the torque converter-to-flexplate nuts.
    - Discard the nuts.

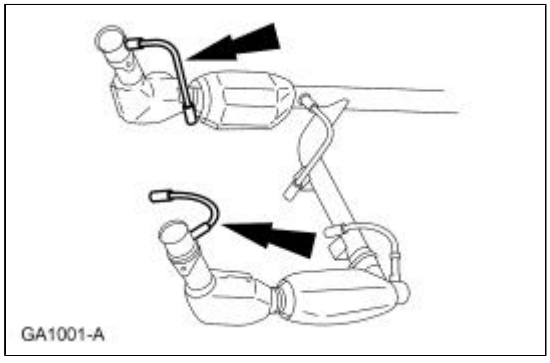


29. **NOTE:** The upper 2 transmission-to-engine bolts will be removed later.

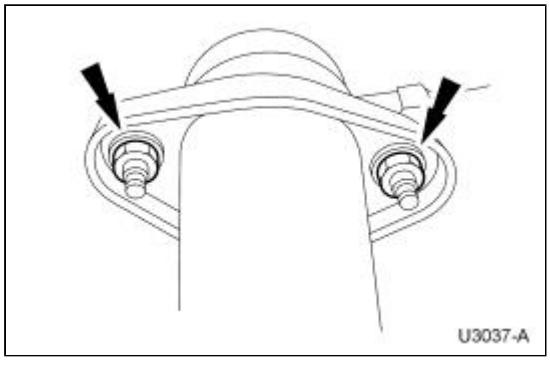
    Remove the lower 5 transmission-to-engine bolts.



30. Disconnect the heated exhaust gas oxygen sensor (HO2S) electrical connectors.



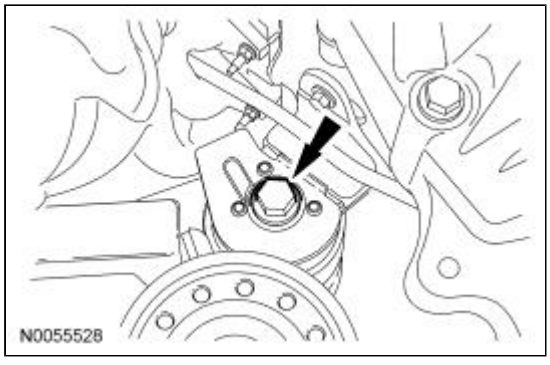
31. Remove the 4 exhaust manifold flange nuts.



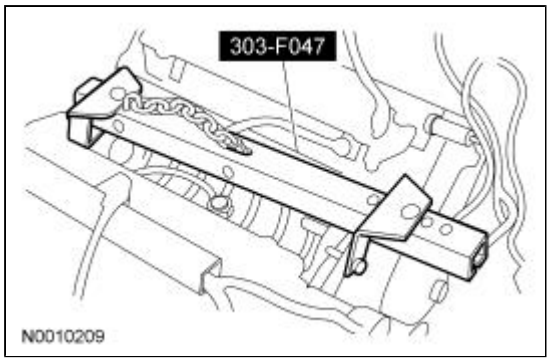
32. **CAUTION: Only use hand tools when removing the engine support insulator through bolts or damage to the engine support insulator-to-cylinder block bracket can occur.**

NOTE: LH shown, RH similar.

Remove the RH and LH engine support insulator through bolts.



33. Remove the upper 2 transmission-to-engine bolts and install the special tool.

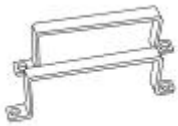
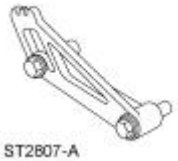


34. Using a suitable floor crane, remove the engine assembly from the vehicle.

Cylinder Head

Printable View (1780 KB)

Special Tool(s)

 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
ST2804-A	Compressor, Valve Spring 303-1039
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1730-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent

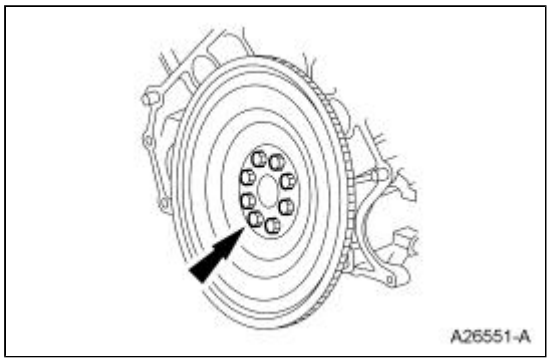
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—

All cylinder heads

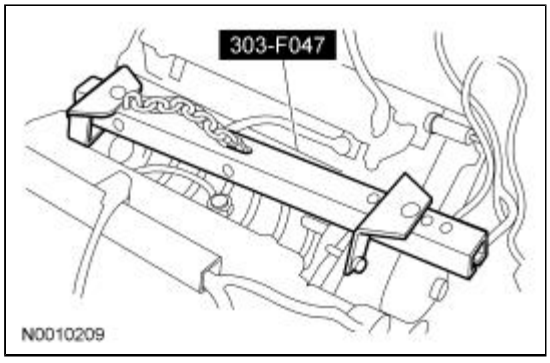
1. Remove the engine. For additional information, refer to Engine in the Removal portion of this section.

2. Remove the bolts and the flexplate.

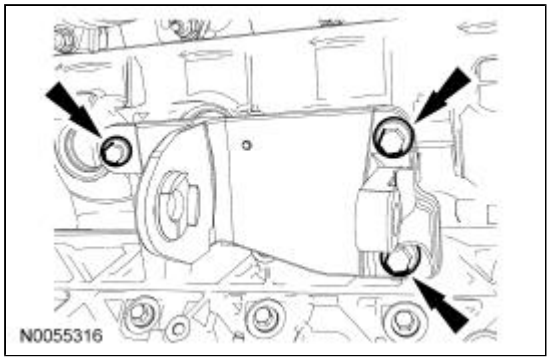


3. Install the engine onto a suitable engine stand.

4. Remove the special tool.

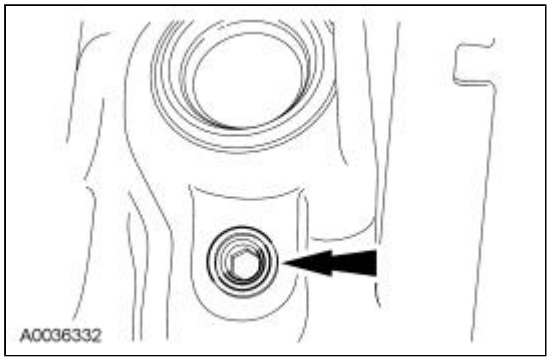


5. Remove the 3 bolts and the RH engine support insulator bracket.



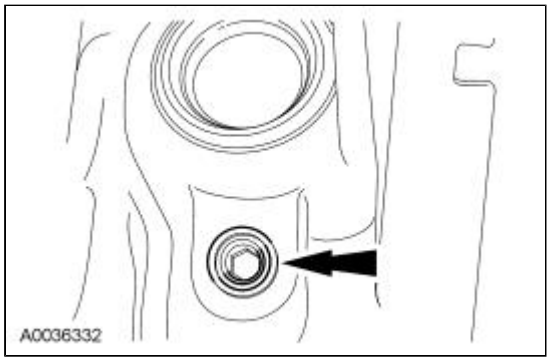
6. **NOTE:** LH shown, RH similar.

   Remove the cylinder block drain plugs and drain the coolant into a suitable container.



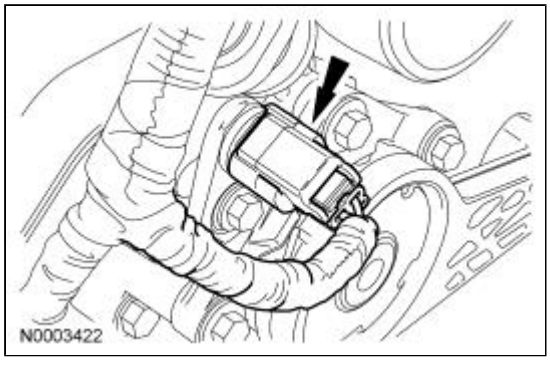
7. **NOTE:** LH shown, RH similar.

   Install the cylinder block drain plugs.
   - Tighten to 24 Nm (18 lb-ft).

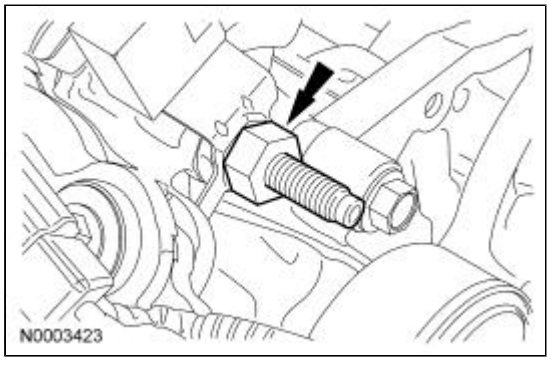


8. **NOTE:** RH shown, LH similar.

   Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

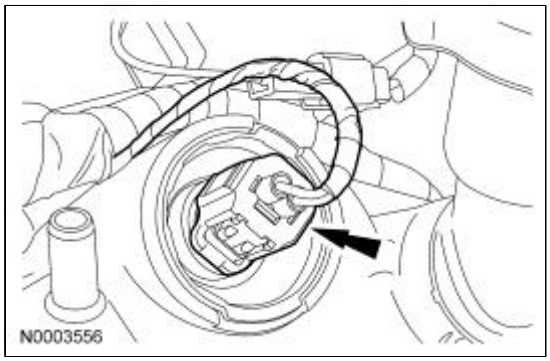


9. Remove the nut and the RH radio ignition interference capacitor.

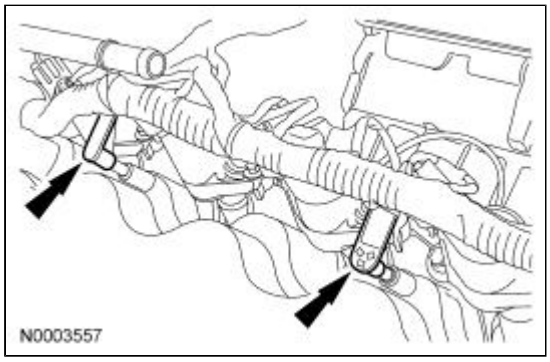


10. **NOTE:** RH shown, LH similar.

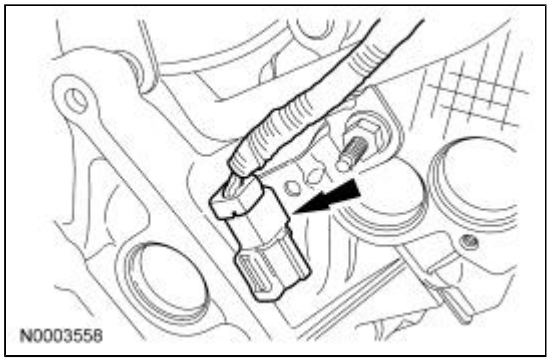
    Disconnect the RH and LH variable camshaft timing (VCT) solenoid electrical connector.



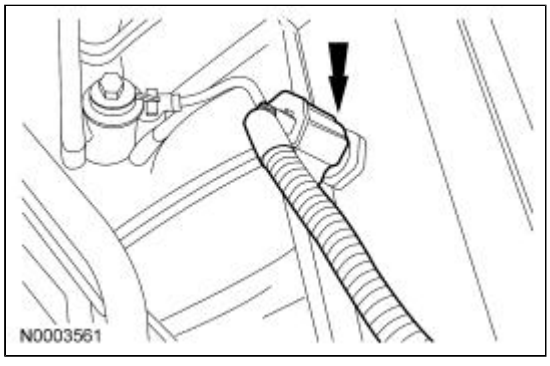
11. Disconnect the 2 engine wiring harness retainers from the RH valve cover studs.



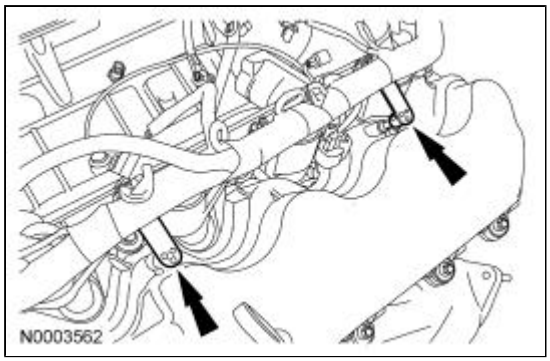
12. Disconnect the electrical connector retainer from the coolant tube.



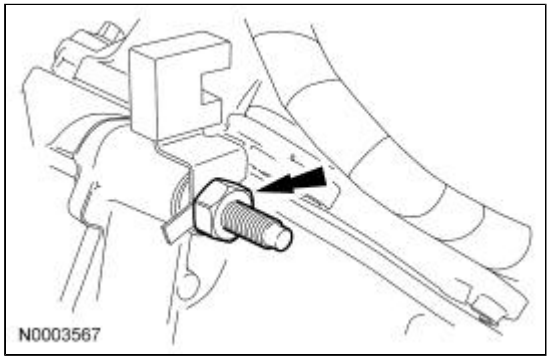
13. Disconnect the cylinder head temperature (CHT) sensor electrical connector.



14. Disconnect the 2 engine wiring harness retainers from the LH valve cover studs.

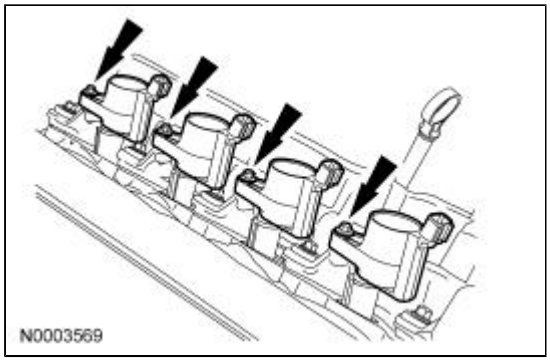


15. Remove the nut and the LH radio ignition interference capacitor.



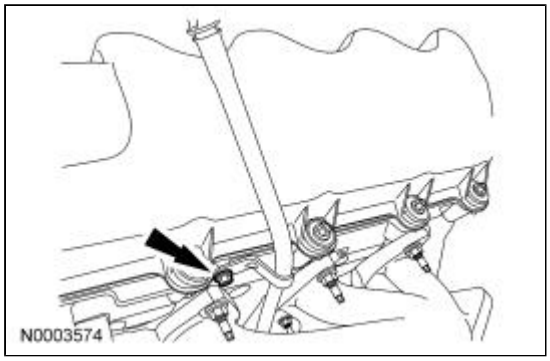
16. **NOTE:** LH shown, RH similar.

    Remove the 8 bolts and the 8 ignition coils.

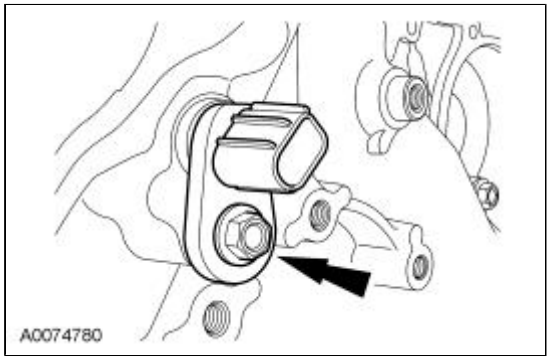


17. Remove the engine wiring harness from the engine assembly.

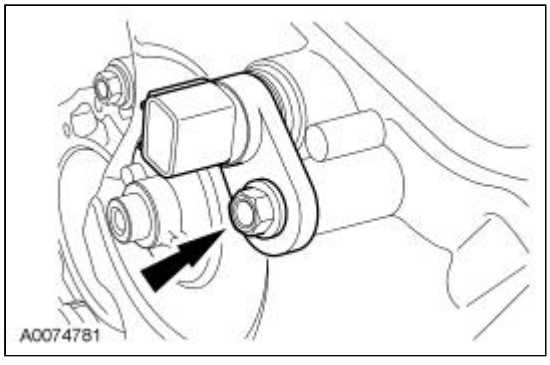
18. Remove the bolt and the oil level indicator tube.
    - Discard the O-ring seal.



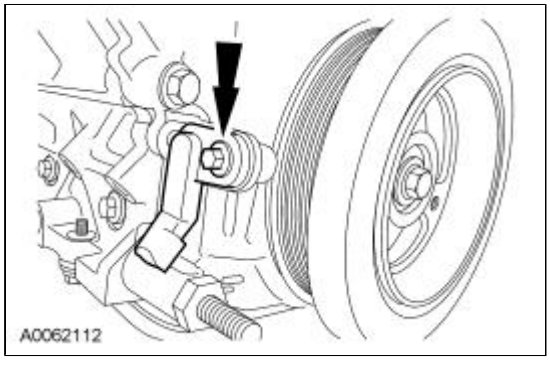
19. Remove the bolt and the RH CMP sensor.



20. Remove the bolt and the LH CMP sensor.



21. Remove the bolt and the CKP sensor.



22. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

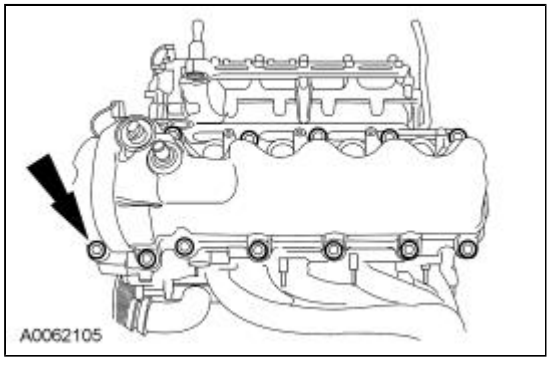
CAUTION: When removing the valve cover, make sure to avoid damaging the VCT solenoid.

NOTE: The fasteners are part of the valve cover and should not be removed.

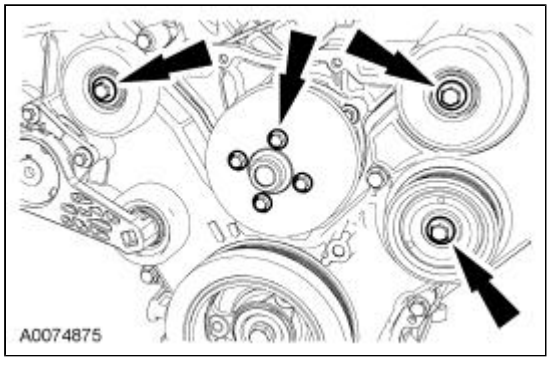
NOTE: LH shown, RH similar.

Loosen the fasteners and remove the valve covers.

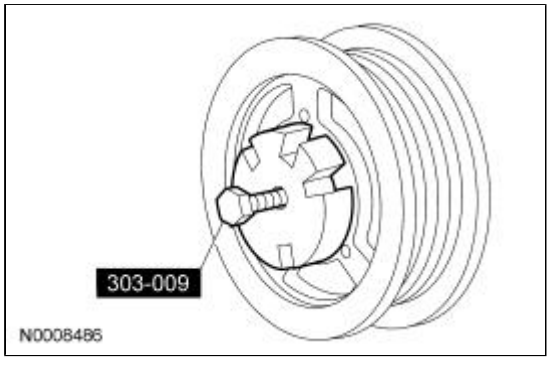
- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



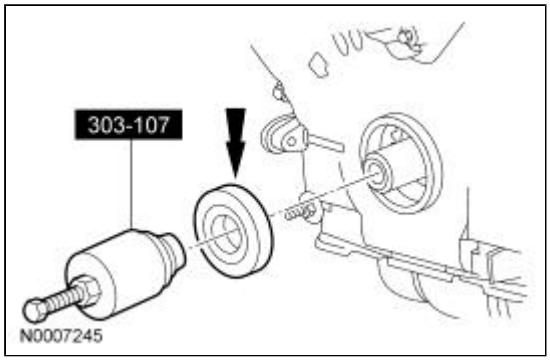
23. Remove the bolts, the coolant pump pulley and the 3 accessory drive belt idler pulleys.



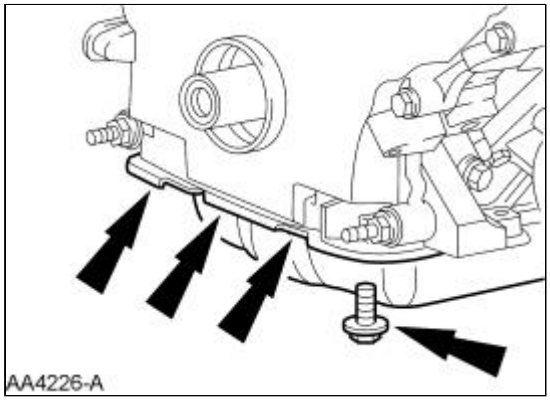
24. Remove and discard the crankshaft pulley bolt. Using the special tool, remove the crankshaft pulley.



25. Using the special tool, remove and discard the crankshaft front seal.

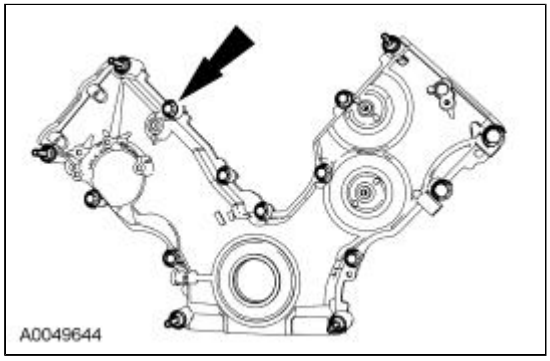


26. Remove the front 4 oil pan bolts.

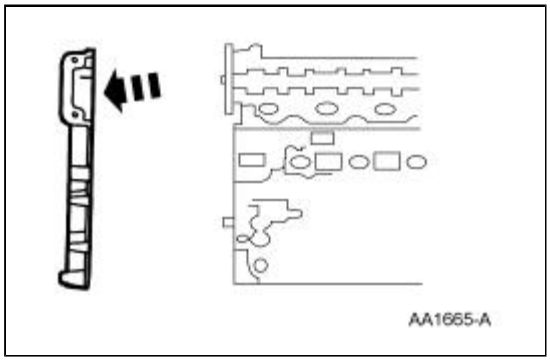


27. **NOTE:** Correct fastener location is essential for assembly procedure. Record fastener location.

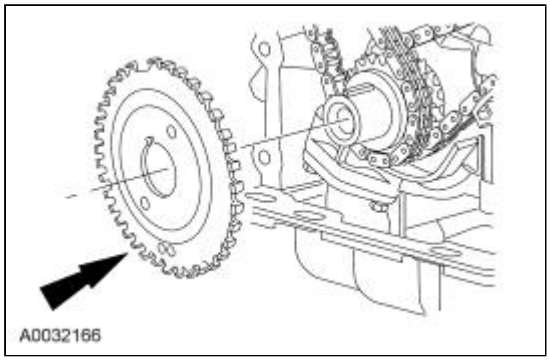
    Remove the fasteners.



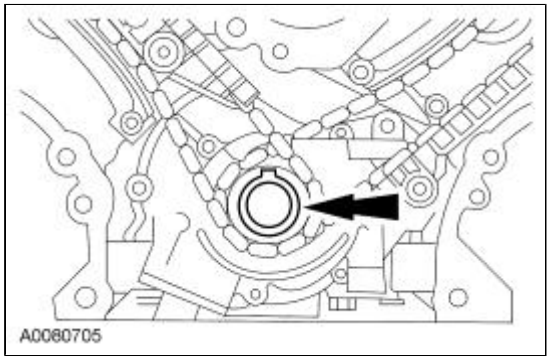
28. Remove the engine front cover from the cylinder block.



29. Remove the crankshaft sensor ring from the crankshaft.

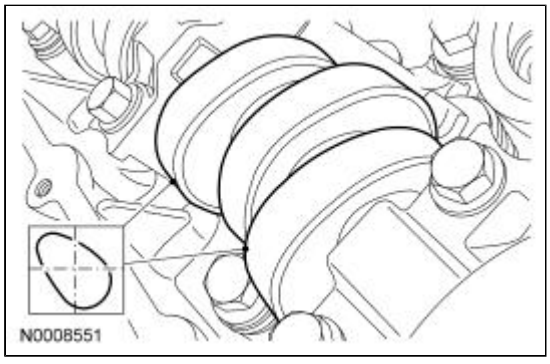


30. Position the crankshaft keyway at the 12 o'clock position.



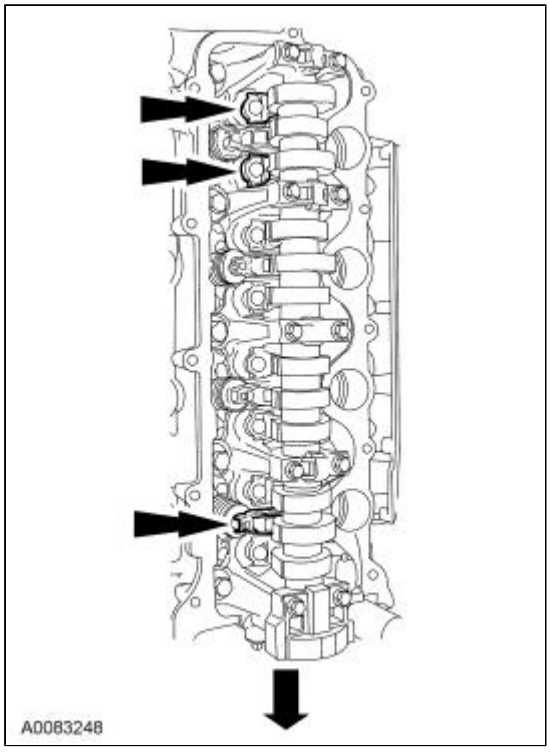
31. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

    The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.



32. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

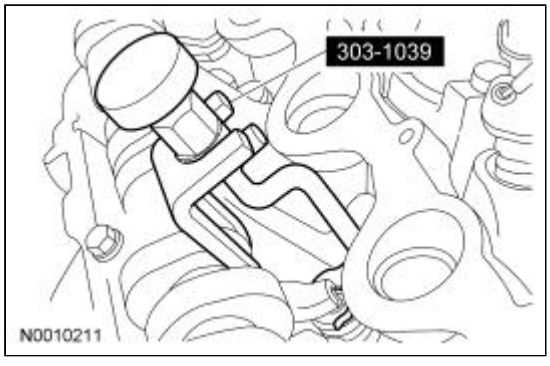
    Remove only the 3 camshaft roller followers shown in the illustration from the RH cylinder head.



33. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

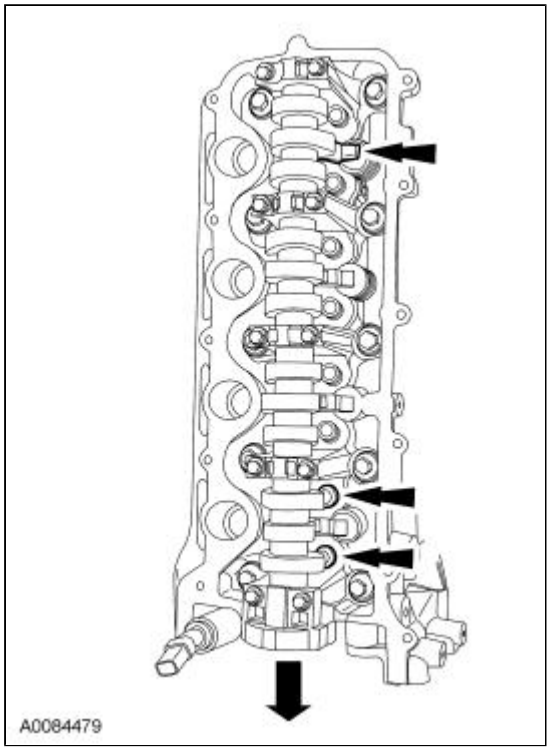
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the RH cylinder head.



34. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

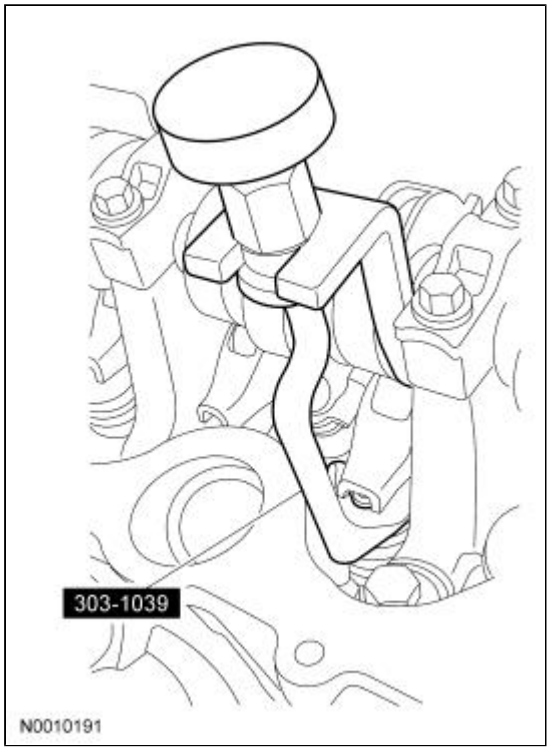
    Remove only the 3 camshaft roller followers shown in the illustration from the LH cylinder head.



35. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

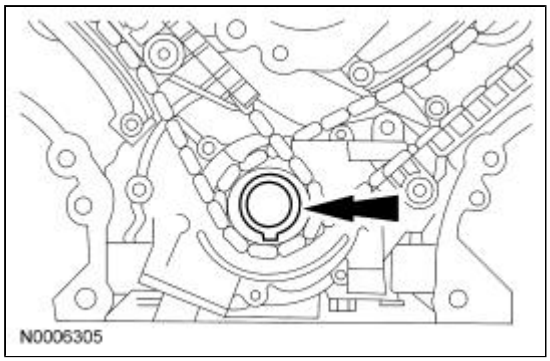
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the LH cylinder head.



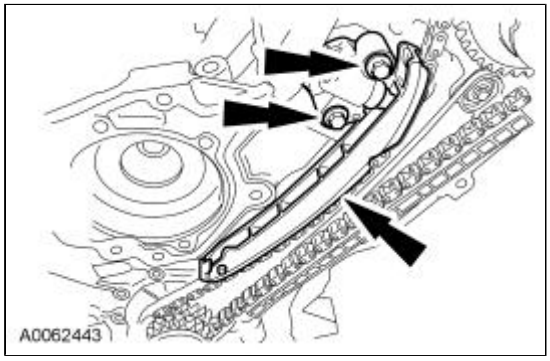
36. **CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.**

Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



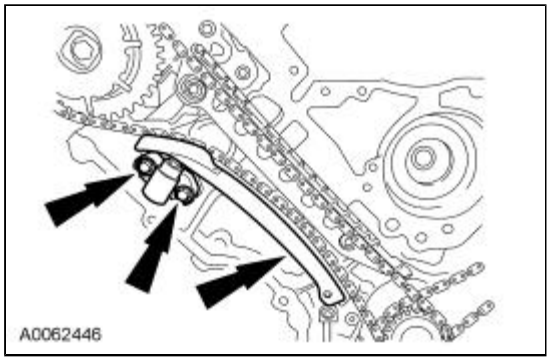
37. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the LH timing chain tensioner and tensioner arm.

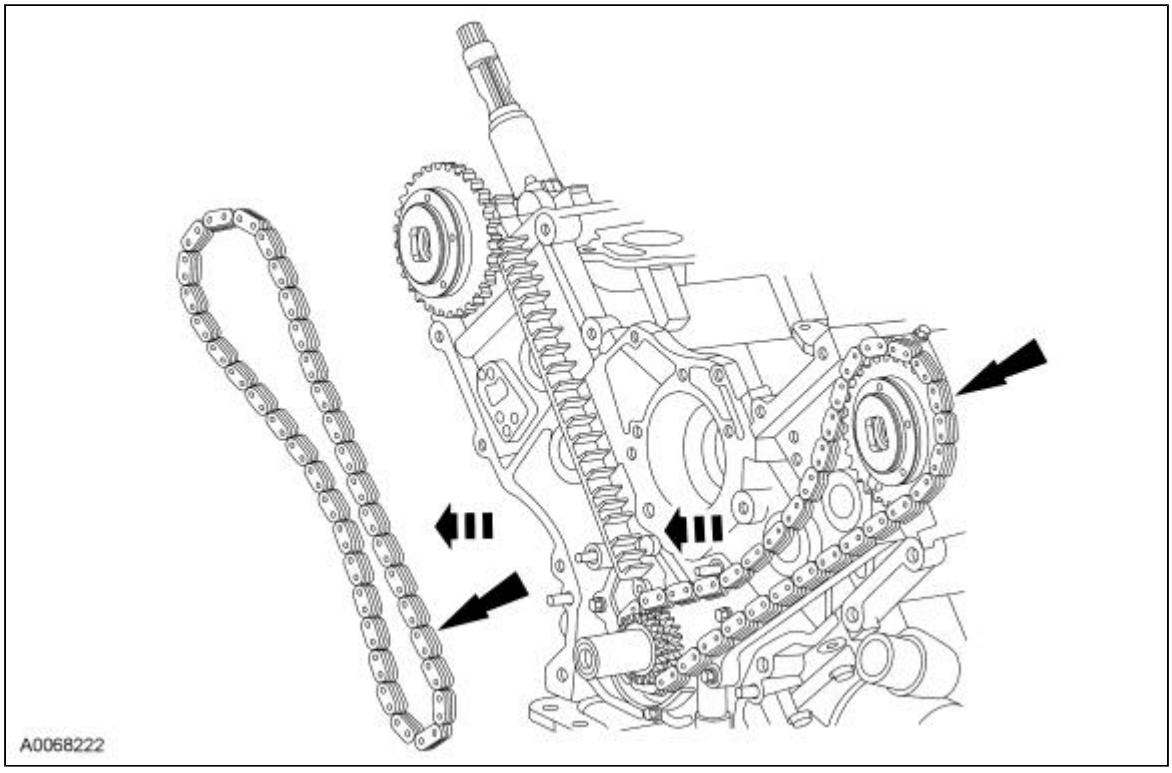


38. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the RH timing chain tensioner and tensioner arm.



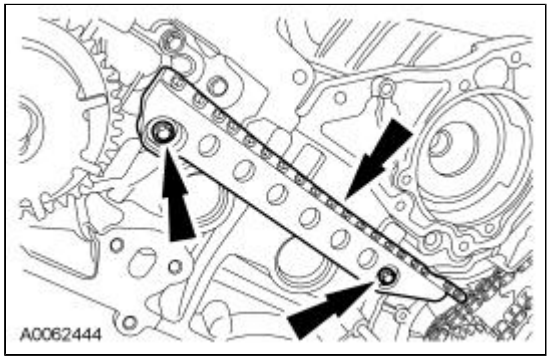
39. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



40. **NOTE:** RH shown, LH similar.

Remove the LH and RH timing chain guides.

- Remove the bolts.
- Remove both timing chain guides.

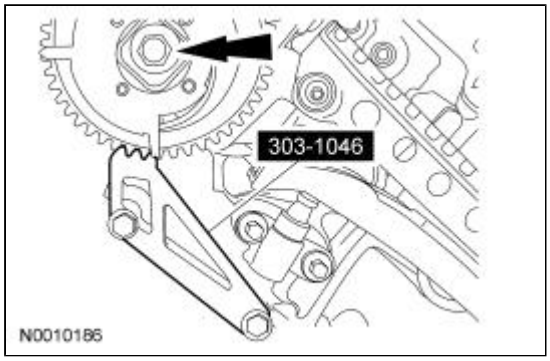


41. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

Using the special tool, remove the bolt and the RH VCT phaser sprocket assembly.

- Discard the camshaft phaser sprocket bolt.

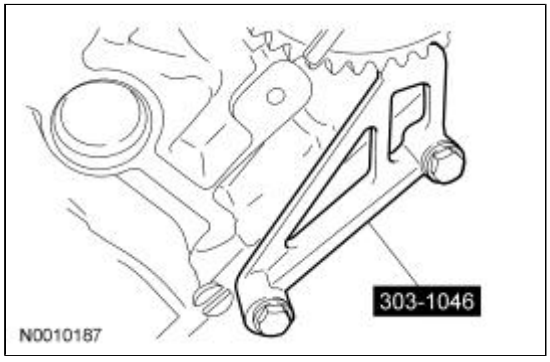


42. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

Using the special tool, remove the bolt and the LH VCT phaser sprocket assembly.

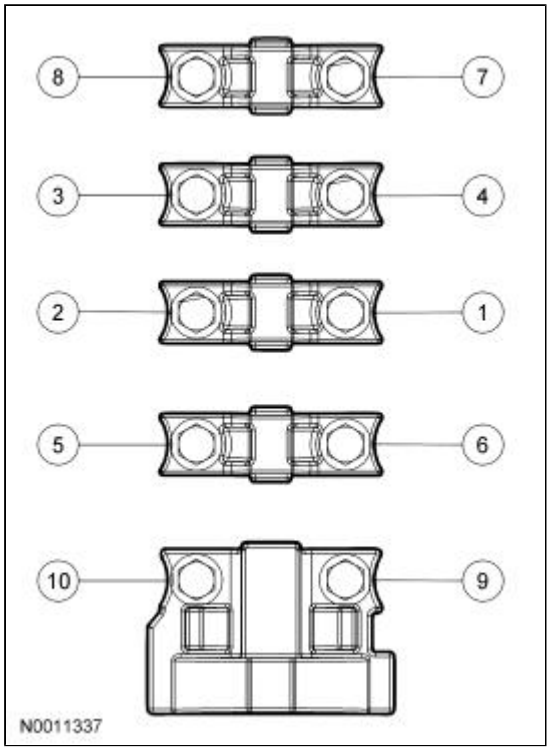
- Discard the camshaft phaser sprocket bolt.



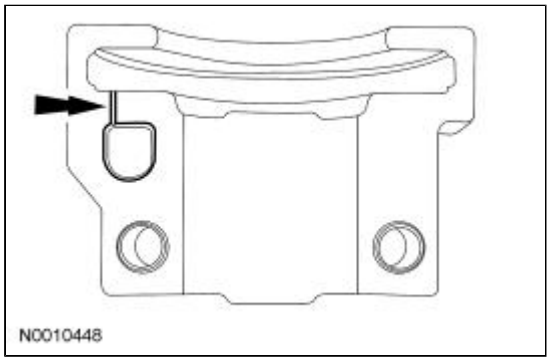
43. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

Remove the bolts in the sequence shown and remove the RH cylinder head front camshaft bearing cap and then the remaining bearing caps.



44. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.

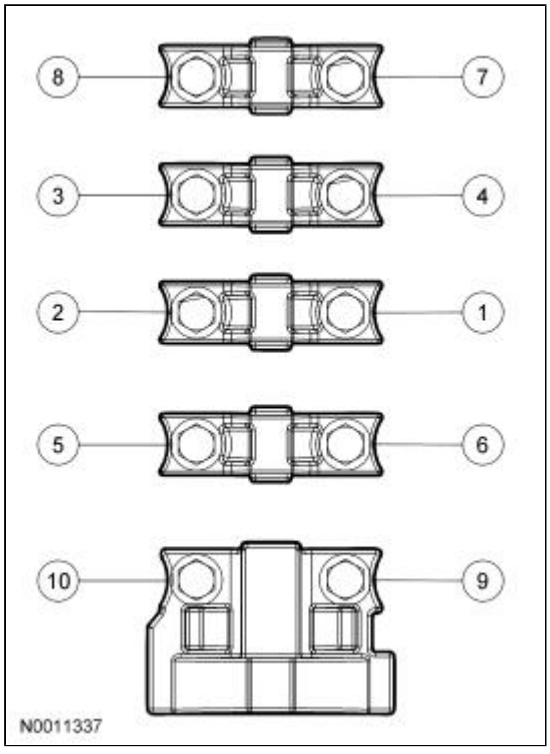


45. Remove the RH camshaft.

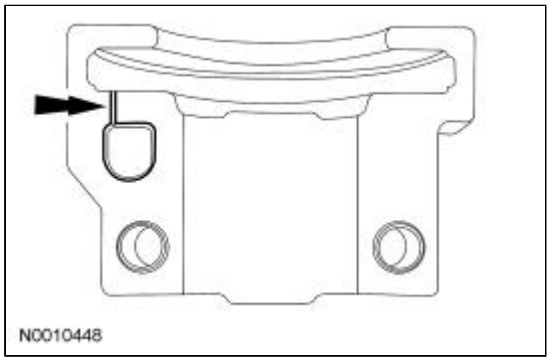
46. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the LH cylinder head front camshaft bearing cap and then the remaining bearing caps.



47. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



48. Remove the LH camshaft.

49. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

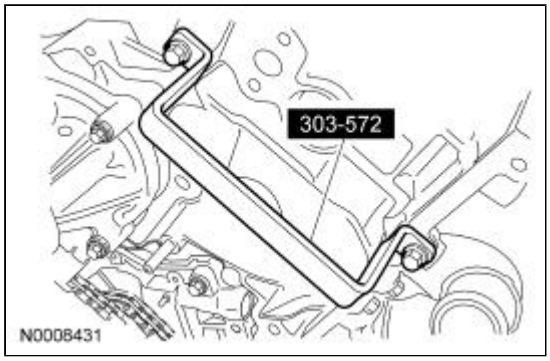
    Remove all of the remaining camshaft roller followers from the cylinder heads.

LH cylinder head

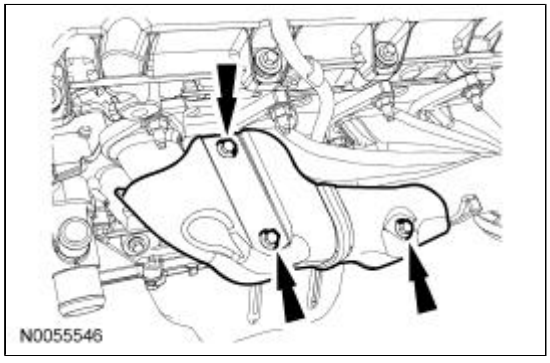
50. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the hydraulic lash adjusters from the LH cylinder head.

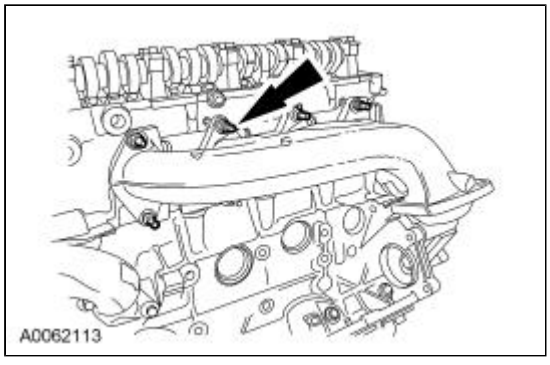
51. Install the special tool onto the LH cylinder head.



52. Remove the 3 bolts and the exhaust manifold heat shield.



53. Remove the 8 nuts, the 8 studs and the LH exhaust manifold.
    - Discard the gaskets, nuts and studs.
    - Inspect the exhaust manifold. For additional information, refer to Section 303-00 .

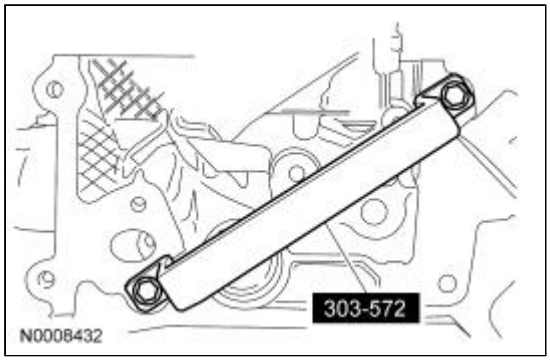


RH cylinder head

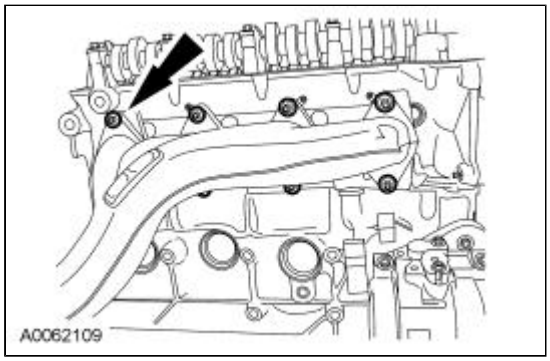
54. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the hydraulic lash adjusters from the RH cylinder heads.

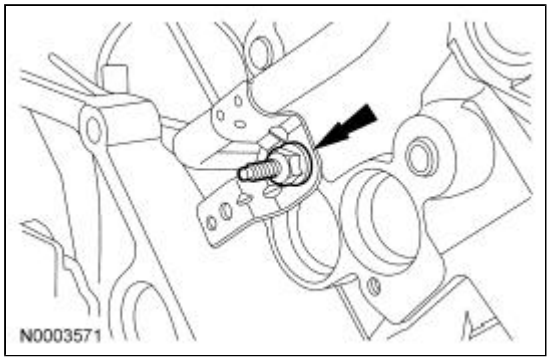
55. Install the special tool onto the RH cylinder head.



56. Remove the 8 nuts, the 8 studs and the RH exhaust manifold.
    - Discard the gasket, nuts and studs.
    - Inspect the exhaust manifold. For additional information, refer to Section 303-00 .



57. Remove the stud bolt and the coolant tube.
    - Discard the O-ring seals.



All cylinder heads

58. **CAUTION: The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.**

    CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

    CAUTION: The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield designed and cannot be reused.

    CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other

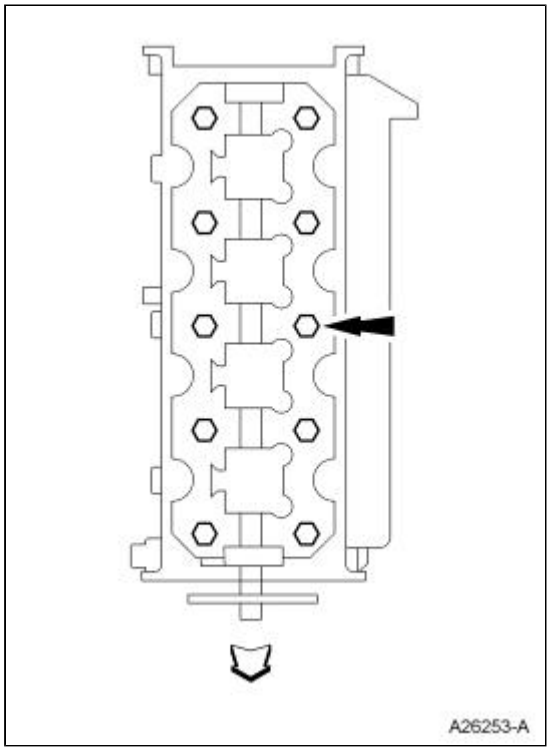
abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

CAUTION: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: RH shown, LH similar.

Remove the bolts and the cylinder head.

- Discard the cylinder head gasket.
- Discard the cylinder head bolts.



59. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

CAUTION: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block.

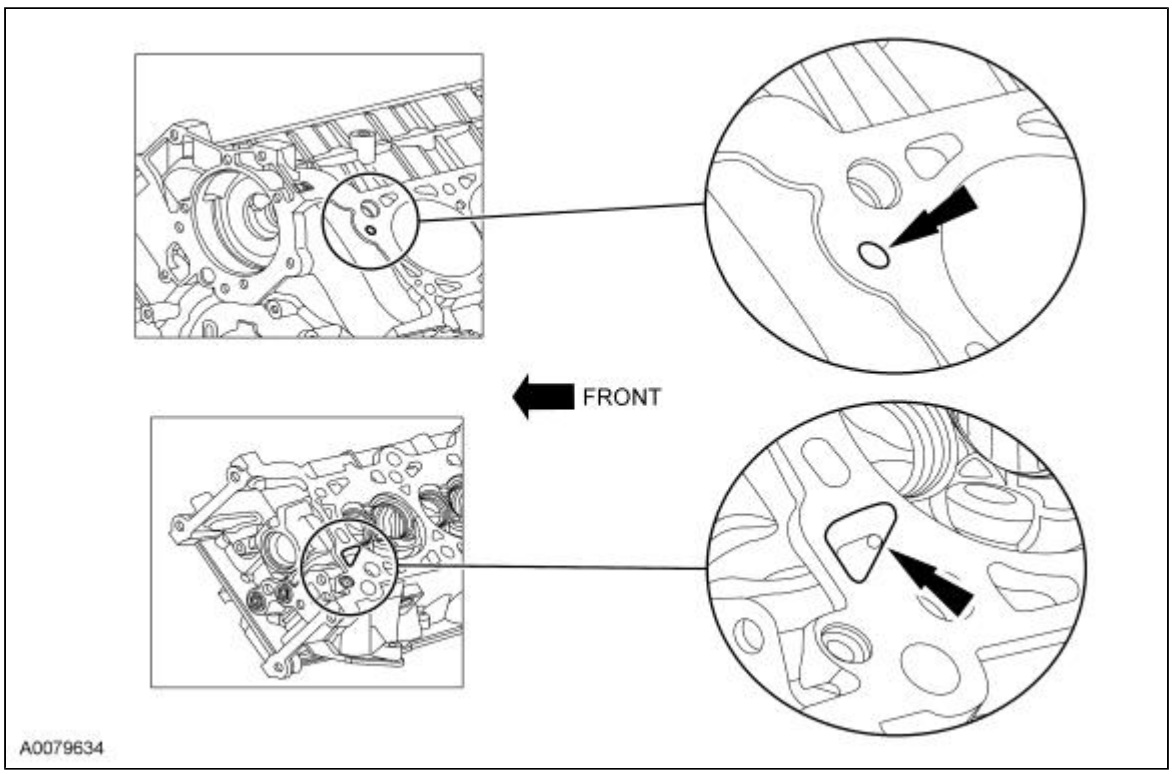
1. Remove any large deposits of silicone or gasket material with a plastic scraper.
2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

60. **NOTE:** Make sure all cylinder head surfaces are clear of any gasket material, RTV, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

NOTE: Use a straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot length. For example, if the straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

NOTE: LH shown, RH similar.

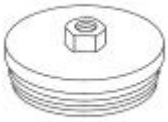
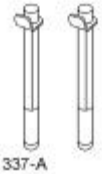
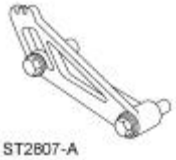
Support the cylinder head on a bench with the head gasket side up. Inspect all areas of the deck face with a straightedge, paying particular attention to the oil pressure feed area. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches longer than 0.0254 mm (0.001 in).



Engine

Printable View (2275 KB)

Special Tool(s)

ST1481-A	Remover, Crankshaft Rear Slinger 303-514 (T95P-6701-AH)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1337-A	Installer, Connecting Rod 303-442 (T93P-6136-A)
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1730-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
	Remover/Installer, Cylinder Head

ST1668-A	303-572 (T97T-6000-A)
ST2804-A	Compressor, Valve Spring 303-1039
ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—

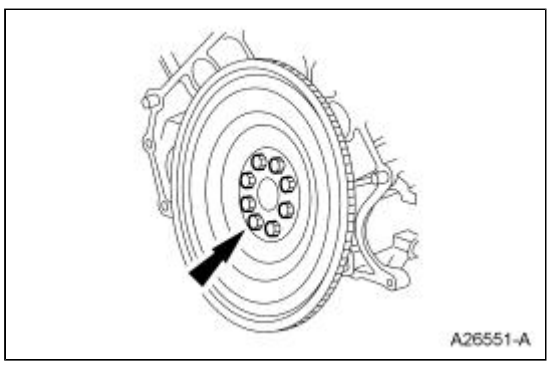
CAUTION: Remove the cylinder heads before removing the crankshaft. Failure to do so can result in engine damage.

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

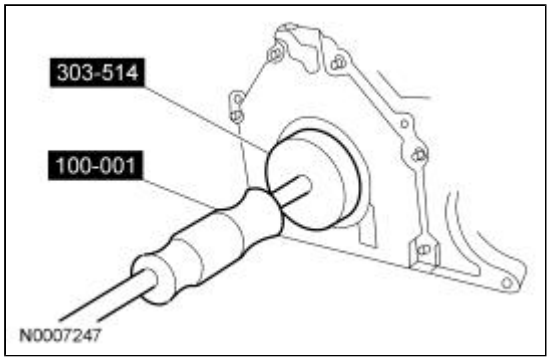
NOTE: The flexplate, crankshaft rear seal and the crankshaft rear oil slinger must be removed before mounting the engine on the engine stand.

NOTE: For additional information, refer to the exploded view under the assembly procedure in this section.

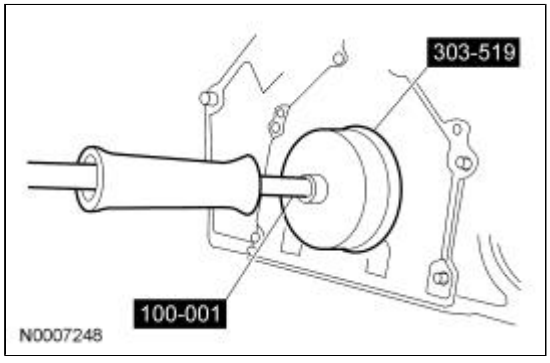
1. Remove the bolts and the flexplate.



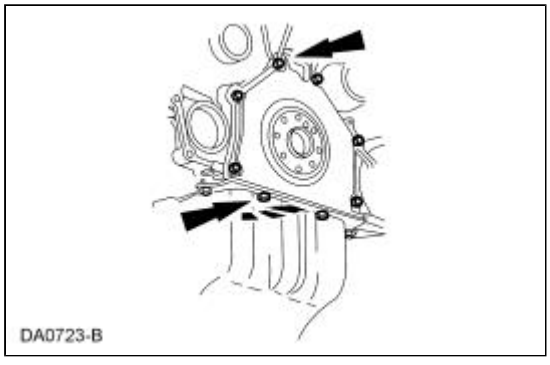
2. Using the special tools, remove and discard the crankshaft rear oil slinger.



3. Using the special tools, remove and discard the crankshaft rear seal.

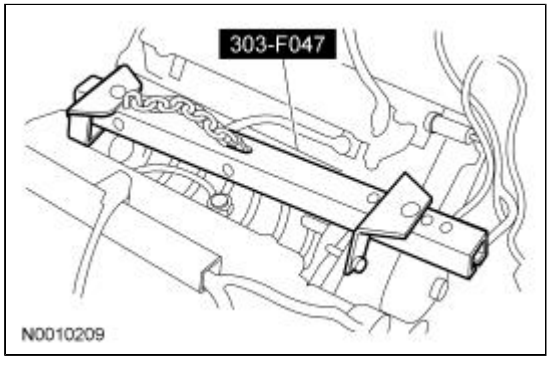


4. Remove the 8 bolts and the crankshaft rear seal retainer plate.

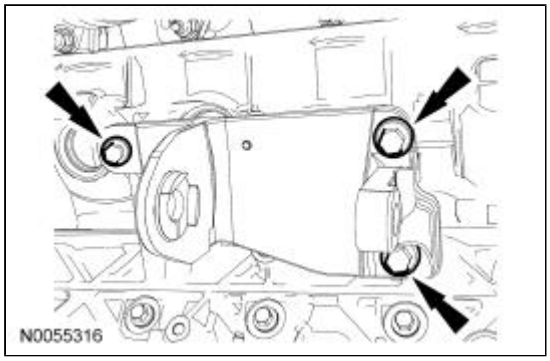


5. Mount the engine on a suitable work stand.

6. Remove the special tool.

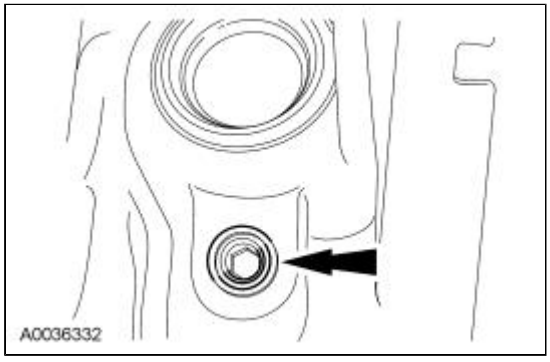


7. Remove the 3 bolts and the RH engine support insulator bracket.



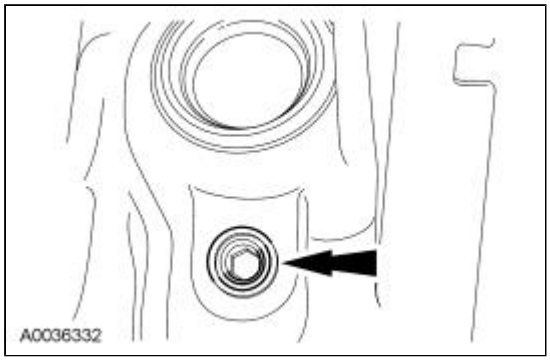
8. **NOTE:** LH shown, RH similar.

   Remove the cylinder block drain plugs and drain the coolant into a suitable container.

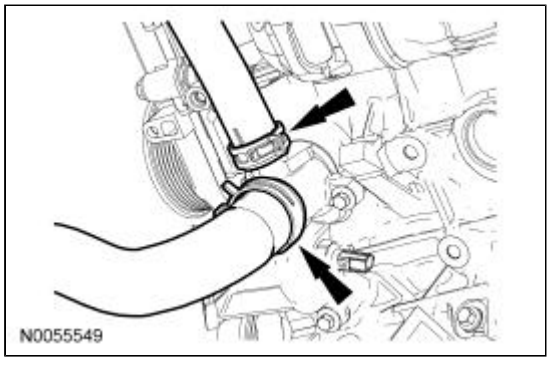


9. **NOTE:** LH shown, RH similar.

   Install the cylinder block drain plugs.
   - Tighten to 24 Nm (18 lb-ft).

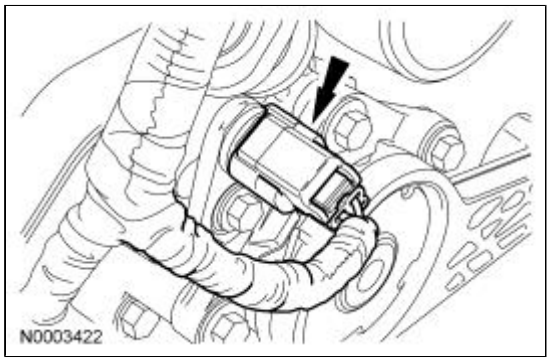


10. Disconnect the 2 coolant hoses from the oil filter adapter.

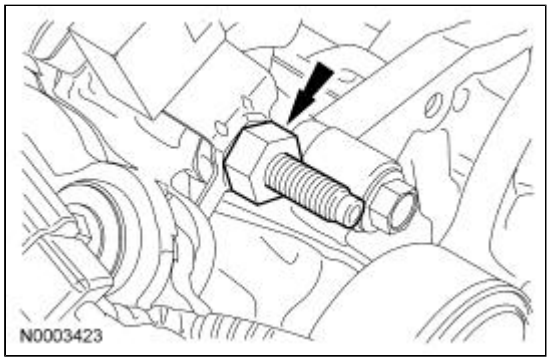


11. **NOTE:** RH shown, LH similar.

    Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

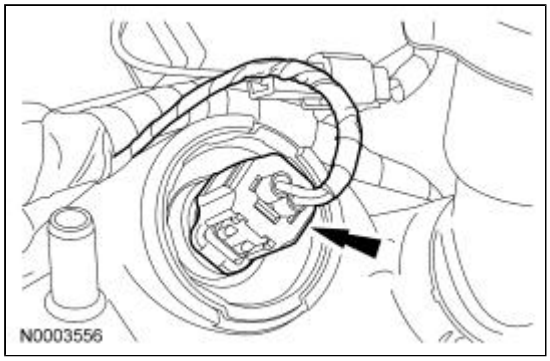


12. Remove the nut and the RH radio ignition interference capacitor.

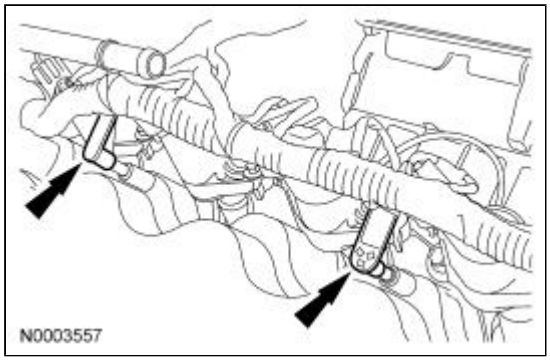


13. **NOTE:** RH shown, LH similar.

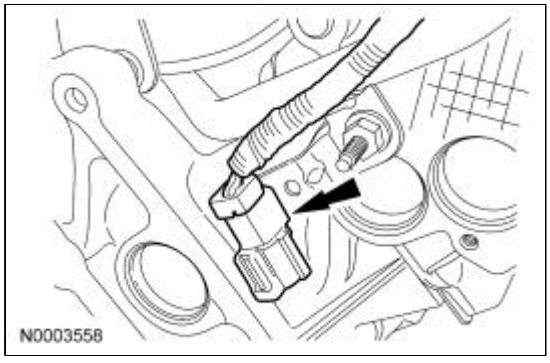
    Disconnect the RH and LH variable camshaft timing (VCT) solenoid electrical connector.



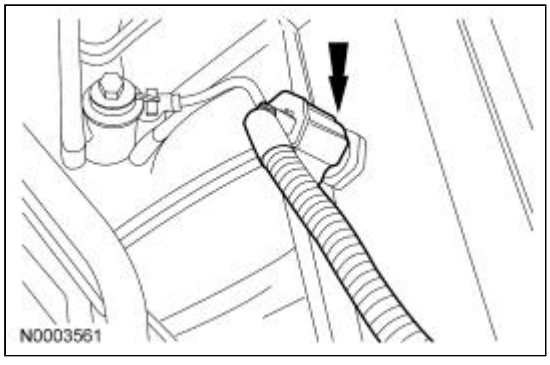
14. Disconnect the 2 engine wiring harness retainers from the RH valve cover studs.



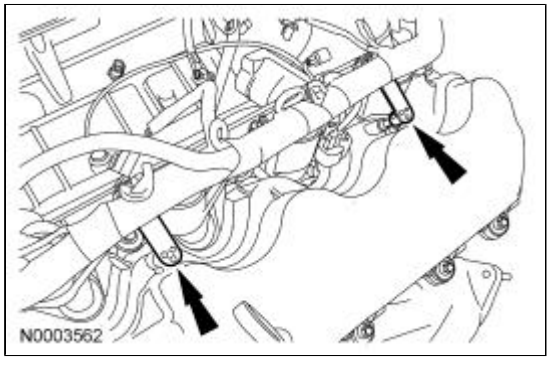
15. Disconnect the electrical connector retainer from the coolant tube.



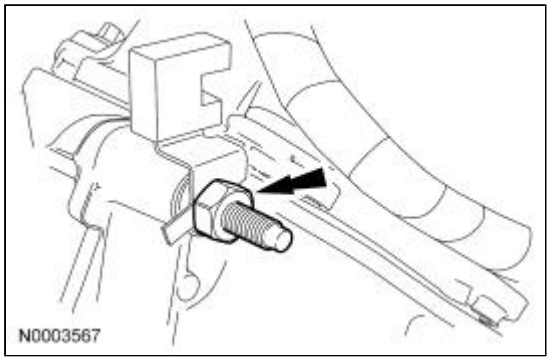
16. Disconnect the cylinder head temperature (CHT) sensor electrical connector.



17. Disconnect the 2 engine wiring harness retainers from the LH valve cover studs.

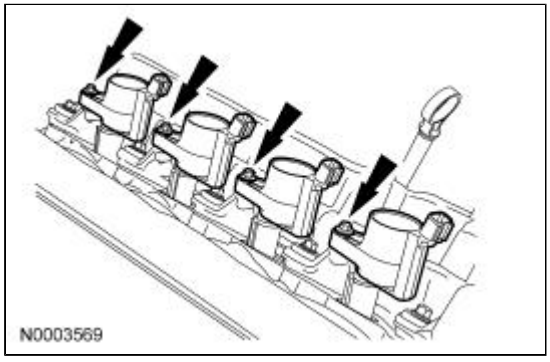


18. Remove the nut and the LH radio ignition interference capacitor.



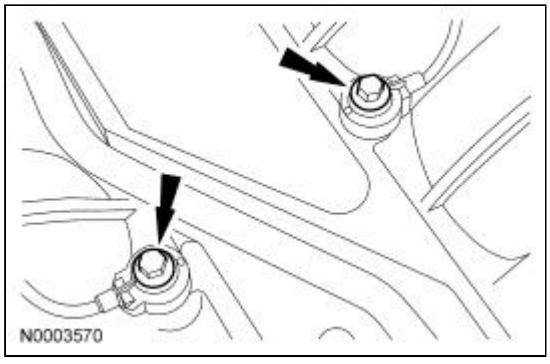
19. **NOTE:** LH shown, RH similar.

    Remove the 8 bolts and the 8 ignition coils.

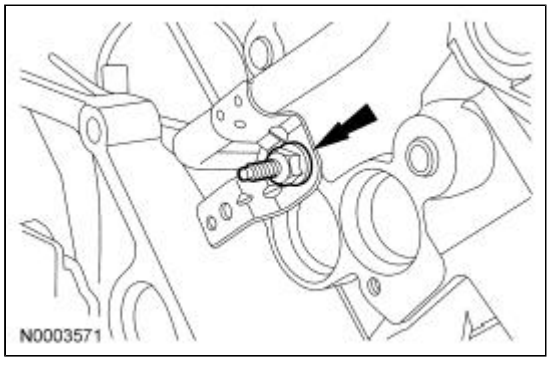


20. Remove the engine wiring harness from the engine assembly.

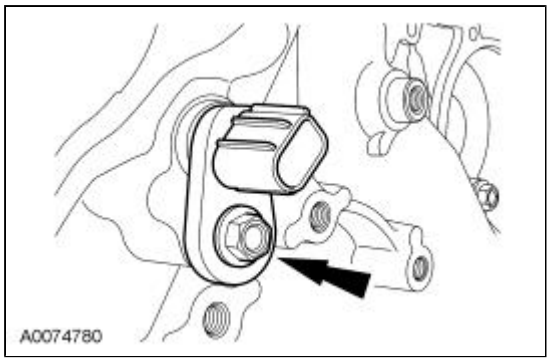
21. Remove the 2 bolts and the 2 knock sensors (KS).



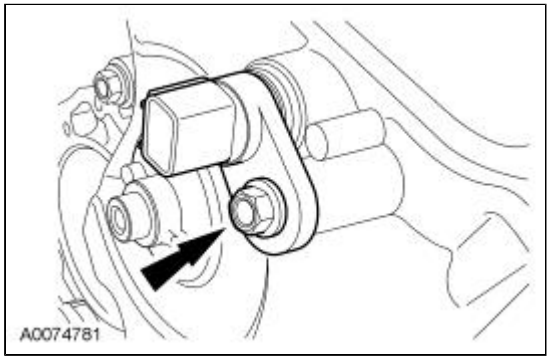
22. Remove the stud bolt and the coolant tube.
    - Discard the O-ring seal.



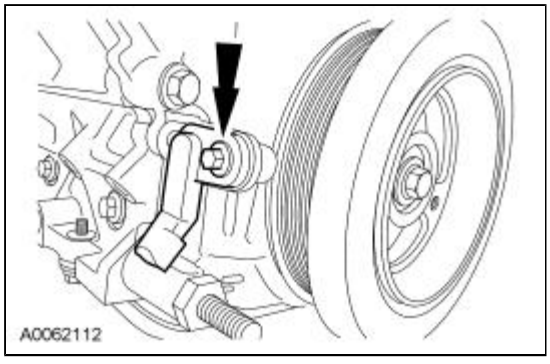
23. Remove the bolt and the RH CMP sensor.



24. Remove the bolt and the LH CMP sensor.



25. Remove the bolt and the crankshaft position (CKP) sensor.



26. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

CAUTION: When removing the valve cover, make sure to avoid damaging the VCT solenoid.

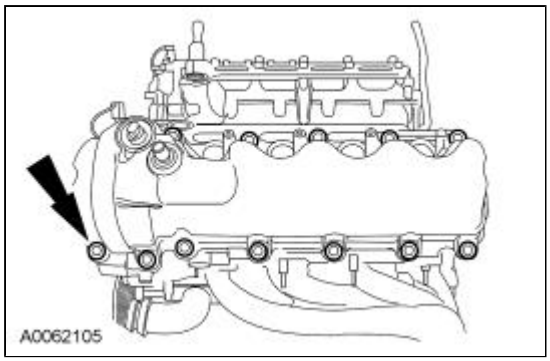
NOTE: The fasteners are part of the valve cover and should not be removed.

NOTE: LH shown, RH similar.

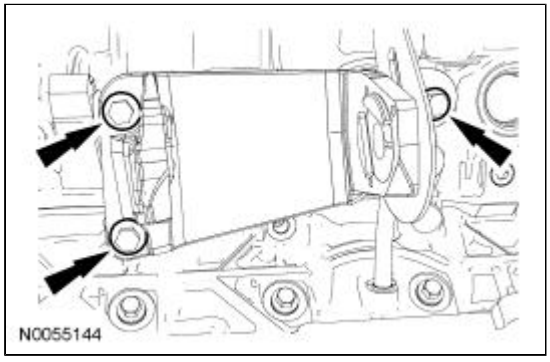
Loosen the fasteners and remove the valve covers.

- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket.

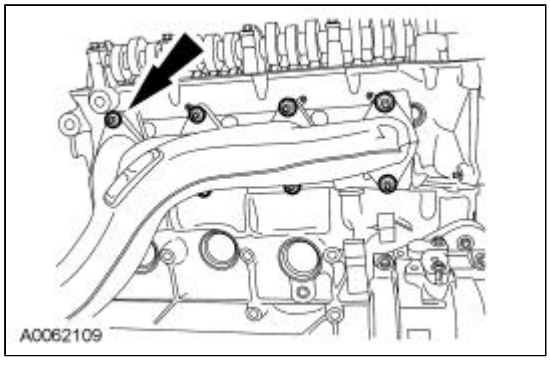
Clean the valve cover gasket groove with soap and water or a suitable solvent.



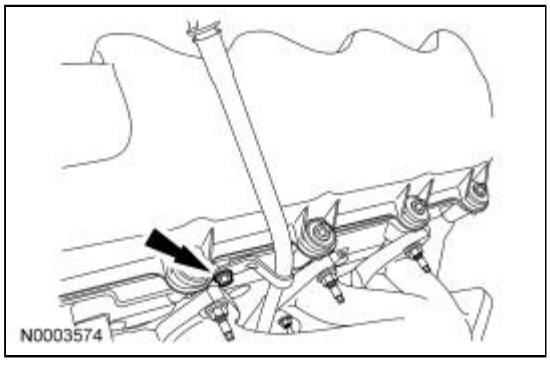
27. Remove the bolts and the LH engine support insulator-to-cylinder block bracket.



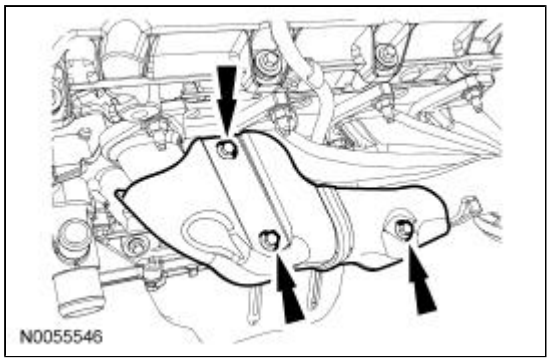
28. Remove the 8 nuts, the 8 studs and the RH exhaust manifold.
    - Discard the gaskets, nuts and studs.
    - Inspect the exhaust manifold. For additional information, refer to Section 303-00 .



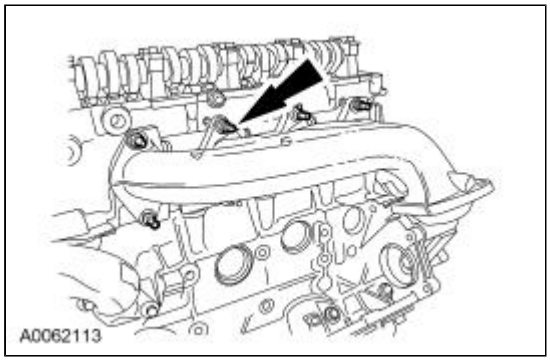
29. Remove the bolt and the oil level indicator tube.
    - Discard the O-ring seal.



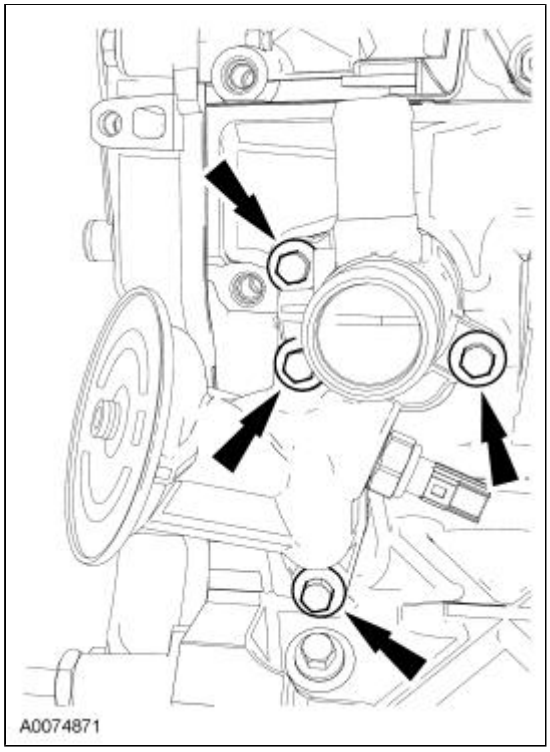
30. Remove the 3 bolts and the LH exhaust manifold heat shield.



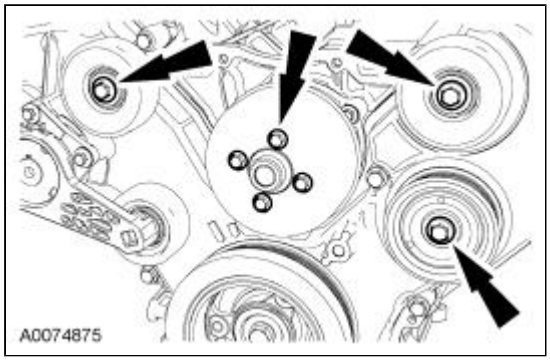
31. Remove the 8 nuts, the 8 studs and the LH exhaust manifold.
    - Discard the gaskets, nuts and studs.
    - Inspect the exhaust manifold. For additional information, refer to Section 303-00 .



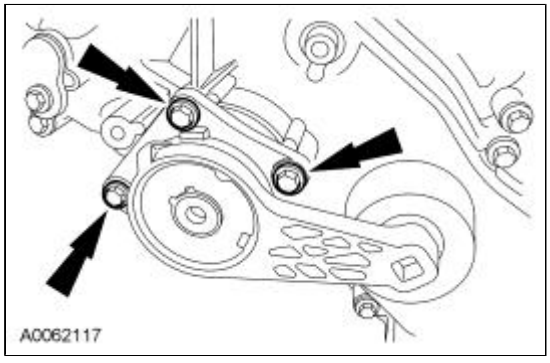
32. Remove the bolts and the oil filter adapter.
    - Discard the gasket.



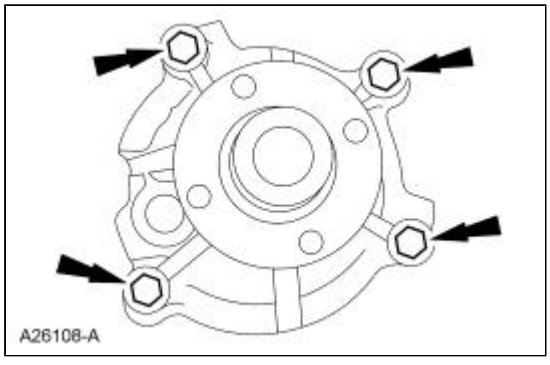
33. Remove the bolts, the coolant pump pulley and the 3 accessory drive belt idler pulleys.



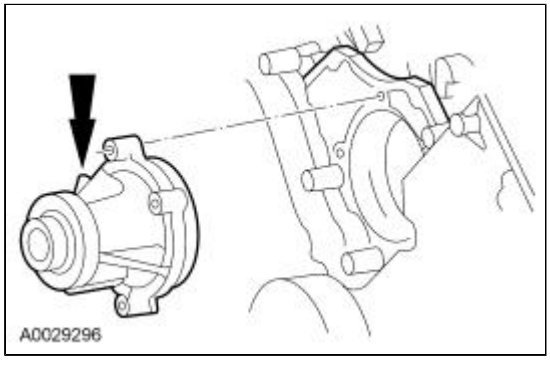
34. Remove the bolts and the accessory drive belt tensioner.



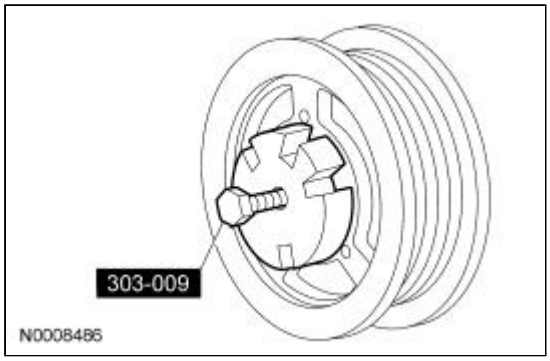
35. Remove the coolant pump bolts.



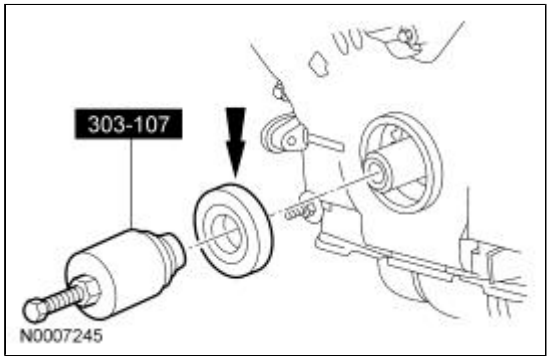
36. Remove the coolant pump from the cylinder block.
    - Discard the O-ring seal.



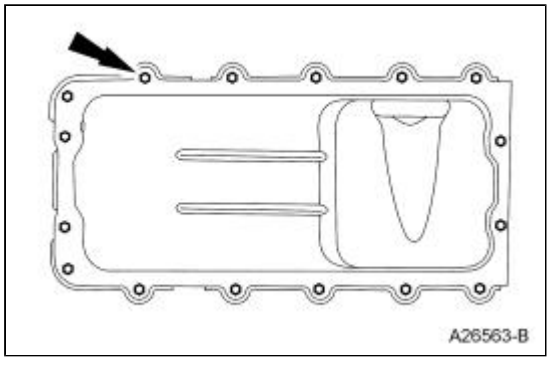
37. Remove and discard the crankshaft pulley bolt. Using the special tool, remove the crankshaft pulley.



38. Using the special tool, remove and discard the crankshaft front seal.

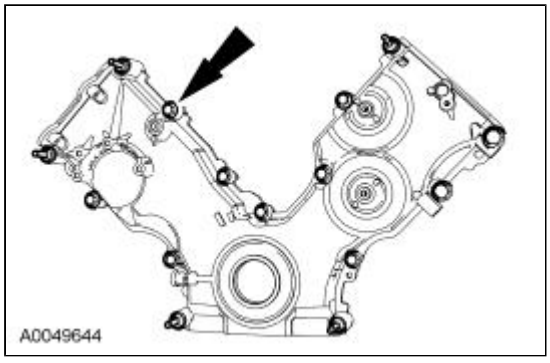


39. Remove the bolts, oil pan and discard the oil pan gasket.

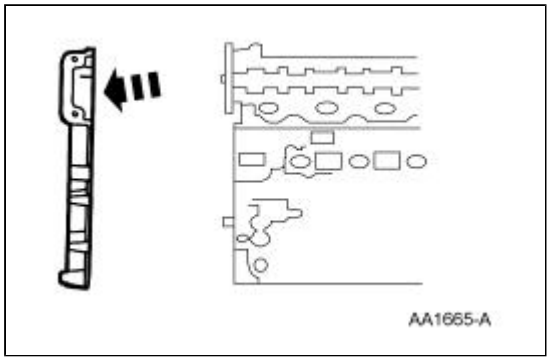


40. **NOTE:** Correct fastener location is essential for the assembly procedure. Record fastener location.

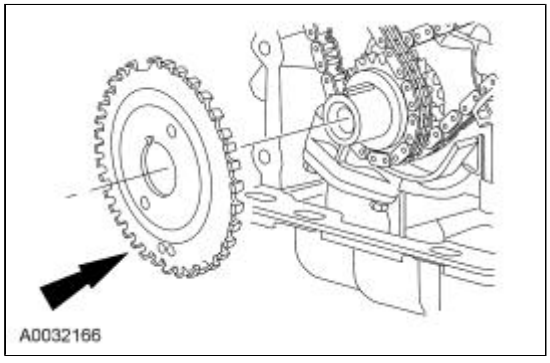
    Remove the fasteners.



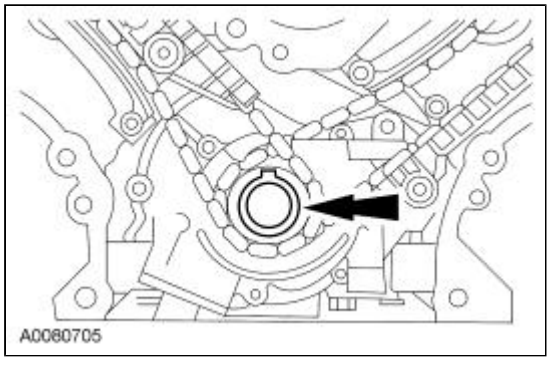
41. Remove the engine front cover from the cylinder block.



42. Remove the crankshaft sensor ring from the crankshaft.

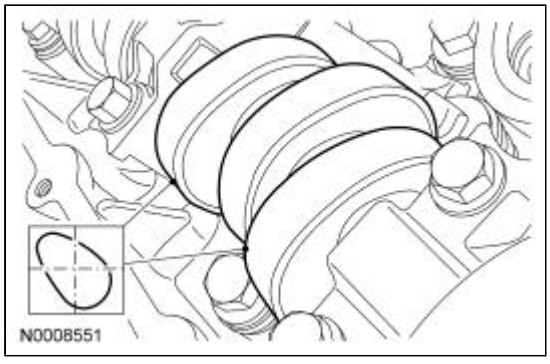


43. Position the crankshaft keyway at the 12 o'clock position.



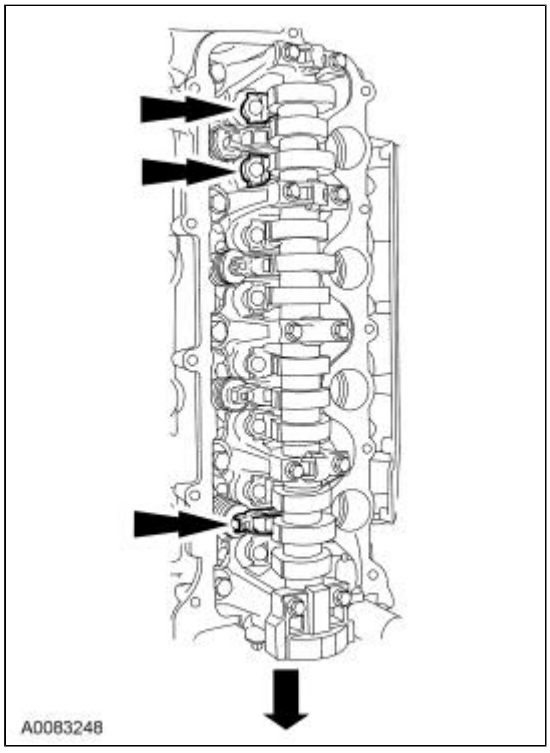
44. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

    The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.



45. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

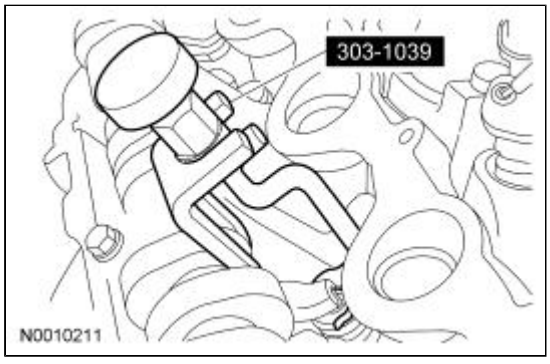
Remove only the 3 camshaft roller followers shown in the illustration from the RH cylinder head.



46. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

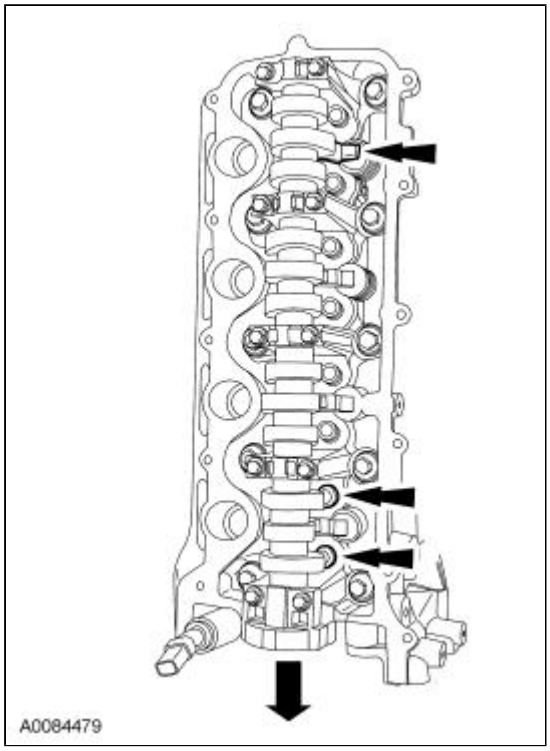
NOTE: It may be necessary to push the valve down while compressing the spring.

Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the RH cylinder head.



47. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

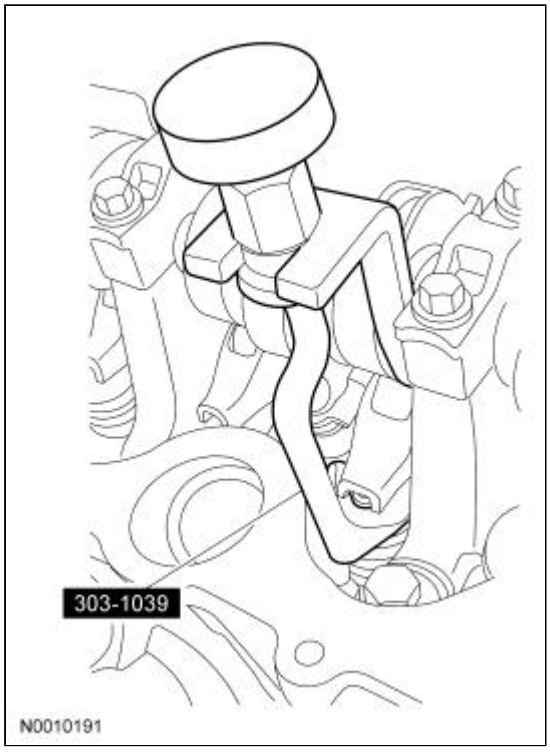
Remove only the 3 camshaft roller followers shown in the illustration from the LH cylinder head.



48. **CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

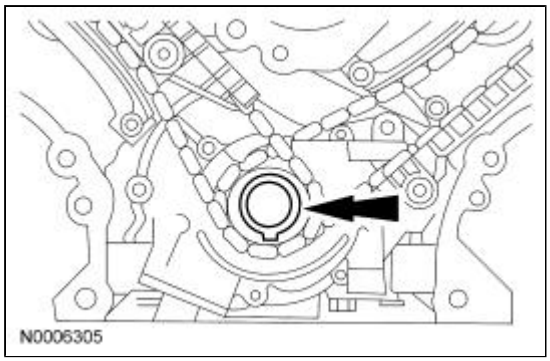
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the LH cylinder head.



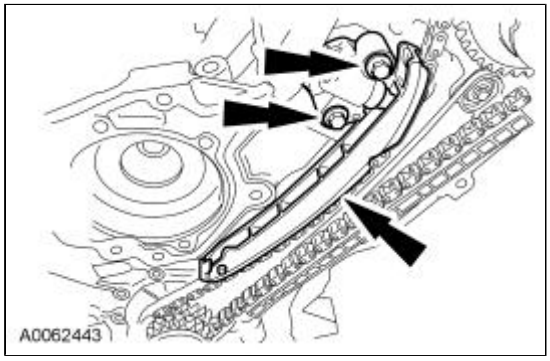
49. **CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.**

Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



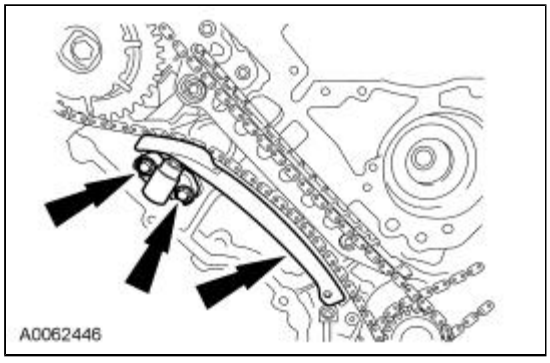
50. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the LH timing chain tensioner and tensioner arm.

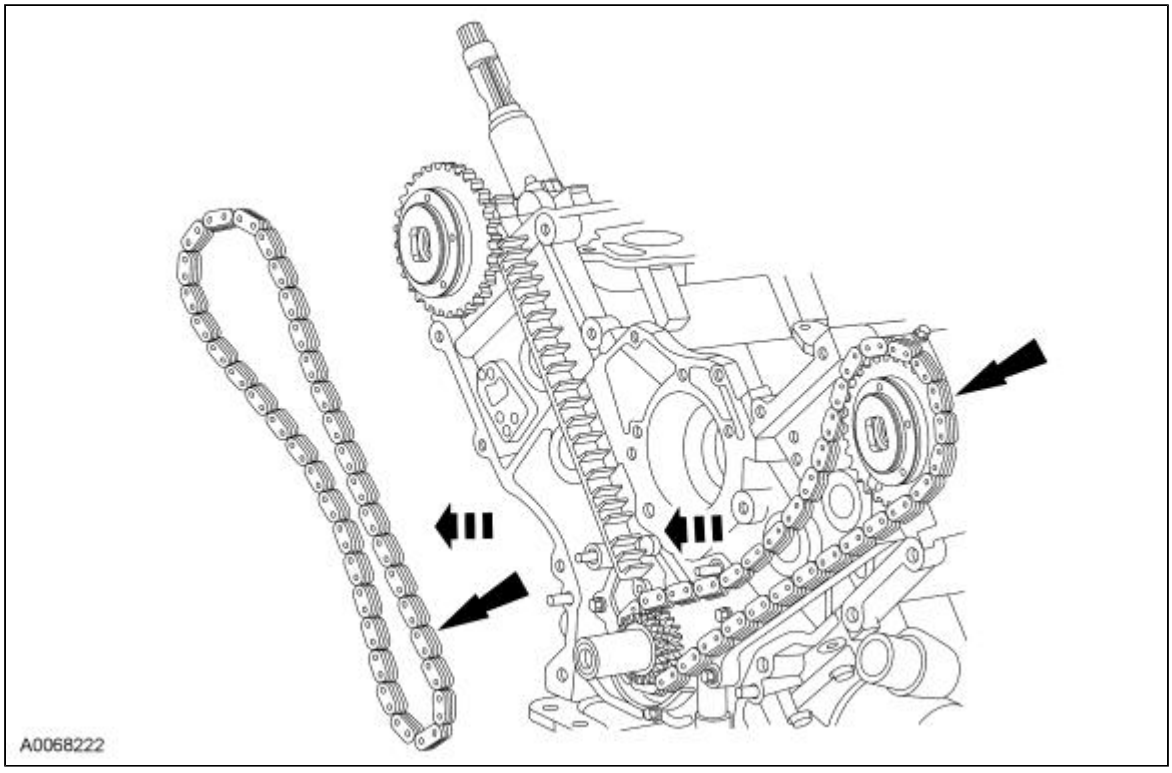


51. **CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.**

    Remove the bolts, the RH timing chain tensioner and tensioner arm.



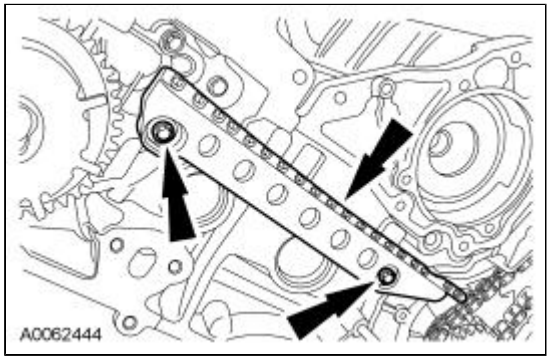
52. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



53. **NOTE:** RH shown, LH similar.

Remove the LH and RH timing chain guides.

- Remove the bolts.
- Remove both timing chain guides.

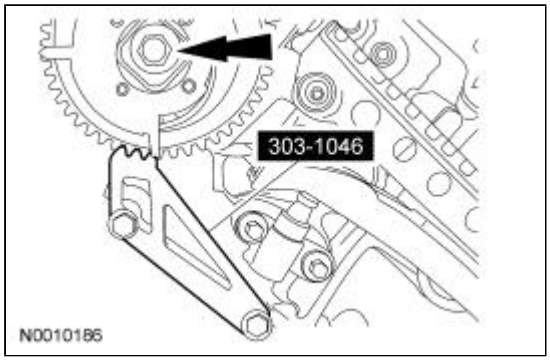


54. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

Using the special tool, remove the bolt and the RH VCT phaser sprocket assembly.

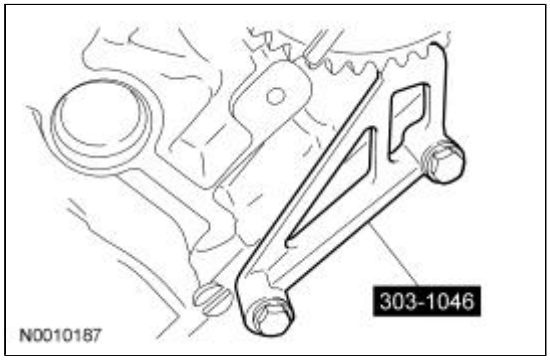
- Discard the VCT phaser sprocket bolt.



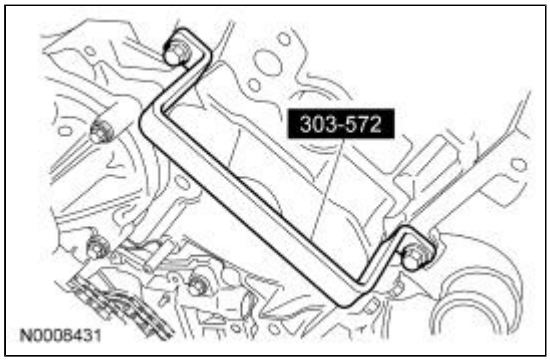
55. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

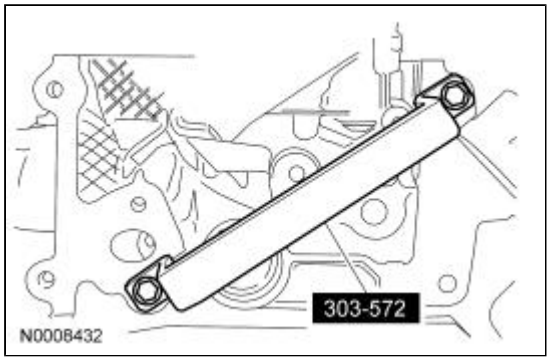
    Using the special tool, remove the bolt and the LH VCT phaser sprocket assembly.
    - Discard the VCT phaser sprocket bolt.



56. Install the special tool onto the LH cylinder head.



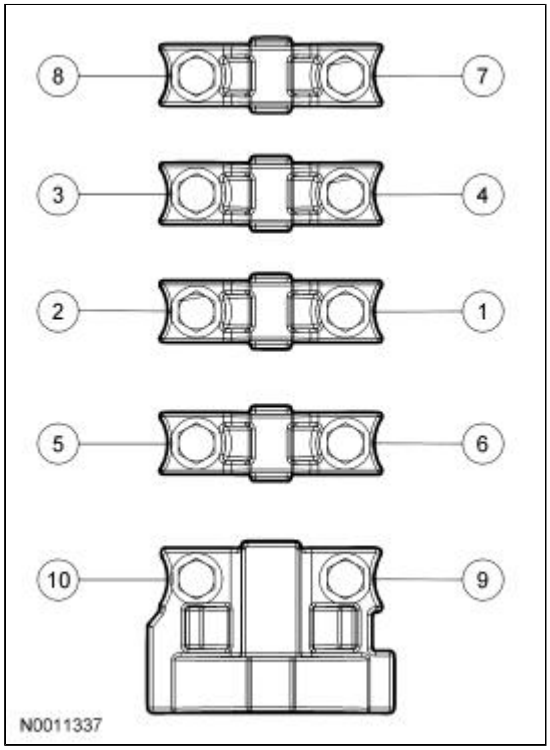
57. Install the special tool onto the RH cylinder head.



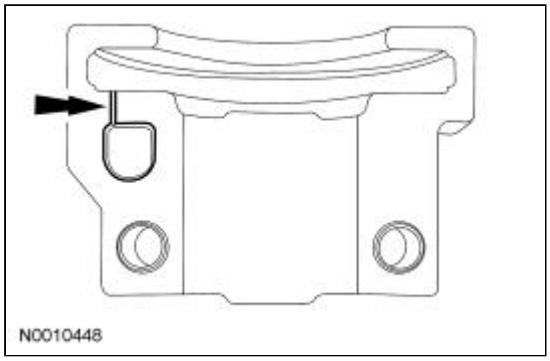
58. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the RH cylinder head front camshaft bearing cap and then the remaining bearing caps.



59. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



60. Remove the RH camshaft.

61. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the remaining camshaft roller followers from the RH cylinder head.

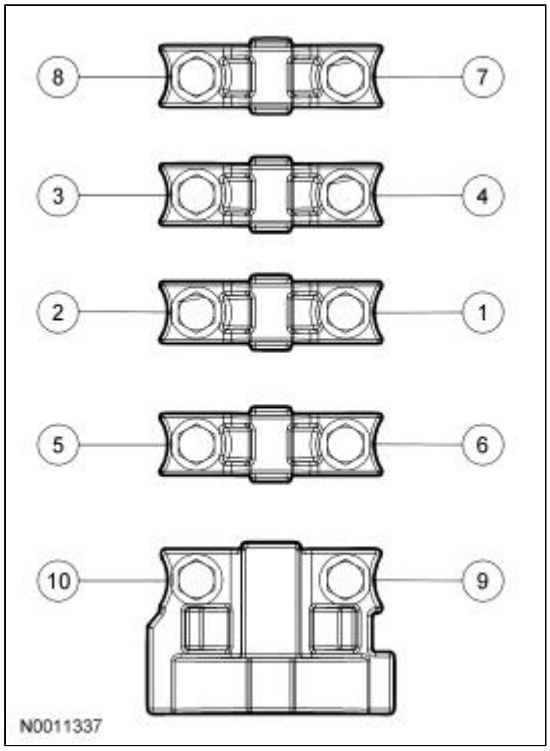
62. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the hydraulic lash adjusters from the RH cylinder head.

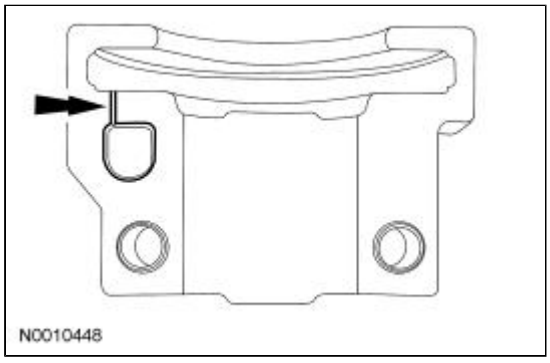
63. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

    Remove the bolts in the sequence shown and remove the LH cylinder head front camshaft bearing cap and then the remaining bearing caps.



64. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



65. Remove the LH camshaft.

66. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the remaining camshaft roller followers from the LH cylinder head.

67. **CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.**

    Remove the hydraulic lash adjusters from the LH cylinder head.

68. **CAUTION: The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.**

CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

CAUTION: The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield designed and cannot be reused.

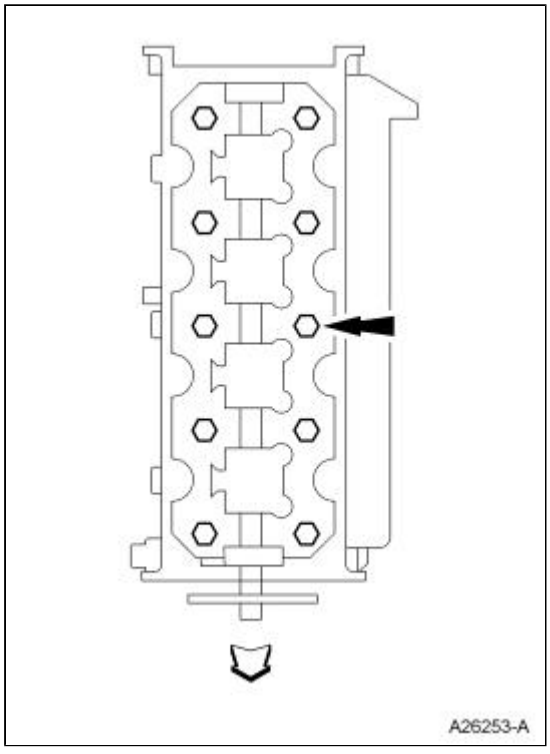
CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

CAUTION: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: RH shown, LH similar.

Remove the bolts and the cylinder head.

- Discard the cylinder head gasket.
- Discard the cylinder head bolts.



69. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

CAUTION: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the

cylinder block.

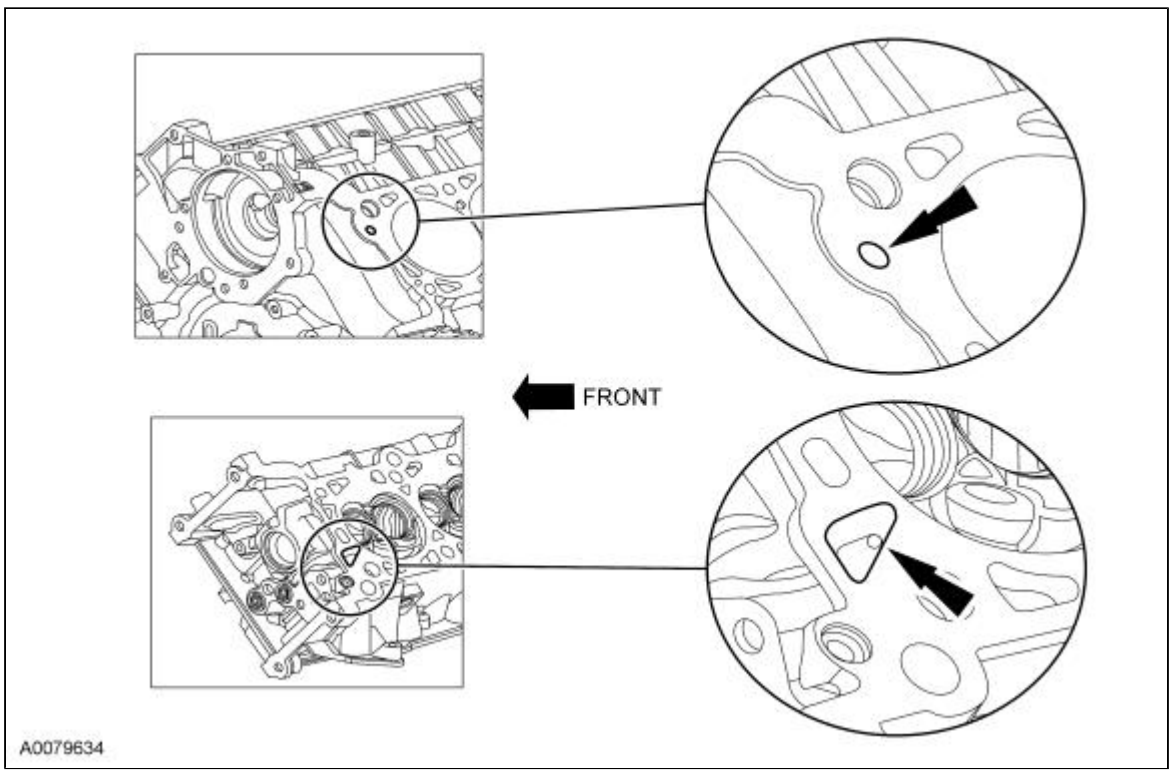
1. Remove any large deposits of silicone or gasket material with a plastic scraper.
2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

70. **NOTE:** Make sure all cylinder head surfaces are clear of any gasket material, RTV, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

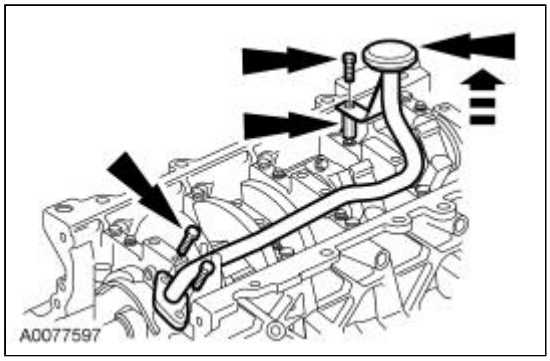
    NOTE: Use a straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot length. For example, if the straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

    NOTE: LH shown, RH similar.

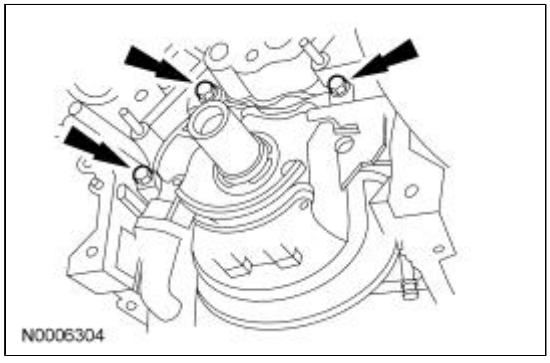
    Support the cylinder head on a bench with the head gasket side up. Inspect all areas of the deck face with a straightedge, paying particular attention to the oil pressure feed area. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches longer than 0.0254 mm (0.001 in).



71. Remove the bolts, the oil pump screen and pickup tube and the spacer.



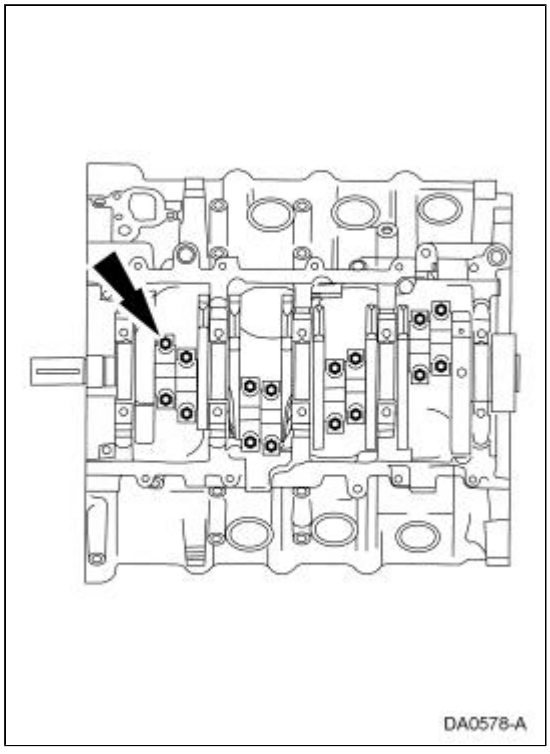
72. Remove the 3 bolts and the oil pump.



73. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following the manufacturer instructions.

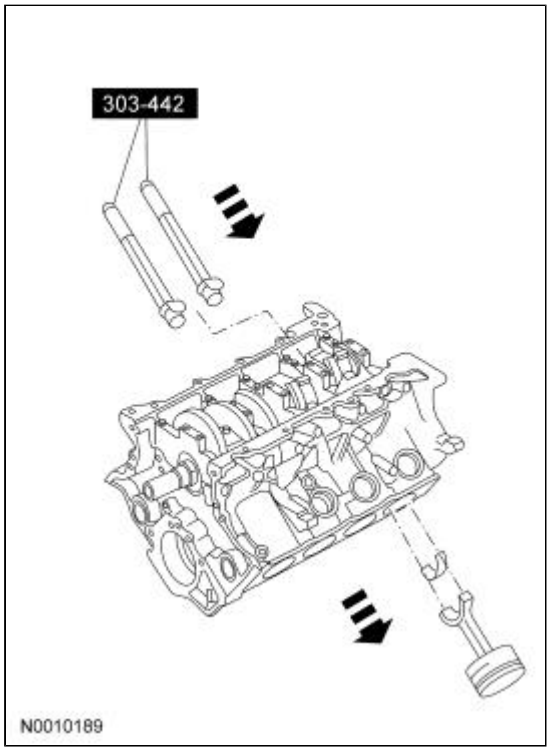
74. **CAUTION: Verify that the connecting rods and rod caps have orientation numbers cast into them. If not, number the connecting rods and rod caps for correct orientation.**

Remove the bolts and the connecting rod caps. Discard the bolts.



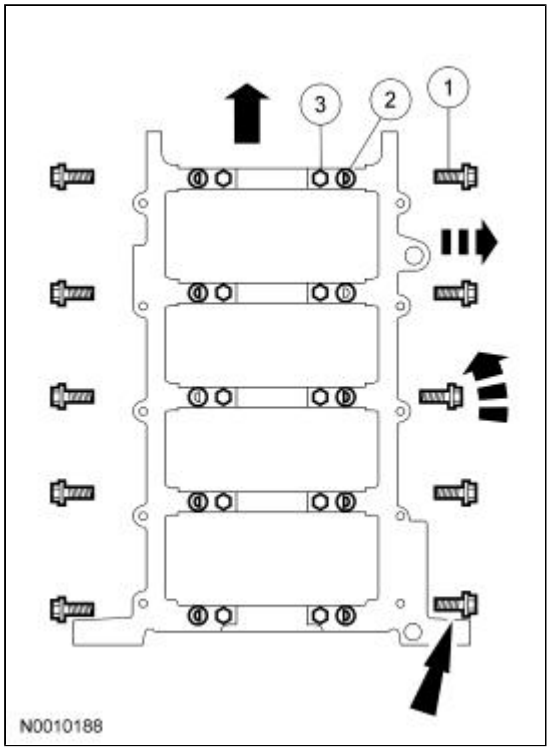
75. **CAUTION: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.**

Use the special tool to push the piston through the top of the cylinder block.

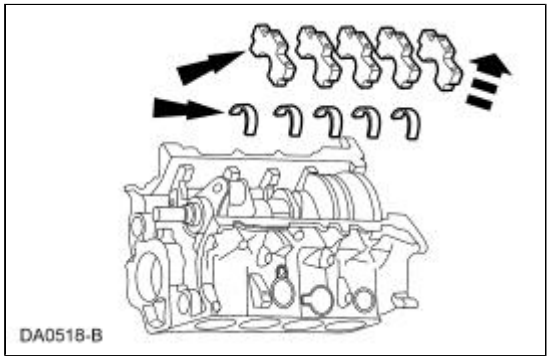


76. Disassemble the 8 pistons. For additional information, refer to Piston in this section.

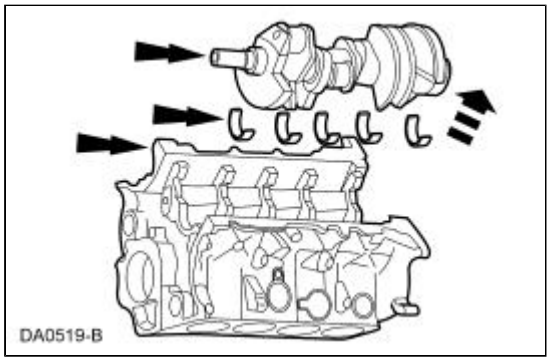
77. Remove the fasteners.
    1. Remove and discard the cross-mounted main cap bolts.
    2. Remove the dowels.
    3. Remove and discard the main bearing cap bolts.



78. Remove the 5 main bearing caps, the lower crankshaft main bearings and the lower thrust washer.



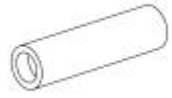
79. Remove the crankshaft, the upper crankshaft main bearings and the upper thrust washers from the cylinder block.



Cylinder Head

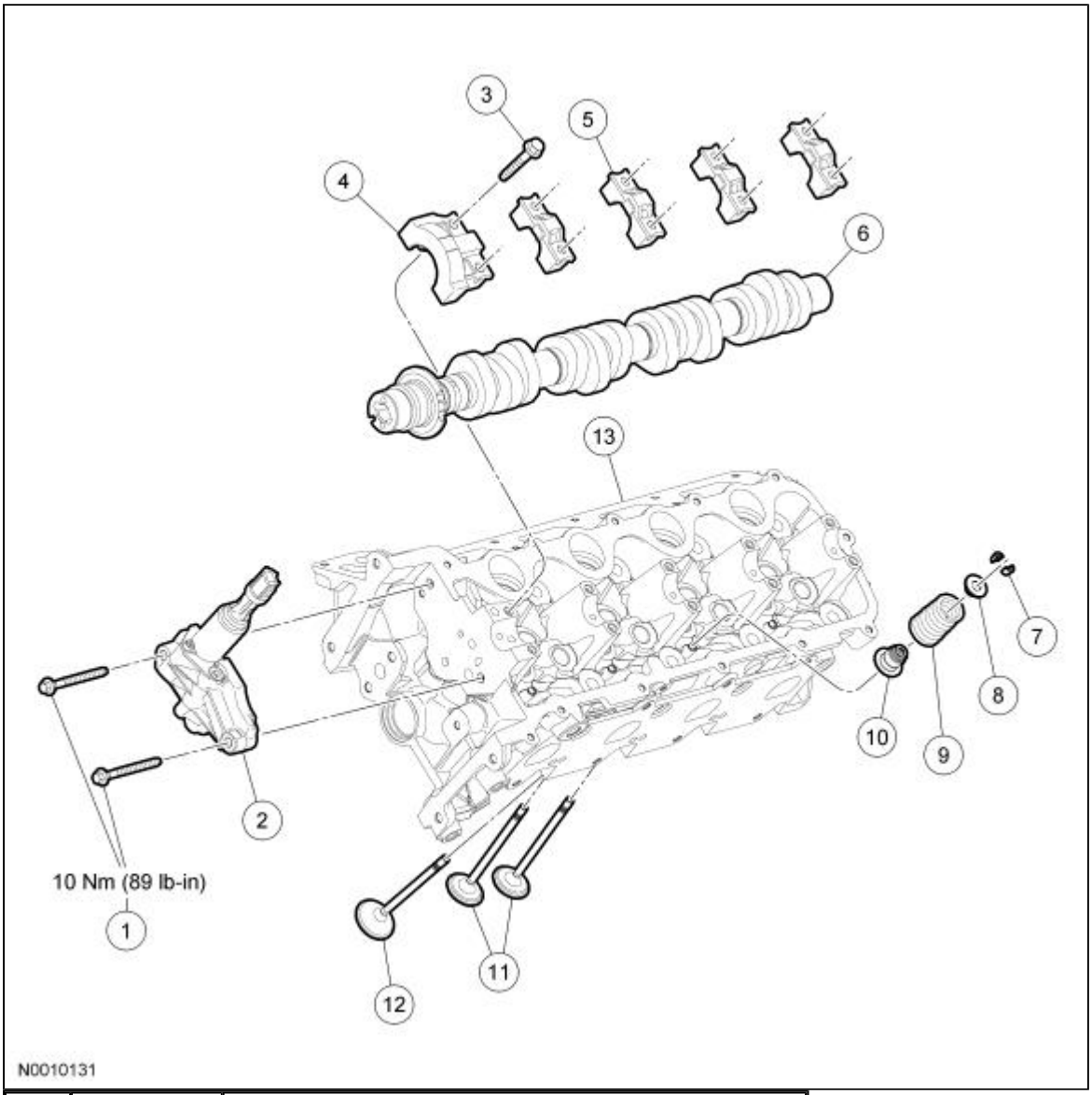
Printable View (277 KB)

Special Tool(s)

ST2804-A	Compressor, Valve Spring 303-1039
 ST1332-A	Installer, Valve Stem Oil Seal 303-383 (T91T-6571-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	W701520	Variable camshaft timing (VCT) housing assembly bolts (2 required)
2	6C261	VCT housing assembly
3	N807834	Camshaft bearing cap bolt (10 required)
4	6B284	Camshaft front bearing cap
5	6B280	Camshaft bearing cap (4 required)
6	6C255	Camshaft
7	6518	Valve spring retainer key (24 required)
8	6514	Valve spring retainer (12 required)
9	6513	Valve spring (12 required)
10	6A517	Valve seal (12 required)
11	6507	Intake valves (8 required)
12	6505	Exhaust valve (4 required)
13	6050	Cylinder head

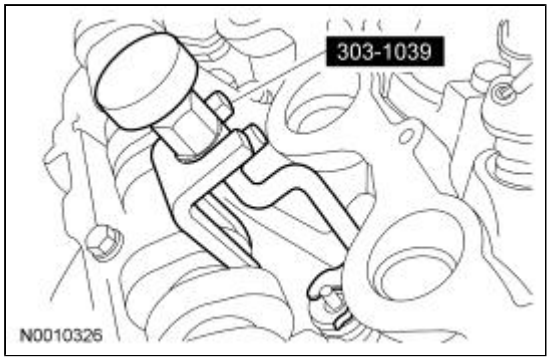
Disassembly

1. Remove the bolts and the variable camshaft timing (VCT) housing.
    - Discard the gasket.

2. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

3. Install the camshaft bearing caps in their original locations.
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the bolts finger tight.

4. Using the special tool, compress the valve spring and remove the valve spring retainer keys.



5. Remove the valve spring retainer, the valve spring and the valve seal.
    - Discard the valve seal.

6. Remove the valve from the cylinder head

7. Repeat the previous 3 steps for each valve.

8. Inspect the components. For additional information, refer to Section 303-00 .

9. **CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.**

    Remove the bolts the front camshaft bearing cap and then the remaining bearing caps.

10. Remove the camshaft.

11. Check the cylinder head for distortion. For additional information, refer to Section 303-00 .

Assembly

1. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

2. Install the camshaft bearing caps in their original locations.
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the bolts finger tight.

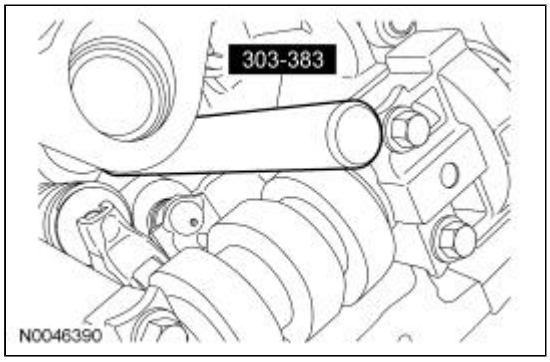
3. **NOTE:** Lubricate the valve stem with clean engine oil prior to installation.

   Install the valve into the cylinder head.

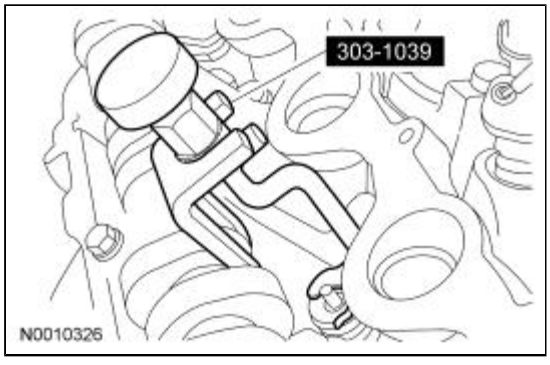
4. **NOTE:** Lubricate the valve seal and valve stem with clean engine oil prior to installation.

   Position a new valve seal onto the valve stem.

5. Using the special tool, install the new valve seal.



6. Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.



7. Repeat the previous 2 steps for each valve.

8. Remove the bolts the front camshaft bearing cap and then the remaining bearing caps.

9. Remove the camshaft.

10. Install a new gasket, the VCT housing and the bolts.
    - Tighten to 10 Nm (89 lb-in).

Piston

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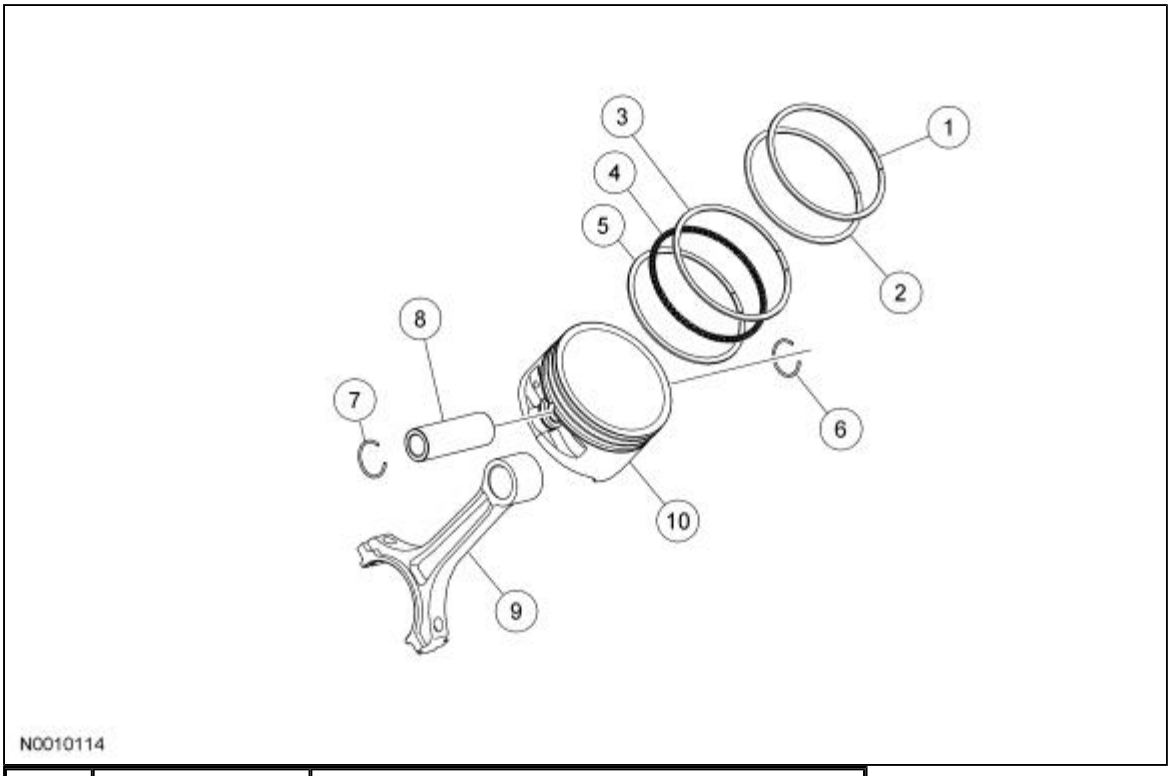
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	6150	Piston compression upper ring
2	6152	Piston compression lower ring
3	6159	Piston oil control upper segment ring
4	6161	Piston oil control spacer
5	6159	Piston oil control lower segment ring
6	6140	Piston pin retainer
7	6140	Piston pin retainer
8	6135	Piston pin
9	6200	Connecting rod
10	6110	Piston

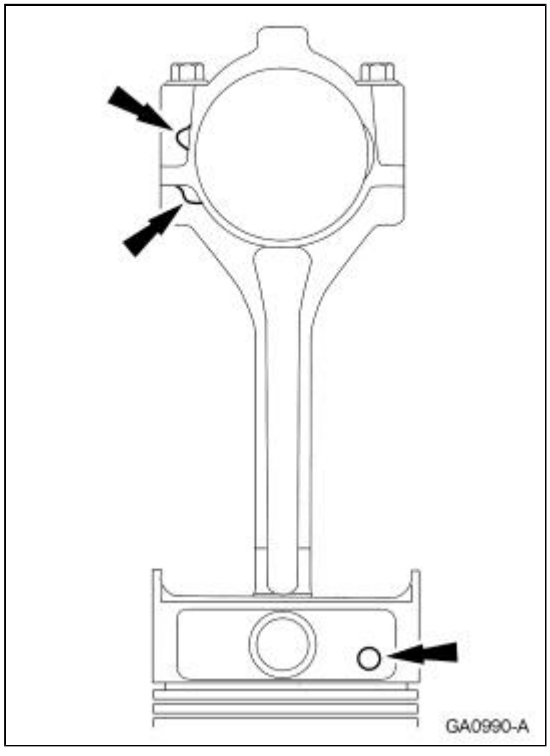
Disassembly

1. Remove the piston rings from the piston.
    - Discard the piston rings.
2. Remove the piston pin retainers and the piston pin.
3. Separate the piston from the connecting rod.
4. Clean and inspect the piston and connecting rod. For additional information, refer to Section 303-00 .

Assembly

1. **NOTE:** The connecting rod must be installed into the piston with identification markings toward the front.

   Position the connecting rod in the piston.



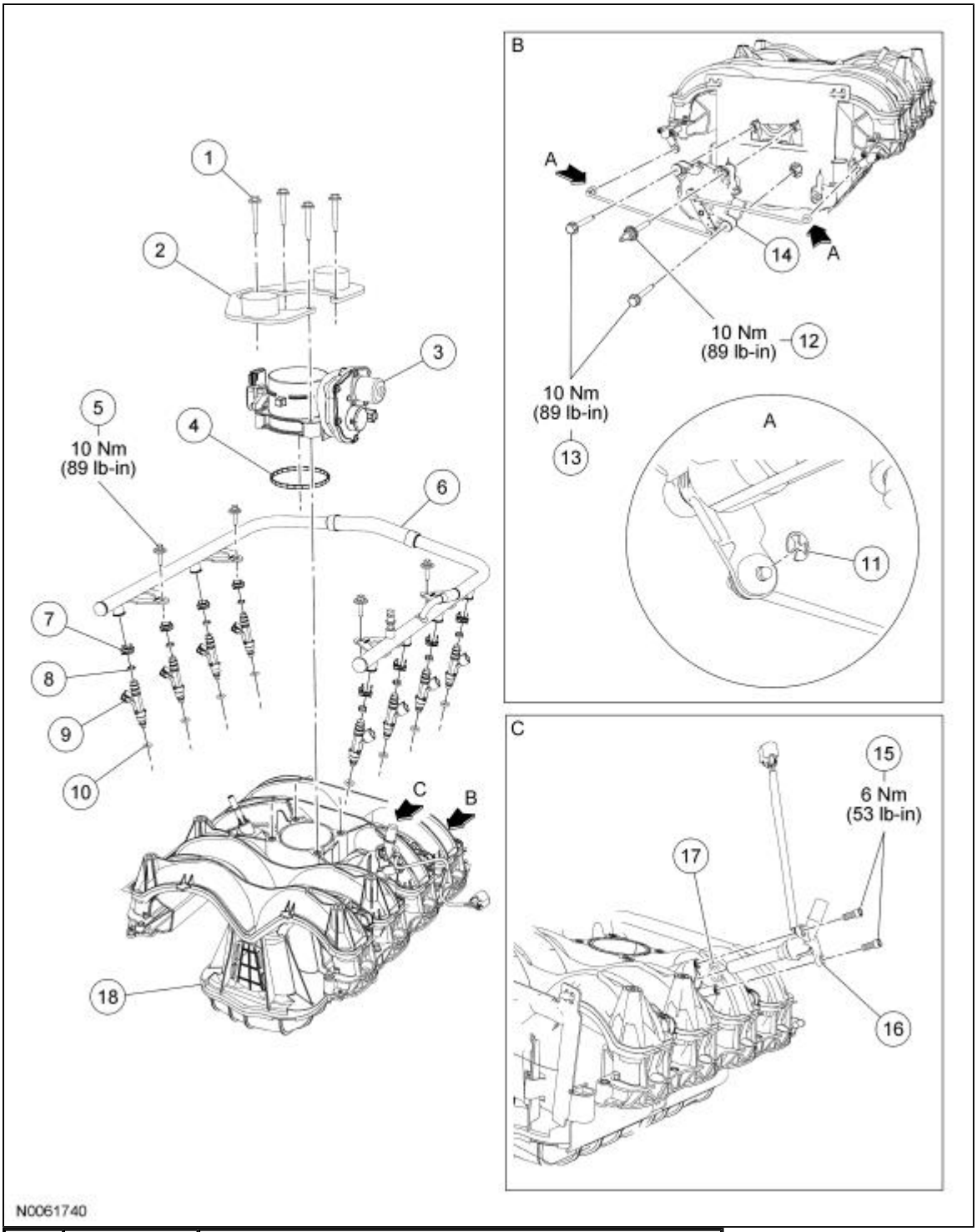
2. Lubricate the piston pin and pin bore with clean engine oil.
3. Install the piston pin in the piston and connecting rod assembly.
4. Install the piston pin retaining clips in the piston.
5. Lubricate the piston and the new piston rings with clean engine oil.
6. Install the piston rings onto the piston.

Intake Manifold Assembly

Printable View (270 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1



Item	Part Number	Description
1	N705438	Throttle body (TB) bolt (4 required)
2	9J444	Vibration damper
3	9F991	TB
4	—	TB gasket (part of 9F991)
5	N705800	Fuel rail bolt (4 required)
6	9F792	Fuel rail
7	9C995	Fuel injector-to-fuel rail locking clip (8 required)
8	—	Fuel injector-to-fuel rail O-ring seal (8 required)

9	9F593	Fuel injector (8 required)
10	—	Fuel injector-to-intake manifold O-ring seal (8 required)
11	—	Charge motion control valve (CMCV) rod locking clip (2 required)
12	W708165	CMCV stud bolt
13	W719084	CMCV bolts (2 required)
14	9G730	CMCV
15	W500204	Positive crankcase ventilation (PCV) heater element bolts (2 required)
16	9F624	PCV heater element
17	—	PCV heater element O-ring seal
18	9Y451	Intake manifold assembly

Disassembly

1. Remove the 4 bolts, the vibration damper and the throttle body (TB).

2. Remove the 4 bolts and the fuel rail.

3. Remove the fuel injector-to-fuel rail locking clips and separate the fuel injectors from the fuel rail.
    - Discard the 2 O-ring seals from each fuel injector.

4. Remove the charge motion control valve (CMCV) rod locking clips.

5. Remove the stud bolt, the 2 bolts and the CMCV.

6. Remove the 2 bolts and the positive crankcase ventilation (PCV) heater element.
    - Discard the O-ring seal.

7. Remove the engine noise shield insulator from the intake manifold.

Assembly

1. Install the engine noise shield insulator onto the intake manifold.

2. **NOTE:** Lubricate the new O-ring seal with clean engine oil prior to installation.

   Using a new O-ring seal, install the PCV heater element and the 2 bolts.
    - Tighten to 6 Nm (53 lb-in).

3. Position the CMCV and install the stud bolt and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

4. Install the CMCV rod locking clips.

5. **NOTE:** Lubricate the new O-ring seal with clean engine oil prior to installation.

   Install new O-ring seals on each of the fuel injectors.

6. Assemble the fuel injectors onto the fuel rail and install the locking clips.

7. Install the fuel rail and fuel injector assembly onto the intake manifold.

8. Install the 4 fuel rail bolts.
    - Tighten to 10 Nm (89 lb-in).

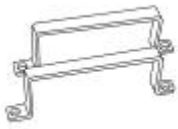
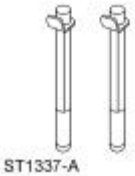
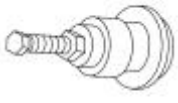
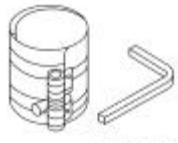
9. **NOTE:** Lubricate the TB-to-intake manifold gasket with clean engine coolant prior to installation.

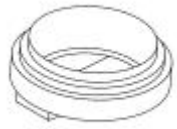
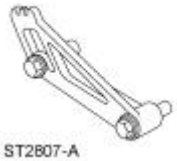
    Install the TB, the vibration damper and tighten the bolts in 2 stages.
    - Stage 1: Tighten to 9 Nm (80 lb-in).
    - Stage 2: Tighten an additional 90 degrees.

Engine

Printable View (3669 KB)

Special Tool(s)

 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)
 ST1337-A	Installer, Connecting Rod 303-442 (T93P-6136-A)
ST2804-A	Compressor, Valve Spring 303-1039
ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
 ST1376-A	Compressor, Piston Ring 303-D032 (D81L-6002-C) or equivalent
	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)

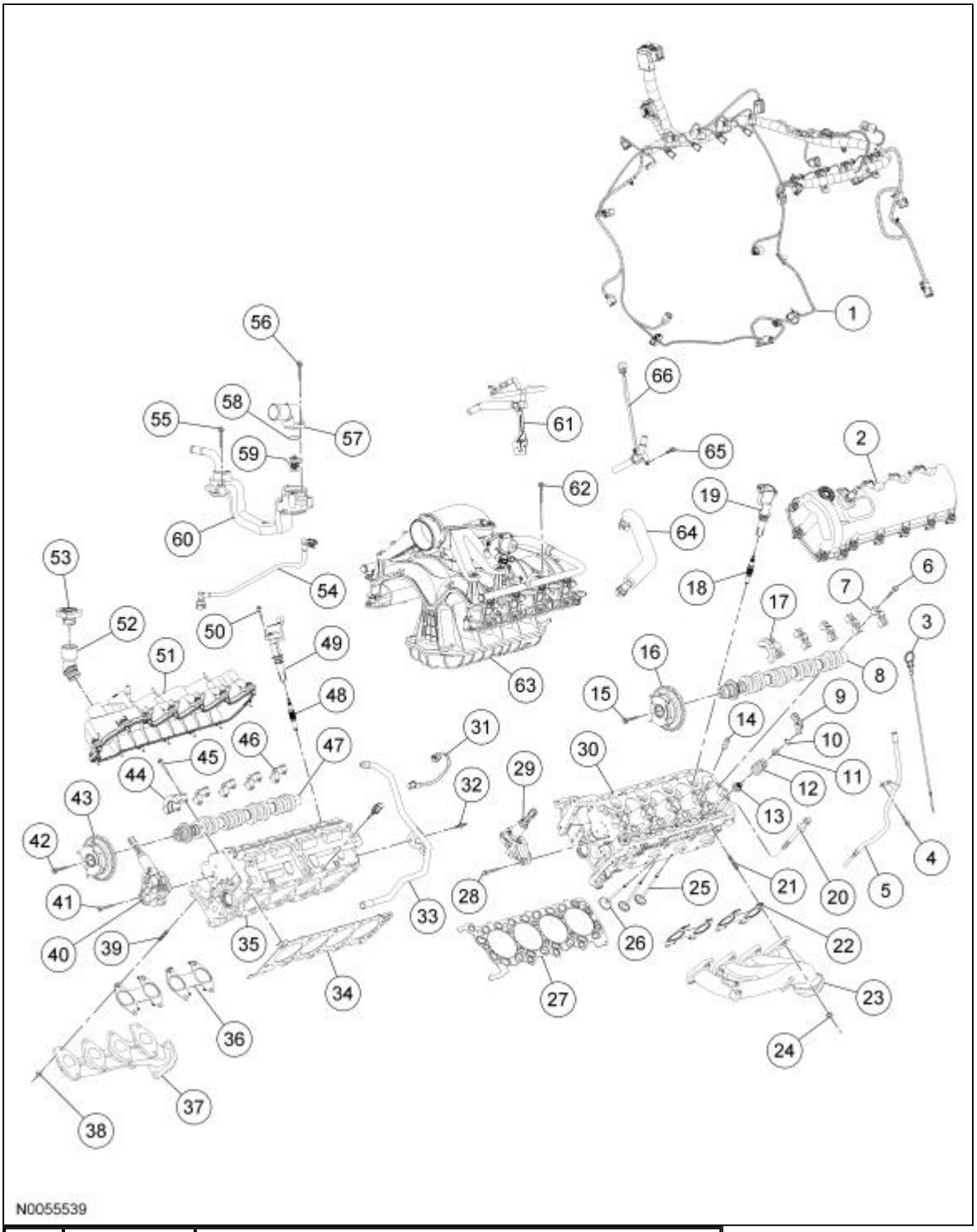
ST1480-A	
ST1482-A	Installer, Crankshaft Oil Slinger 303-517 (T95P-6701-CH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-EH)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST2806-A	Alignment Pins, Cylinder Head 303-1040 (SR-015486)
ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium	

Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	—

Engine — Upper End

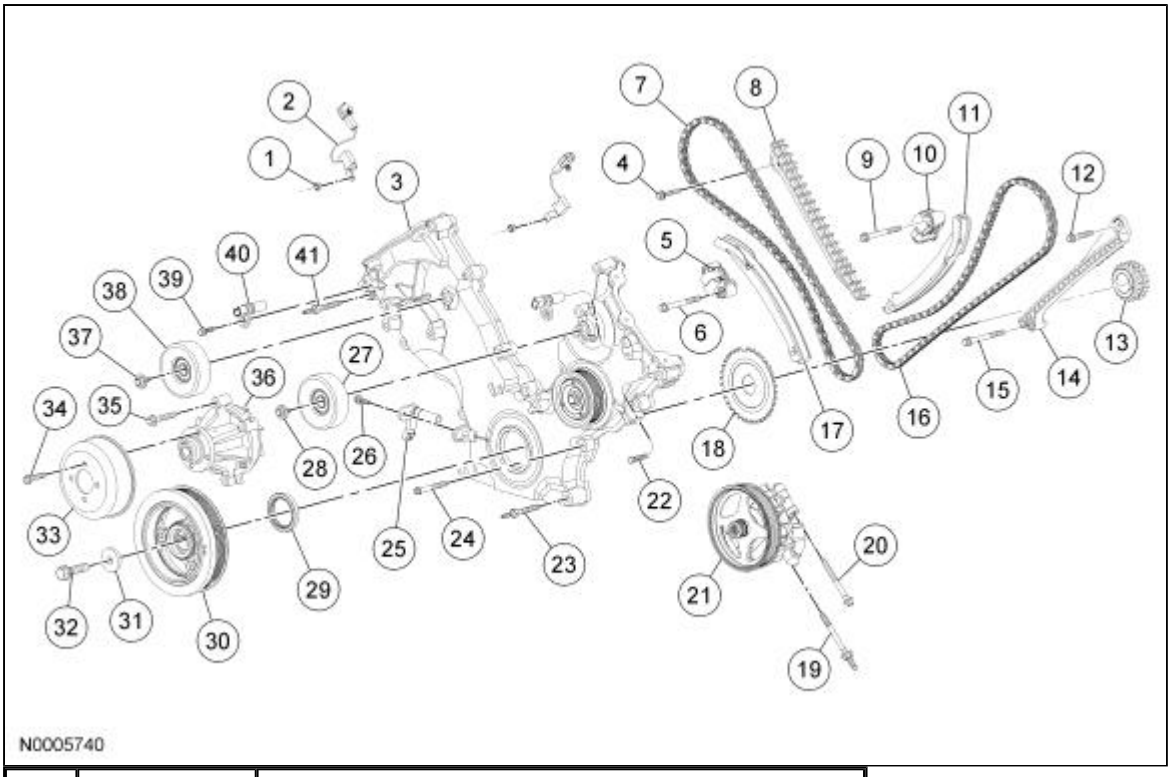


Item	Part Number	Description
1	12B637	Engine wiring harness
2	6A505	Valve cover — LH
3	6750	Oil level indicator
4	N605892	Oil level indicator tube bolt
5	6K873	Oil level indicator tube
6	N807834	Camshaft bearing cap bolt (10 required)
7	6B280	Camshaft bearing cap (4 required)
8	6C255	Camshaft — LH

9	6529	Roller follower (24 required)
10	6518	Valve spring retainer key (48 required)
11	6514	Valve spring retainer (24 required)
12	6513	Valve spring (24 required)
13	6A517	Valve stem seal (24 required)
14	6C501	Hydraulic lash adjuster (24 required)
15	6279	Camshaft phaser sprocket bolt — LH
16	6C524	Camshaft phaser sprocket — LH
17	6B284	Camshaft bearing cap
18	12405	Spark plug (4 required)
19	12A366	Ignition coil (4 required)
20	6065	Cylinder head bolt (20 required)
21	W707747	Exhaust manifold stud (8 required)
22	9Y431	Exhaust manifold gaskets (2 required)
23	9431	Exhaust manifold — LH
24	W701706	Exhaust manifold nut (8 required)
25	6507	Intake valve (16 required)
26	6505	Exhaust valve (8 required)
27	6083	Cylinder head gasket — LH
28	W701520	Variable camshaft timing (VCT) oil control solenoid assembly bolt (2 required)
29	6C261	VCT oil control solenoid assembly
30	6050	Cylinder head — LH
31	14B102	Cylinder head temperature (CHT) sensor jumper harness
32	W701571	Heater outlet tube stud bolt
33	18663	Heater outlet tube
34	6051	Cylinder head gasket — RH
35	6049	Cylinder head — RH
36	9Y431	Exhaust manifold gasket (2 required)
37	9430	Exhaust manifold — RH
38	W701706	Exhaust manifold nut (8 required)
39	W707747	Exhaust manifold stud (8 required)
40	6C260	VCT oil control solenoid assembly
41	W701520	VCT oil control solenoid assembly bolt (2 required)
42	6279	Camshaft phaser sprocket bolt — RH
43	6C524	Camshaft phaser sprocket — RH
44	6B284	Camshaft bearing cap
45	N807834	Camshaft bearing cap bolt (10 required)
46	6B280	Camshaft bearing cap (4 required)
47	6251	Camshaft — RH
48	12405	Spark plug (4 required)

49	12A366	Ignition coil (4 required)
50	W706175	Ignition coil bolt (8 required)
51	6582	Valve cover — RH
52	6765	Oil fill adapter
53	6766	Oil fill adapter cap
54	6758	Crankcase ventilation tube
55	W503282	Coolant crossover tube bolt (3 required)
56	W503279	Thermostat housing bolt (2 required)
57	8594	Thermostat housing
58	N806807	Thermostat O-ring seal
59	8575	Thermostat
60	8C369	Coolant crossover tube
61	9A474	Intake manifold vacuum tube and support bracket
62	W709775	Intake manifold bolt (10 required)
63	9Y451	Intake manifold assembly
64	6K817	Positive crankcase ventilation (PCV) tube
65	W500204	PCV heater element assembly bolt (2 required)
66	9F624	PCV heater element assembly

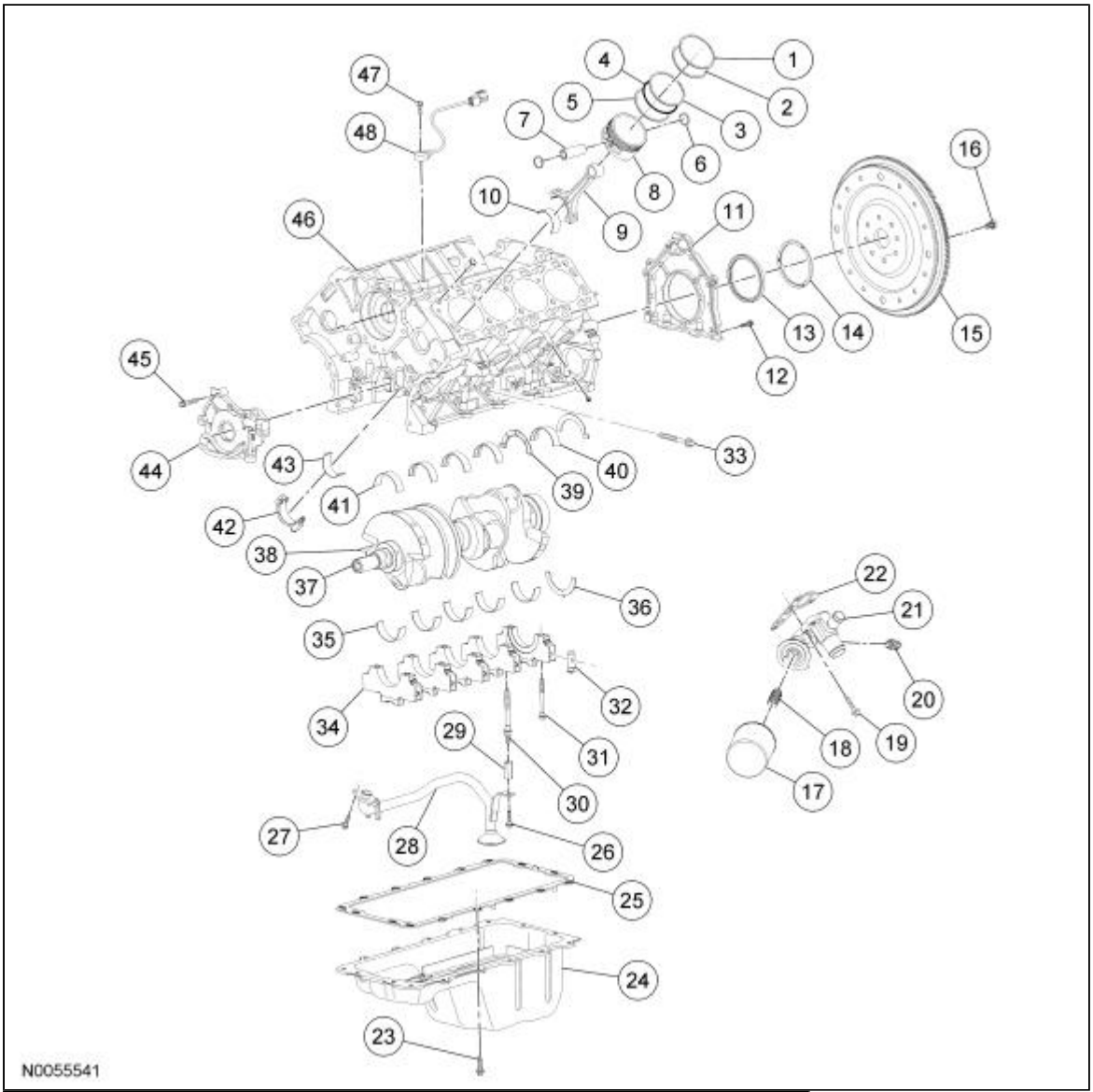
Engine — Front End



Item	Part Number	Description
1	N804758	Radio ignition interference capacitor nut
2	18801	Radio ignition interference capacitor
3	6C086	Engine front cover

4	W503282	Timing chain guide bolt— RH (2 required)
5	6L266	Timing chain tensioner — RH
6	N606543	Timing chain tensioner bolt — RH (2 required)
7	6268	Timing chain — RH
8	6M256	Timing chain guide — RH
9	N606543	Timing chain tensioner bolt — LH (2 required)
10	6M269	Timing chain tensioner — LH
11	6M274	Tensioner arm — LH
12	N605892	Timing chain guide upper bolt — LH
13	6306	Crankshaft sprocket
14	6B274	Timing chain guide — LH
15	N606527	Timing chain guide lower bolt — LH
16	6268	Timing Chain — LH
17	6K255	Tensioner arm — RH
18	12A227	Ignition pulse wheel
19	W707225	Power steering pump stud bolt
20	W706447	Power steering pump bolt (2 required)
21	3A696	Power steering pump assembly
22	W706605	Engine front cover bolt
23	N808529	Engine front cover stud bolt (2 required)
24	N806177	Engine front cover bolt (9 required)
25	6C315	Crankshaft position (CKP) sensor
26	N806155	CKP sensor bolt
27	19A216	Accessory drive belt idler pulley
28	N808102	Accessory drive belt idler pulley bolt
29	6700	Crankshaft front seal
30	6316	Crankshaft pulley
31	N806165	Crankshaft pulley washer
32	W701512	Crankshaft pulley bolt
33	8A528	Coolant pump pulley
34	N806282	Coolant pump pulley bolt (4 required)
35	N808794	Coolant pump bolt (4 required)
36	8501	Coolant pump
37	N808102	Accessory drive belt idler pulley bolt
38	19A216	Accessory drive belt idler pulley
39	N806155	Camshaft position (CMP) sensor bolt (2 required)
40	6B288	CMP sensor (2 required)
41	W709573	Engine front cover stud bolt (3 required)

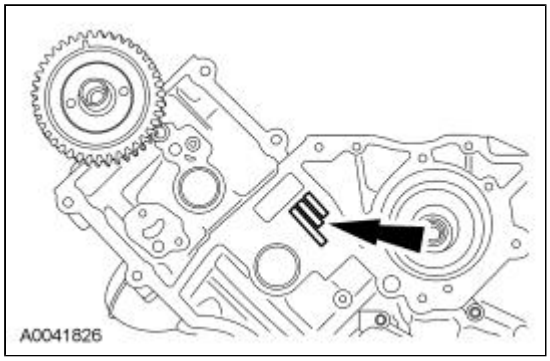
Engine — Lower End



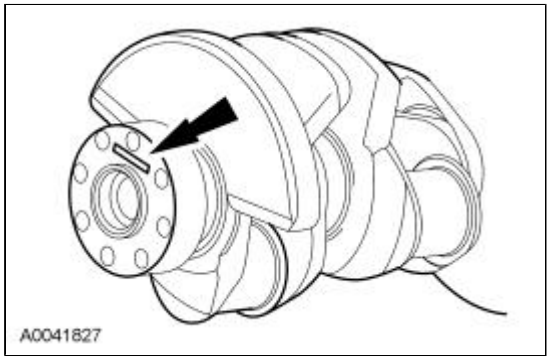
Item	Part Number	Description
1	6150	Upper compression ring (8 required)
2	6152	Lower compression ring (8 required)
3	6159	Outer oil control ring (8 required)
4	6161	Inner oil control ring (8 required)
5	6159	Outer oil control ring (8 required)
6	6140	Piston pin retainer (16 required)
7	6135	Piston pin (8 required)
8	6110	Piston (8 required)
9	6200	Connecting rod assembly (8 required)
10	6211	Connecting rod bearing (8 required)
11	6K318	Crankshaft rear seal retainer plate
12	N806155	Crankshaft rear seal retainer plate bolt (6 required)
13	6310	Crankshaft rear seal
14	6701	Crankshaft oil slinger

15	6375	Flexplate
16	N806168	Flexplate bolt (8 required)
17	6714	Oil filter
18	6890	Oil filter threaded adapter
19	N806156	Oil filter adapter bolt (4 required)
20	9278	Engine oil pressure (EOP) switch
21	6881	Oil filter adapter
22	6A636	Oil filter adapter gasket
23	W701605	Oil pan bolt (16 required)
24	6675	Oil pan
25	6710	Oil pan gasket
26	N605904	Oil pump screen and pickup tube bolt
27	N806155	Oil pump screen and pickup tube bolt (2 required)
28	6622	Oil pump screen and pickup tube
29	N806180	Oil pump screen and pickup tube spacer
30	6K258	Crankshaft main bearing cap stud
31	6345	Crankshaft main bearing cap bolt (9 required)
32	6A346	Crankshaft main bearing dowel (10 required)
33	6C357	Crankshaft main bearing cap bolt (10 required)
34	6325	Crankshaft main bearing cap (5 required)
35	6A338	Crankshaft bearing — lower (5 required)
36	6K302	Crankshaft thrust washer — lower
37	6303	Crankshaft
38	N806201	Crankshaft key
39	6A341	Crankshaft thrust washer — upper (2 required)
40	6333	Crankshaft bearing — upper (4 required)
41	6W337	Crankshaft bearing — upper
42	6210	Connecting rod cap (8 required)
43	6211	Connecting rod bearing (8 required)
44	6621	Oil pump
45	N806183	Oil pump bolt (3 required)
46	6010	Cylinder block
47	W500225	Knock sensor bolt (2 required)
48	12A699	Knock sensor (2 required)

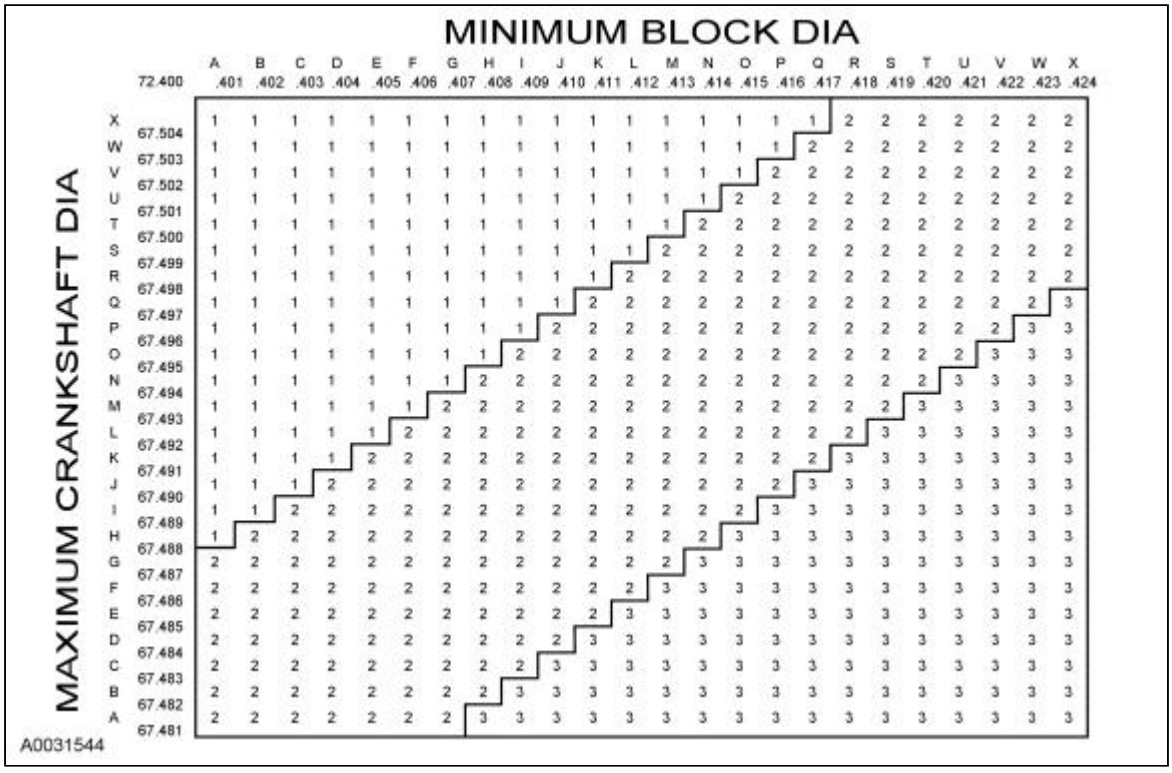
1. Record the main bearing code found on the front of the engine block.



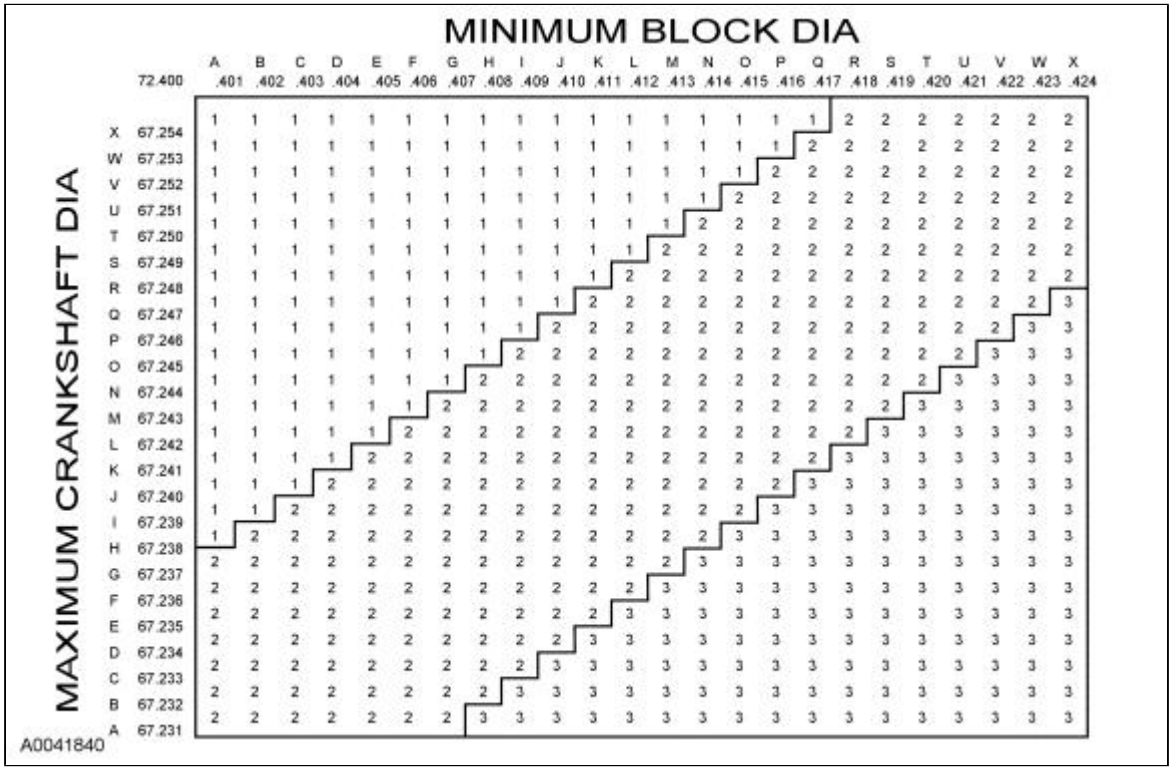
2. Record the main bearing code found on the back of the crankshaft.



3. Using the data recorded earlier and the Bearing Select Fit Chart, Standard Bearings, determine the required bearing grade for each main bearing.
    - Read the first letter of the engine block main bearing code and the first letter of the crankshaft main bearing code.
    - Read down the column below the engine block main bearing code letter, and across the row next to the crankshaft main bearing code letter, until the 2 intersect. This is the required bearing grade for the number one crankshaft main bearing.
    - As an example, if the engine block code letter is "F" and the crankshaft code letter is "D", the correct bearing grade for this main bearing is a "2".
    - Repeat this process for the remaining 4 main bearings.



4. If oversize bearings are being used, use the procedure in the previous step and the Bearing Select Fit Chart, Oversize Bearings to determine the required bearing grade for each main bearing.

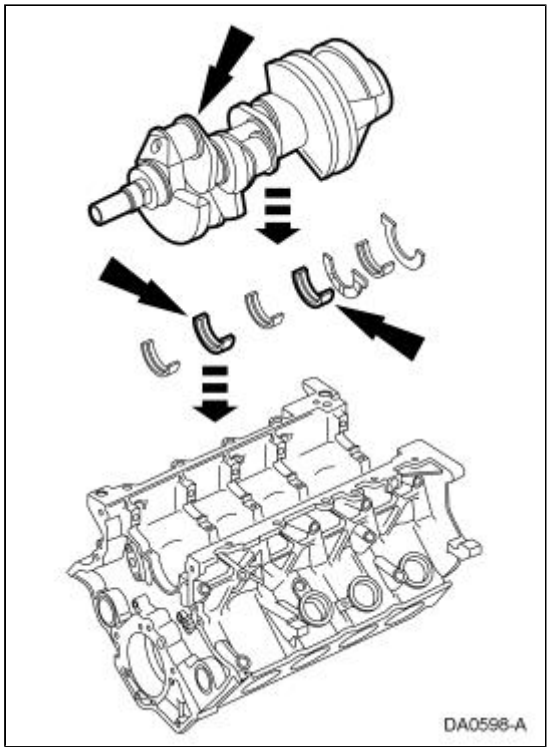


5. **NOTE:** Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.

   Install the crankshaft upper main bearings into the cylinder block and lubricate them with clean engine oil.

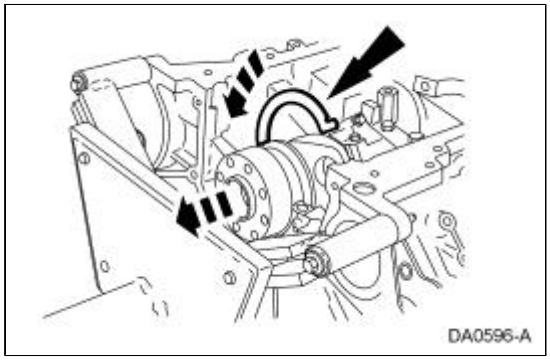
6. **NOTE:** The upper thrust washers are shown for location purposes only. Do not install the upper thrust washers until the crankshaft is installed. Refer to the following 2 steps.

   Install the crankshaft onto the upper crankshaft main bearings.



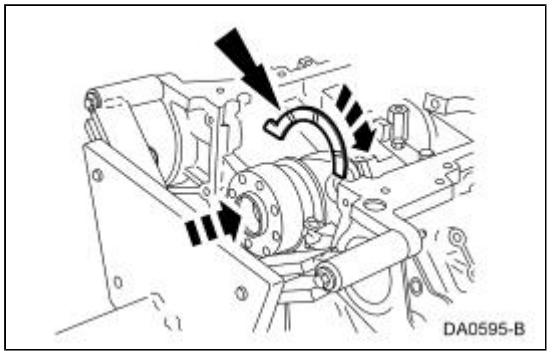
7. **NOTE:** The oil groove on the thrust washer must face toward the front of the engine (against the crankshaft thrust surface).

   Push the crankshaft rearward and install the rear crankshaft upper thrust washer at the back of the No. 5 main boss.



8. **NOTE:** The oil groove on the thrust washer must face toward the front of the engine (against the crankshaft surface).

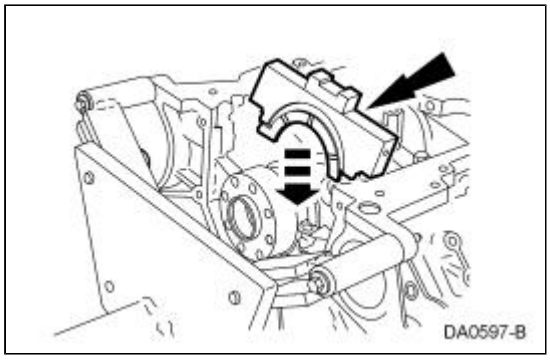
   Push the crankshaft forward and install the front crankshaft upper thrust washer at the front of the No. 5 main boss.



9. **NOTE:** To aid in assembly, apply petroleum jelly to the back of the crankshaft thrust washer.

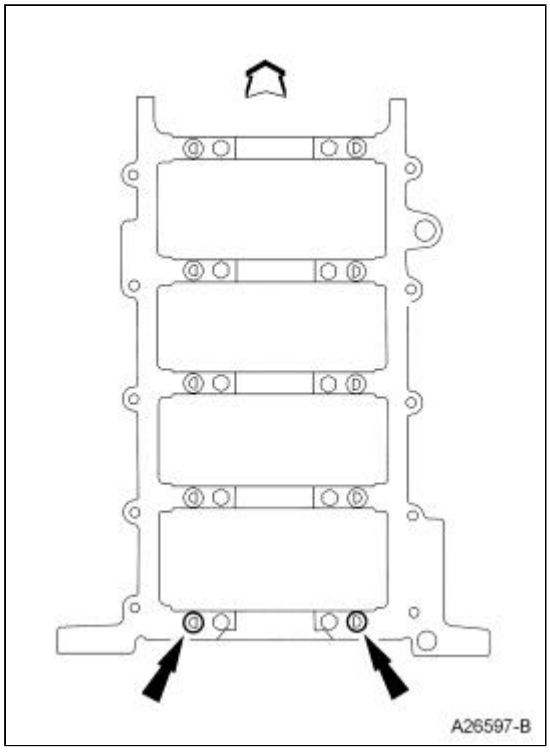
   NOTE: The oil groove on the thrust washer must face toward the rear of the engine (crankshaft surface).

   Install the lower crankshaft thrust washer to the back side of the No. 5 main bearing cap, with oil grooves facing the crankshaft surface.

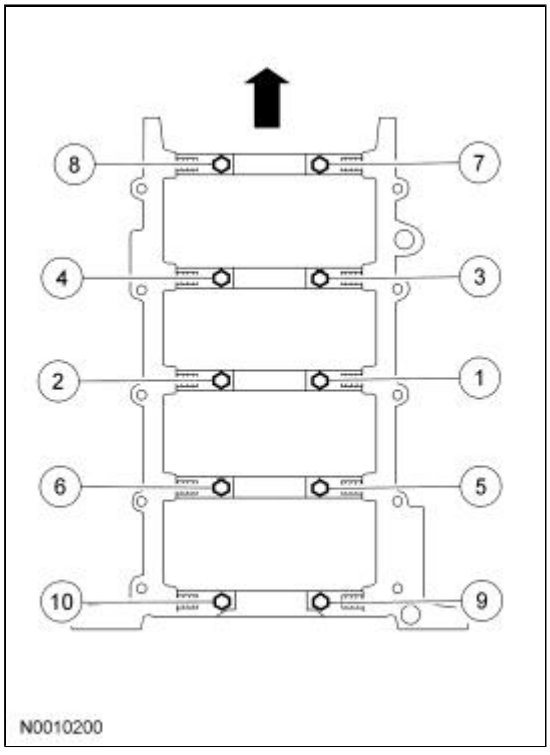


10. Install the crankshaft lower main bearings into the main bearing caps and lubricate them with clean engine oil. Locate the main bearing cap on the cylinder block and, keeping the cap as square as possible, alternately draw the cap down evenly using the cap fasteners.

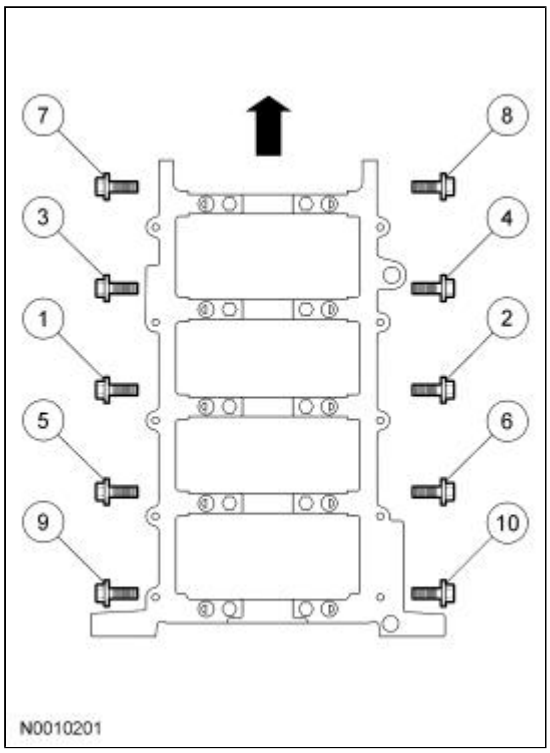
11. Install the dowel pins so the flat sides face the crankshaft.



12. Install the vertical main bearing cap fasteners and tighten in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.

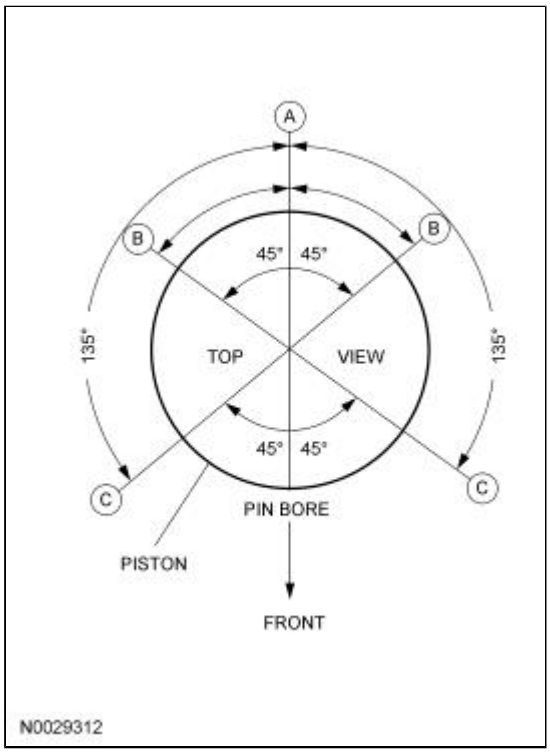


13. Install the side bolts and tighten them in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 30 Nm (22 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



14. Assemble the 8 pistons. For additional information, refer to Piston in this section.

15. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.



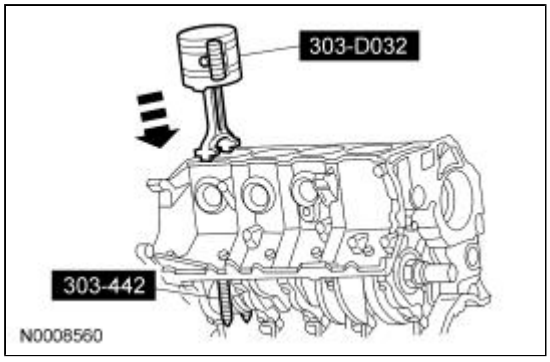
16. Check the piston-to-cylinder block and piston ring clearances. For additional information, refer to Section 303-00 .

17. **CAUTION: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.**

NOTE: The following piston installation steps are for all 8 connecting rods, rod bearings and pistons. Only one connecting rod, rod bearing and piston is shown.

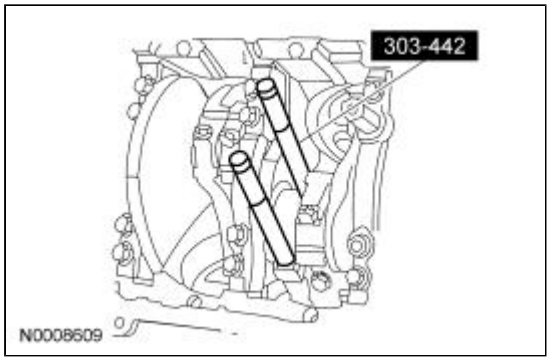
Use the special tools to install the connecting rod with the upper connecting rod bearing in place.

- Lubricate the piston and ring with clean engine oil
- Lubricate the rod bearings with clean engine oil.



18. **CAUTION: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.**

Once the connecting rod is seated on the crankshaft journal, remove the special tools.



19. **CAUTION: The rod cap installation must keep the same orientation as marked during disassembly.**

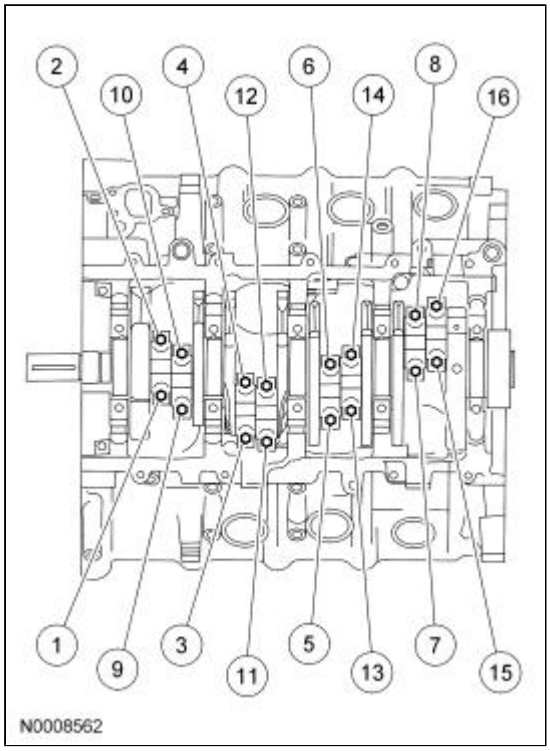
NOTE: The connecting rod caps are of the "cracked" design and must mate with the connecting rod ends. Excessive bearing clearance will result if not mated correctly.

Position the lower bearing and connecting rod, and install the new bolts loosely.

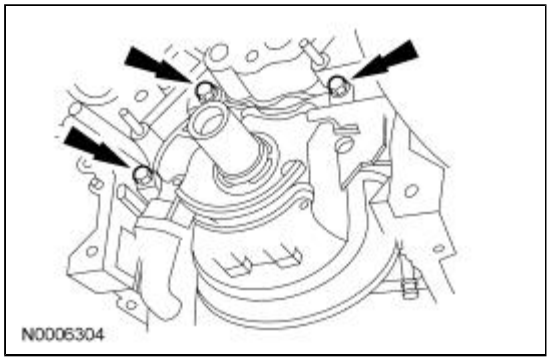
20. **NOTE:** Main bearing caps are removed for clarity.

Tighten the bolts in 2 stages, in the sequence shown.

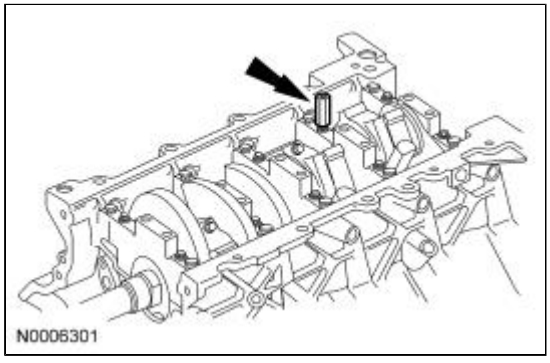
- Stage 1: Tighten to 43 Nm (32 lb-ft).
- Stage 2: Tighten an additional 105 degrees.



21. Position the oil pump and install the bolts.
    - Tighten to 10 Nm (89 lb-in).



22. Install the oil pump screen and pickup tube spacer.
    - Tighten to 25 Nm (18 lb-ft).

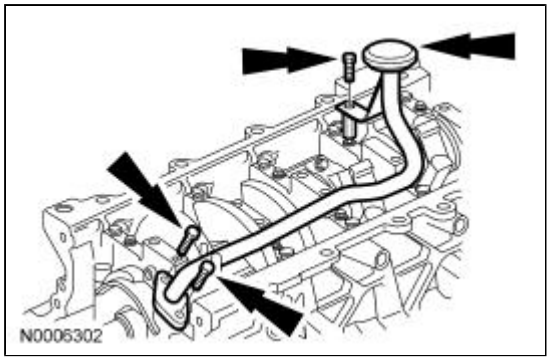


23. **CAUTION: Make sure the O-ring is in place and not damaged. A missing or damaged O-ring can cause foam in the lubrication system, low oil pressure and severe engine damage.**

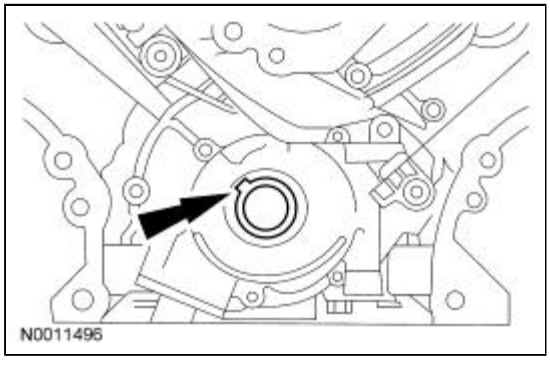
NOTE: Clean and inspect the mating surfaces and install a new O-ring. Lubricate the O-ring with clean engine oil prior to installation.

Position the oil pump screen and pickup tube and install the bolts.

- Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
- Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).



24. Position the crankshaft keyway at the 11 o'clock position.



25. **CAUTION: Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore.**

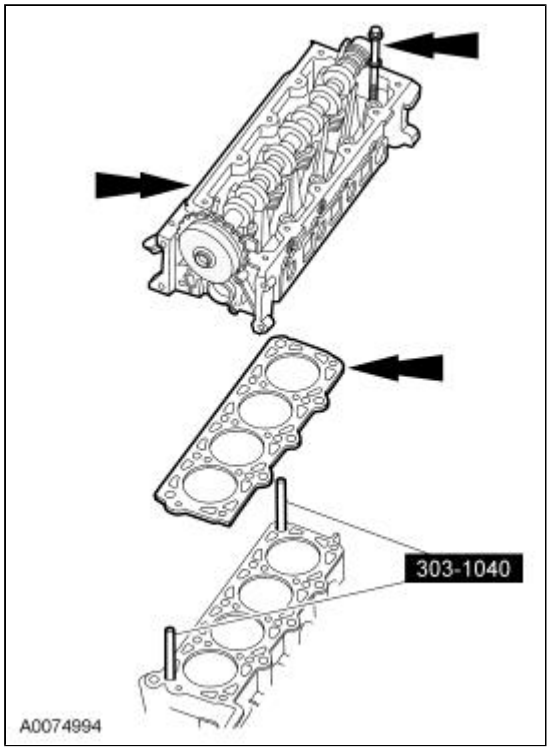
CAUTION: The use of sealing aids (aviation cement, copper spray, and glue) is not permitted. The gasket must be installed dry.

CAUTION: The cylinder head bolts must be discarded and new bolts installed. They are tighten-to-yield designed and cannot be reused.

NOTE: Do not turn the crankshaft until instructed to do so.

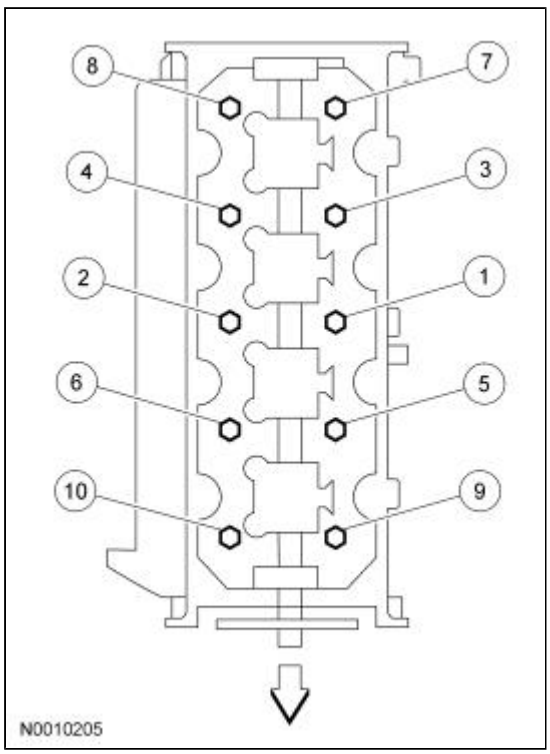
NOTE: LH shown, RH similar.

Using the special tools, position the cylinder head gaskets and cylinder heads over the dowels and install the cylinder head bolts loosely.

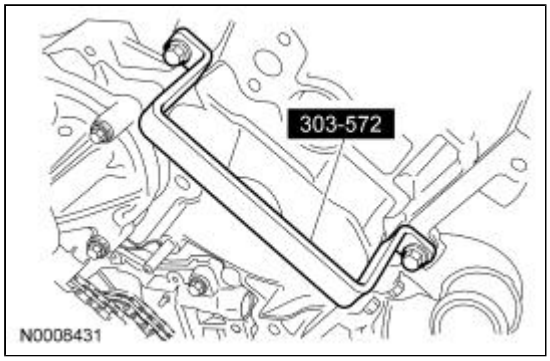


26. **NOTE:** RH shown, LH similar.

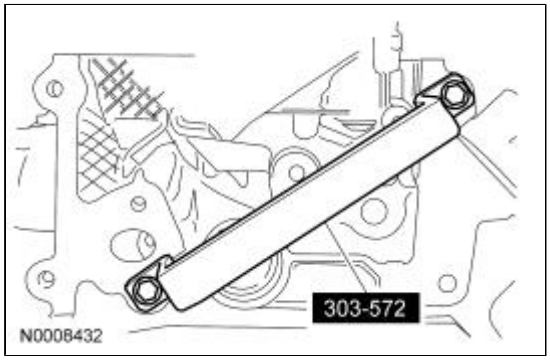
    Tighten the bolts in 3 stages, in the sequence shown.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.
    - Stage 3: Tighten an additional 90 degrees.



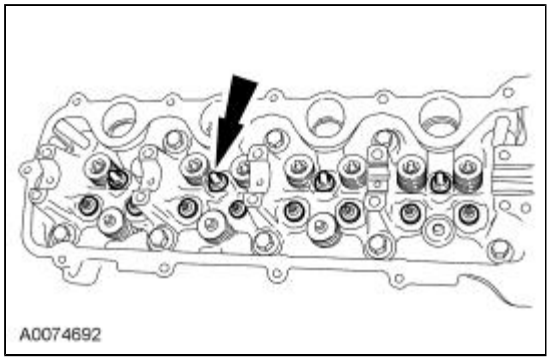
27. Remove the special tool from the LH cylinder head.



28. Remove the special tool from the RH cylinder head.



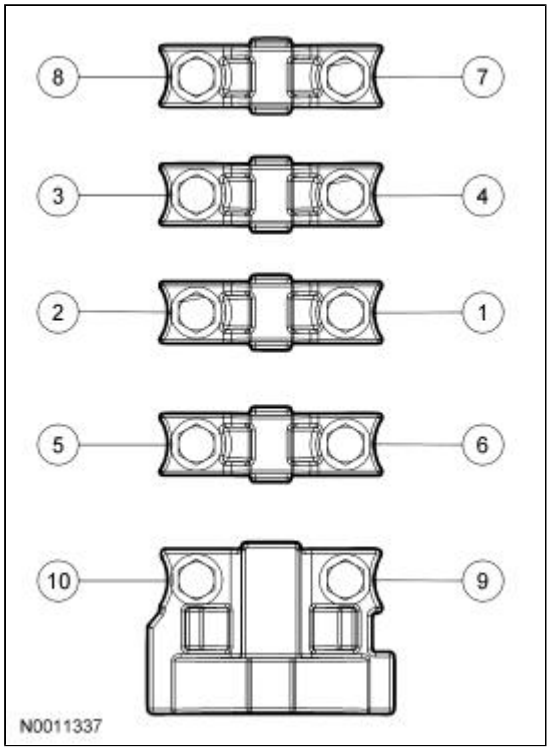
29. Install the hydraulic lash adjusters into the RH and LH cylinder heads.
    - Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.



30. Install the LH and RH camshafts.
    - Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

31. **NOTE:** LH shown, RH similar.

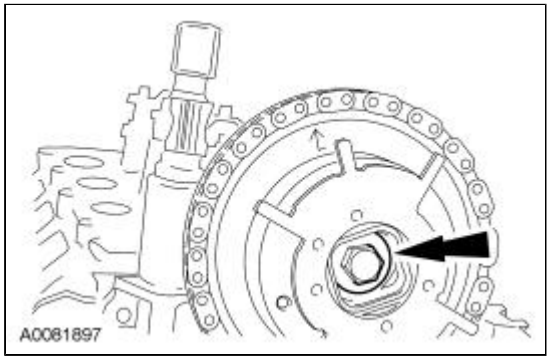
    Install the LH and RH camshaft bearing caps in their original locations.
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the bolts loosely.
    - Tighten to 10 Nm (89 lb-in) in the sequence shown.



32. **CAUTION: Damage to the variable camshaft timing (VCT) phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTE: LH shown, RH similar.

    Install the VCT phaser sprockets and new VCT phaser sprocket bolts finger tight.

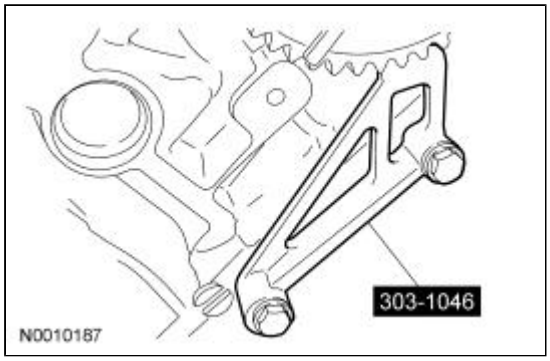


33. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

    NOTE: LH shown, RH similar.

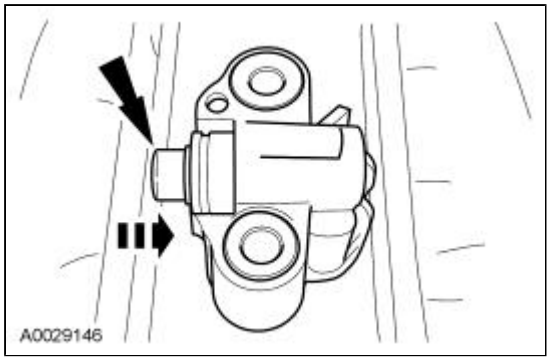
    Using the special tool, tighten the LH and RH VCT phaser sprocket bolts in 2 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



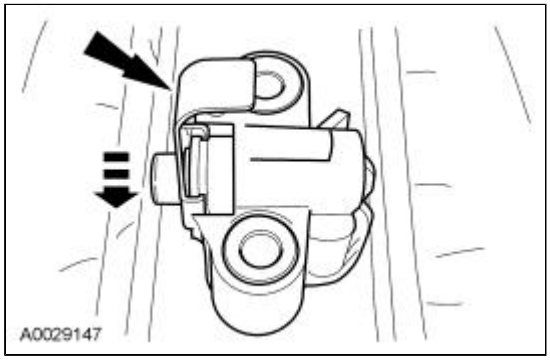
34. **CAUTION: Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

    CAUTION: Prior to installation, inspect the tensioner-sealing bead for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.

    Compress the tensioner plunger, using a vise.

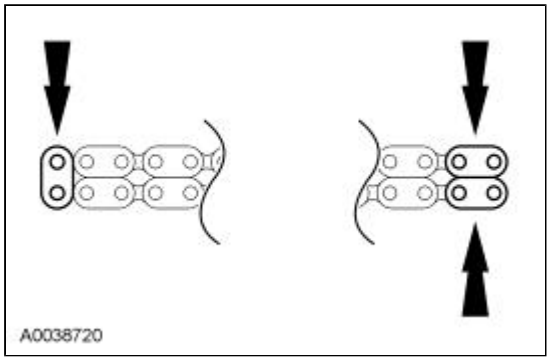


35. Install a retaining clip on the tensioner to hold the plunger in during installation.

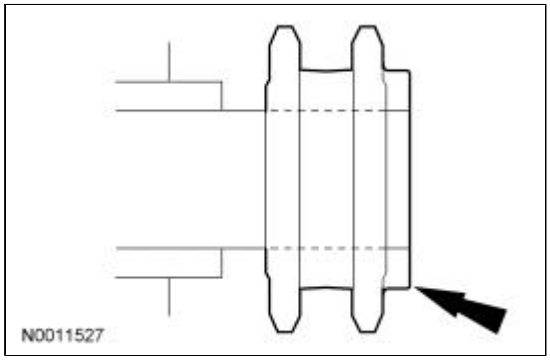


36. Remove the tensioner from the vise.

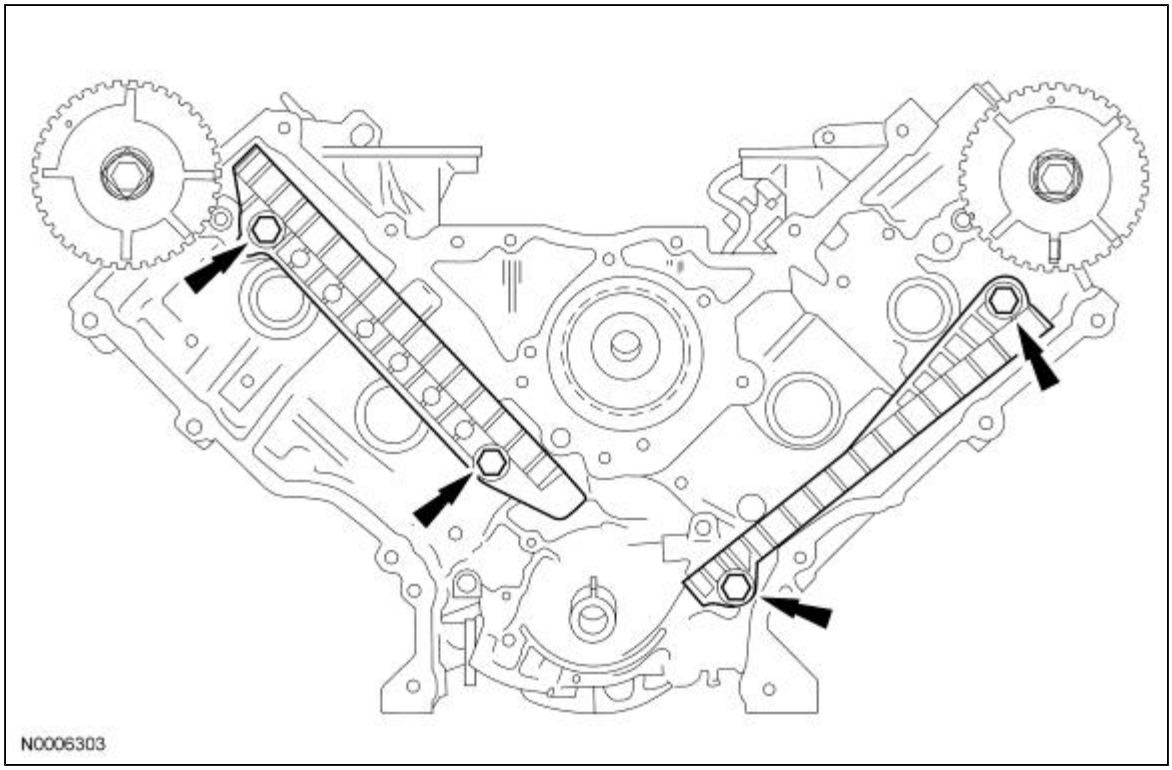
37. If the copper links are not visible, mark 2 links on one end and 1 link on the other end, and use as timing marks.



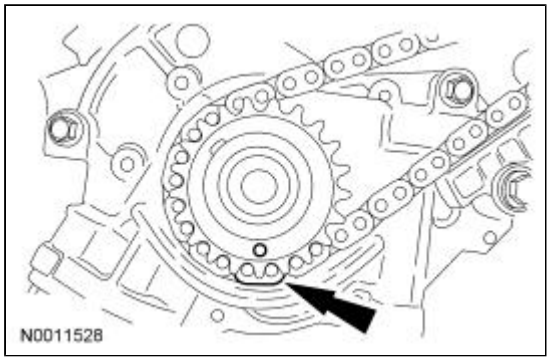
38. Install the crankshaft sprocket, making sure the flange faces forward.



39. Install the 4 bolts and the LH and RH timing chain guides.
    - Tighten to 10 Nm (89 lb-in).

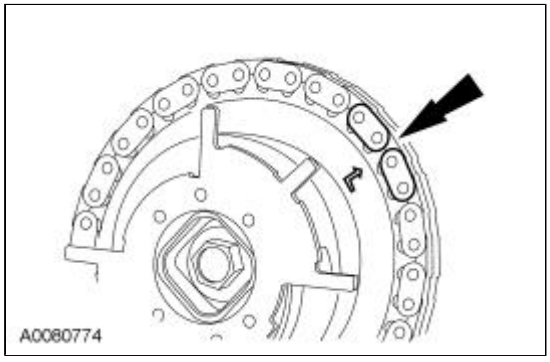


40. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



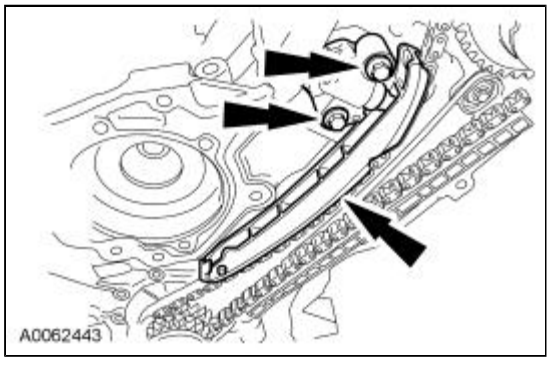
41. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

    Position the timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.

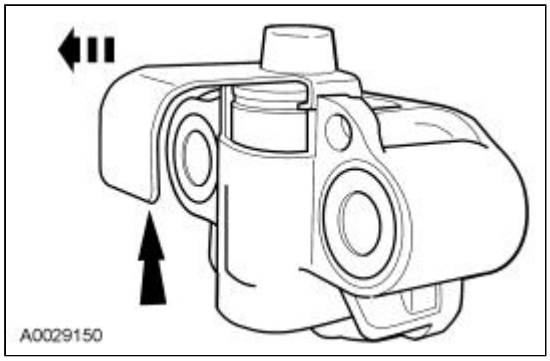


42. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

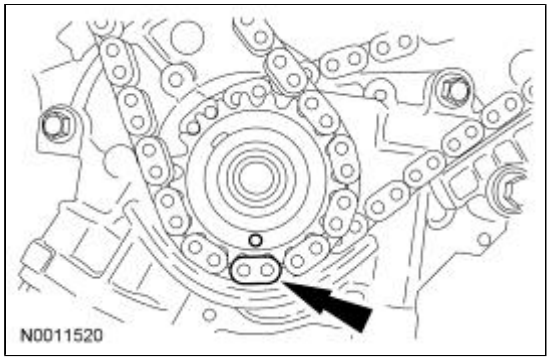
    Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and bolts.
    - Tighten to 25 Nm (18 lb-ft).



43. Remove the retaining clip from the LH timing chain tensioner.

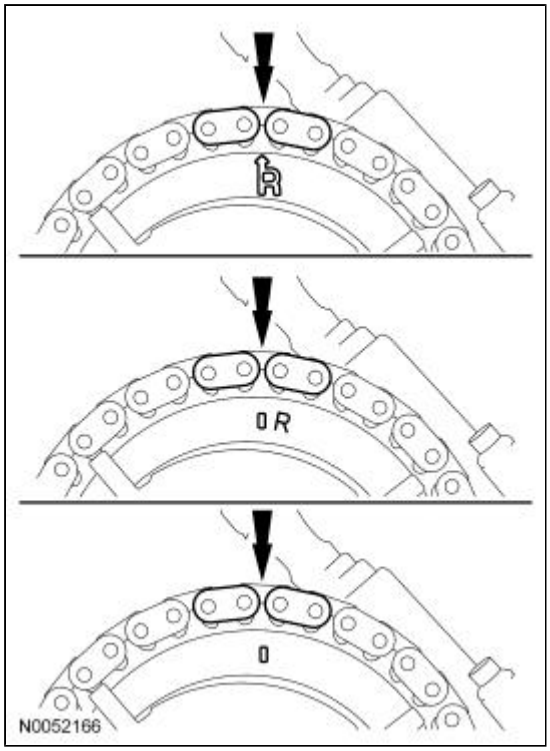


44. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.



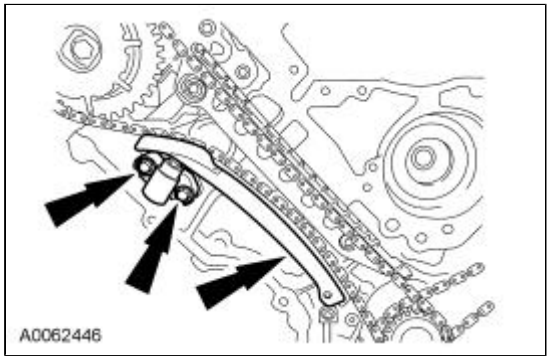
45. **NOTE:** The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

    Position the RH timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.

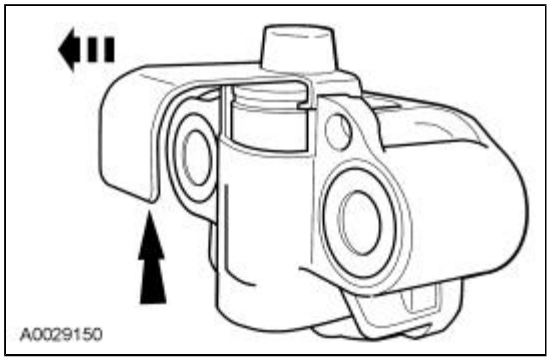


46. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and bolts.

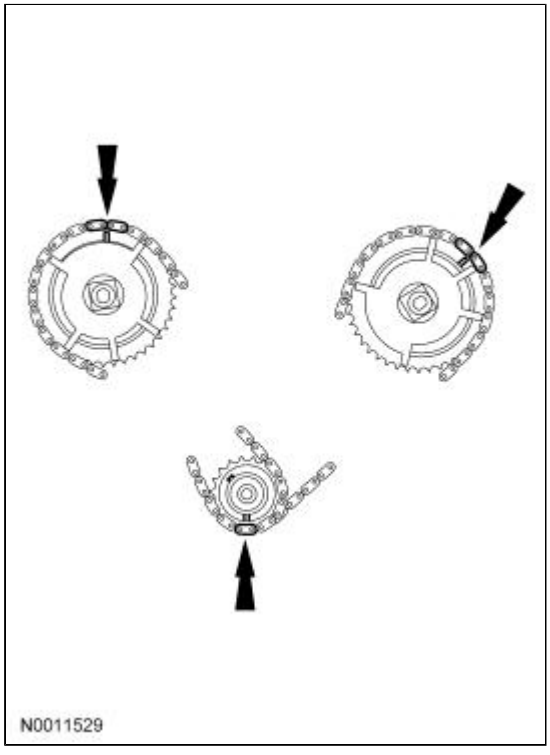
- Tighten to 25 Nm (18 lb-ft).



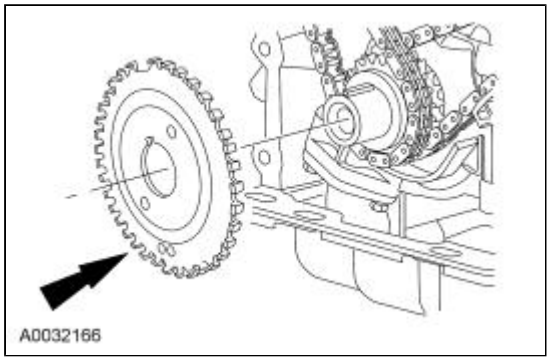
47. Remove the retaining clip from the RH timing chain tensioner.



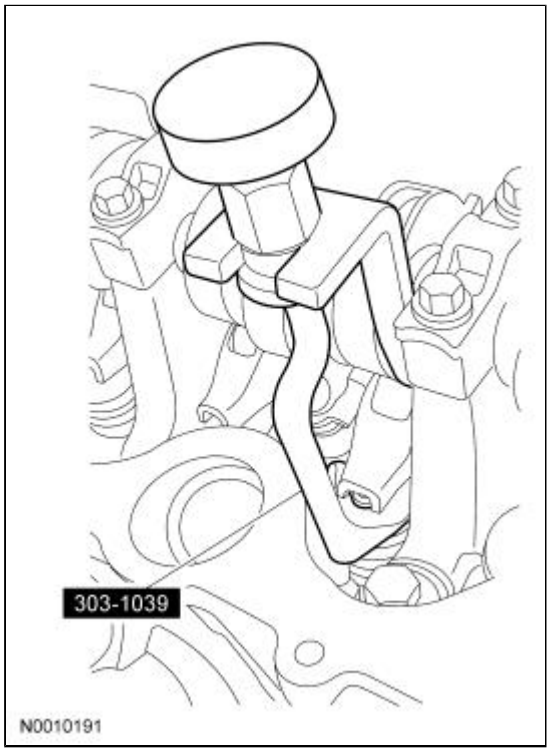
48. As a post-check, verify correct alignment of all timing marks.



49. Install the crankshaft sensor ring on the crankshaft.



50. Using the special tool, install all of the camshaft roller followers.
    - Lubricate the camshaft roller followers with clean engine oil prior to installation.

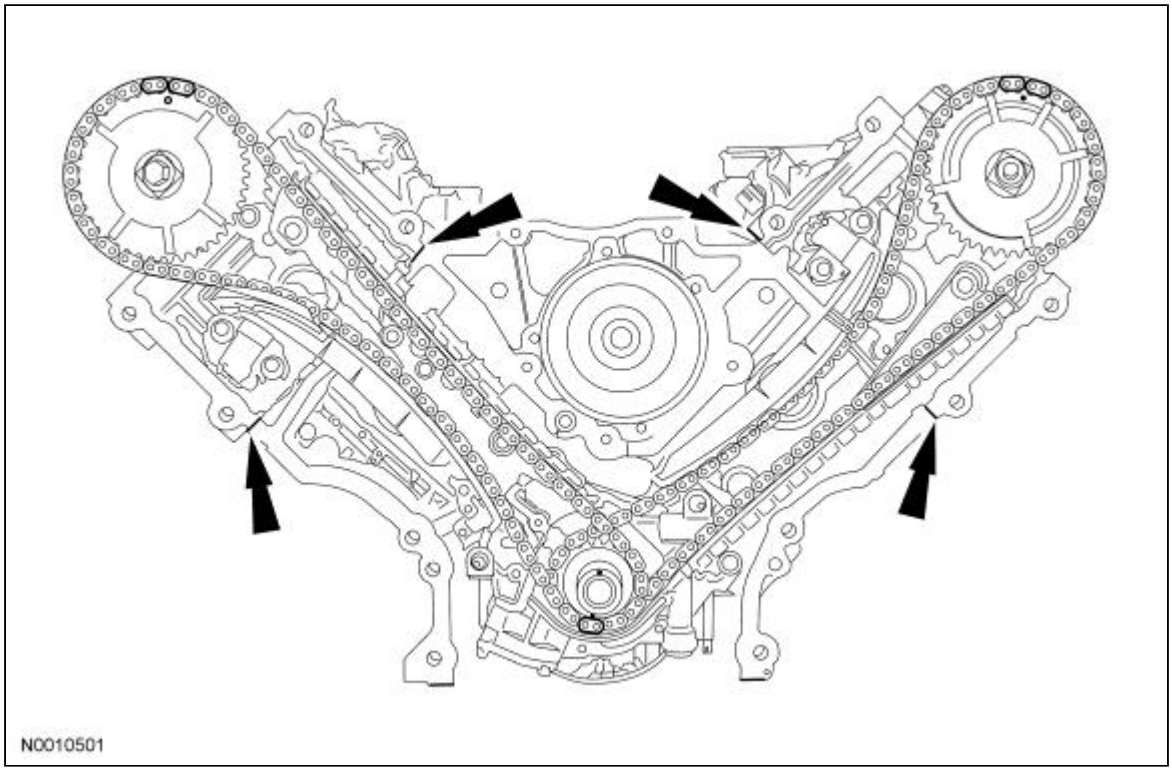


51. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

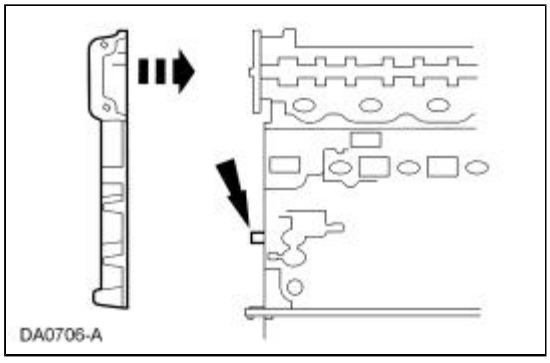
    NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    NOTE: Make sure that the engine front cover gasket are in place on the engine front cover before installation.

    Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown.



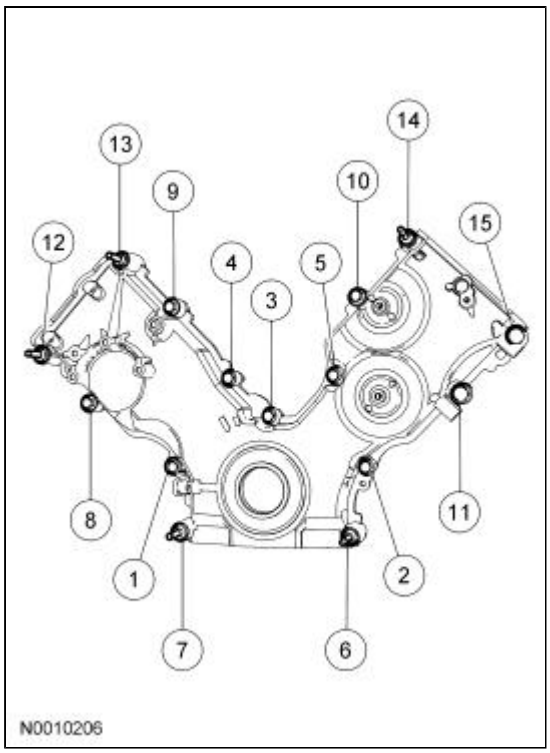
52. Install new engine front cover gaskets on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger-tight.



53. Tighten the engine front cover fasteners in sequence in 2 stages.
Stage 1: Tighten fasteners 1 through 15 to 25 Nm (18 lb-ft).
Stage 2: Tighten fasteners 6 and 7 to 48 Nm (35 lb-ft).

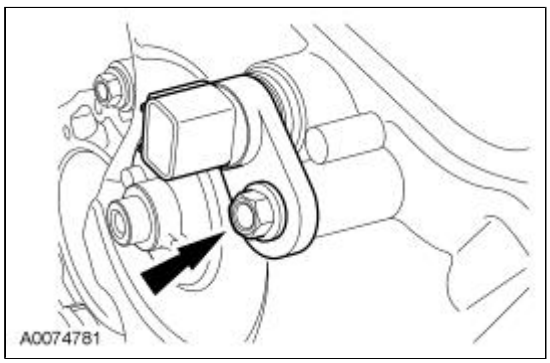
Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
5	N806177	Bolts, Hex Flange Head Pilot, M8 x 1.25 x 50
6	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
7	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50

11	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
12	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
13	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
14	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
15	W706605	Bolt, Hex Head Pilot, M8 x 1.25 x 56



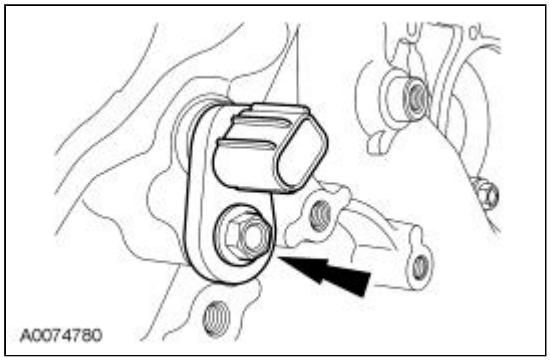
54. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

    Install the LH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



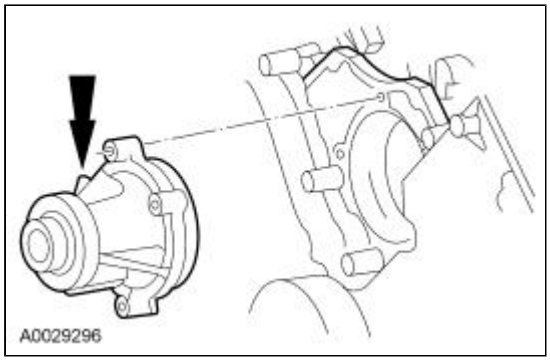
55. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

    Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

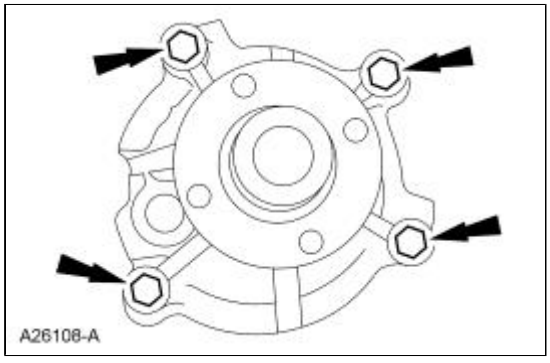


56. **CAUTION: Do not rotate the coolant pump housing once the coolant pump has been positioned in the cylinder block. Damage to the O-ring seal will occur.**

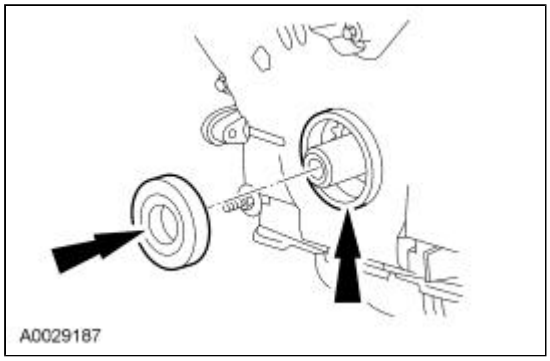
    Position the coolant pump and install the bolts loosely.
    - Lubricate the new O-ring seal using clean engine coolant and install the O-ring seal onto the coolant pump.



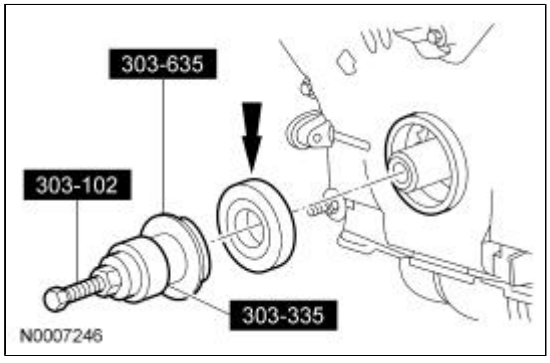
57. Tighten the 4 coolant pump bolts.
    - Tighten to 25 Nm (18 lb-ft).



58. Lubricate the engine front cover and the crankshaft front seal inner lip with clean engine oil.

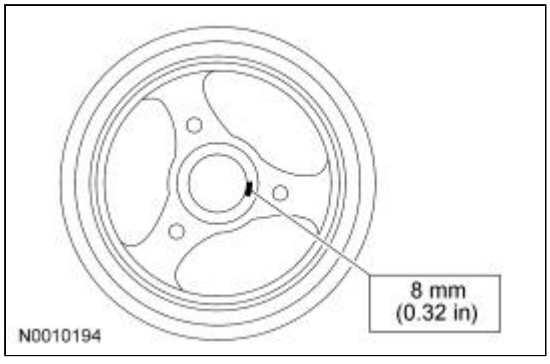


59. Using the special tools, install a new crankshaft front seal into the engine front cover.

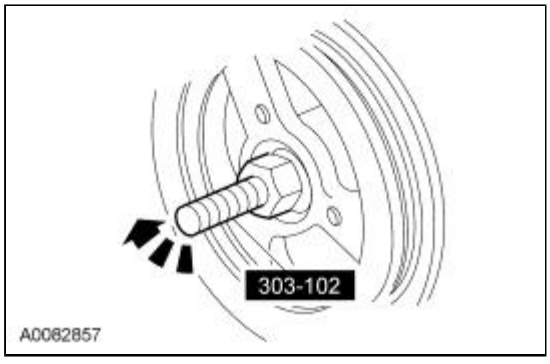


60. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

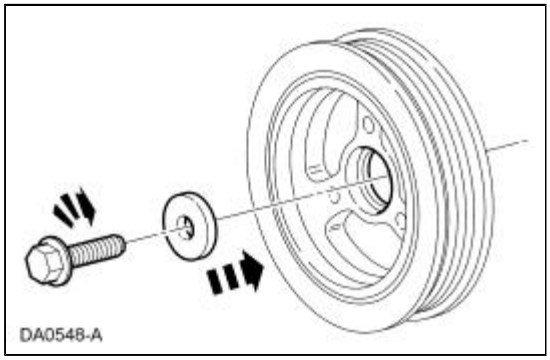
    Apply silicone gasket and sealant to the Woodruff key slot on the crankshaft pulley.



61. Use the special tool to install the crankshaft pulley.

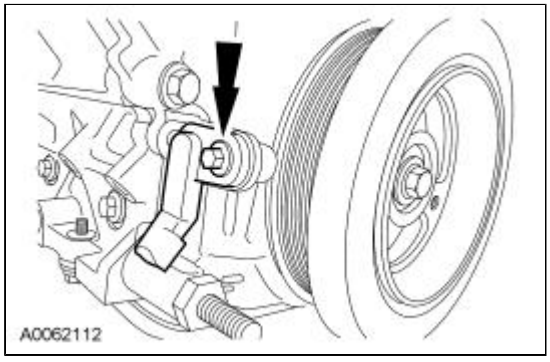


62. Tighten the new crankshaft pulley bolt in 4 stages.
    - Stage 1: Tighten to 90 Nm (66 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

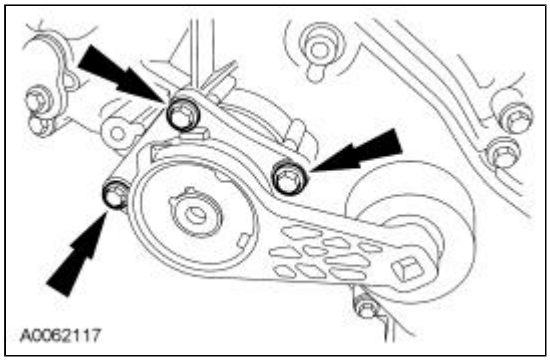


63. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

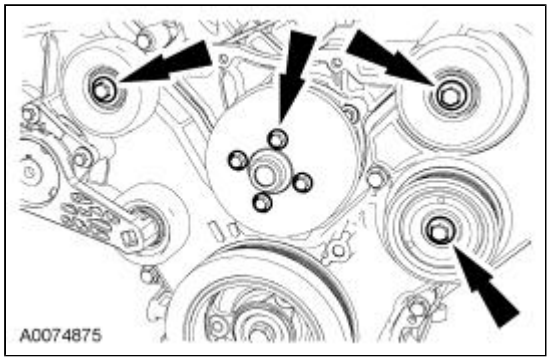
    Install the crankshaft position (CKP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



64. Position the accessory drive belt tensioner and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).



65. Install the 3 accessory drive belt idler pulleys, the coolant pump pulley and the 7 bolts.
    - Tighten to 25 Nm (18 lb-ft).

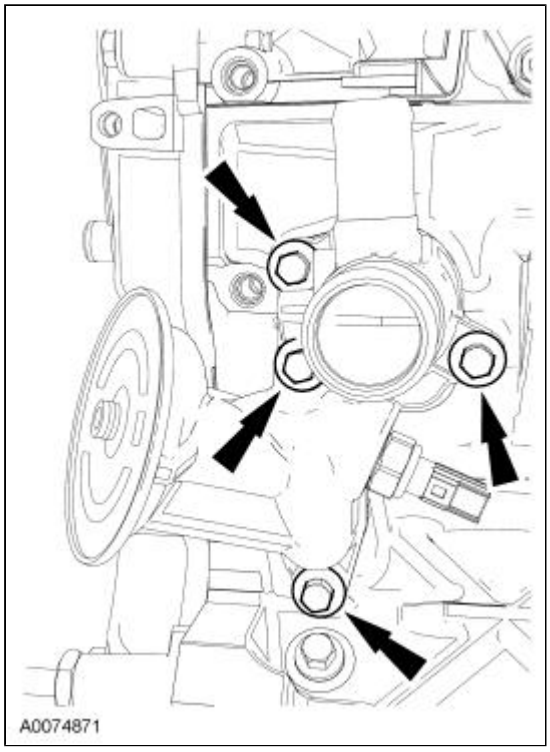


66. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

NOTE: Clean and inspect the mating surfaces, and install a new gasket.

Position the oil filter adapter and install the 4 bolts.

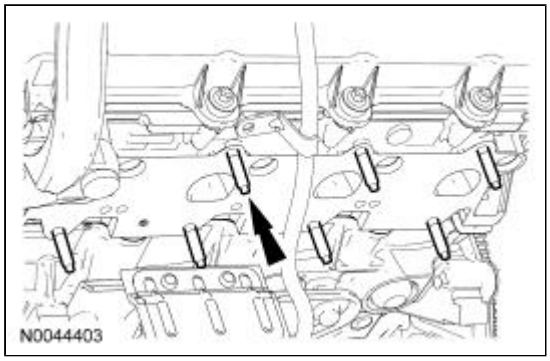
- Tighten to 25 Nm (18 lb-ft).



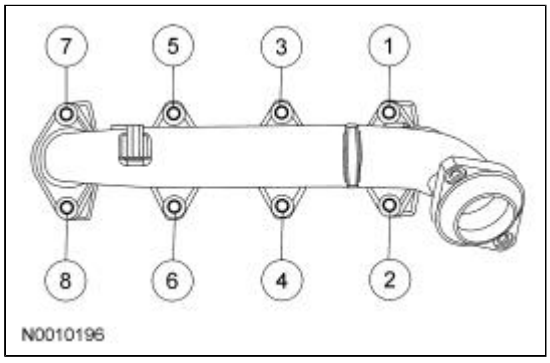
67. **NOTE:** LH shown, RH similar.

Install 16 new exhaust manifold studs.

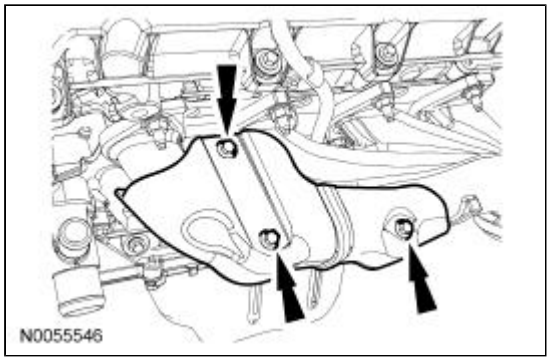
- Tighten to 12 Nm (9 lb-ft).



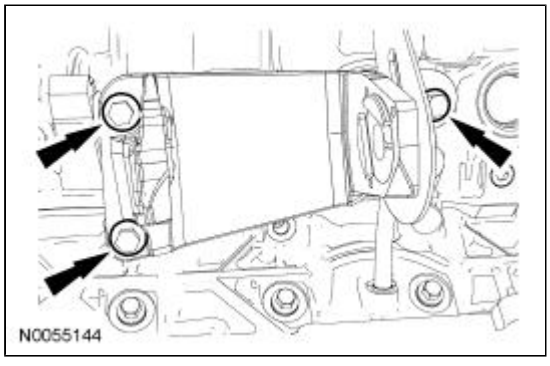
68. Position a new gasket, the LH exhaust manifold and tighten the 8 nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



69. Position the exhaust manifold heat shield and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

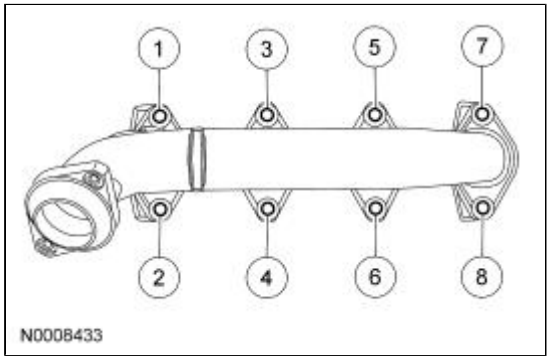


70. Position the LH engine support insulator-to-cylinder block bracket and install the 3 bolts.
    - Tighten to 63 Nm (46 lb-ft).

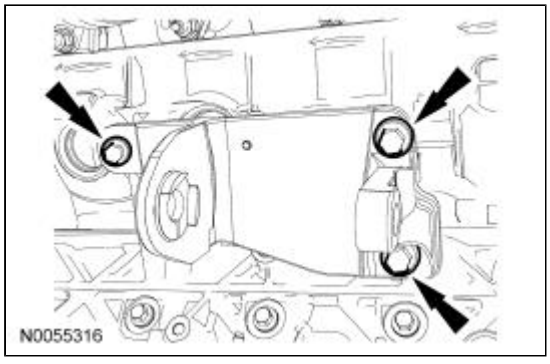


71. Position a new gasket, the RH exhaust manifold and tighten the 8 nuts in the sequence shown.

- Tighten to 25 Nm (18 lb-ft).



72. Position the RH engine support insulator-to-cylinder block bracket and install the 3 bolts.
    - Tighten to 63 Nm (46 lb-ft).

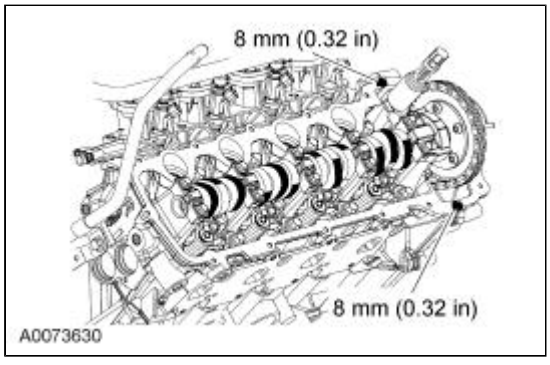


73. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

74. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

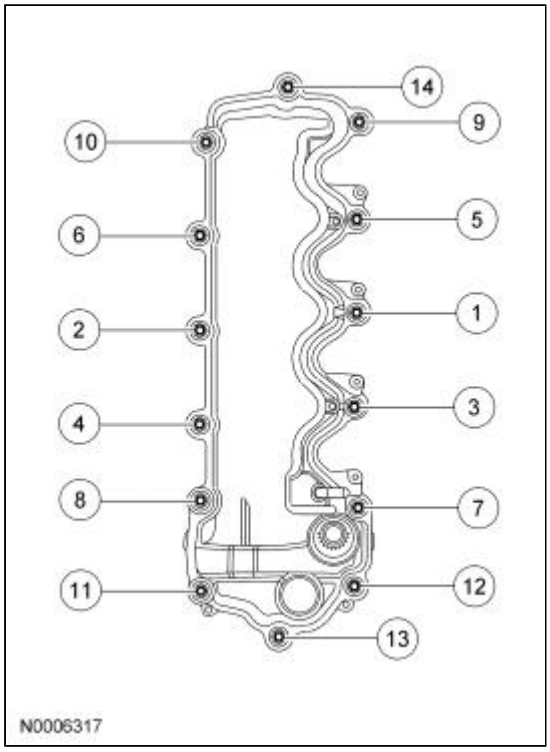


75. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT**

solenoid.

Position the RH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.

- Tighten to 10 Nm (89 lb-in).

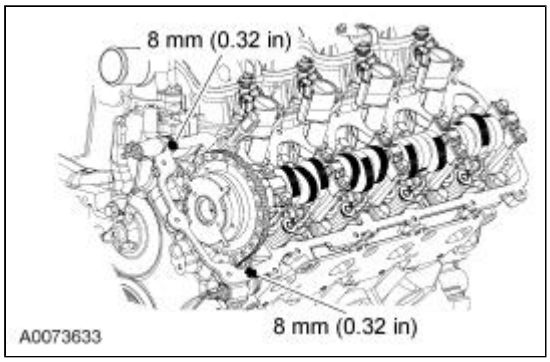


76. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

77. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

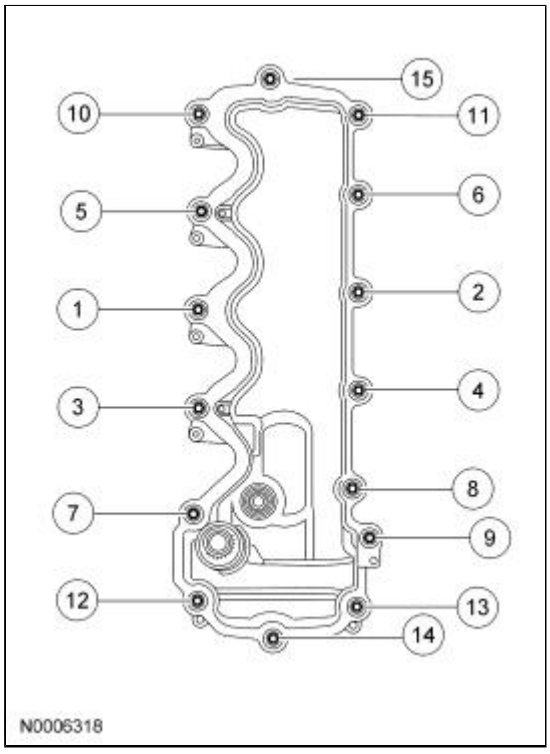
    Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



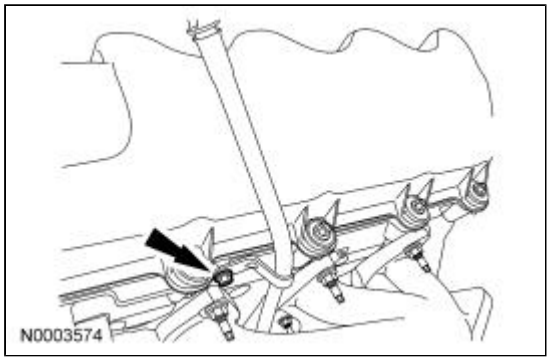
78. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT solenoid.**

Position the LH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.

- Tighten to 10 Nm (89 lb-in).



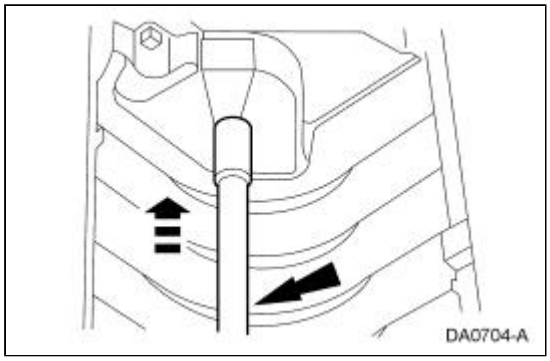
79. Install the oil level indicator tube and the bolt.
    - Install a new O-ring seal and lubricate the O-ring seal with clean engine oil prior to installation.
    - Tighten to 10 Nm (89 lb-in).



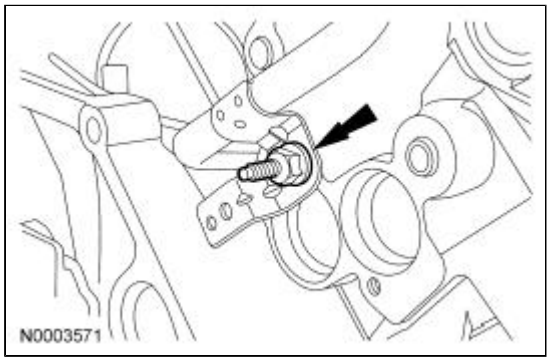
80. **NOTE:** Do not reuse the O-ring seals.

NOTE: Lubricate the O-ring seals with clean engine coolant prior to installation.

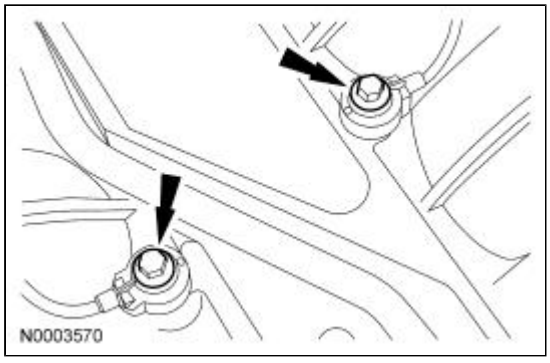
Slide the coolant tube forward with the new O-ring seals into the cylinder block.



81. Install the coolant tube stud bolt.
    - Tighten to 10 Nm (89 lb-in).



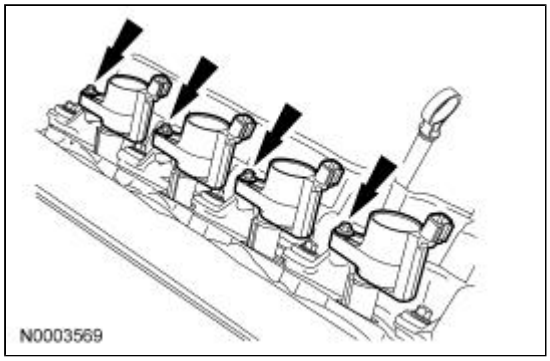
82. Install the 2 knock sensors (KS) and the bolts.
    - Tighten to 20 Nm (15 lb-ft).



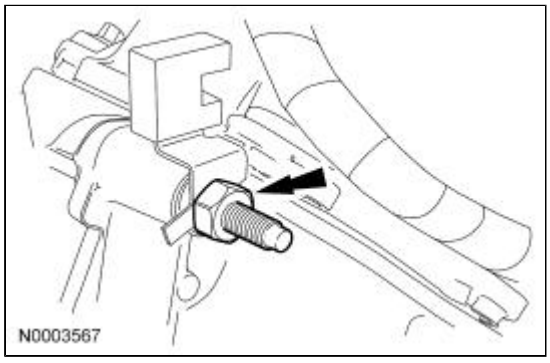
83. Position the electrical harness on the engine assembly and connect the engine wiring harness retainers to the valve cover studs.

84. **NOTE:** LH shown, RH similar.

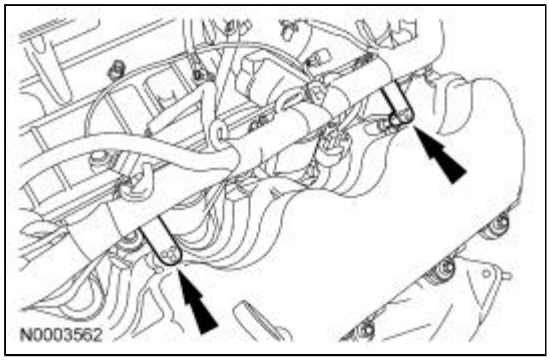
    Install the 8 ignition coils and the 8 bolts.
    - Tighten to 6 Nm (53 lb-in).



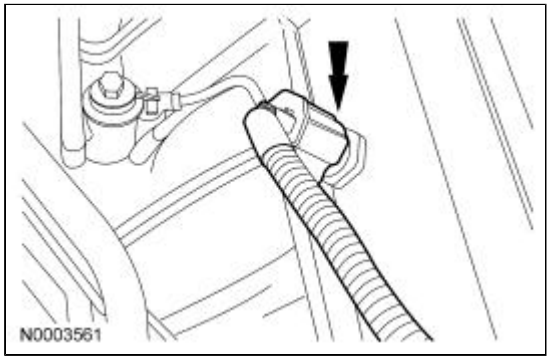
85. Install the LH radio ignition interference capacitor and the nut.
    - Tighten to 25 Nm (18 lb-ft).



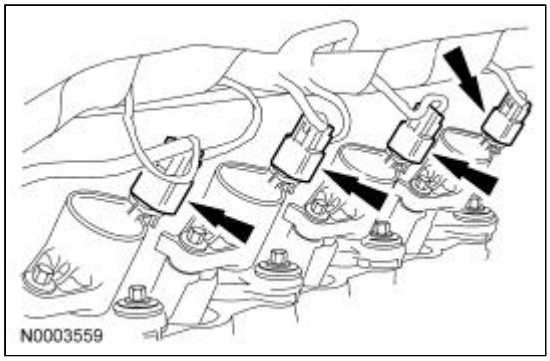
86. Connect the 2 engine wiring harness retainers to the LH valve cover studs.



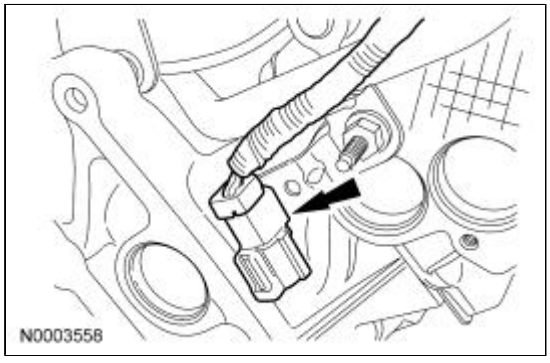
87. Connect the cylinder head temperature (CHT) sensor electrical connector.



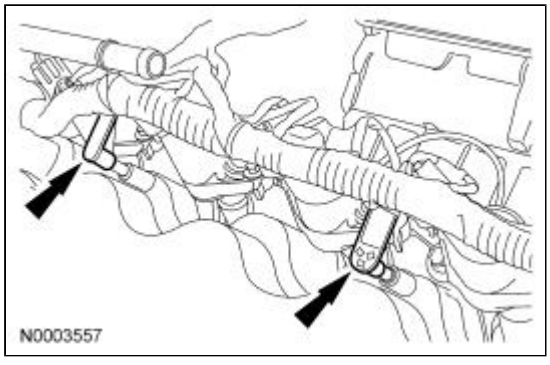
88. Connect the 4 RH ignition coil electrical connectors.



89. Connect the electrical connector retainer to the coolant tube.

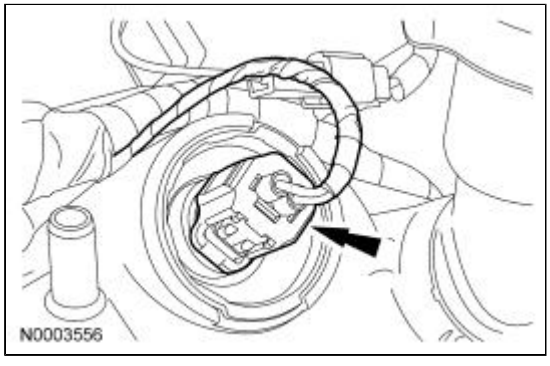


90. Connect the 2 engine wiring harness retainers from the RH valve cover studs.

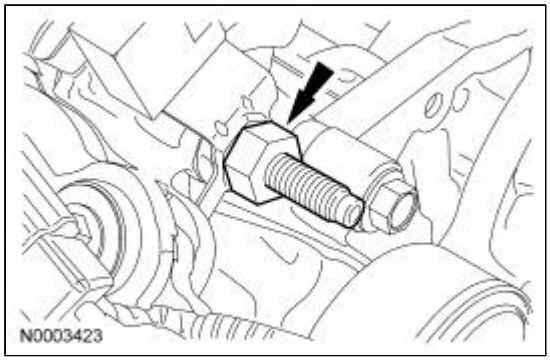


91. **NOTE:** RH shown, LH similar.

    Connect the RH and LH variable camshaft timing (VCT) solenoid electrical connector.

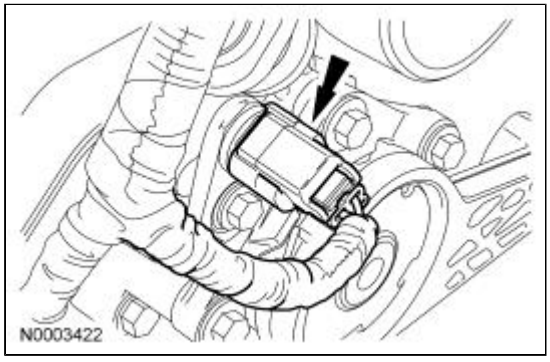


92. Install the RH radio ignition interference capacitor and the nut.
    - Tighten to 25 Nm (18 lb-ft).

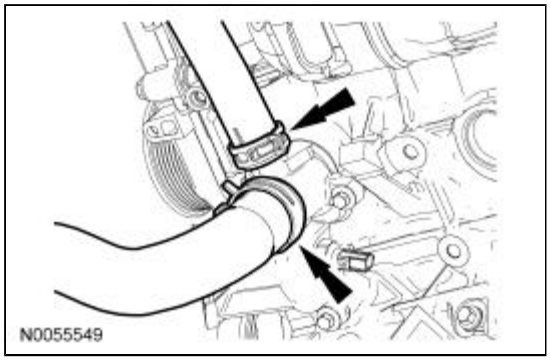


93. **NOTE:** RH shown, LH similar.

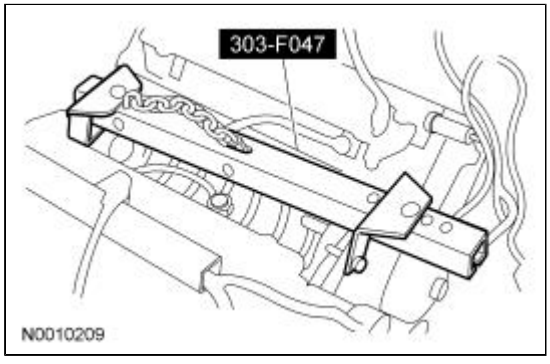
    Disconnect the RH and LH CMP sensor electrical connectors.



94. Connect the 2 coolant hoses to the oil filter adapter.



95. Install the special tool.



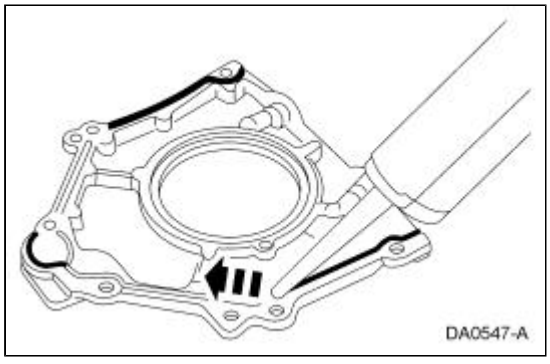
96. Using a suitable floor crane, remove the engine from the engine stand.

97. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the aluminum retainer plate. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

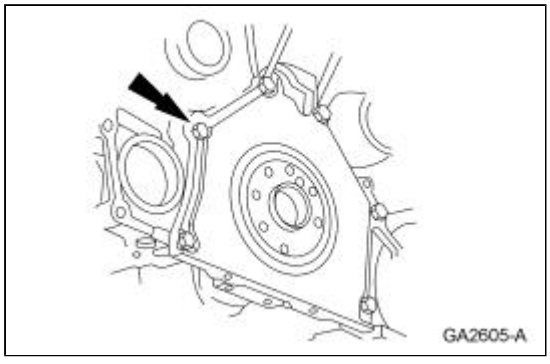
    Inspect the crankshaft rear seal retainer plate. Clean the mating surface for the rear seal retainer plate with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

98. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

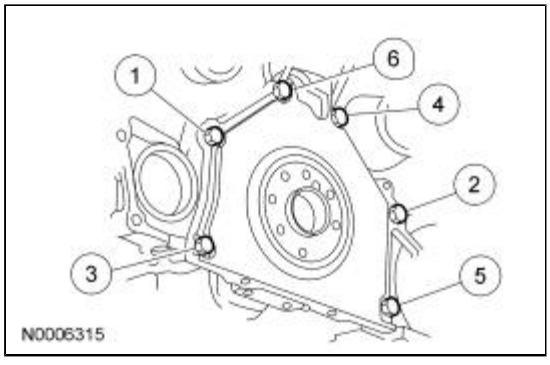
    Apply a 4 mm (0.16 in) bead of silicone gasket and sealant around the crankshaft rear seal retainer sealing surface.



99. Install the crankshaft rear seal retainer plate and loosely install the 6 bolts.



100. Tighten the bolts in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).

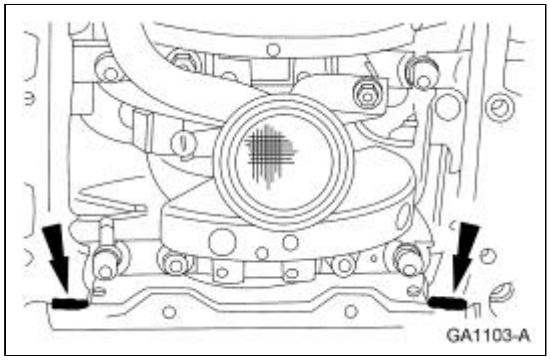


101. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Inspect the oil pan. Clean the mating surface for the oil pan with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

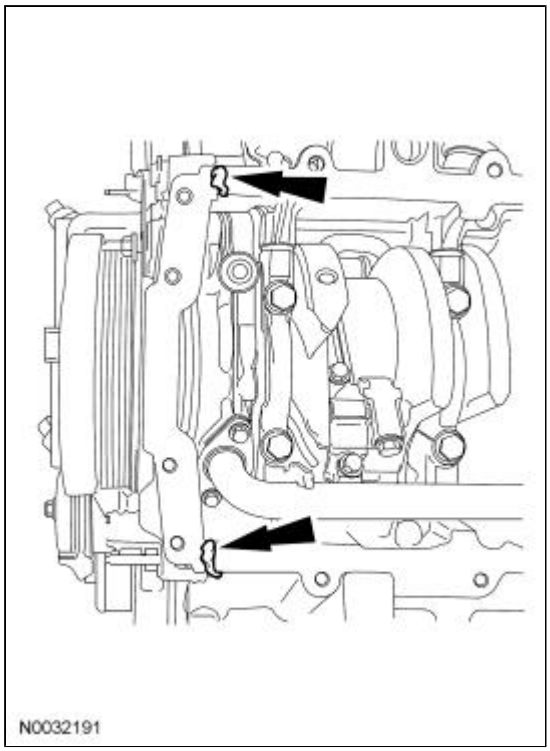
102. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply silicone gasket and sealant at the crankshaft rear seal retainer plate-to-cylinder block sealing surface.

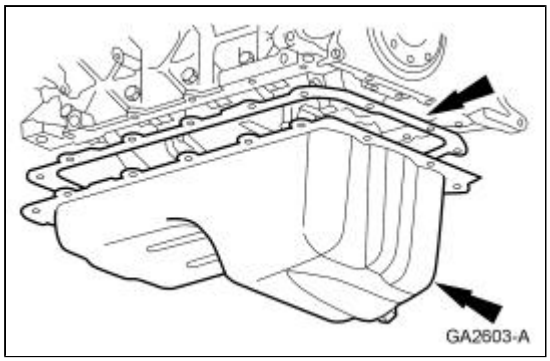


103. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

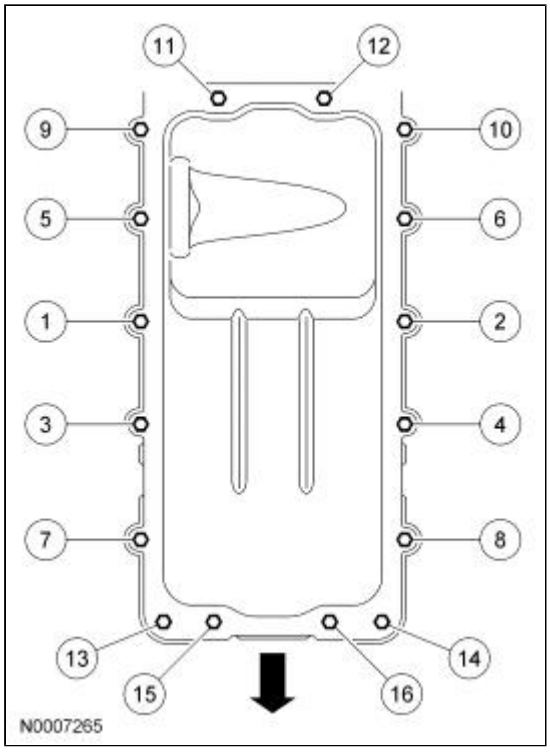
Apply silicone gasket and sealant at the engine front cover-to-cylinder block sealing surface.



104. Install the oil pan gasket and the oil pan and loosely install the bolts.

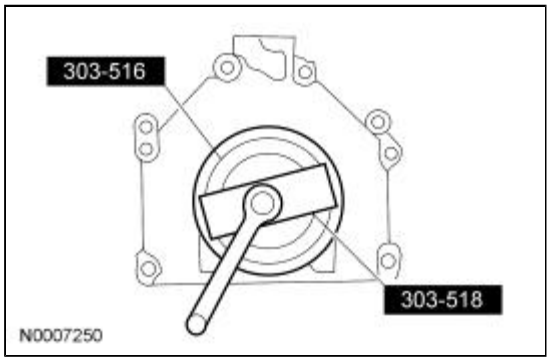


105. Tighten the bolts in 3 stages, in the sequence shown.
    - Stage 1: Tighten to 2 Nm (18 lb-in).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).
    - Stage 3: Tighten an additional 60 degrees.

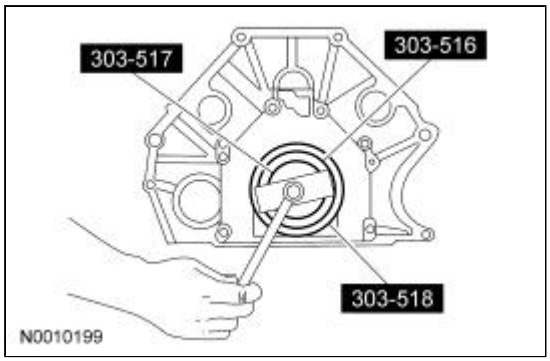


106. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

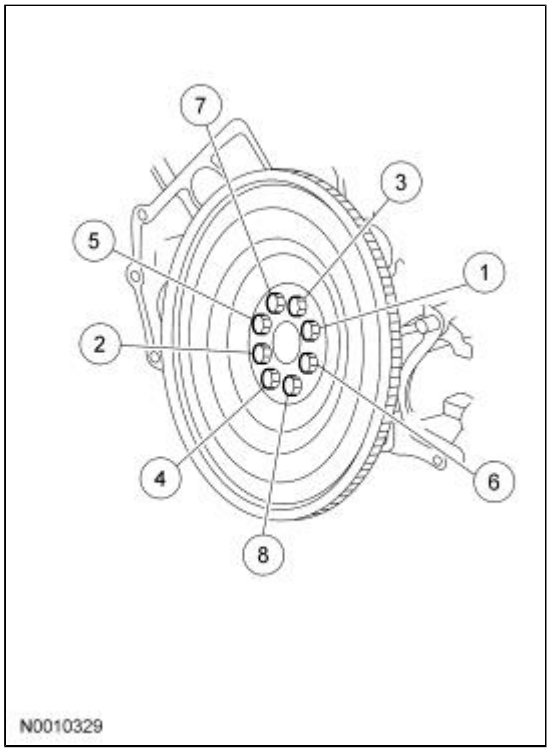
Using the special tools, install a new crankshaft rear seal.



107. Using the special tools, install a new crankshaft rear oil slinger.



108. Install the flexplate and the 8 bolts in the sequence shown.
    - Tighten to 80 Nm (59 lb-ft).



Engine

Printable View (865 KB)

Special Tool(s)

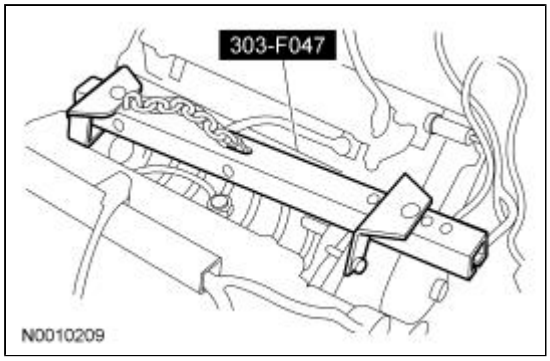
ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Threadlock 262 TA-26	WSK-M2G351-A6

1. Using a suitable floor crane, position the engine assembly into the vehicle.

2. Remove the special tool.

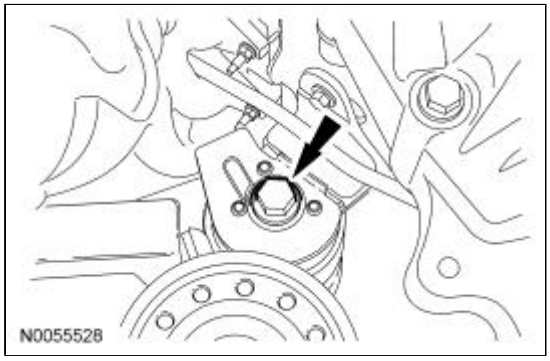


3. **CAUTION: Only use hand tools when installing the engine support insulator through bolt or damage to the engine support insulator-to-cylinder block bracket can occur.**

   NOTE: LH shown, RH similar.

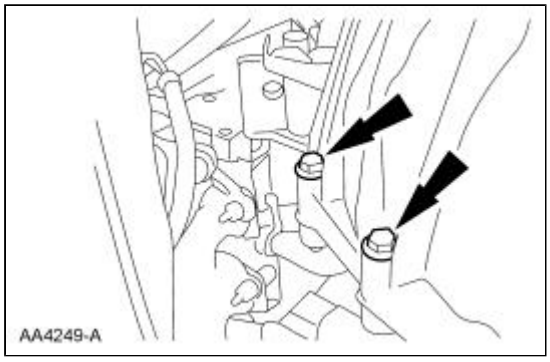
   Install the LH and RH engine support insulator bolts.
   - Apply Threadlock 262 to the bolt threads prior to installation.

- Tighten to 350 Nm (258 lb-ft).

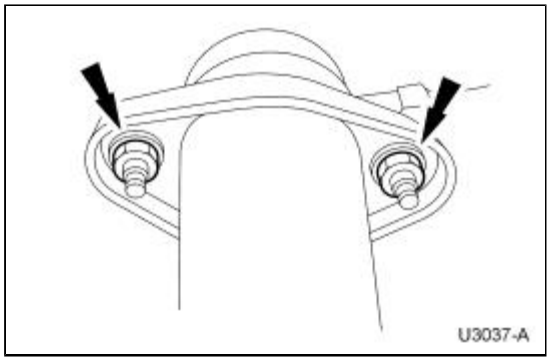


4. **NOTE:** Align the engine-to-transmission dowels before installing the engine-to-transmission bolts.

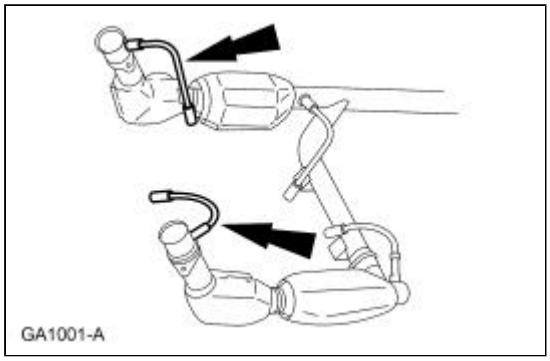
   Install the lower 5 transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).



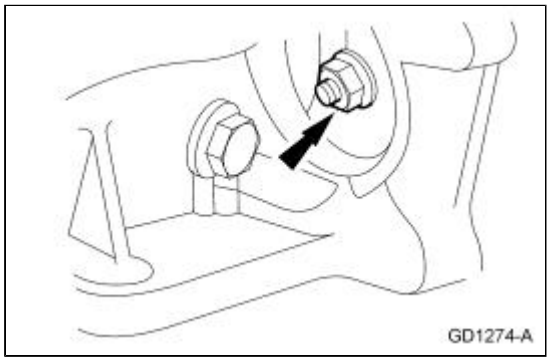
5. Install the 4 exhaust manifold-to-catalytic converter nuts.
   - Tighten to 40 Nm (30 lb-ft).



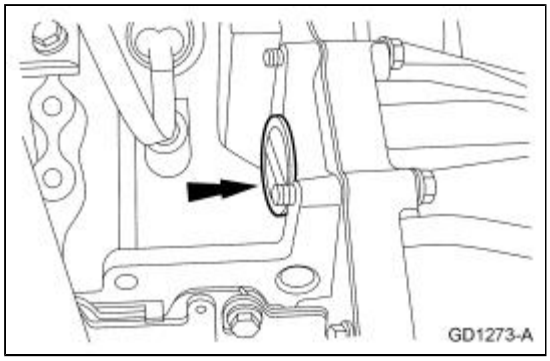
6. Connect the heated exhaust gas oxygen sensor (HO2S) electrical connectors.



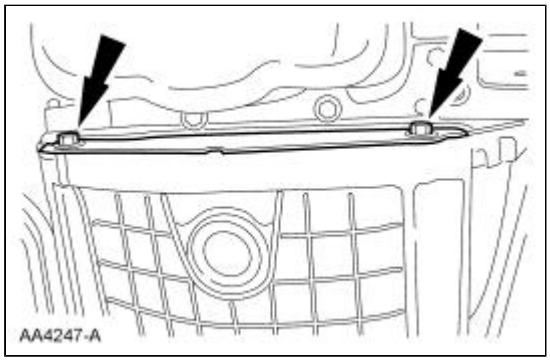
7. Install new torque converter-to-flexplate nuts.
    - Tighten to 35 Nm (26 lb-ft).



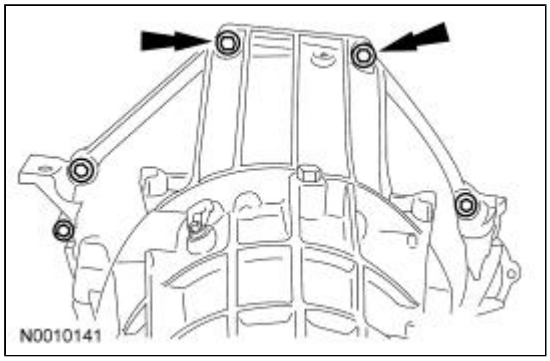
8. Install the cylinder block opening cover.



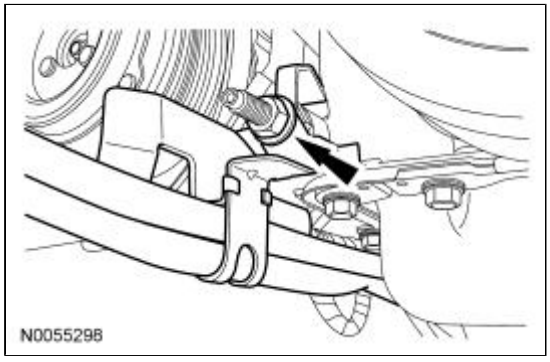
9. Install the flexplate inspection cover and the 2 bolts.
    - Tighten to 35 Nm (26 lb-ft).



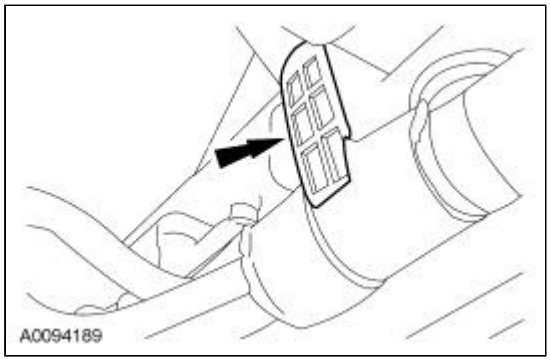
10. Install the upper 2 transmission-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).



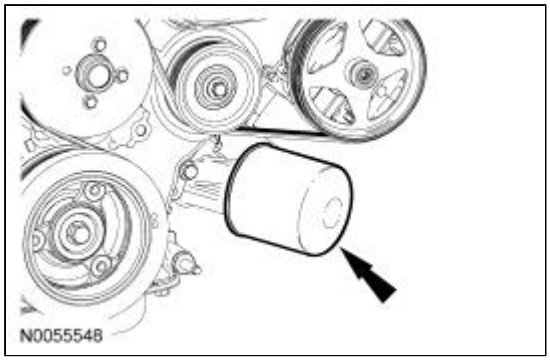
11. Position the starter wiring harness and transmission fluid cooler tube support brackets and install the nut.
    - Tighten to 10 Nm (89 lb-in).



12. Connect the starter wiring harness retainer.

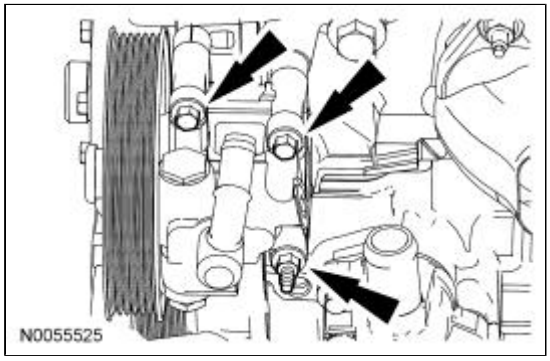


13. Install a new oil filter.
    - Tighten to 15 Nm (11 lb-ft).

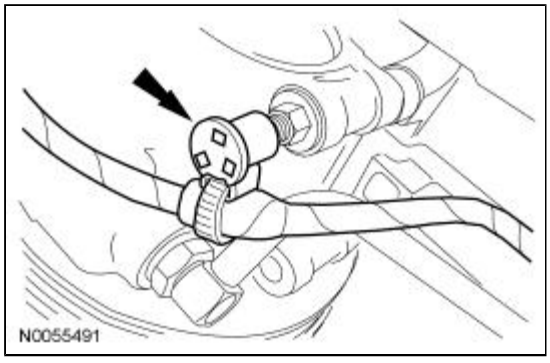


14. Position the power steering pump and install the stud bolt and the 2 bolts.

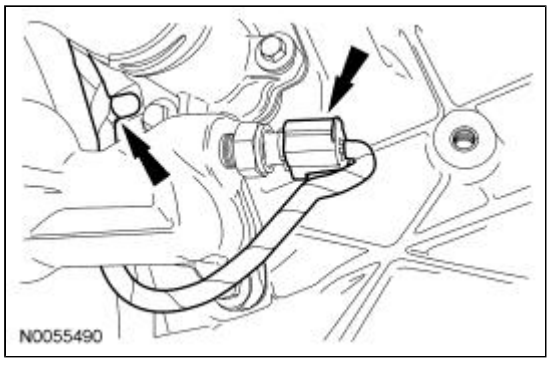
- Tighten to 25 Nm (18 lb-ft).



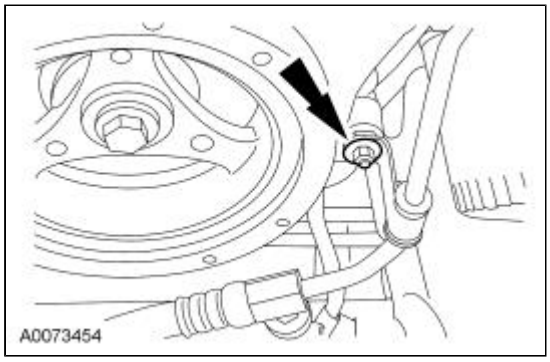
15. Connect the wiring harness position retainer to the power steering pump stud bolt.



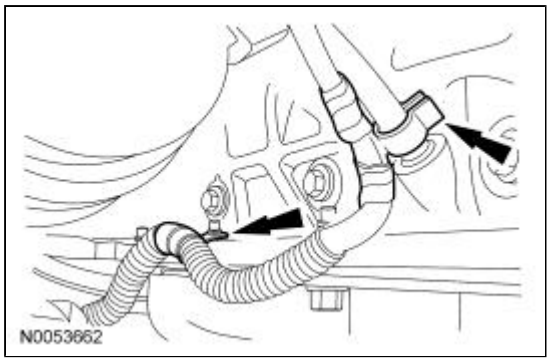
16. Connect the wiring harness position retainer and the engine oil pressure (EOP) switch electrical connector.



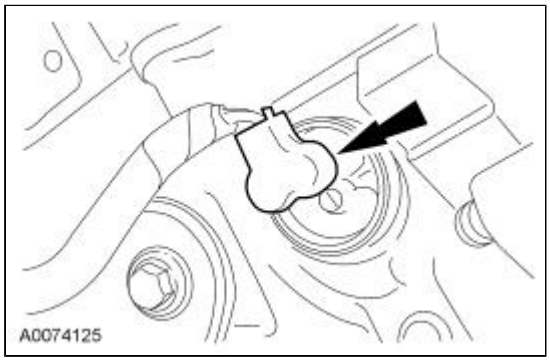
17. Install the power steering pump support bracket and the nut.
    - Tighten to 10 Nm (89 lb-in).



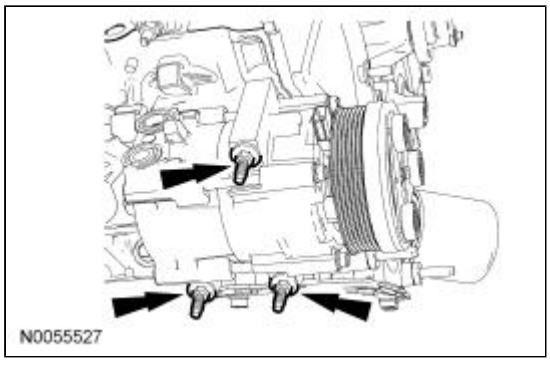
18. If equipped, connect the block heater wiring harness retainers.



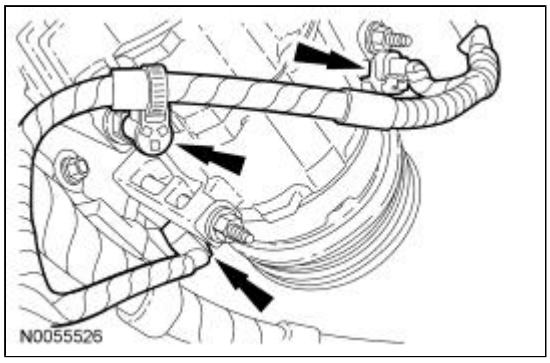
19. If equipped, connect the block heater electrical connector.



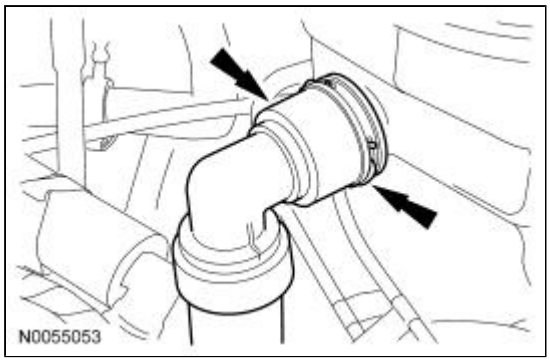
20. Position the A/C compressor and install the 3 stud bolts.
    - Tighten to 25 Nm (18 lb-ft).



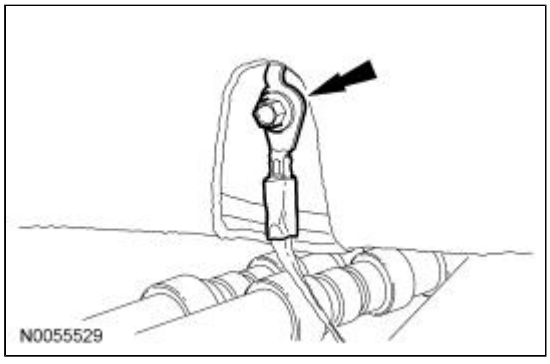
21. Connect the wiring harness position retainer and the crankshaft position (CKP) sensor and A/C compressor electrical connectors.



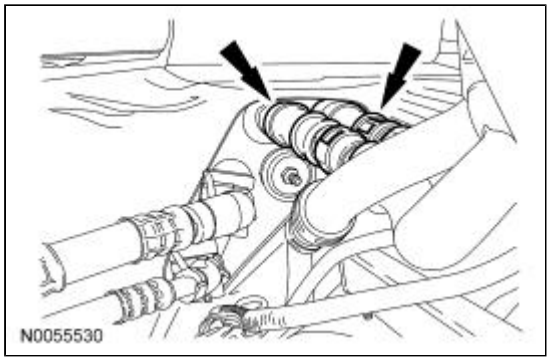
22. Install the clip and connect the degas bottle coolant outlet hose quick connect coupling.



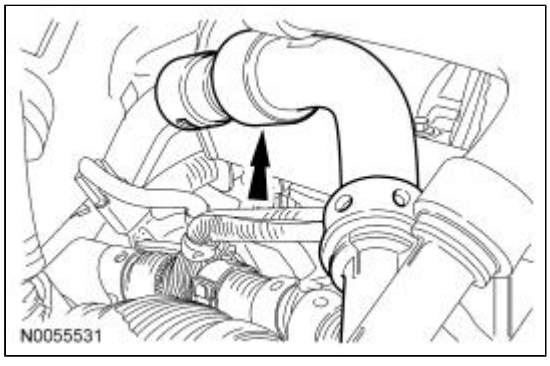
23. Position the ground cable and install the bolt.
    - Tighten to 10 Nm (89 lb-in).



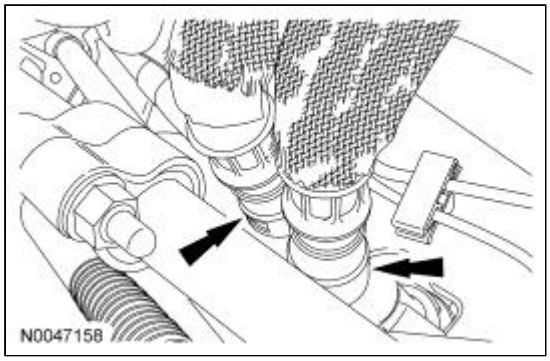
24. Position the 2 heater coolant hoses and connect the quick connect couplings.



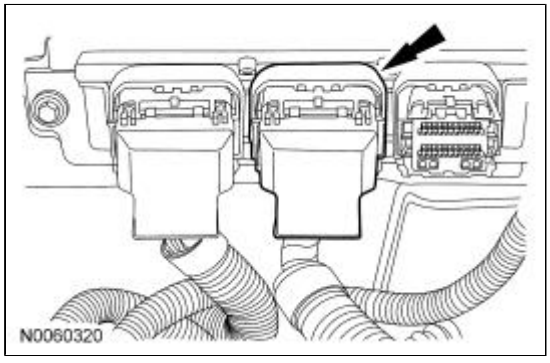
25. Connect the heater coolant hose quick connect coupling.



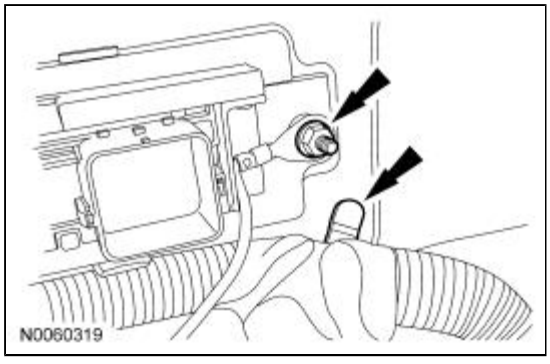
26. If equipped, connect the 2 auxiliary heat coolant hose quick connect couplings.



27. Connect the powertrain control module (PCM) electrical connector.



28. Connect the wiring harness retainer and ground cable and install the nut.
    - Tighten to 10 Nm (89 lb-in).



29. Install the accessory drive belt.

30. Install the bypass tube. For additional information, refer to Section 303-03 .

31. Install the cooling module. For additional information, refer to Section 303-03 .

32. If servicing the engine on a four wheel drive (4WD) vehicle, install the front drive shaft. For additional information, refer to Section 205-01 .

33. Install the starter. For additional information, refer to Section 303-06 .

34. Install the hood.

35. Fill the crankcase with clean engine oil.

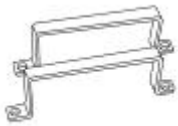
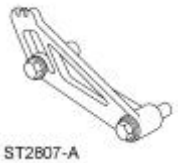
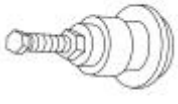
36. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

37. Fill and bleed the power steering system. For additional information, refer to Section 211-00 .

Cylinder Head

Printable View (2142 KB)

Special Tool(s)

 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)
ST2804-A	Compressor, Valve Spring 303-1039
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	—

All cylinder heads

1. **CAUTION: Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore.**

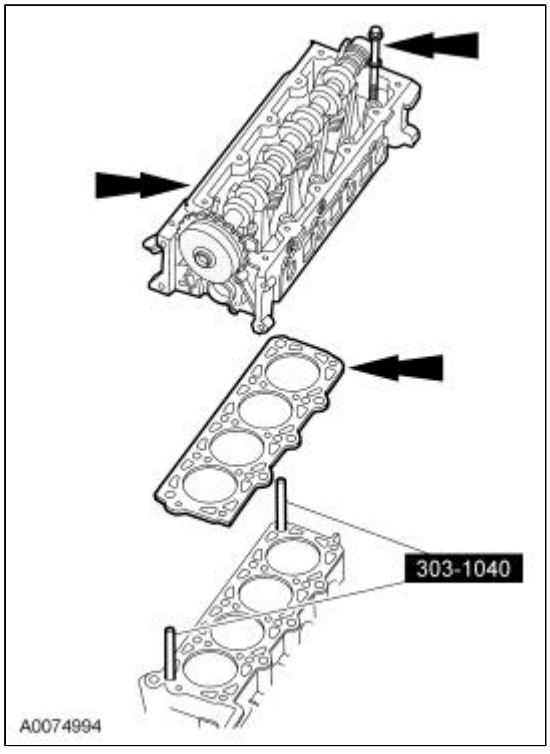
   CAUTION: The use of sealing aids (aviation cement, copper spray, and glue) is not permitted. The gasket must be installed dry.

   CAUTION: The cylinder head bolts must be discarded and new bolts installed. They are tighten-to-yield designed and cannot be reused.

   NOTE: Do not turn the crankshaft until instructed to do so.

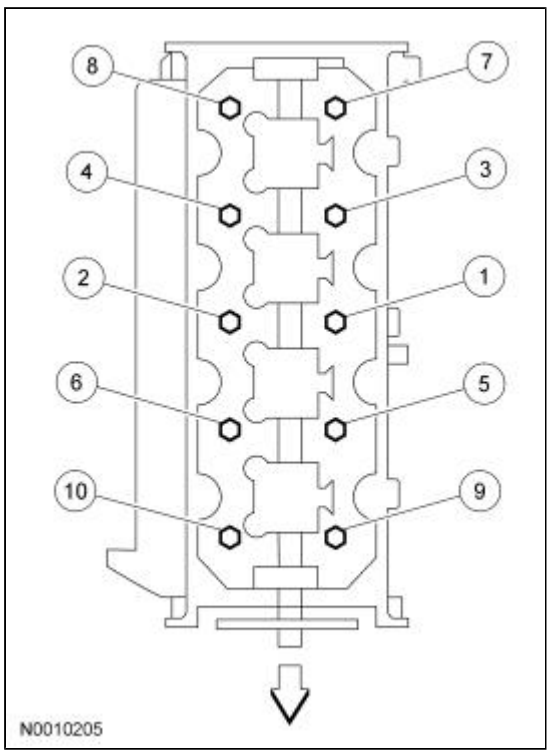
   NOTE: LH shown, RH similar.

   Using the special tools, position the cylinder head gaskets and cylinder heads over the dowels and install the cylinder head bolts loosely.



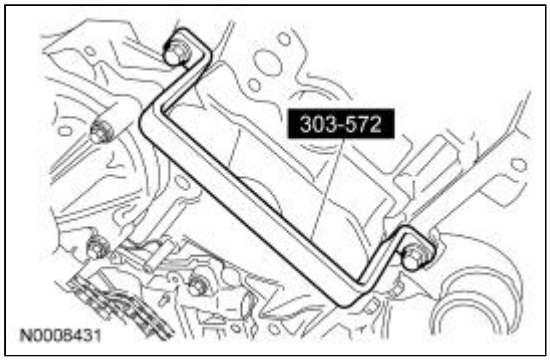
2. **NOTE:** RH shown, LH similar.

   Tighten the bolts in 3 stages, in the sequence shown.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.
   - Stage 3: Tighten an additional 90 degrees.

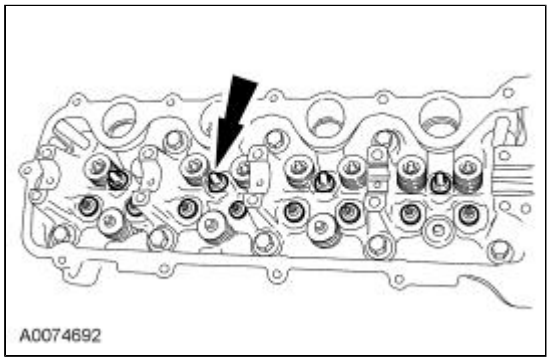


LH cylinder head

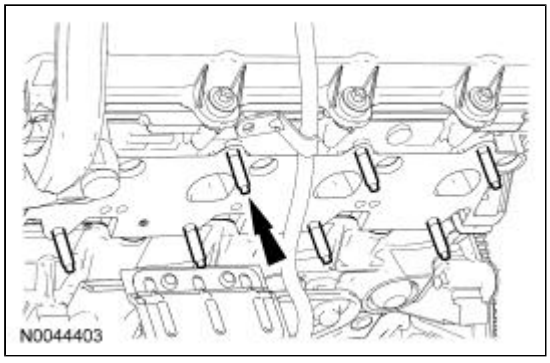
3. Remove the special tool from the LH cylinder head.



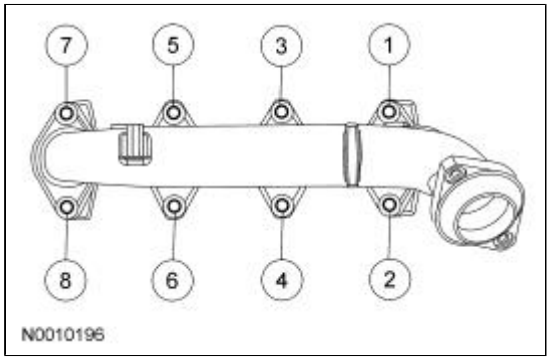
4. Install the hydraulic lash adjusters into the LH cylinder head.
    - Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.



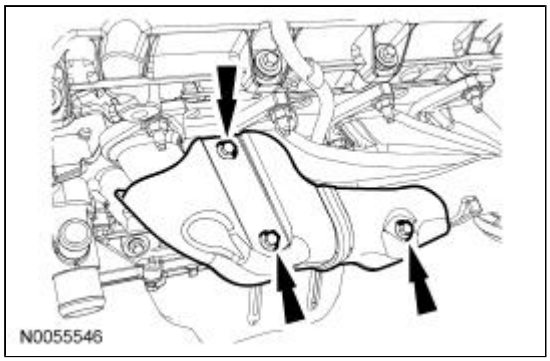
5. Install 8 new exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).



6. Position a new gasket, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).

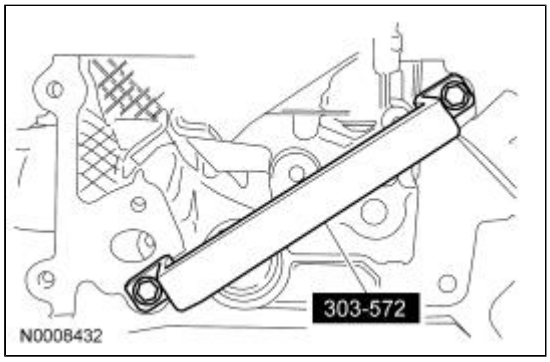


7. Position the exhaust manifold heat shield and install the 3 bolts.

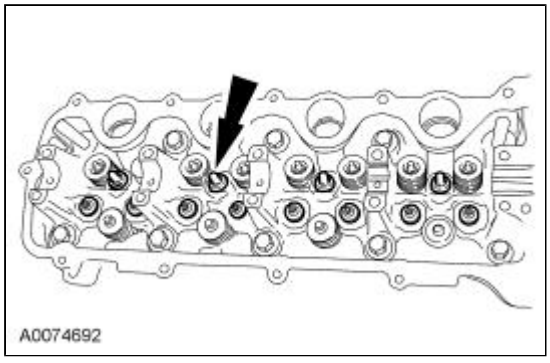


RH cylinder head

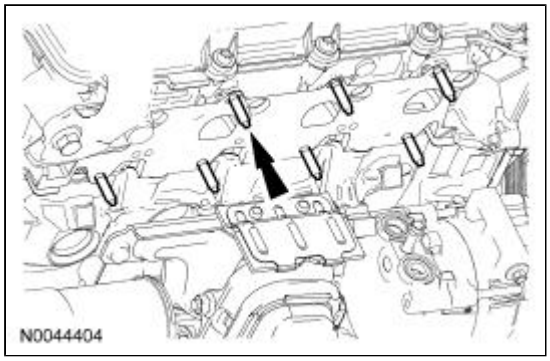
8. Remove the special tool from the RH cylinder head.



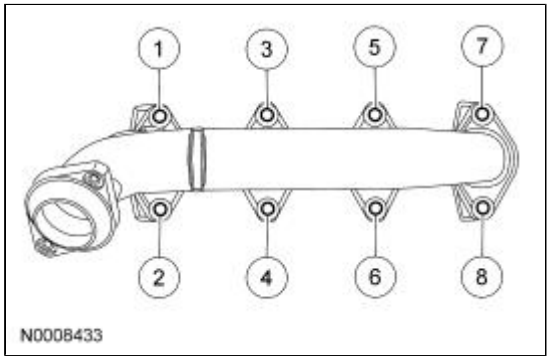
9. Install the hydraulic lash adjusters into the RH cylinder head.
    - Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.



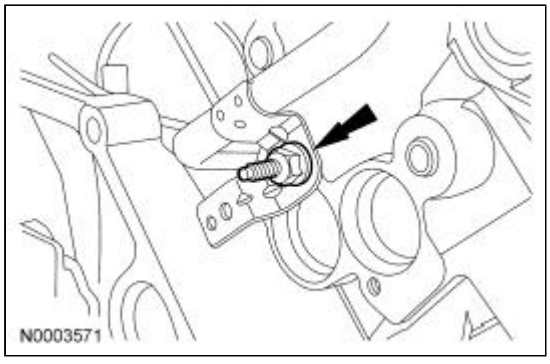
10. Install 8 new exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).



11. Position a new gasket, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



12. Install the coolant tube and the stud bolt.
    - Tighten to 10 Nm (89 lb-in).

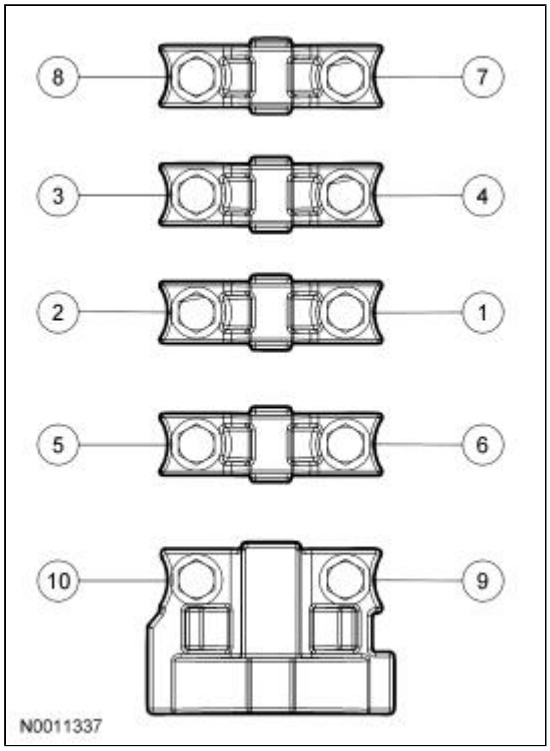


All cylinder heads

13. Install the LH and RH camshafts.
    - Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

14. **NOTE:** LH shown, RH similar.

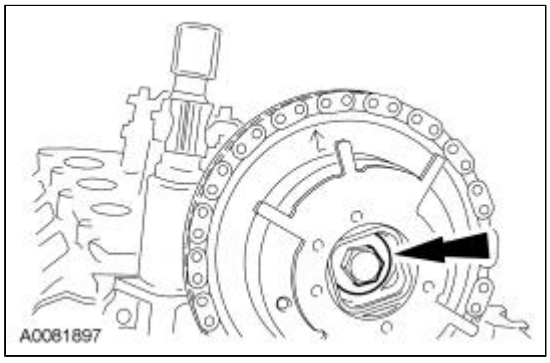
    Install the LH and RH camshaft bearing caps in their original locations.
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the bolts loosely.
    - Tighten to 10 Nm (89 lb-in) in the sequence shown.



15. **CAUTION: Damage to the variable camshaft timing (VCT) phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTE: LH shown, RH similar.

    Install the VCT phaser sprockets and new VCT phaser sprocket bolts finger tight.

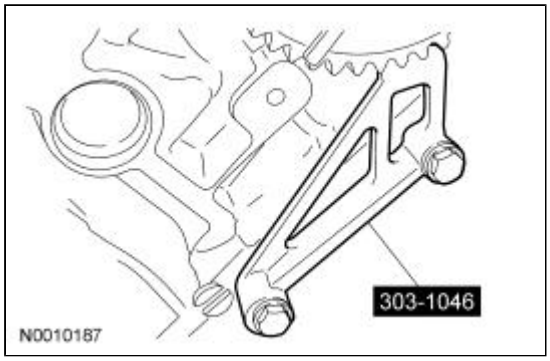


16. **CAUTION: Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    CAUTION: Only use hand tools to remove the VCT phaser sprocket assembly or damage may occur to the camshaft or VCT phaser sprocket.

    NOTE: LH shown, RH similar.

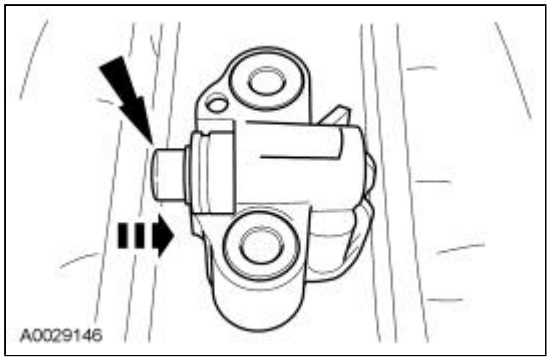
    Using the special tool, tighten the LH and RH VCT phaser sprocket bolts in 2 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



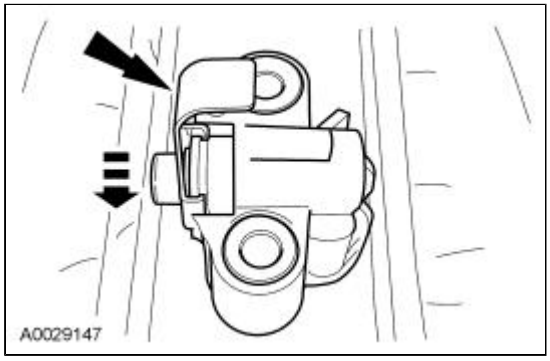
17. **CAUTION: Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

    CAUTION: Prior to installation, inspect the tensioner-sealing bead for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.

    Compress the tensioner plunger, using a vise.

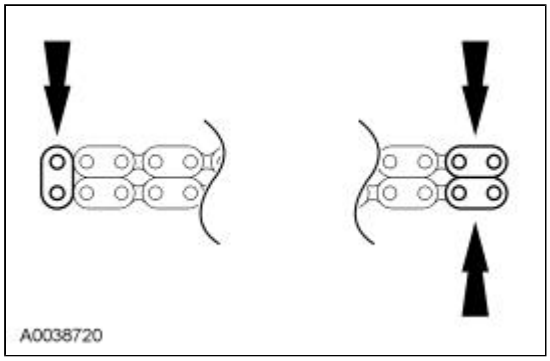


18. Install a retaining clip on the tensioner to hold the plunger in during installation.

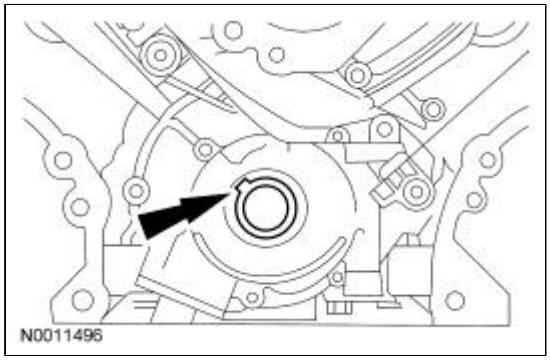


19. Remove the tensioner from the vise.

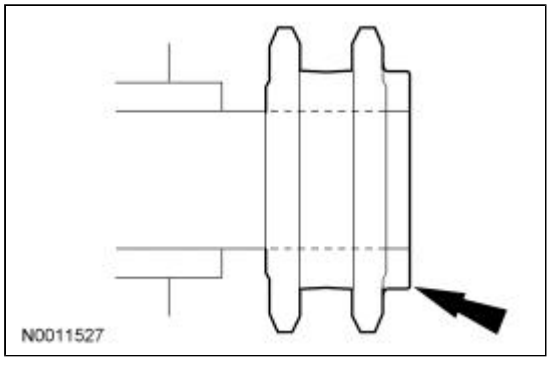
20. If the copper links are not visible, mark 2 links on one end and 1 link on the other end, and use as timing marks.



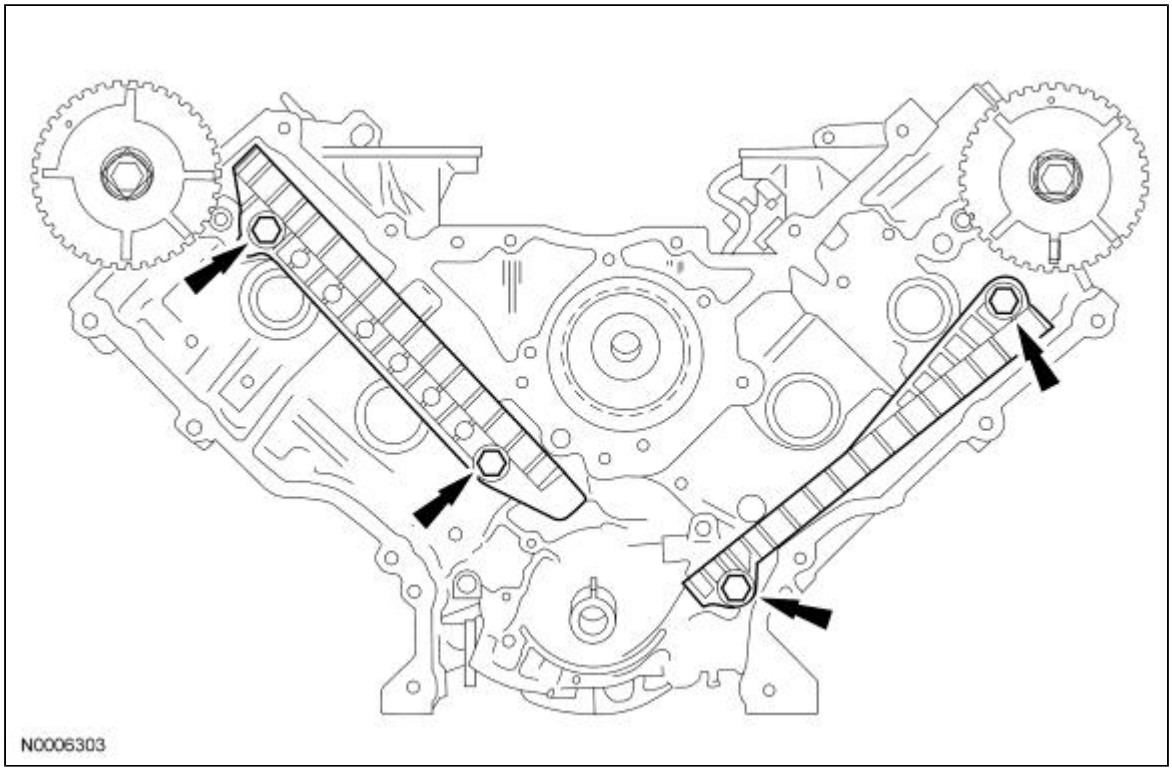
21. Position the crankshaft keyway at the 11 o'clock position.



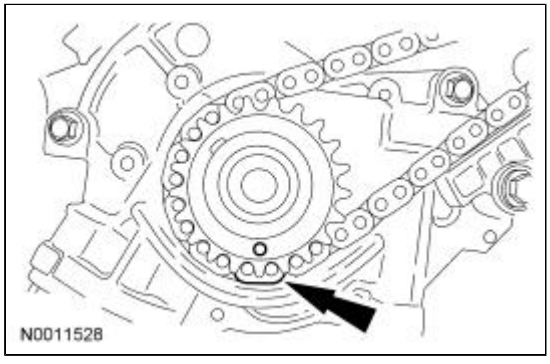
22. Install the crankshaft sprocket, making sure the flange faces forward.



23. Install the 4 bolts and the LH and RH timing chain guides.
    - Tighten to 10 Nm (89 lb-in).

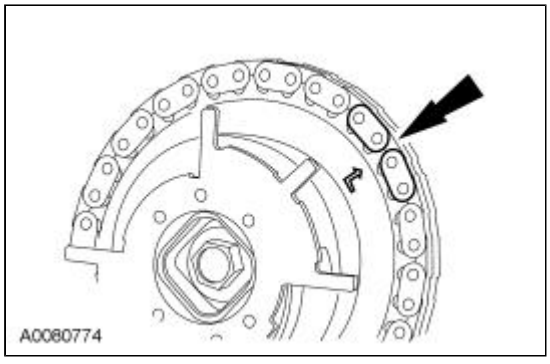


24. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



25. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

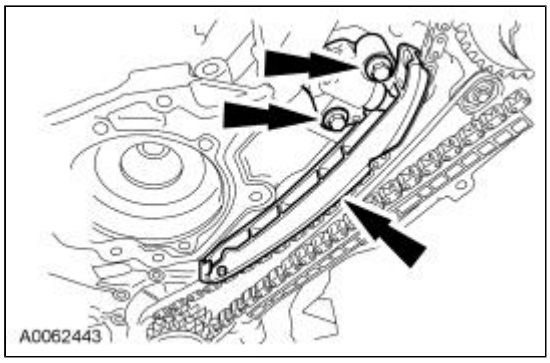
    Position the timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.



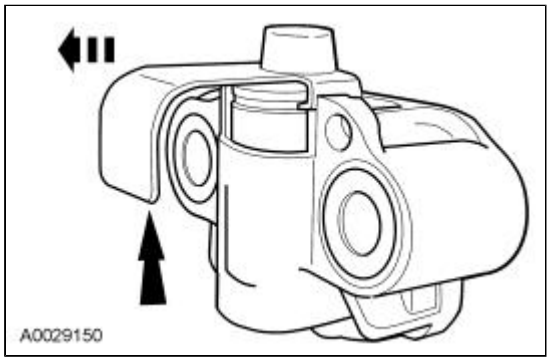
26. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and bolts.

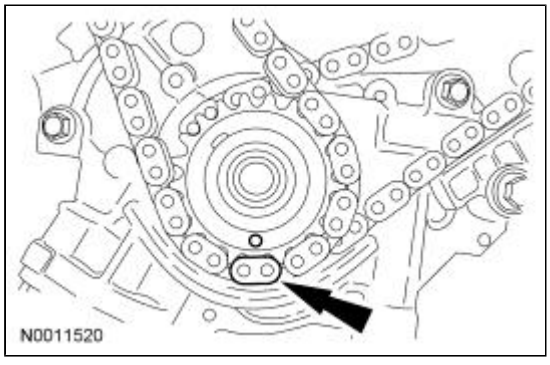
- Tighten to 25 Nm (18 lb-ft).



27. Remove the retaining clip from the LH timing chain tensioner.

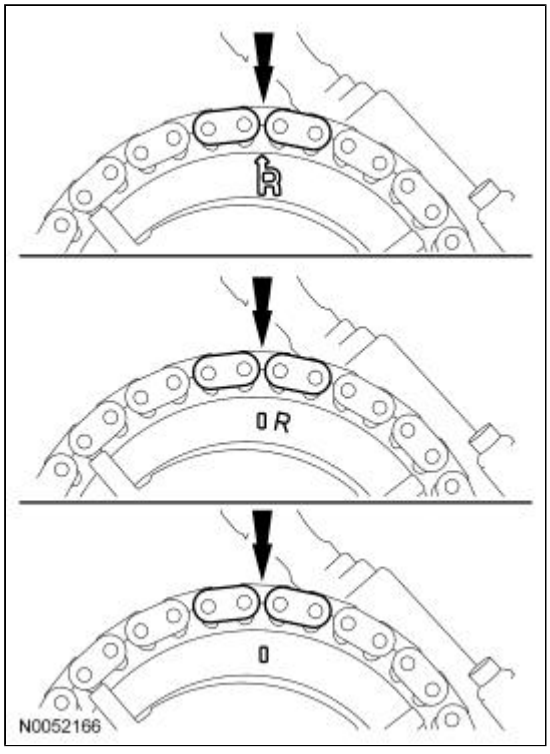


28. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.

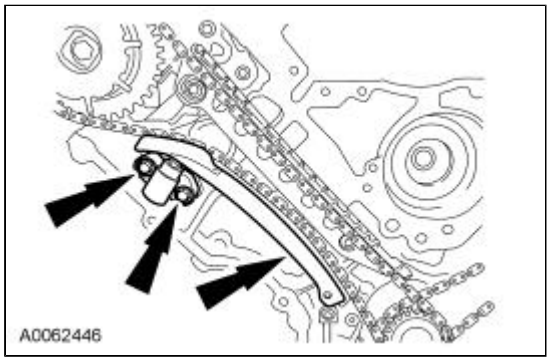


29. **NOTE:** The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

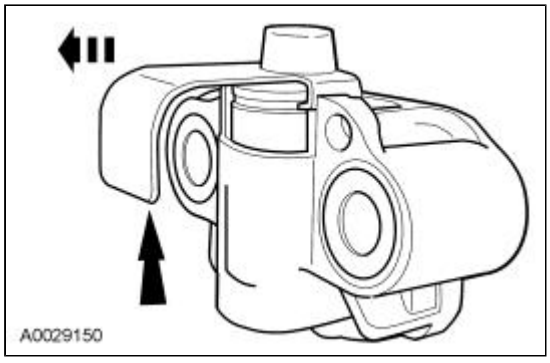
    Position the RH timing chain on the VCT phaser sprocket with the timing mark positioned between the 2 copper (marked) chain links.



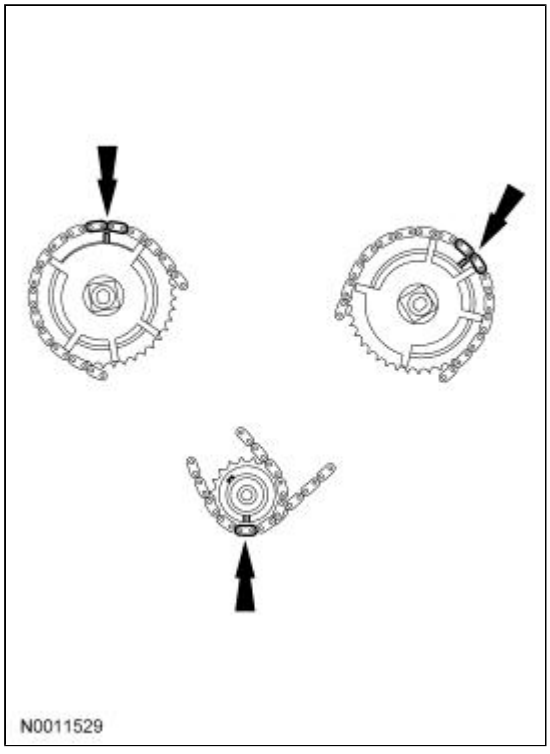
30. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and bolts.
    - Tighten to 25 Nm (18 lb-ft).



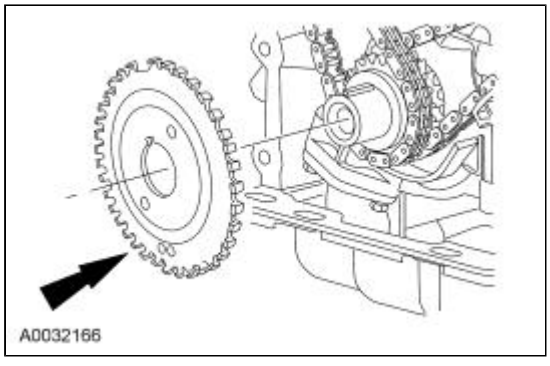
31. Remove the retaining clip from the RH timing chain tensioner.



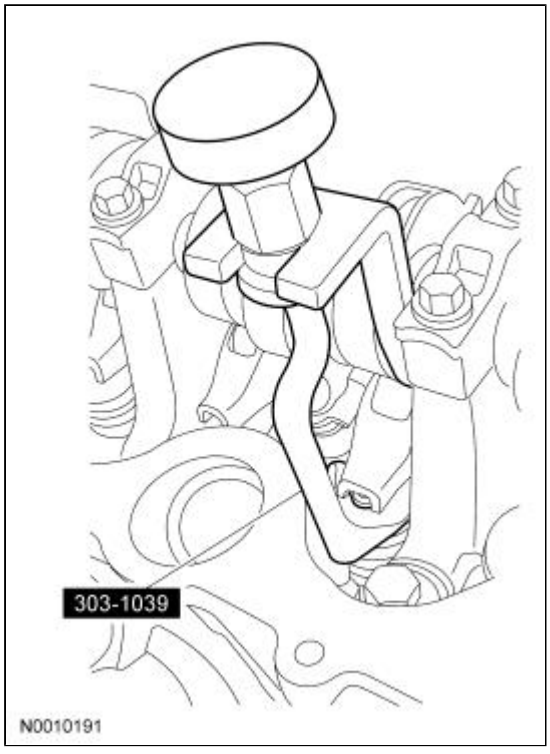
32. As a post-check, verify correct alignment of all timing marks.



33. Install the crankshaft sensor ring on the crankshaft.



34. Using the special tool, install all of the camshaft roller followers.
    - Lubricate the camshaft roller followers with clean engine oil prior to installation.

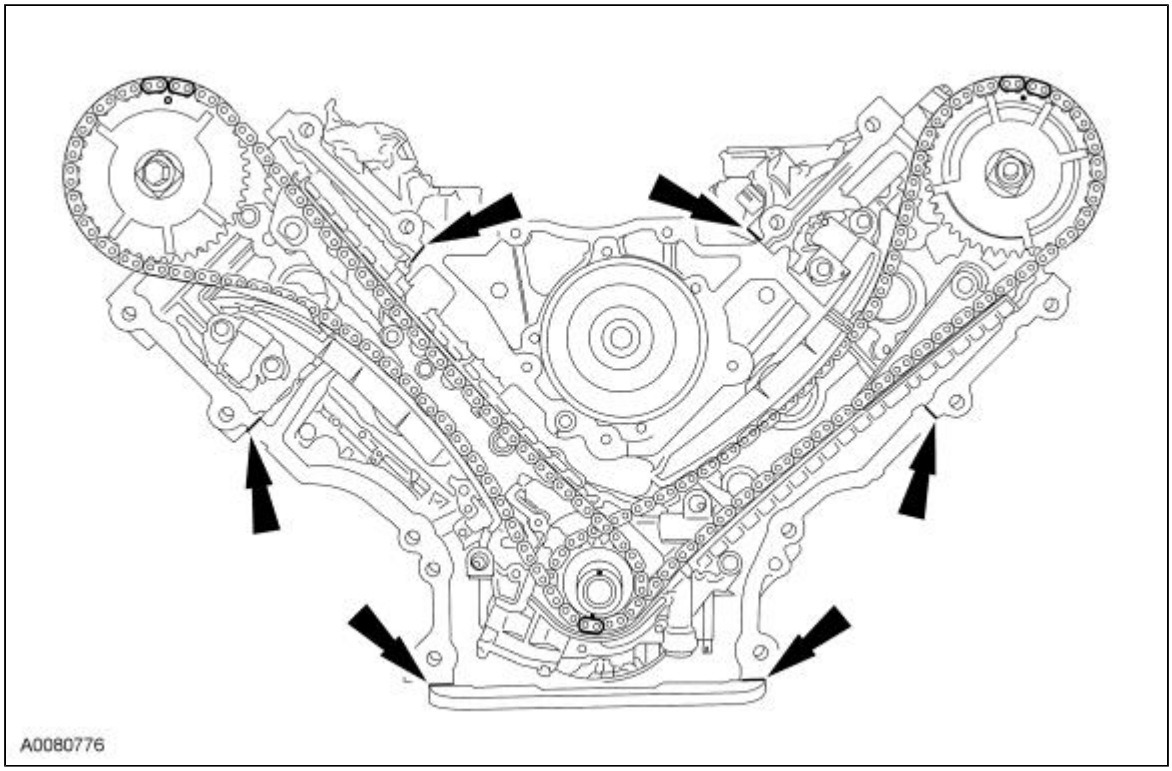


35. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

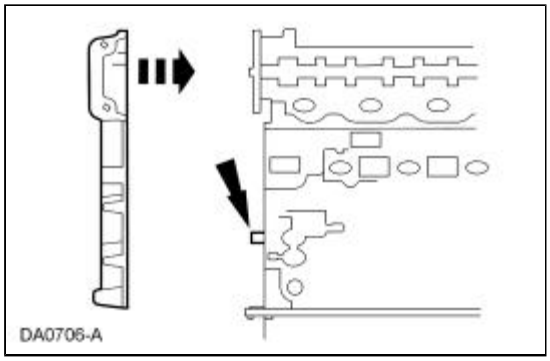
    NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

    NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

    Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface and the oil pan-to-cylinder block surface, at the locations shown.



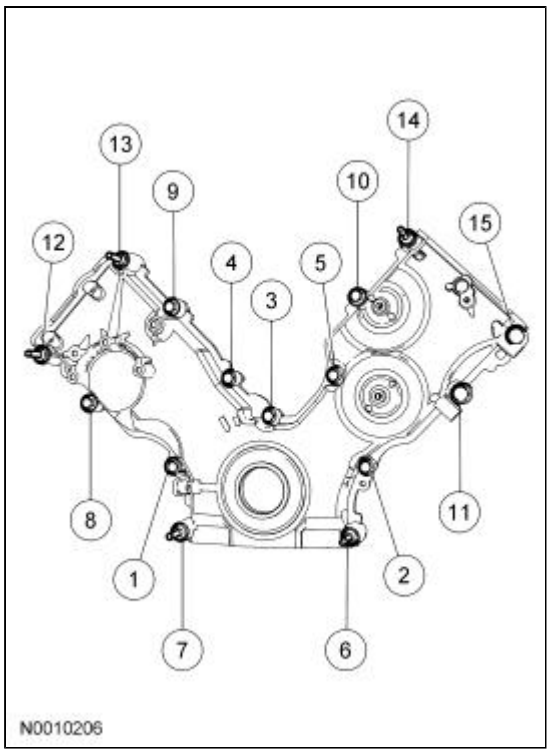
36. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger-tight.



37. Tighten the engine front cover fasteners in sequence in 2 stages.
Stage 1: Tighten fasteners 1 through 15 to 25 Nm (18 lb-ft).
Stage 2: Tighten fasteners 6 and 7 to 48 Nm (35 lb-ft).

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
5	N806177	Bolts, Hex Flange Head Pilot, M8 x 1.25 x 50
6	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
7	N808529	Stud, Hex Head Pilot, M10 x 1.5 x 1.5 x 103
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50

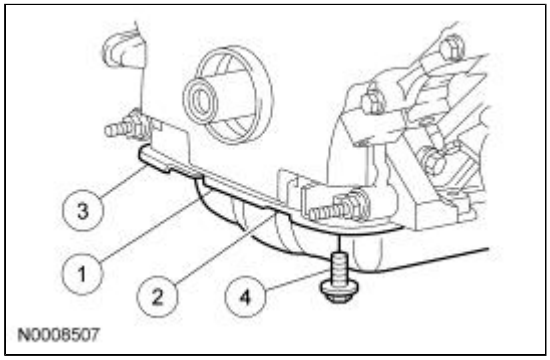
11	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 50
12	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
13	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
14	W709573	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 1.25 x 94
15	W706605	Bolt, Hex Head Pilot, M8 x 1.25 x 56



38. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

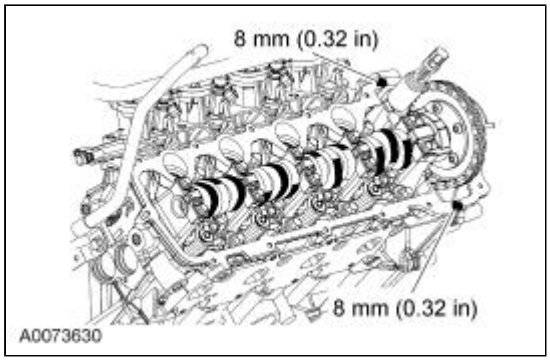
39. Install the 4 front oil pan bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten an additional 60 degrees.



40. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer.

Failure to follow this procedure can cause future oil leakage.

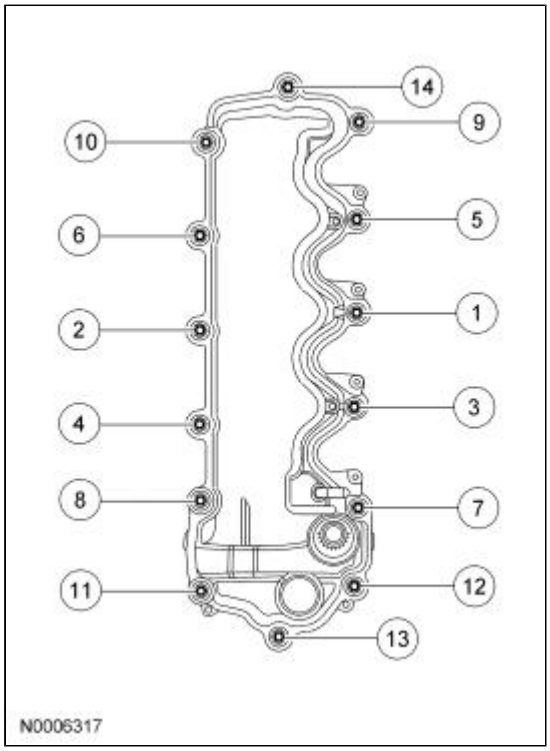
Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



41. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT solenoid.**

Position the RH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.

- Tighten to 10 Nm (89 lb-in).



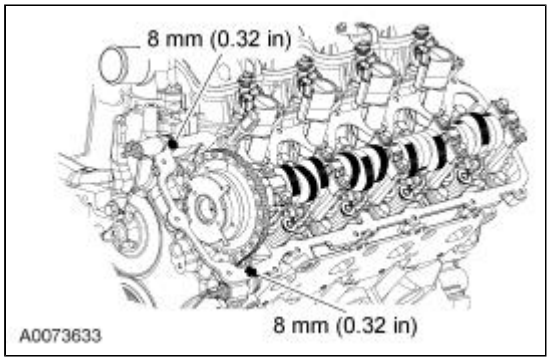
42. **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

43. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the

packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

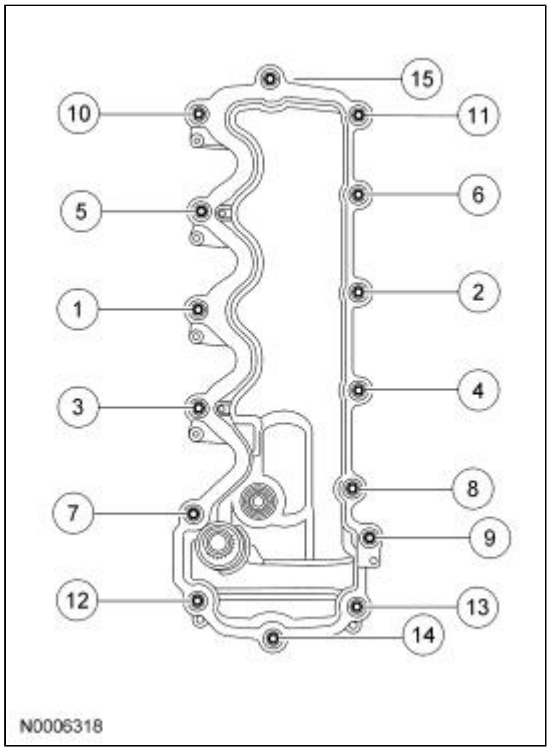
Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



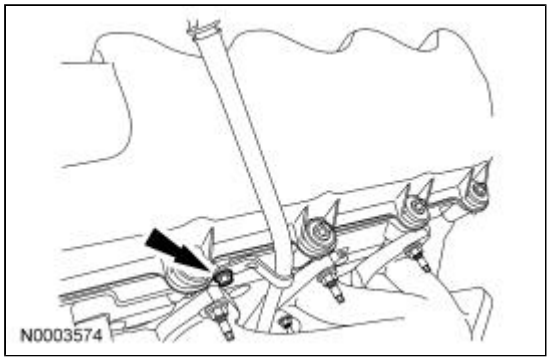
44. **CAUTION: When installing the valve cover, make sure to avoid damaging the VCT solenoid.**

Position the LH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.

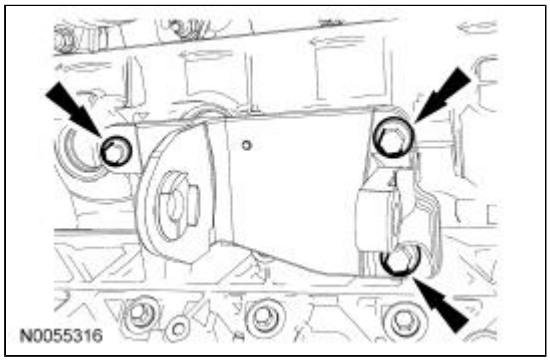
- Tighten to 10 Nm (89 lb-in).



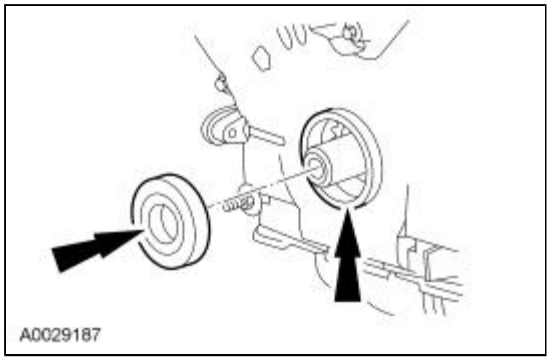
45. Install the oil level indicator tube and the bolt.
    - Install a new O-ring seal and lubricate the O-ring seal with clean engine oil prior to installation.
    - Tighten to 10 Nm (89 lb-in).



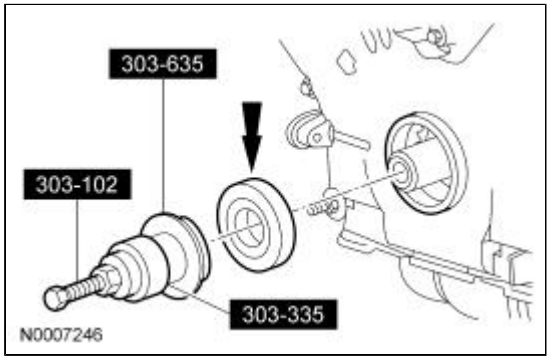
46. Position the RH engine support insulator and install the 3 bolts.
    - Tighten to 63 Nm (46 lb-ft).



47. Lubricate the engine front cover and the crankshaft front seal inner lip with clean engine oil.

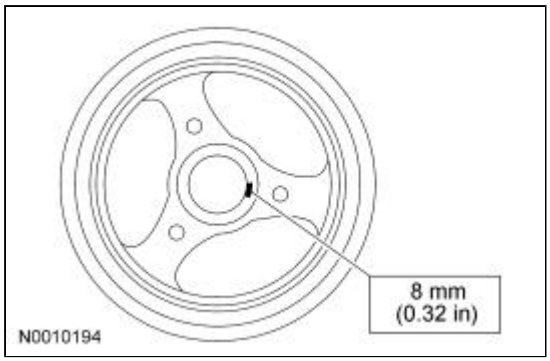


48. Using the special tools, install a new crankshaft front seal into the engine front cover.

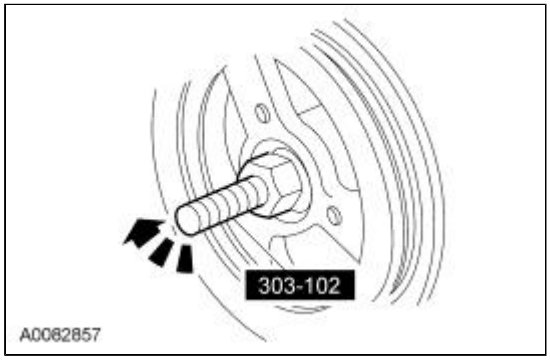


49. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

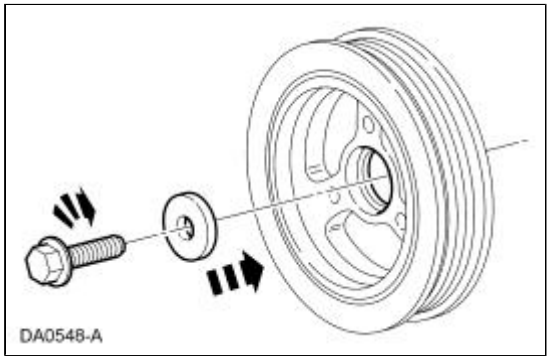
Apply silicone gasket and sealant to the Woodruff key slot on the crankshaft pulley.



50. Using the special tool, install the crankshaft pulley.

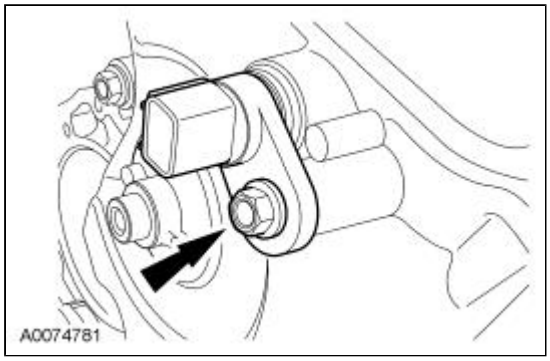


51. Tighten the new crankshaft pulley bolt in 4 stages.
    - Stage 1: Tighten to 90 Nm (66 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.



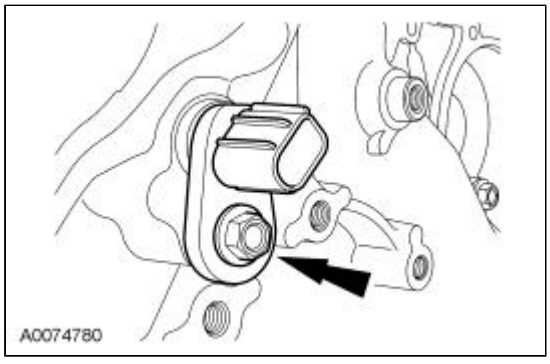
52. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

    Install the LH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



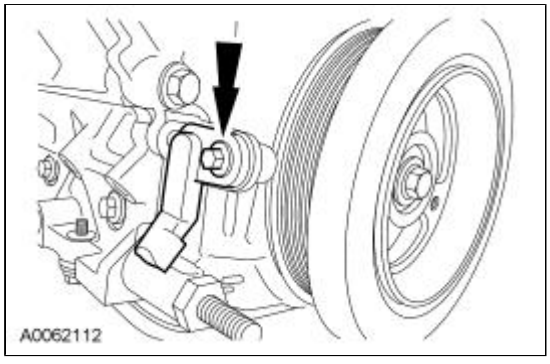
53. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

    Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

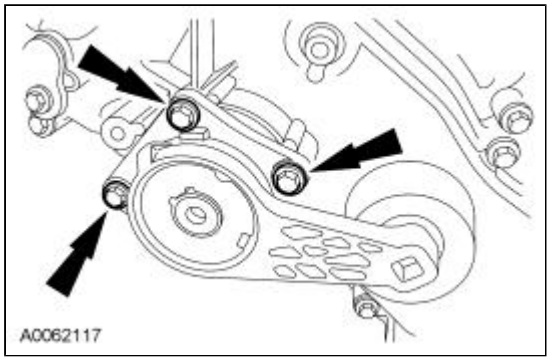


54. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

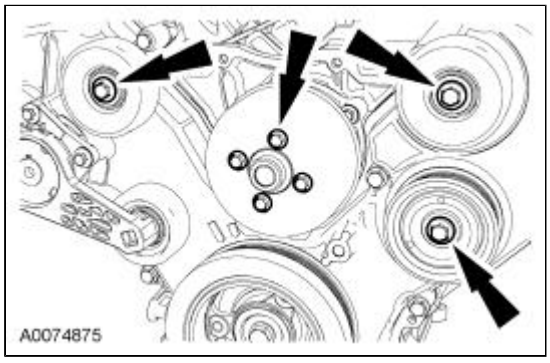
    Position the crankshaft position (CKP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



55. Position the accessory drive belt tensioner and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).



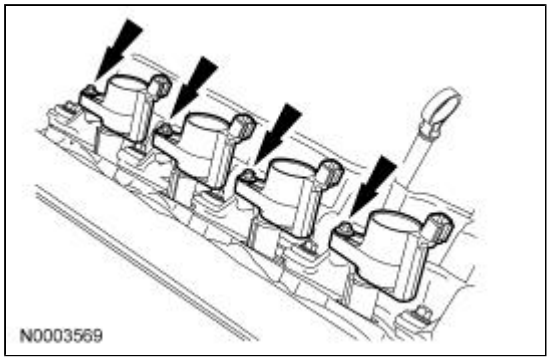
56. Install the 3 accessory drive belt idler pulleys, the coolant pump pulley and the 7 bolts.
    - Tighten to 25 Nm (18 lb-ft).



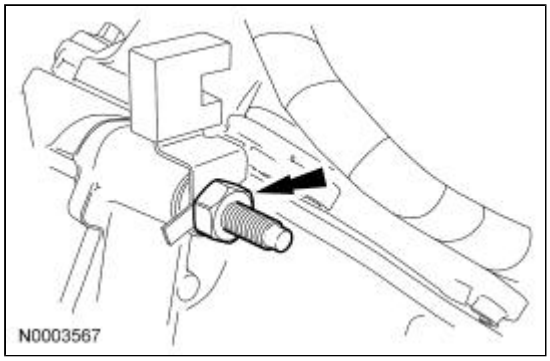
57. Position the electrical harness on the engine assembly and connect the engine wiring harness retainers to the valve cover studs.

58. **NOTE:** LH shown, RH similar.

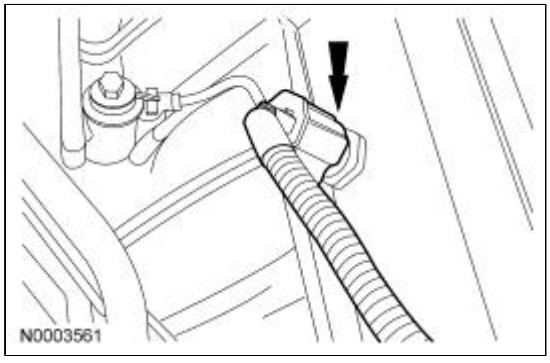
    Install the 8 ignition coils and the 8 bolts.
    - Tighten to 6 Nm (53 lb-in).



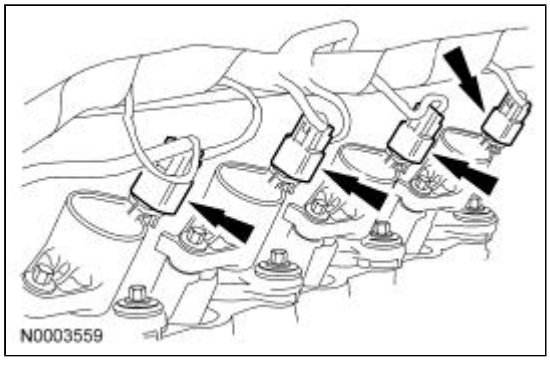
59. Install the LH radio ignition interference capacitor and the nut.
    - Tighten to 25 Nm (18 lb-ft).



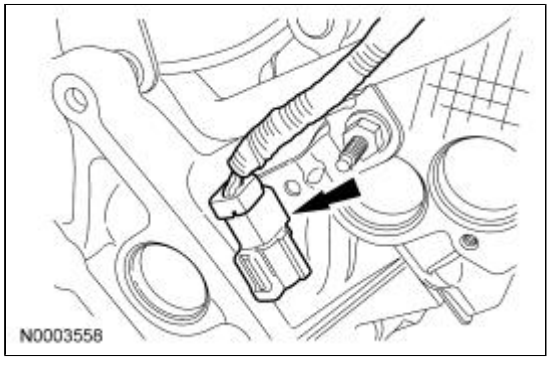
60. Connect the cylinder head temperature (CHT) sensor electrical connector.



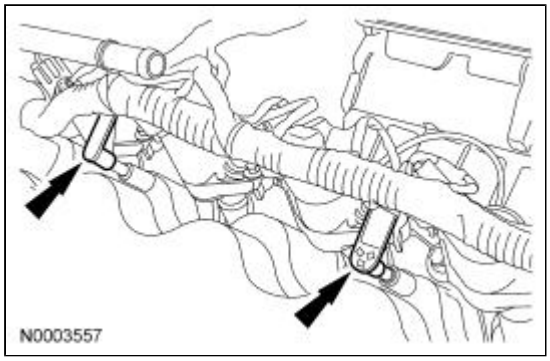
61. Connect the 4 RH ignition coil electrical connectors.



62. Connect the electrical connector retainer to the coolant tube.

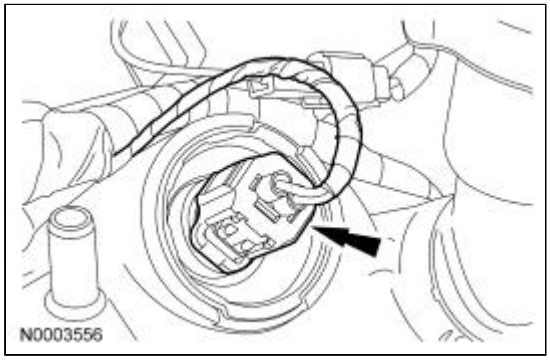


63. Connect the 2 engine wiring harness retainers from the RH valve cover studs.

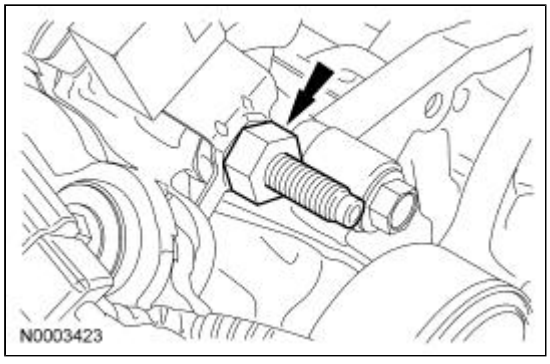


64. **NOTE:** RH shown, LH similar.

    Connect the RH and LH VCT solenoid electrical connectors.

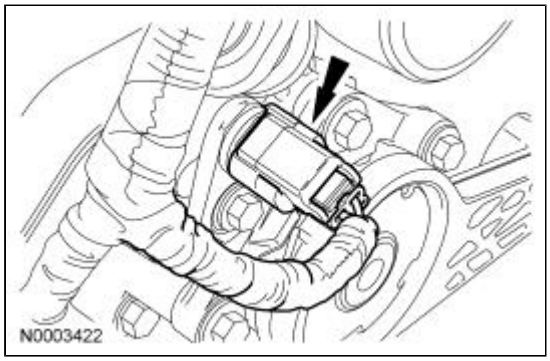


65. Install the RH radio ignition interference capacitor and the stud bolt.
    - Tighten to 25 Nm (18 lb-ft).



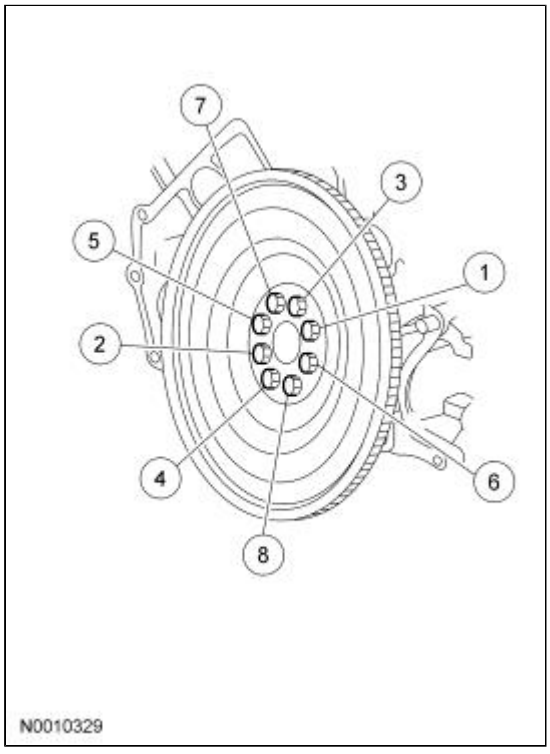
66. **NOTE:** RH shown, LH similar.

    Connect the RH and LH CMP sensor electrical connectors.



67. Using a suitable floor crane, remove the engine from the engine stand.

68. Install the flexplate and the 8 bolts in the sequence shown.
    - Tighten to 80 Nm (59 lb-ft).



69. Install the engine. For additional information, refer to Engine in the Installation portion of this section.

Printable View (82 KB)

General Specifications

Item	Specification
Cooling System Capacity	
Base radiator without aux. rear heat	19.5L (20.6 qt) [a]
Base radiator with aux. rear heat	22L (23.2 qt) [a]
Heavy duty trailer tow radiator without aux. rear heat	20L (21.1 qt) [a]
Heavy duty trailer tow radiator with aux. rear heat	22.5L (23.8 qt) [a]
Coolant Type	
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1 [b]
Other Chemicals	
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B
Premium Cooling System Flush VC-1	ESR-M14P7-A
Cooling System Pressure Test	
Radiator test pressure	138 kPa (20 psi)
Radiator Cap Pressure Test Specifications	
Pressure relief opening pressure	110 kPa (16 psi)
Thermostat Opening Temperatures	
Starts to open	86.7-90.6°C (188-195°F)
Fully open	97.8-101.7°C (208-215°F)

[a] Includes degas bottle fluid level between the COOLANT FILL LEVEL lines.
[b] Use the same type of coolant that was drained from cooling system. Do not mix coolant types.

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C condenser fitting nuts	8	—	71
Battery power cable nut	10	—	89
Block heater retaining screw	2	—	18
Bypass tube bolts	10	—	89
Cooling module bolts	25	18	—
Coolant pump bolts	25	18	—
Coolant pump pulley bolts	25	18	—
Degas bottle bolts	10	—	89
Fan clutch bolts	7	—	62

Fan clutch electrical connector support bracket nut	13	10	—
Fan clutch nut	133	98	—
Fan shroud bolts	10	—	89
Hood latch assembly bolts	25	18	—
Horn assembly bolt	10	—	89
Power steering fluid reservoir bolt	11	8	—
Power distribution box (PDB) support bracket bolts	10	—	89
Radiator assembly-to-radiator support bolts	10	—	89
Radiator support bolts	25	18	—
Thermostat housing bolts	10	—	89

Engine Cooling

Printable View (467 KB)

CAUTION: Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US), CVC-7-A (Canada); or equivalent (yellow color) meeting Ford specification WSS-M97B51-A1. Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.

The cooling system consists of the following components:

- Block heater
- Bypass tube
- Degas bottle
- Degas bottle cap
- Fan blade
- Electronic fan clutch
- Fan shroud
- Radiator
- Radiator draincock
- Upper and lower radiator hoses
- Bypass coolant hose
- Coolant pump
- Coolant thermostat

The coolant pump:

- circulates the coolant.

The coolant thermostat:

- controls coolant temperature.
- allows quicker engine warm-up.

The degas bottle:

- holds surplus coolant when hot.
- de-aerates the system reducing hot spots.
- is the location for service fill.
- allows coolant expansion and system pressurization.
- replenishes coolant to the system.

The fan blade:

- draws air through the radiator to help cool the system coolant.

The fan clutch:

- is an electronically controlled clutch that controls the fan speed.

The radiator:

- cannot be serviced. Install a new radiator.
- allows excess heat to be transferred to the air.

The optional block heater:

- electrical heating element is installed in the core plug opening.
    - uses a standard 110V electrical supply
- keeps the engine coolant warm during cold weather.

CAUTION: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.

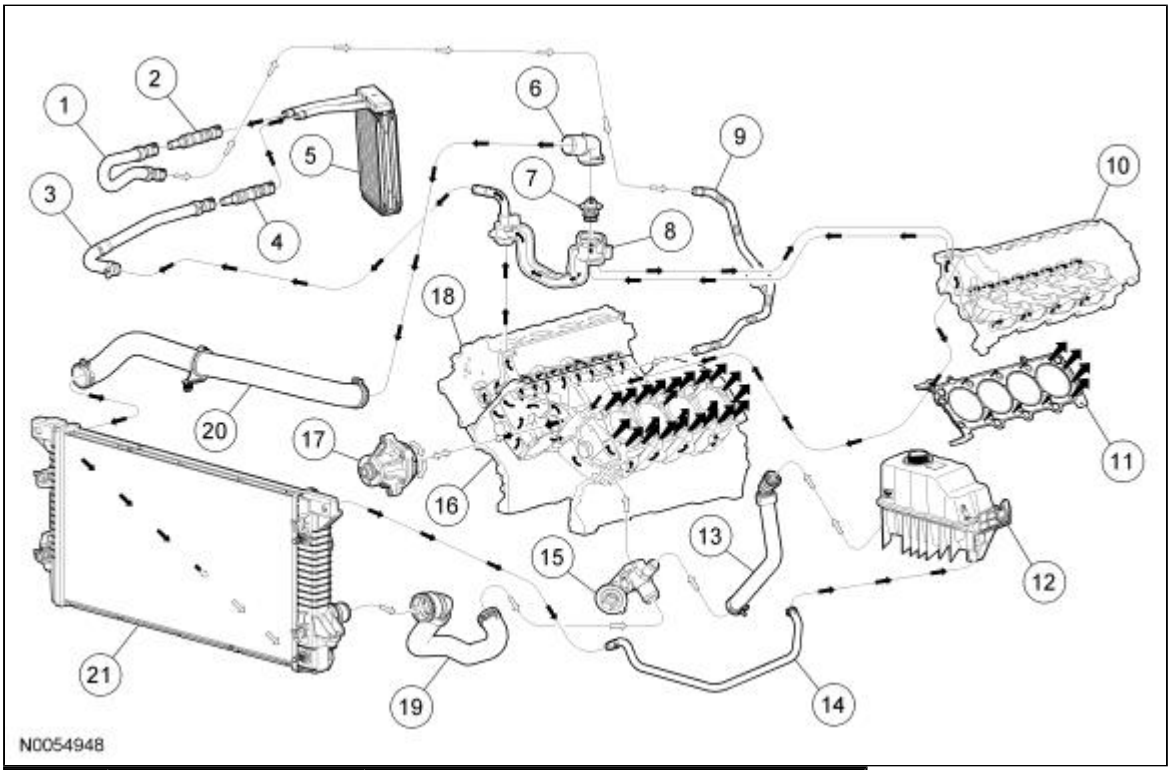
When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- Add Motorcraft Premium Gold Engine Coolant. Use the same type of coolant that is present in the system. Do not mix coolant types.
- Do not add orange-colored Motorcraft Specialty Orange Engine Coolant. Mixing coolants may degrade the coolant's protection rating.
- Do not add alcohol, methanol or brine or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix with recycled coolant. Use of such a coolant may harm the engine and cooling system components.

Coolant Flow Diagram, Expedition and Navigator without Auxiliary Heater

NOTE: Black arrows indicate hot, white arrows indicate cold.

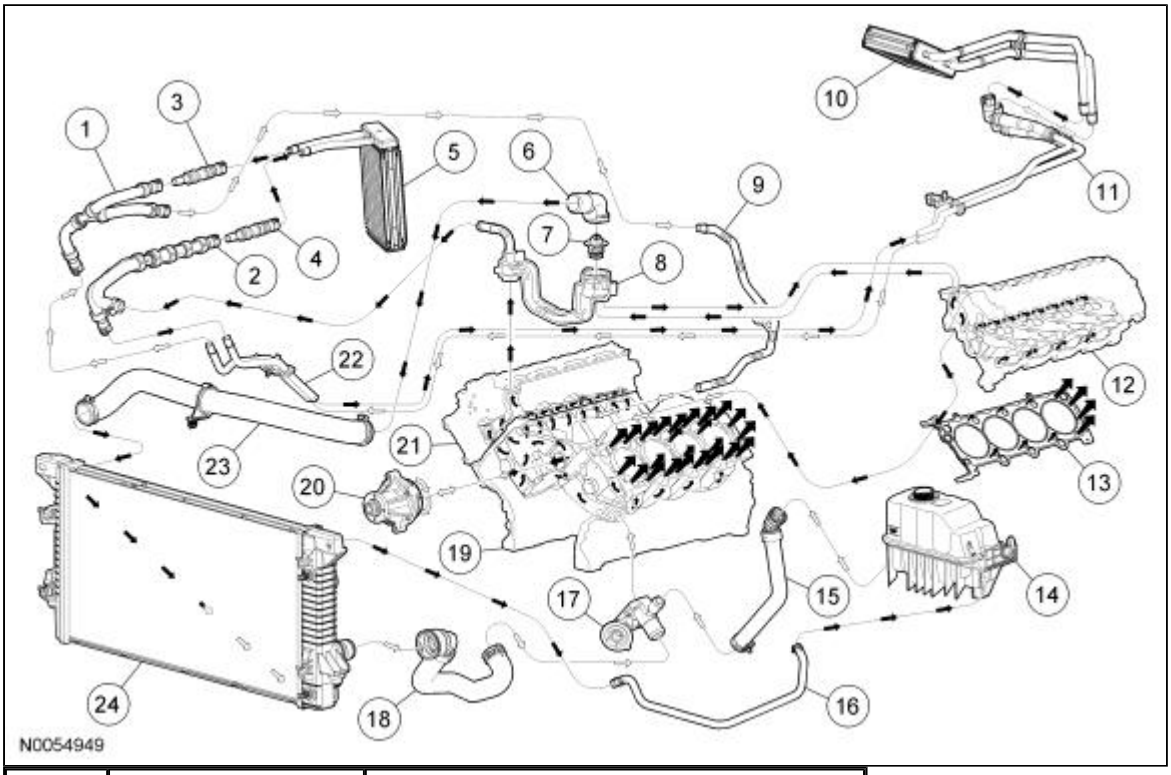


Item	Part Number	Description

1	18K580	Heater outlet hose
2	18K580	Heater outlet hose
3	18K579	Heater inlet hose
4	18K580	Heater inlet hose
5	18476	Heater core
6	8594	Thermostat housing
7	8575	Thermostat
8	8C369	Engine coolant bypass tube
9	18663	Heater coolant outlet tube
10	6050	LH cylinder head
11	6083	LH cylinder head gasket
12	8A080	Degas bottle
13	8C351	Degas bottle outlet hose
14	8W005	Degas bottle inlet hose
15	6881	Oil filter adapter
16	6010	Cylinder block
17	8501	Coolant pump
18	6049	RH cylinder head
19	8B273	Lower radiator hose
20	8B274	Upper radiator hose
21	8005	Radiator

Coolant Flow Diagram, Expedition and Navigator with Auxiliary Heater

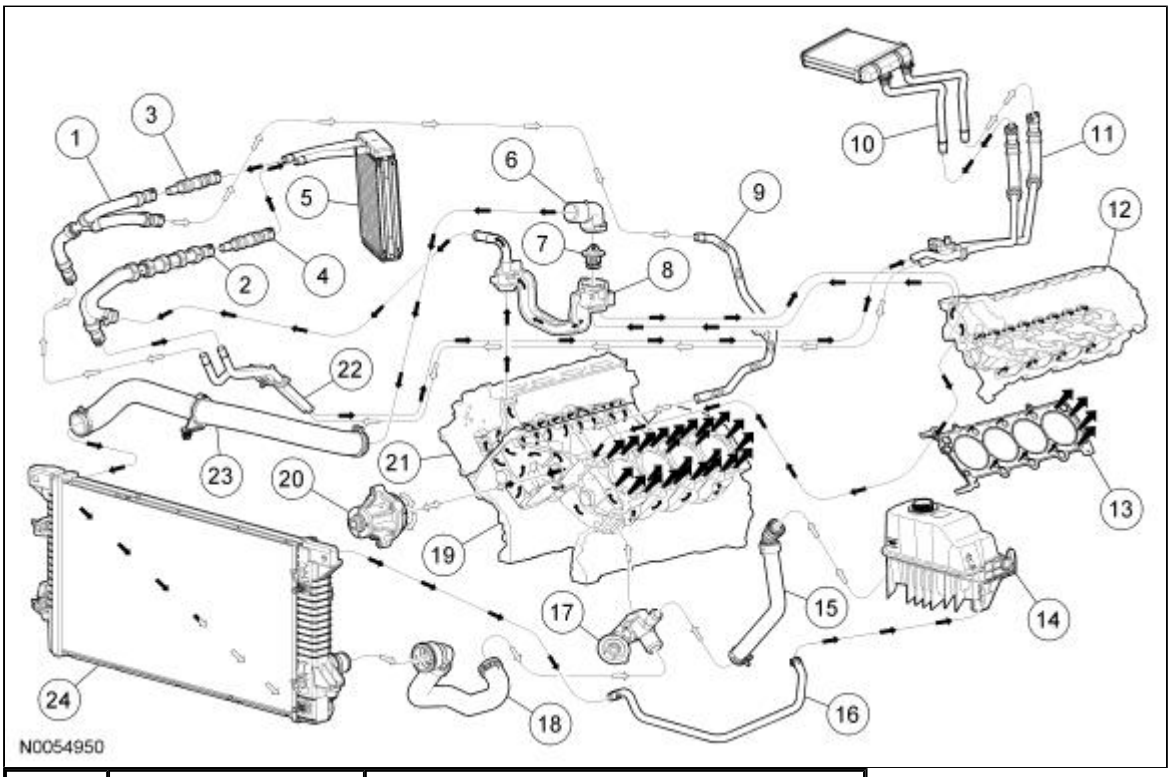
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	18K580	Heater outlet hose
2	18K579	Heater inlet hose
3	18K580	Heater outlet hose
4	18K580	Heater inlet hose
5	18476	Heater core
6	8594	Thermostat housing
7	8575	Thermostat
8	8C369	Engine coolant bypass tube
9	18663	Heater coolant outlet tube
10	18K470	Auxiliary heater core
11	18K470	Auxiliary heater tubes
12	6050	LH cylinder head
13	6083	LH cylinder head gasket
14	8A080	Degas bottle
15	8C351	Degas bottle outlet hose
16	8W005	Degas bottle inlet hose
17	6881	Oil filter adapter
18	8B273	Lower radiator hose
19	6010	Cylinder block
20	8501	Coolant pump
21	6049	RH cylinder head
22	18K470	Auxiliary heater tubes
23	8B274	Upper radiator hose
24	8005	Radiator

Coolant Flow Diagram, Expedition EL and Navigator L with Auxiliary Heater

NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	18K580	Heater outlet hose
2	18K579	Heater inlet hose
3	18K580	Heater outlet hose
4	18K580	Heater inlet hose
5	18476	Heater core
6	8594	Thermostat housing
7	8575	Thermostat
8	8C369	Engine coolant bypass tube
9	18663	Heater coolant outlet tube
10	18K470	Auxiliary heater core
11	18K470	Auxiliary heater tubes
12	6050	LH cylinder head
13	6083	LH cylinder head gasket
14	8A080	Degas bottle
15	8C351	Degas bottle outlet hose
16	8W005	Degas bottle inlet hose
17	6881	Oil filter adapter
18	8B273	Lower radiator hose
19	6010	Cylinder block

20	8501	Coolant pump
21	6049	RH cylinder head
22	18K470	Auxiliary heater tubes
23	8B274	Upper radiator hose
24	8005	Radiator

Engine Cooling

Printable View (148 KB)

Special Tool(s)

ST1474-A	Pressure Test Kit 014-R1072 or equivalent
ST1720-A	Battery/Antifreeze Tester 014-R1060 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Inspection and Verification

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

CAUTION: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color) meeting Ford specification WSS-M97B51-A1. Do not mix coolant types.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Verify the customer concern.
2. Visually check the engine coolant level at the degas bottle or coolant expansion tank when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system diagnostic trouble codes (DTCs) retrieved.
5. **NOTE:** Take note of any coolant odor or steam coming from cooling system components.

   If the system coolant is filled correctly and no DTCs associated with fail-safe cooling are retrieved, verify the customer's concern by operating the engine to duplicate the condition.
6. **NOTE:** Refer to the coolant flow diagram in the Description and Operation, Engine Cooling portion of this section.

   Inspect to determine if any of the following mechanical or electrical concerns apply.

Visual Inspection Chart

Mechanical	Electrical
• Leaks or weeps at: ▪ Hoses ▪ Tubes ▪ Clamp joints ▪ Quick connect couplings (if equipped) ▪ Gaskets ▪ O-Rings ▪ Thermostat housing ▪ Radiator ▪ Pressure relief cap ▪ Coolant pump ▪ Heater core (wet floor or coolant odor in vehicle) ▪ Heater control valve ▪ Heated throttle body or heated throttle body adapter (if equipped) ▪ Coolant crossover manifold assembly (if equipped) ▪ Oil cooler (if equipped) ▪ Degas bottle (if equipped) ▪ Coolant expansion tank (if equipped) ▪ Heated positive crankcase ventilation (PCV) (if equipped) ▪ Fuel pressure regulator Clayton bowl (if equipped) ▪ Cylinder block core plugs ▪ Cylinder head core plugs (if equipped) ▪ Block heater (if equipped)	• Inoperative or damaged: ▪ Electric cooling fan (if equipped) ▪ Electronically actuated fan clutch ▪ Electronically actuated fan clutch controller ▪ Wiring, connectors, relays or modules ▪ Engine coolant temperature (ECT) sensor (if equipped) ▪ Cylinder head temperature (CHT) sensor ▪ Intake air temperature (IAT) sensor ▪ Mass air flow (MAF) sensor ▪ Vehicle speed sensor (VSS)

Visual Inspection Chart

Mechanical	Electrical
• Cracked or damaged: ▪ Hoses	

▪ Tubes ▪ Hose clamps ▪ Heater control valve (if equipped) ▪ Thermostat housing ▪ Radiator ▪ Pressure relief cap ▪ Cooling fan ▪ Fan clutch (if equipped) ▪ Coolant pump ▪ Degas bottle (if equipped) ▪ Coolant expansion tank (if equipped) ▪ Oil cooler (if equipped) ▪ Coolant crossover manifold assembly (if equipped) ▪ Cylinder block core plugs ▪ Cylinder head core plugs (if equipped) ▪ Block heater (if equipped) • Restricted airflow through the A/C condenser/radiator • Drive belt loose, worn or installed incorrectly • Broken or weak drive belt tensioner • Excessive white or light gray exhaust smoke (may have burnt coolant odor) • Coolant in engine oil • Engine oil in coolant • Coolant in automatic transmission fluid (if equipped) • Automatic transmission fluid (if equipped) in coolant	

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary. Test the system for normal operation.

8. Inspect the coolant condition.
    1. Inspect the coolant color.
        - If Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color) meeting Ford specification WSS-M97B51-A1 has a clear or pale yellow color, this indicates higher water content than required.
        - **NOTE:** If Cooling System Stop Leak Pellets VC-6 or equivalent meeting Ford specification WSS-M99B37-B6 are used, darkening of the Motorcraft Premium Coolant from yellow to golden tan will occur.

          Dark brown could indicate unauthorized stop leak may have been used. Use Cooling System Stop Leak Pellets VC-6 or equivalent meeting Ford specification WSS-M99B37-B6.
        - A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water and Premium Gold Engine Coolant.
        - An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For information on engine diagnosis, refer to Section 303-00.
        - A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to component tests in this section. If engine oil is suspected, the cause of the leak may be internal to the engine. Refer to Section 303-00.
        - A red, orange or light green colored sheen on top of the coolant may indicate that transmission fluid is entering the cooling system. The cause may be a leaky radiator. Pressure test the cooling system. Refer to the component tests in this section.
    2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Battery/Anti-Freeze Tester. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - Maximum coolant concentration is 60/40 for cold weather areas.
        - Minimum coolant concentration is 40/60 for warm weather areas.

3. Adjust coolant range and level if necessary:
    - If coolant is low, add specified coolant mixture only.
    - If the engine coolant tests too weak, remove some of the engine coolant and add straight engine coolant until the readings are within acceptable levels.
    - If the engine coolant tests strong, remove some of the engine coolant and add straight distilled water until the readings are within acceptable levels.

9. If the concern remains after the inspection, determine the symptom(s). GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Loss of coolant	• Coolant hoses or tubes • Hose clamps • Coolant pump O-ring seal or gasket • Thermostat O-ring seal or gasket • Thermostat housing • Radiator • Transmission fluid cooler (in radiator) (if equipped) (may leak internally or externally) • Degas bottle (if equipped) • Coolant expansion tank (if equipped) • Pressure relief cap • Coolant pump leaking from weep hole • Auxiliary coolant pump (if equipped) • Heater core • Heater control valve (if equipped) • Coolant crossover manifold assembly (if equipped) • Engine gaskets (may leak internally or externally) • Oil cooler (if equipped) (may leak internally or externally) • Heated throttle body or heated throttle body adapter (if equipped) • Heated positive crankcase ventilation (PCV) (if equipped) • Fuel pressure regulator coolant bowl (if equipped) • Cylinder block core plugs • Cylinder head core plugs (if equipped) • Block heater (if equipped)	• Go To Pinpoint Test A .
• The engine	• Low coolant level	• Go To Pinpoint Test B .

overheats	• External engine coolant leak • Airlock in system • Pressure relief cap installation • Restricted airflow through the A/C condenser/radiator • Internal engine coolant leak • Coolant condition/concentration • Accessory drive components • Non-OEM engine enhancement components • Electric cooling fan (if equipped) • Mechanical cooling fan (if equipped) • Mechanical cooling fan clutch (if equipped) • Radiator • Thermostat • Engine coolant temperature indicator system (gauge) • Engine coolant temperature (ECT) sensor (if equipped) • Cylinder head temperature (CHT) sensor (if equipped) • Heater core • Coolant pump • Coolant flow restriction	
• The engine does not reach normal operating temperature	• Low coolant level • Thermostat • Mechanical fan clutch always engaged • Engine coolant temperature indicator system (gauge) • ECT sensor (if equipped) • CHT sensor (if equipped)	• Go To Pinpoint Test C .
• The block heater does not operate correctly	• Block heater power cable • Block heater	• CHECK continuity in all 3 power cable circuits. If any circuit measures greater than 5 ohms, INSTALL a new power cable. • INSTALL a new block heater.
• The electric cooling fan(s) or electronically controlled fan clutch is inoperative in one or more speeds or	• Wiring • Relays • Fuses • Fan control module • Cooling fan motor(s) • Cooling fan resistor(s) • Electric fan clutch	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

does not operate correctly (if equipped)		
• The electric cooling fan(s) stays on all the time (if equipped)	• Wiring • Relays	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual
• Noisy electric cooling fan operation (if equipped)	• Foreign material contamination • Fan motor • Fan blade detached from fan motor	• REMOVE the foreign material from the cooling fan and shroud. TEST the system for normal operation. If still noisy, INSTALL a new cooling fan assembly. • INSTALL a new cooling fan assembly.
• Noisy mechanical fan operation (if equipped)	• Fan clutch	• CARRY OUT the Fan Clutch Test — Minimum Speed Requirement component test.

Pinpoint Tests

Pinpoint Test A: Loss of Coolant

Possible Causes

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing
- Heater control valve (if equipped)
- Radiator
- Transmission fluid cooler (in radiator) (if equipped)
- Pressure relief cap
- Coolant pump leaking from weep hole
- Auxiliary coolant pump (if equipped)
- Heater core
- Heated throttle body or heated throttle body adapter (if equipped)
- Coolant crossover manifold assembly (if equipped)
- Engine gaskets
- Oil cooler (if equipped)
- Degas bottle (if equipped)
- Coolant expansion tank (if equipped)
- Heated positive crankcase ventilation (PCV) (if equipped)
- Fuel pressure regulator coolant bowl (if equipped)
- Cylinder block core plugs
- Cylinder head core plugs (if equipped)
- Block heater (if equipped)

PINPOINT TEST A: LOSS OF COOLANT

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

Test Step	Result / Action to Take
A1 CARRY OUT INSPECTION AND VERIFICATION • Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to A2.
A2 CHECK THE ENGINE COOLANT LEVEL **NOTE:** Allow the engine to cool before checking the engine coolant level. • Key in OFF position. • Visually inspect the engine coolant level at the degas bottle or the coolant expansion tank. • **Is the engine coolant level within specifications?**	**Yes** GO to A3. **No** ADJUST the engine coolant level as necessary. GO to A3
A3 PRESSURE TEST THE ENGINE COOLING SYSTEM • Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** If the vehicle is equipped with a coolant expansion tank, GO to A4. If the vehicle is equipped with a degas bottle, GO to A5.
A4 CHECK THE PRESSURE RELIEF CAP • Carry out the pressure relief cap pressure test. Refer to Component Test, Pressure Relief Cap Pressure Test in this section. • **Is the pressure relief cap OK?**	**Yes** GO to A5. **No** INSTALL a new pressure relief cap. TEST the system for normal operation.
A5 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK • Inspect the engine coolant in the degas bottle or coolant expansion tank for signs of engine oil or transmission fluid. • **Is engine oil or transmission fluid evident in the coolant?**	**Yes** If engine oil is evident, GO to Section 303-00 for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure.. TEST the system for normal

	operation. **No** GO to A6 .
A6 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES	
• **NOTE:** Use U-View® Combustion Leak Tester part number 560000 or equivalent. • Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases. • **Are combustion gases present?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to A7 .
A7 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT	
• Remove the oil level indicators from the engine and the transmission. • **Is coolant evident in the oil or transmission fluid?**	**Yes** If coolant is in the engine oil, GO to Section 303-00 . If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure.. **No** The cooling system is operational.

Pinpoint Test B: The Engine Overheats

Possible Causes

- Low coolant level
- External engine coolant leak
- Airlock in system
- Pressure relief cap installation
- Restricted airflow through the A/C condenser/radiator
- Internal engine coolant leak
- Coolant condition/concentration
- Accessory drive components
- Non-OEM engine enhancement components
- Electric cooling fan (if equipped)
- Mechanical cooling fan blade (if equipped)
- Mechanical cooling fan clutch (if equipped)
- Engine coolant temperature indicator system (gauge)
- Engine coolant temperature (ECT) sensor (if equipped)
- Cylinder head temperature (CHT) sensor (if equipped)
- Heater core
- Coolant pump
- Coolant flow restriction

PINPOINT TEST B: THE ENGINE OVERHEATS

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to

the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

Test Step	Result / Action to Take
B1 CARRY OUT INSPECTION AND VERIFICATION • Carry out the inspection and verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to B2.
B2 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs) • **NOTE:** Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for correct scan tool hook-up procedure. • Check for DTCs P1299 or P1285. • **Is DTC P1299 or P1285 present?**	**Yes** GO to B3. **No** CHECK the engine coolant temperature gauge operation. REFER to Section 413-01.
B3 CHECK FOR AN AIRFLOW OBSTRUCTION • Check the radiator or A/C condenser for an obstruction such as leaves or cardboard. • **Is an obstruction present?**	**Yes** REMOVE the obstruction. TEST the system for normal operation. **No** GO to B4.
B4 CHECK THE ENGINE COOLANT LEVEL **NOTE:** Allow the engine to cool before checking the coolant level. • Key in OFF position. • Visually check the engine coolant level in the degas bottle or coolant expansion tank. • **Is the engine coolant level within specification?**	**Yes** GO to B5. **No** ADJUST the engine coolant level as necessary. GO to B5.
B5 PRESSURE TEST THE ENGINE COOLING SYSTEM • Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** Vehicles equipped with an expansion tank, GO to B6. Vehicles equipped with a degas bottle, GO to B7.
B6 CHECK THE PRESSURE RELIEF CAP • Carry out the pressure relief cap pressure test. Refer to Component Test, Pressure Relief Cap Pressure Test in this section. • **Is the pressure relief cap OK?**	**Yes** GO to B7. **No** INSTALL a new pressure relief cap. TEST the system for normal operation.

B7 CHECK COOLANT CONDITION	
• Check the coolant for dirt, rust or contamination and check the coolant concentration. • **Is the coolant condition OK?**	**Yes** Vehicles equipped with an electric cooling fan, GO to B8 . Vehicles equipped with a mechanical cooling fan, GO to B9 . **No** FLUSH the engine cooling system. REFER to Cooling System Flushing in this section. TEST the system for normal operation.
B8 CHECK THE ELECTRIC COOLING FAN OPERATION	
• Start the engine. • Place the climate control function selector in the MAX A/C position and the blower motor switch in the HI position. • **Did the electric cooling fan operate?**	**Yes** If the vehicle is also equipped with a mechanical cooling fan, GO to B9 . Otherwise, GO to B10 . **No** CARRY OUT the electric cooling fan diagnostic procedure. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B9 CHECK THE MECHANICAL COOLING FAN OPERATION	
• Key in OFF position. • If the vehicle is equipped with a viscous fan clutch, carry out the Fan Clutch Tests in the Component Tests portion of this section. If the vehicle is equipped with an electronically actuated fan clutch, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is the cooling fan operation OK?**	**Yes** GO to B9 . **No** INSTALL a new fan clutch. TEST the system for normal operation.
B10 CHECK THE COOLANT PUMP OPERATION	
• Start the engine. • Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold side equipped vehicles). Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose. • **Is the heater outlet hose hot?**	**Yes** GO to B11 . **No** INSTALL a new water pump. TEST the system for normal operation.
B11 CHECK THE THERMOSTAT OPERATION	
• Start the engine. • Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold side thermostat equipped vehicles). Feel the upper radiator hose (hot side thermostat equipped vehicles) or the lower radiator hose (cold side thermostat equipped vehicles). • **Is the upper (hot side thermostat equipped vehicles) or lower (cold side equipped vehicles) radiator hose hot?**	**Yes** CHECK the engine coolant temperature gauge operation. REFER to Section 413-01 . **No** GO to B12 .
B12 VISUALLY INSPECT THE THERMOSTAT	
• Carry out the Thermostat Visual Inspection in the Component Tests portion of this section. • **Is the thermostat damaged?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation.

	No INSTALL a new thermostat. TEST the system for normal operation. If the engine still overheats, INSTALL a new radiator. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Reach Normal Operating Temperature

Possible Causes

- Low coolant level
- Thermostat
- Engine coolant temperature (ECT) indicator system (gauge)
- ECT sensor
- Cylinder head temperature (CHT) sensor
- Engine cooling fan

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

Test Step	Result / Action to Take
C1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs) P0125 or P0128	
NOTE: Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for correct scan tool hook-up procedure. • Check for DTCs P0125 or P0128. • **Is DTC code P0125 or P0128 present?**	**Yes** If the vehicle is equipped with an electric cooling fan, GO to C2 . If the vehicle is equipped with a mechanical cooling fan, GO to C3 . **No** If an inoperative engine coolant temperature gauge is suspected, CHECK the engine coolant temperature gauge operation. REFER to Section 413-01 . If an inoperative climate control system is suspected, CHECK the climate control system operation. REFER to Section 412-00 .
C2 CHECK THE ELECTRIC COOLING FAN OPERATION	
• Allow the engine to cool. • Make sure the A/C switch is OFF (if equipped). • Start the engine. • Check the electric cooling fan. • **Is the electric cooling fan on all the time?**	**Yes** DIAGNOSE the electric cooling fan operation. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** If the vehicle is also equipped with a

	mechanical cooling fan, GO to C3 . Otherwise, GO to C4 .
C3 CHECK THE MECHANICAL COOLING FAN OPERATION	
• Carry out the cooling fan clutch component tests. For a mechanical cooling fan clutch, refer to Component Tests in this section. For an electronic cooling fan clutch, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is the cooling fan clutch OK?**	**Yes** GO to C4 . **No** INSTALL a new cooling fan clutch. TEST the system for normal operation.
C4 CHECK THE COOLANT LEVEL	
• **NOTE:** Allow the engine to cool before checking the coolant level. • Visually check the engine coolant level in the degas bottle or coolant expansion tank. • **Is the engine coolant level within specification?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation. **No** Go To Pinpoint Test A to diagnose a coolant leak.

Component Tests

Cooling System Pressure Test — Degas Bottle Systems

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Turn the engine OFF.
2. Check the engine coolant level. Adjust the coolant level as necessary.
3. Attach the Radiator/Heater Core Pressure Tester to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick-connect fitting of the test adapter.
4. **CAUTION: Do not pressurize the cooling system beyond the maximum pressure listed in the specifications table in this section.**

   NOTE: If the plunger of the pressure tester is depressed too fast, an erroneous pressure reading will result.

   Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained. If the pressure reading exceeds the maximum cap pressure listed in the specifications table, install a new pressure relief cap.

5. If the system does not hold pressure, remove the pressure relief cap and wash in clean water to dislodge all the foreign material from the gasket. Check the sealing surface in the filler neck of the degas bottle for nicks or cuts. If the cooling system still does not hold the minimum pressure listed in the specifications table, install a new pressure relief cap and recheck the system

6. **NOTE:** If the pressure drops after a new pressure relief cap is installed, check for leaks at the engine-to-heater core hoses, engine-to-radiator hoses, radiator, heater core(s) and other system components and connections. Any leaks that are found must be corrected and the system rechecked.

   Pressurize the engine cooling system as described in Step 4 above. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.

7. If no leaks are found and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.

8. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Refer to Section 303-00 to diagnose the engine.

9. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

Cooling System Pressure Test — Coolant Expansion Tank Systems

WARNING: Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in personal injury.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Turn the engine OFF.

2. Remove the pressure relief cap. Top off the radiator as needed. Fit the pressure tester to the radiator fill neck.

3. **CAUTION: Do not pressurize the cooling system beyond 138 kPa (20.0 psi).**

   NOTE: If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.

   Pump the cooling system to a maximum of 138 kPa (20.0 psi) and hold for 2 minutes. If the pressure drops within this time, inspect for leaks and repair as necessary.

4. If no leaks are found and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.

5. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Refer to Section 303-00 to diagnose the engine.

Pressure Relief Cap Pressure Test

1. Inspect the pressure relief cap and seals for damage or deterioration. Install a new pressure relief cap if necessary.

2. Fit the pressure relief cap to the Radiator/Heater Core Pressure Tester Kit using the correct adapter.

3. **NOTE:** If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.

   Slowly pump the pressure tester until the pressure gauge stops increasing and note the highest pressure reading. Release the pressure and repeat the test. Install a new pressure relief cap if the pressure is not within specification. Refer to the General Specifications chart in this section.

Thermostat

A new thermostat should be installed only after the following tests and checks have been carried out:

- Pinpoint Test A, B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.

2. Examine the thermostat for signs of damage including:
   - Valve not fully seated (light visible through the valve
   - Foreign material lodged in the main valve
   - Bent or broken frame or flange
   - Bent or broken spring
   - Bent or broken valve or valve stem
   - Wax leaking from wax reservoir or a bulge in the reservoir
   - Any other damage or distortion

3. **NOTE:** If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.

   If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.

4. If no damage is found during the inspection, continue troubleshooting the system concern. Go to the Symptom Chart for further instructions.

Thermostat Electrical Test

1. The thermostat monitor is designed to verify correct thermostat operation. The monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, diagnostic trouble code (DTC) P0125 or P0128 is set the malfunction

indicator lamp will be illuminated.

Radiator Leak Test, Removed From Vehicle

CAUTION: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

NOTE: Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator.

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Fan Clutch Test

1. Turn the engine OFF and wait until the fan comes to a complete stop.

2. Spin the fan blade by hand. A light resistance should be felt. If there is no resistance or very high resistance, the minimum and maximum fan speeds must be checked. For an electronically actuated fan clutch, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For a viscous fan clutch, carry out the following:

Fan Clutch Test — Minimum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.

2. Make sure the A/C is OFF, if equipped.

3. **WARNING: To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine until the fan blade has been first examined for possible cracks and separation. Failure to follow these instructions may result in personal injury.**

   Start the engine and run it at approximately 2,000 rpm for 5 minutes or until there is a noticeable reduction in fan noise to allow the fan clutch to go into disengaged mode.

4. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.

5. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan speed.

6. The fan blade speed must be less than 1,500 rpm at 3,000 coolant pump rpm.

7. Turn the engine off.

8. If the fan blade speed was greater than 1,500 rpm, install a new fan clutch.

Fan Clutch Test — Maximum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.

2. Block off areas on each side of the radiator in the engine compartment, the front of the radiator grille and the bumper. Close the hood. This will raise the temperature of the air striking the fan clutch and should cause the fan blade to operate at maximum speed.

3. Place the climate control function selector switch in the MAX A/C position and the blower motor switch in the HI position, if equipped.

4. **WARNING: To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine until the fan blade has been first examined for possible cracks and separation. Failure to follow these instructions may result in personal injury.**

   NOTE: Do not open the hood to check the coolant pump or fan pulley temperature. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the infrared thermometer through the wheel well or from under the vehicle.

   Start the engine and run it at approximately 2,000 rpm until normal operating temperature has been achieved. Using an infrared thermometer, monitor the coolant pump or fan pulley. Run the engine until the coolant pump or fan pulley is at least 96°C (205°F).

5. **NOTE:** Do not open the hood to check the coolant pump or fan pulley or fan blade speed. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the laser photo tachometer through the wheel well or from under the vehicle.

   Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.

6. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan blade speed.

7. The fan blade speed must be greater than the specified rpm at 3,000 rpm coolant pump or fan pulley rpm. Refer to the specification table in this section for correct fan speed.

8. Open the hood and allow the engine to idle momentarily to lower engine temperature. Turn the engine off and remove the blocks from the radiator, grill and bumper.

9. If the fan blade speed is less than specified, install a new fan clutch.

Cooling System Draining, Filling and Bleeding

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Special Tool(s)

ST2618-A	RADKITPLUS 078-00497

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Draining

WARNING: To avoid personal injury, do not remove the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.

CAUTION: The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated it must be recycled or disposed of correctly.

CAUTION: Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant. Always fill the cooling system with the same type of coolant that is present in the system. Do not mix coolant types.

NOTE: Less than 80% of the coolant capacity can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

1. Make sure the engine is cool.
2. Wrap a thick cloth around the coolant pressure relief cap on the degas bottle. Slowly turn the cap counterclockwise until the pressure begins to release.
3. Step back while the pressure releases.
4. When you are sure all the pressure has been released, use the cloth to turn and remove the cap.
5. Place a suitable container below the radiator draincock. Drain the coolant.
    - Tighten the radiator draincock when finished.

Filling and Bleeding with RADKITPLUS

1. Using the special tool, install the RADKITPLUS and follow the RADKITPLUS manufacturer's instructions to fill and bleed the cooling system.

Filling and Bleeding without RADKITPLUS

CAUTION: Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant. Always fill the cooling system with the same type of coolant that is present in the system. Do not mix coolant types.

CAUTION: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level.

When adding engine coolant, use a 50/50 mixture of distilled water and engine coolant.

To maintain the integrity of the coolant and the cooling system:

- **Do not add orange-colored Motorcraft Specialty Orange Engine Coolant. Mixing coolants may degrade the coolant's corrosion protection.**
- **Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.**
- **Do not mix with recycled coolant. Use of such coolant may harm the engine and cooling system components.**

1. Fill the radiator through the degas bottle until the coolant level is between the COOLANT FILL LEVEL marks.

2. On the electronic manual temperature control (EMTC), move the temperature blend selector to the full WARM position. On the electronic automatic temperature control (EATC), set the temperature to 32°C (90°F).

3. Run the engine at idle until it reaches normal operating temperature.

4. Add the correct coolant mixture to the degas bottle until the coolant level is at the upper COOLANT FILL LEVEL mark.

5. Turn the engine off and allow it to cool.

6. Repeat Steps 1 through 5 until the degas bottle level is correct, with the engine cool.

7. **CAUTION: If the air discharge remains cool and the engine coolant temperature gauge does not move, the engine coolant level is low in the engine and must be filled. Stop the engine, allow it to cool and fill the cooling system.**

   Select the maximum heater temperature and blower motor speed settings. Position the control to discharge air at the A/C vents.

8. Start the engine and allow it to idle until it reaches normal operating temperature. While the engine is idling, feel for hot air from the A/C vents.
   - Hot air should discharge from the A/C vents. The engine coolant temperature gauge

should maintain a stabilized reading in the middle of the NORMAL range and the upper radiator hose should feel hot to the touch.

9. Shut the engine off and allow it to cool.
10. Check the engine coolant level in the degas bottle and fill it as necessary.
11. Repeat Steps 7 through 10 as necessary.
12. Check the cooling system for leaks.
13. Install the pressure relief cap to the degas bottle.

Cooling System Flushing

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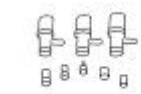
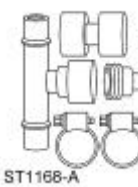
Special Tool(s)

ST2421-A	Coolant System Drain/Flush/Fill 164-R3673 or equivalent
 ST1167-A	Flush Kit 164-R3658
 ST1168-A	Drain Kit 164-R3662 or equivalent

Material

Item	Specification
Premium Cooling System Flush VC-1	ESR-M14P7-A

1. **WARNING: To avoid personal injury, do not remove the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

   Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the thermostat.

3. Install the thermostat housing without the thermostat.

4. **NOTE:** For additional information, refer to the cooling system Flush-All Operating Instructions for specific vehicle hook-up.

   Use cooling system Flush-All, Flush Kit Hardware Package and Drain kit to flush the engine and radiator.
   Use Premium Cooling System Flush.

5. Install the thermostat.

6. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Block Heater

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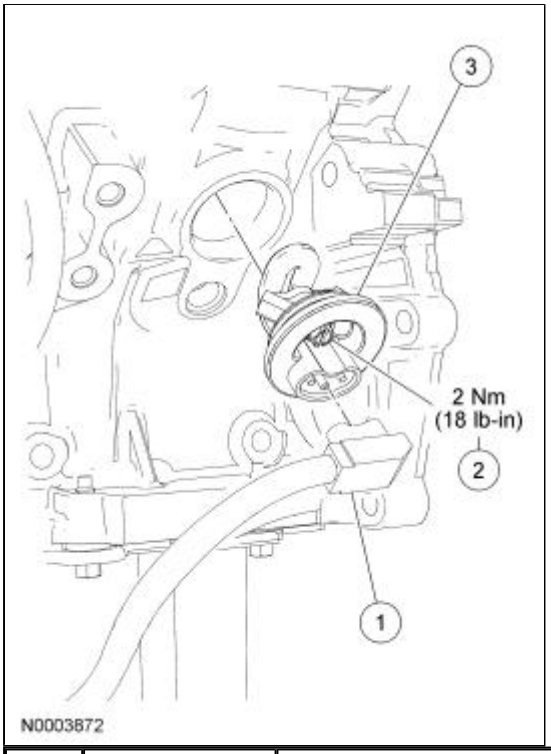
Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1



Item	Part Number	Description
1	14A199	Block heater electrical connector
2	—	Block heater retaining screw (part of 6A051)
3	6A051	Block heater

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. **CAUTION: Do not loosen the block heater retaining screw more than necessary for removal.**

   Loosen the block heater retaining screw and remove the block heater.
   - To install, tighten to 2 Nm (18 lb-in).

3. **NOTE:** Route the block heater power cable away from hot or rotating components, or damage to the cable can occur.

   NOTE: Lubricate the block heater O-ring seal with clean engine coolant prior to installation.

   To install, reverse the removal procedure.

Bypass Tube

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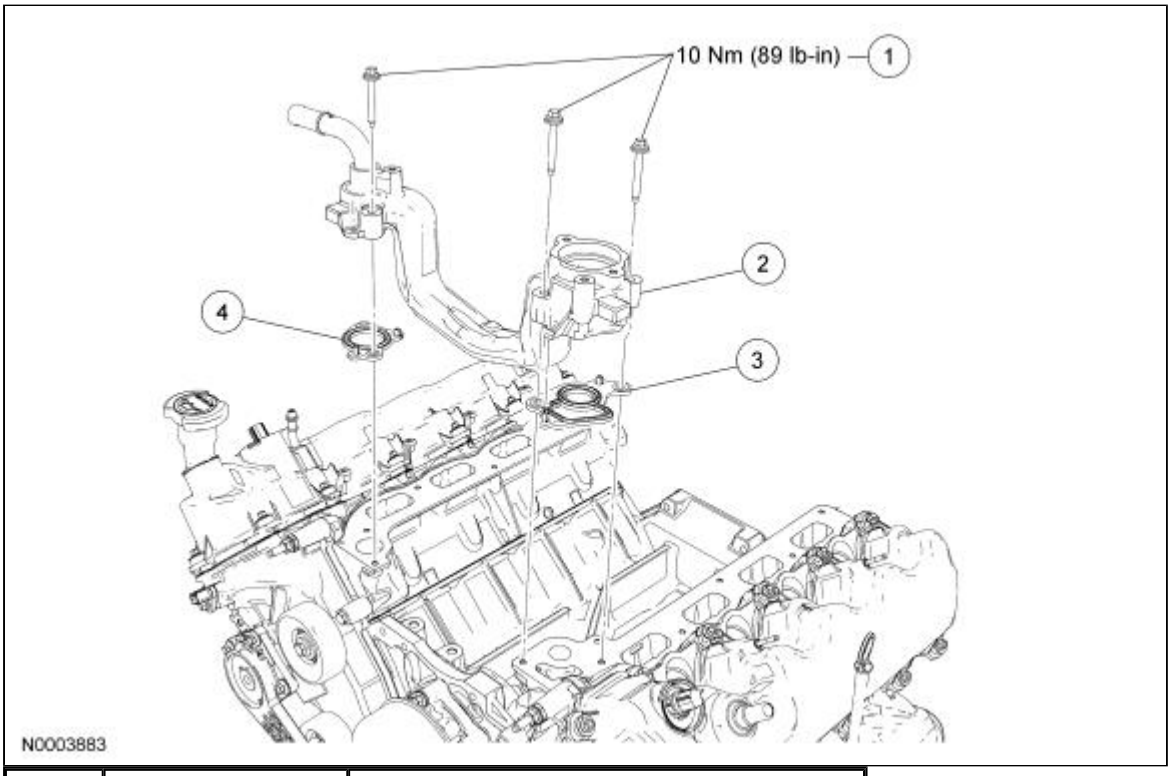
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket Remover ZC-30	—



Item	Part Number	Description
1	W503282	Bypass tube bolts (3 required)
2	8C368	Bypass tube
3	8C388	Bypass tube gasket (LH)
4	8C387	Bypass tube gasket (RH)

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the intake manifold. For additional information, refer to Section 303-01 .

3. Remove the 3 bolts, the bypass tube, and discard the bypass tube gaskets.
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.
    - Inspect the mating surfaces and clean the sealing surfaces with metal surface prep and silicone gasket remover. Follow the directions on the packaging.
    - Install new bypass tube gaskets.

Thermostat and Thermostat Housing

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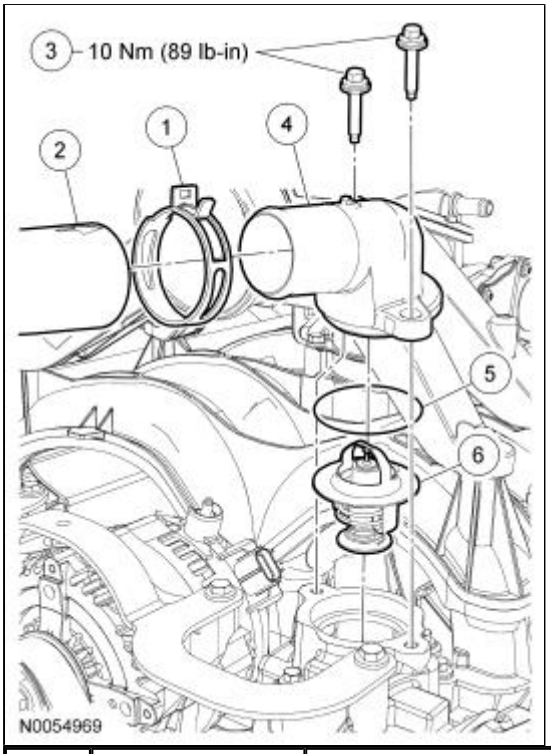
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—



Item	Part Number	Description
1	15161	Upper radiator hose clamp
2	8B274	Upper radiator hose
3	W503279	Thermostat housing bolts (2 required)
4	8594	Thermostat housing
5	N806807	Thermostat O-ring seal
6	8575	Thermostat

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. If servicing the thermostat housing, disconnect the upper radiator hose from the thermostat housing.

3. Remove the 2 bolts, the thermostat housing and the thermostat. Discard the O-ring seal.
   - To install, tighten to 10 Nm (89 lb-in).

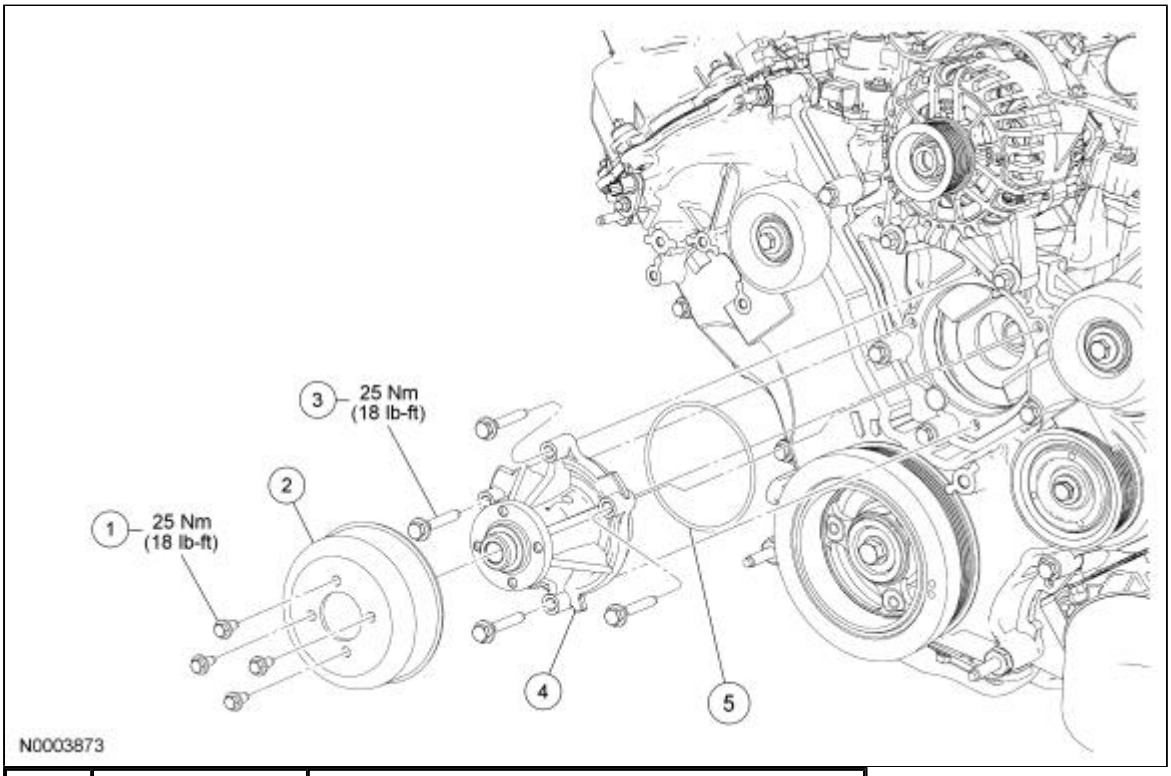
4. To install, reverse the removal procedure.
    - Inspect the mating surfaces. Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging.
    - Install a new O-ring seal.

Coolant Pump

Printable View (268 KB)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft Metal Surface Prep ZC-31	—



Item	Part Number	Description
1	N806282	Coolant pump pulley bolt (4 required)
2	8A528	Coolant pump pulley
3	N808794	Coolant pump bolt (4 required)
4	8501	Coolant pump
5	391108	Coolant pump O-ring seal

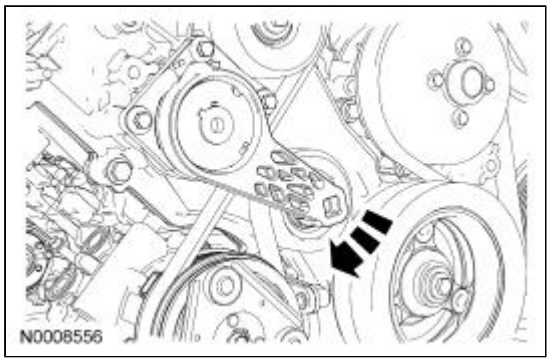
Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the cooling fan. For additional information, refer to Cooling Fan in this section.

3. Loosen the 4 coolant pump pulley bolts.
    - To install, tighten to 25 Nm (18 lb-ft).

4. Rotate the belt tensioner clockwise and disconnect the accessory drive belt from the coolant pump pulley.



5. Remove the 4 bolts and the coolant pump pulley.

6. Remove the 4 bolts and the coolant pump. Discard the O-ring seal.
    - To install, tighten to 25 Nm (18 lb-ft).

7. To install, reverse the removal procedure.
    - Inspect the mating surfaces. Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging.
    - Install a new O-ring seal. Lubricate the O-ring seal with clean engine coolant prior to installation.

Cooling Module

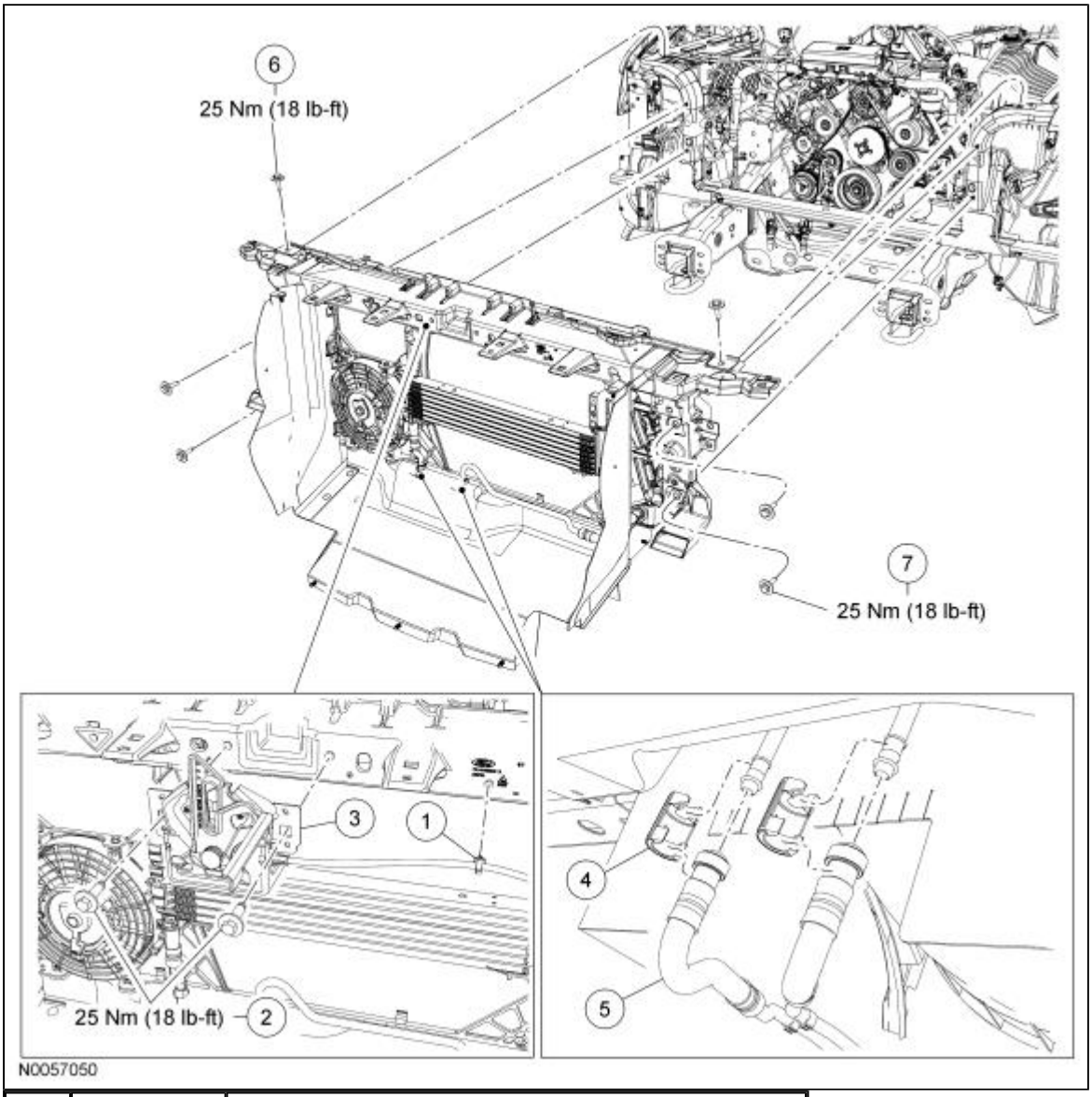
Printable View (586 KB)

Special Tool(s)

ST2935A	Disconnect Tool, Transmission Cooler Line 307-569

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	16B975	Hood latch assembly cable retainer
2	W711848	Hood latch assembly bolts (2 required)
3	6100	Hood latch assembly
4	7J801	Transmission fluid cooler tube secondary latches (2 required)
5	7H420	Transmission fluid cooler tube (2 required)
6	W701835	Cooling module upper bolt (2 required)
7	W701835	Cooling module front bolt (4 required)

Removal

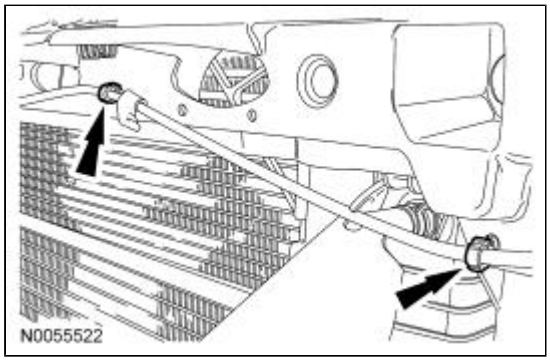
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

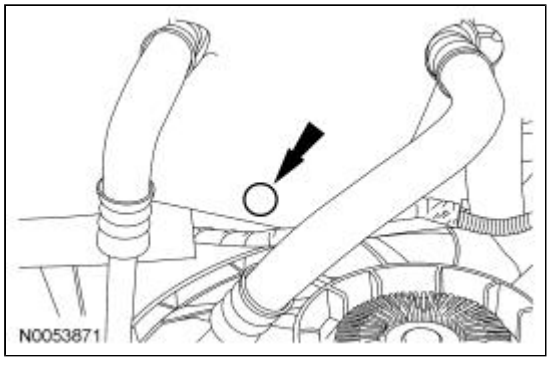
2. Drain the engine cooling system. For additional information, refer to Cooling System Draining.

Filling and Bleeding in this section.

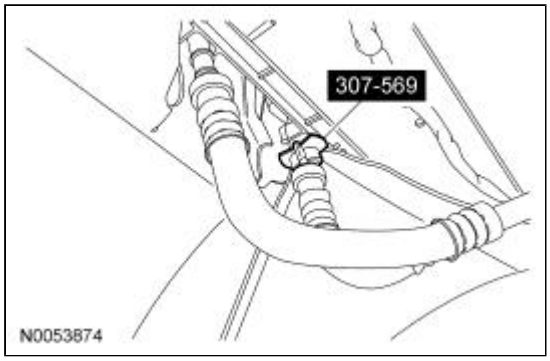
3. Recover the A/C system refrigerant. For additional information, refer to Section 412-00 .
4. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
5. Remove the RH and LH headlamp assemblies. For additional information, refer to Section 417-01 .
6. Remove the front fascia. For additional information, refer to Section 501-19 .
7. Remove the cooling fan shroud. For additional information, refer to Cooling Fan Shroud in this section.
8. Remove the 2 hood latch assembly bolts.
9. Disconnect the cable position retainers and position the hood latch assembly aside.



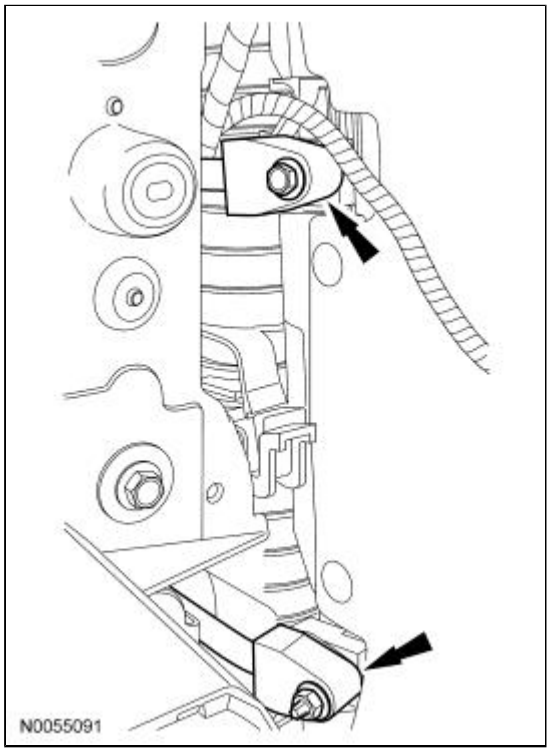
10. Remove the pushpin and move the air deflector aside.



11. Remove the transmission cooler tube secondary latches.
12. Using the special tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler hoses.

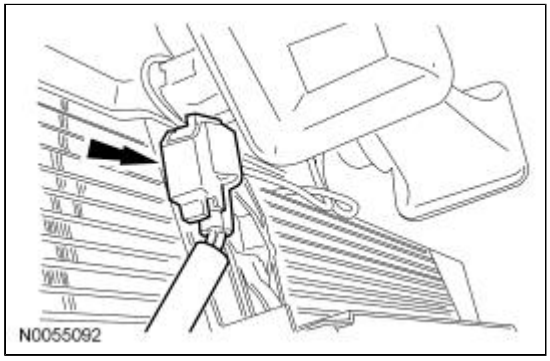


13. Remove the 2 condenser inlet fitting nuts and disconnect the 2 fittings.
    - Discard the O-ring seals.



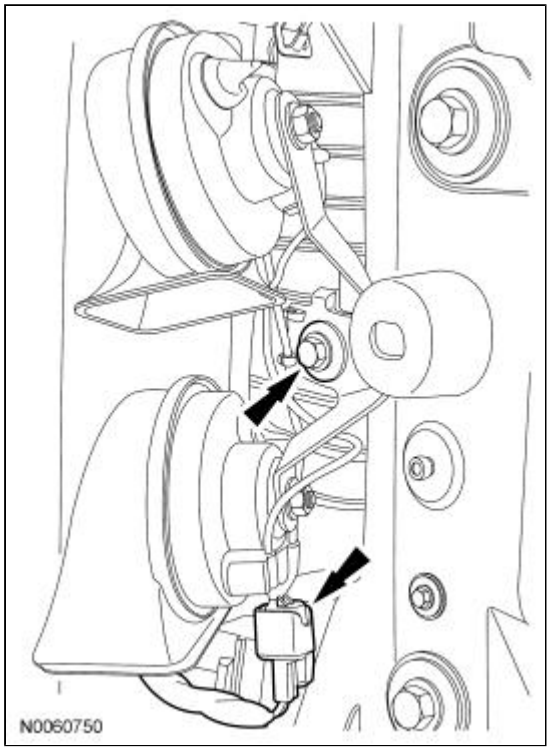
Expedition vehicles

14. Disconnect the horn electrical connector.



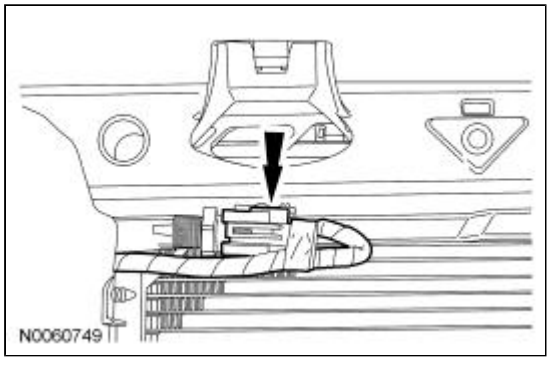
Navigator vehicles

15. Disconnect the electrical connector and remove the bolt and the horn assembly.



All vehicles

16. Disconnect the ambient temperature sensor electrical connector.



17. Remove the 6 radiator support bolts and remove the cooling module from the vehicle.

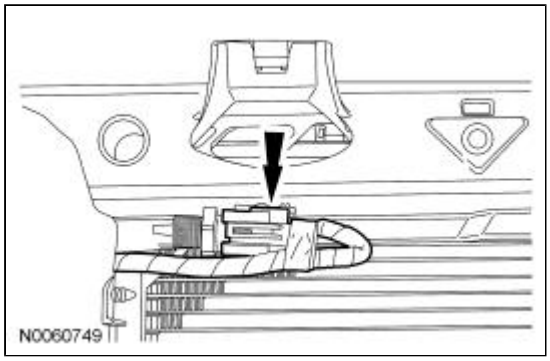
Installation

All vehicles

1. Position the cooling module in the vehicle.

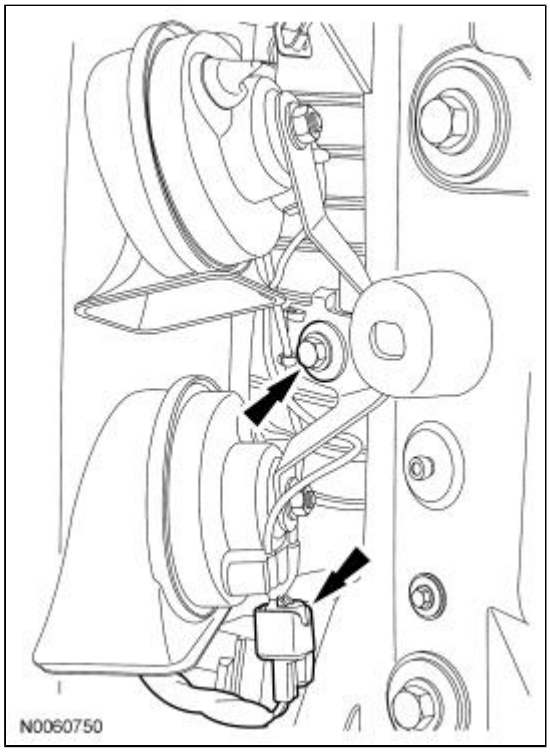
2. Install the 6 radiator support bolts.
    - Tighten to 25 Nm (18 lb-ft).

3. Connect the ambient temperature sensor electrical connector.



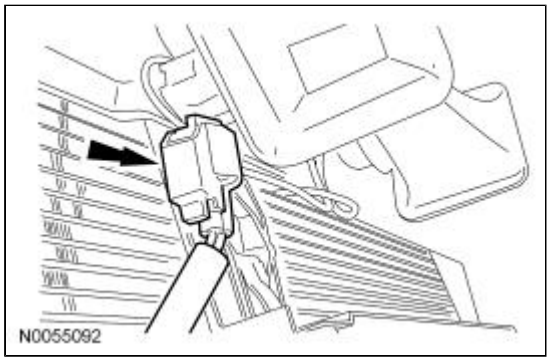
Navigator vehicles

4. Position the horn assembly and install the bolt and connect the electrical connector.
    - Tighten to 10 Nm (89 lb-in).



Expedition vehicles

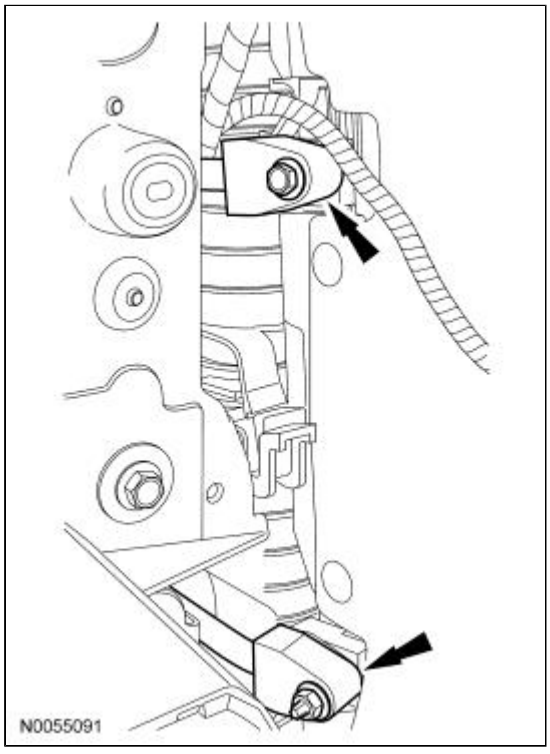
5. Connect the horn electrical connector.



All vehicles

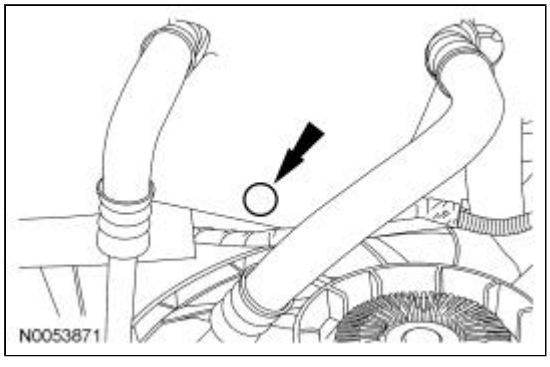
6. **NOTE:** Lubricate the new O-ring seals with PAG Refrigerant Compressor Oil prior to installation.

   Using new O-ring seals, connect the A/C fittings and install the 2 nuts.
   - Tighten to 8 Nm (71 lb-in).



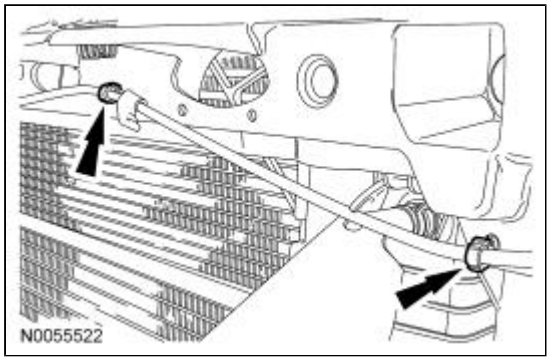
7. Connect the transmission fluid cooler tubes and install the secondary latches.

8. Position the air deflector and install the pushpin.



9. Position the hood latch assembly and install the 2 hood latch assembly bolts.
   - Tighten to 25 Nm (18 lb-ft).

10. Connect the hood latch cable position retainers.



11. Install the cooling fan shroud. For additional information, refer to Cooling Fan Shroud in this section.

12. Install the front fascia. For additional information, refer to Section 501-19 .

13. Install the RH and LH headlamp assemblies. For additional information, refer to Section 417-01 .

14. Connect the battery ground cable. For additional information, refer to Section 414-01 .

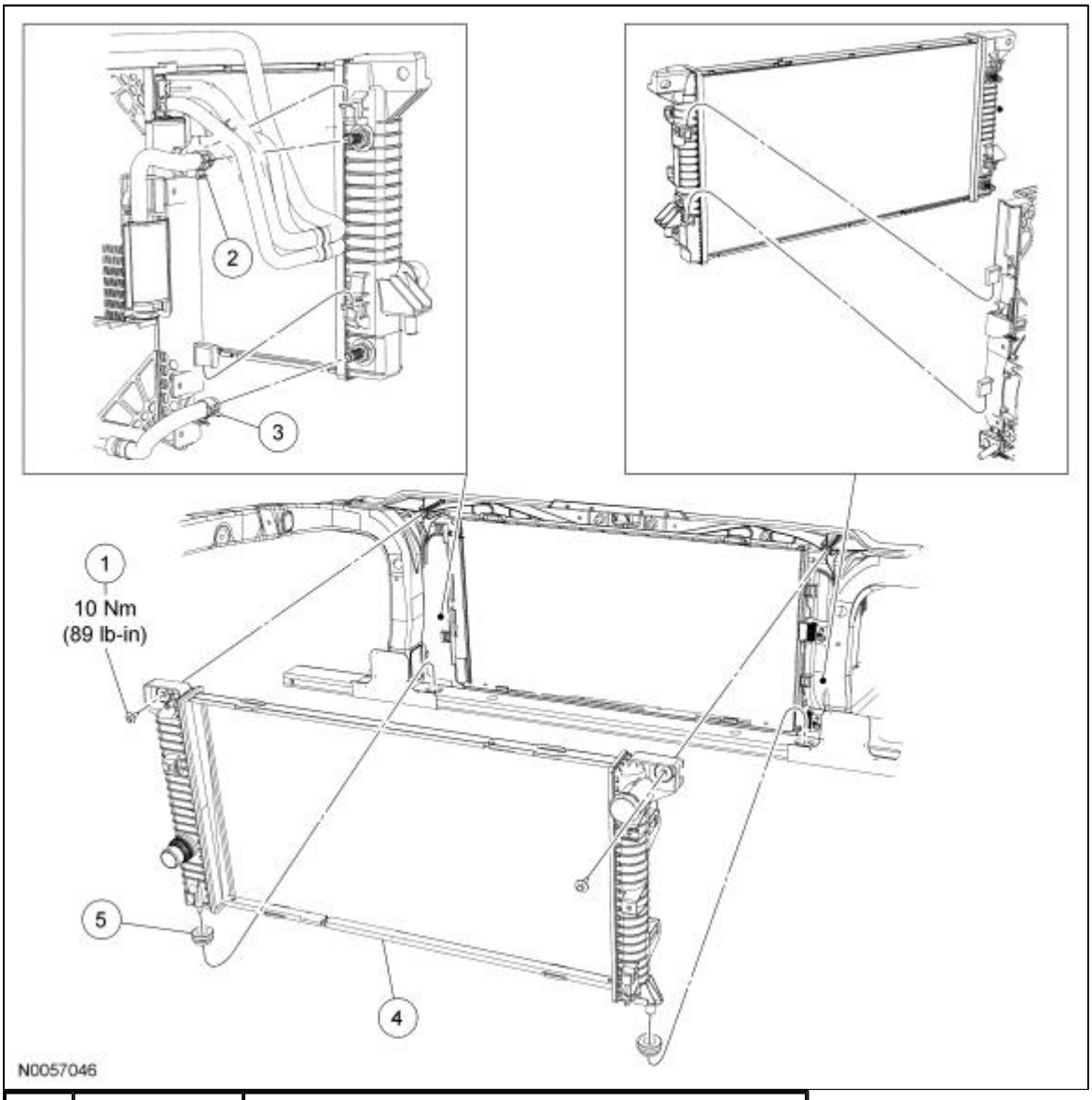
15. Fill and bleed the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

16. Fill the transmission with fluid and verify correct operation. For additional information, refer to Section 307-01A or Section 307-01B .

17. Evacuate, leak test and charge the refrigerant system. For additional information, refer Section 412-00 .

Radiator

Printable View (381 KB)



Item	Part Number	Description
1	W503924	Radiator support bolt (2 required)
2	7F113	Transmission fluid cooler-to-radiator upper hose
3	7B028	Transmission fluid cooler-to-radiator lower hose
4	8005	Radiator
5	8B204	Radiator insulator (2 required)

Removal and Installation

All vehicles

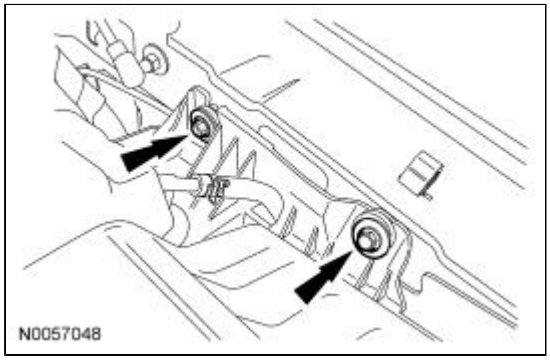
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the RH and LH headlamp assemblies. For additional information, refer to Section 417-01 .

3. Remove the cooling fan shroud. For additional information, refer to Cooling Fan Shroud in this section.

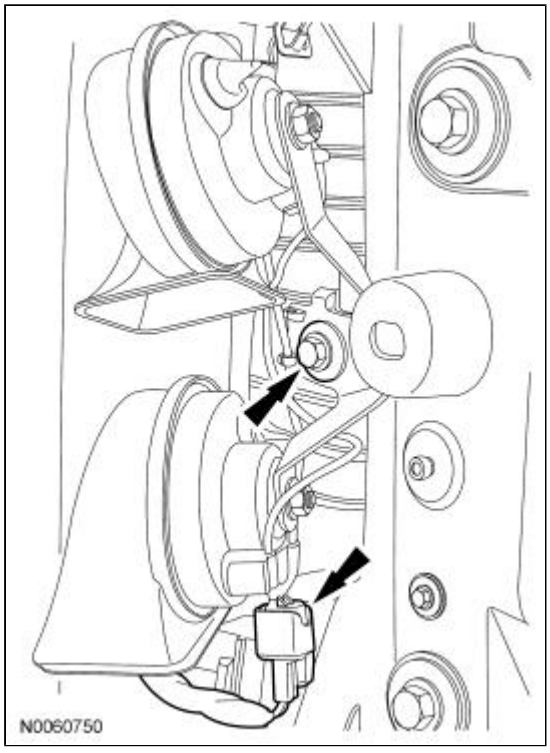
4. Remove the 2 radiator-to-radiator support bolts.
   - To install, tighten to 10 Nm (89 lb-in).

5. Remove the 2 bolts and position the degas bottle aside.
   - To install, tighten to 10 Nm (89 lb-in).



Navigator vehicles

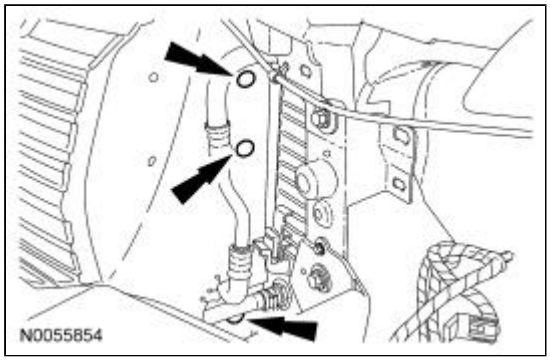
6. Disconnect the electrical connector and remove the bolt and the horn assembly.
   - To install, tighten to 10 Nm (89 lb-in).



All vehicles

7. **NOTE:** LH shown, RH similar.

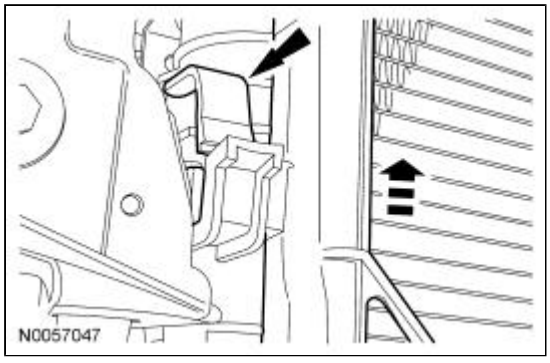
   Remove the 6 LH and RH air deflector-to-condenser core pin-type retainers.



8. Disconnect the 2 transmission fluid cooler-to-radiator hoses.

9. **NOTE:** The cooling module must be positioned rearward to raise and detach the 4 condenser mounts from the radiator.

   Depress the retaining tabs on the 2 lower condenser mounting brackets and raise the condenser assembly until the 4 condenser mounting brackets detach from the radiator.



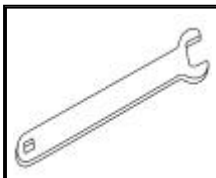
10. Remove the radiator.

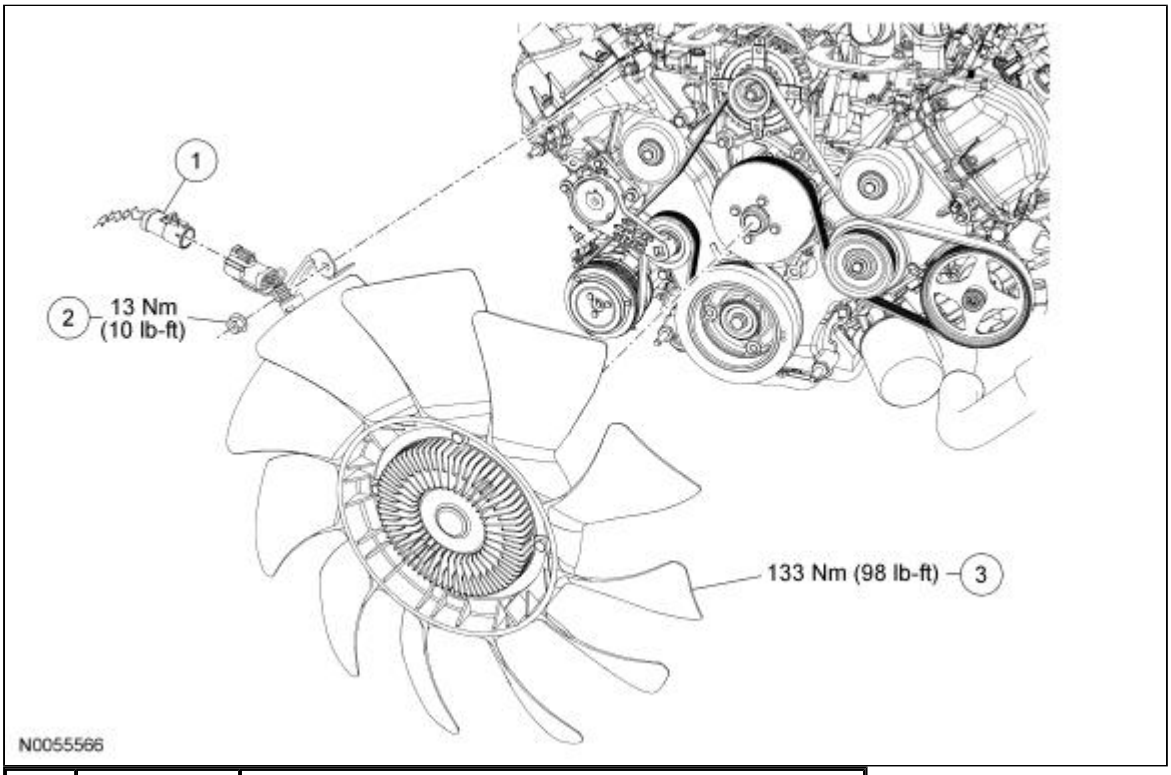
11. To install, reverse the removal procedure.
    - Fill the transmission fluid level. For additional information, refer to Section 307-01A or Section 307-01B .

Cooling Fan

Printable View (275 KB)

Special Tool(s)

 ST1500-A	Wrench, Fan Clutch Nut 303-214 (T83T-6312-B)
ST2133-A	Holding Wrench, Fan Pulley 303-239 (T84T-6312-C)



Item	Part Number	Description
1	—	Cooling fan electronic clutch electrical connector (part of 12B637)
2	W710417	Cooling fan electronic clutch wiring harness support bracket nut
3	8600	Cooling fan and clutch assembly

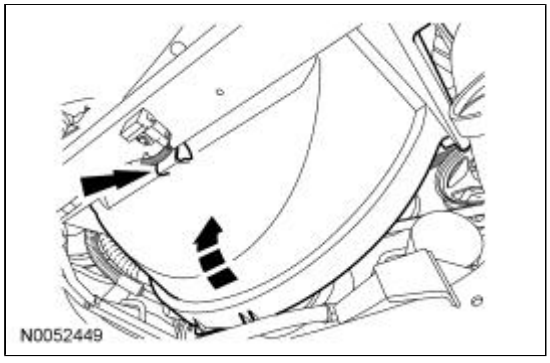
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

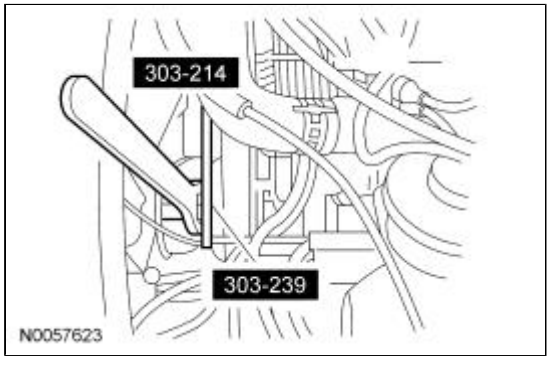
2. Disconnect the cooling fan electronic clutch electrical connector.

3. Remove the nut and the cooling fan electronic clutch harness support bracket from the stud bolt.
   - To install, tighten to 13 Nm (10 lb-ft).

4. Release the cooling fan shroud position tab and rotate the shroud upwards until the lower tab locks into position.



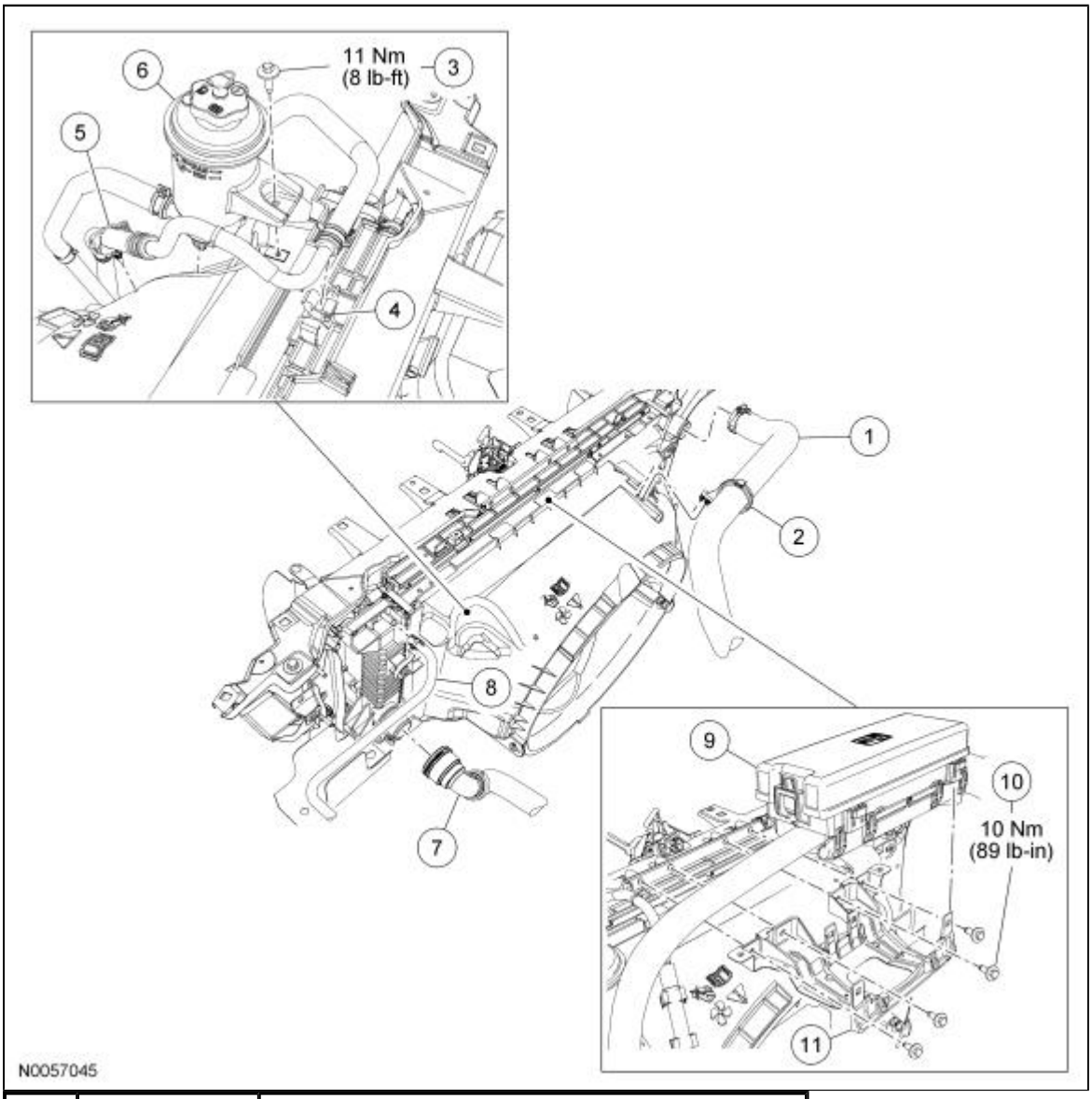
5. Using the special tools, remove the cooling fan and clutch assembly.
   - To install, tighten to 133 Nm (98 lb-ft).
   - If servicing the cooling fan or cooling fan clutch, refer to Cooling Fan and Cooling Fan Clutch in this section.



6. To install, reverse the removal procedure.

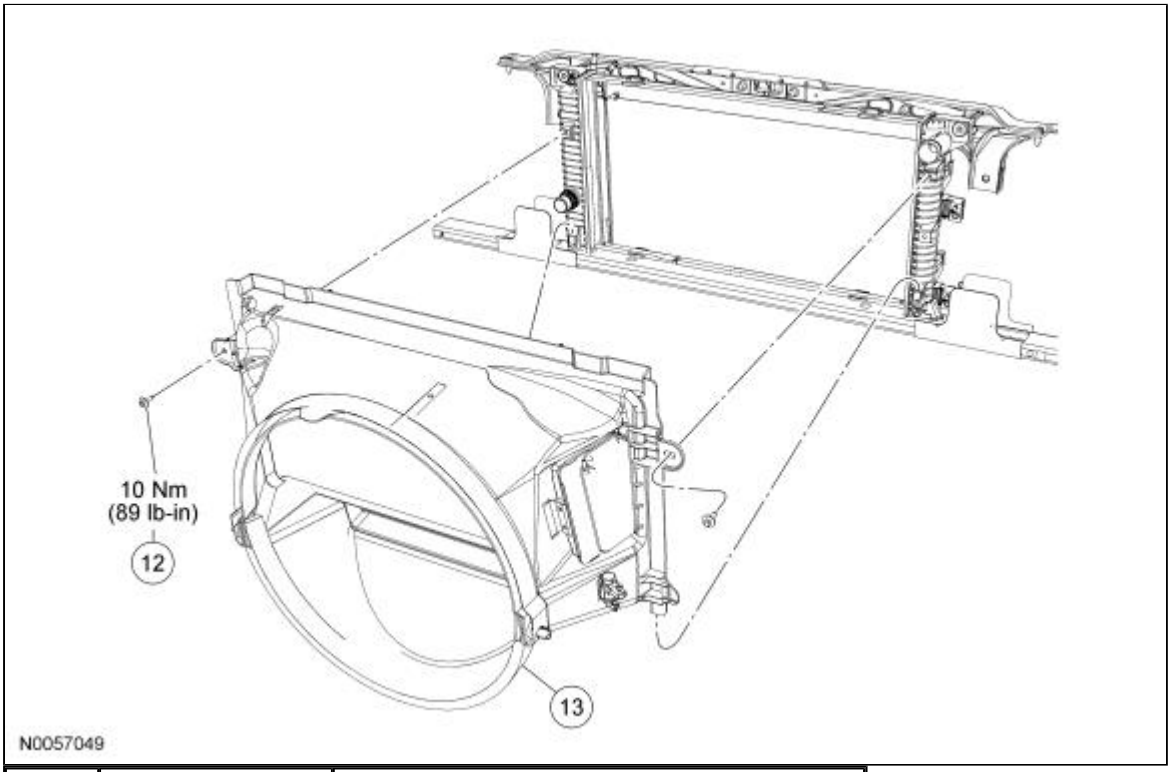
Cooling Fan Shroud

Printable View (629 KB)



Item	Part Number	Description
1	8B274	Upper radiator hose
2	8W287	Upper radiator hose retainer
3	W503924	Power steering fluid reservoir assembly bolt
4	3A005	Power steering hose position retainer
5	3A713	Power steering hose position retainer
6	3A697	Power steering fluid reservoir assembly
7	8B273	Lower radiator hose
8	8W005	Degas bottle inlet hose
9	14A067	Power distribution box (PDB)
10	W701842	PDB support bracket bolt (4 required)

11	180107	PDB support bracket



Item	Part Number	Description
12	W503924	Radiator shroud bolt (2 required)
13	8A247	Radiator shroud

Removal and Installation

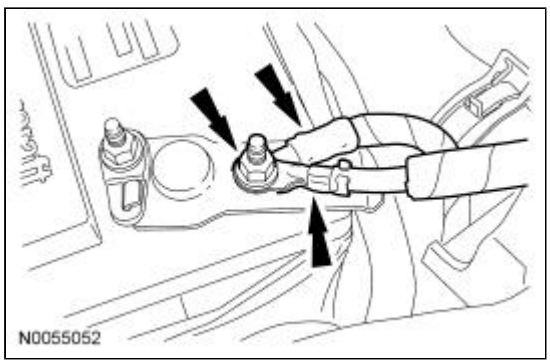
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

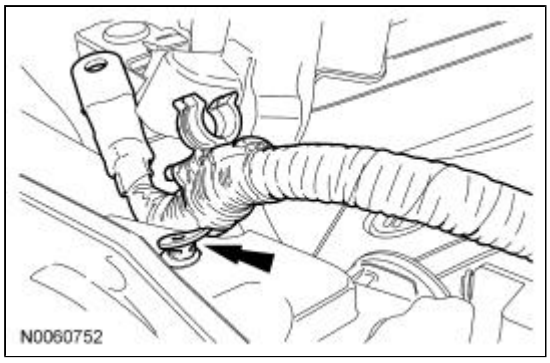
3. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

4. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

5. Remove the nut and disconnect the electrical cables.
   - To install, tighten to 10 Nm (89 lb-in).



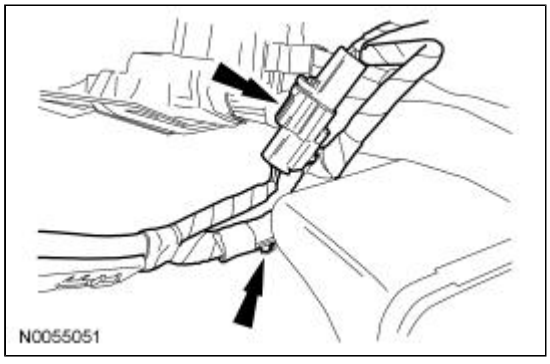
6. Disconnect the wiring harness retainer.



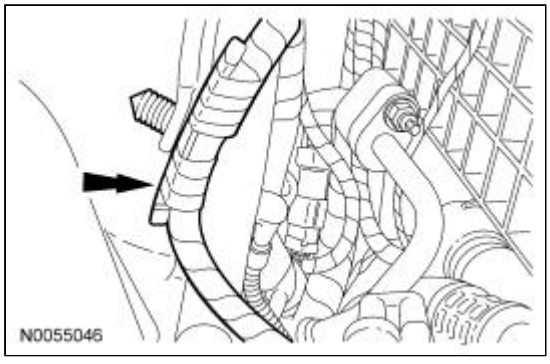
7. Disconnect the upper radiator hose from the radiator.

8. Disconnect the upper radiator hose position retainer from the cooling fan shroud.

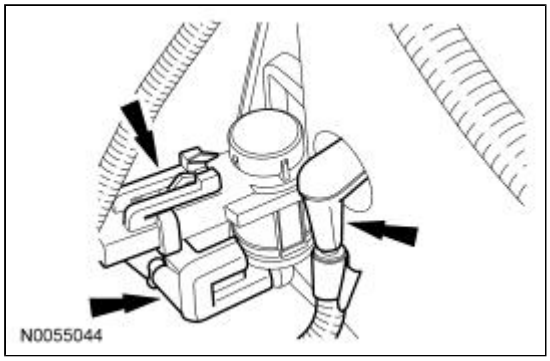
9. Disconnect the electrical connector and the wiring harness position retainer.



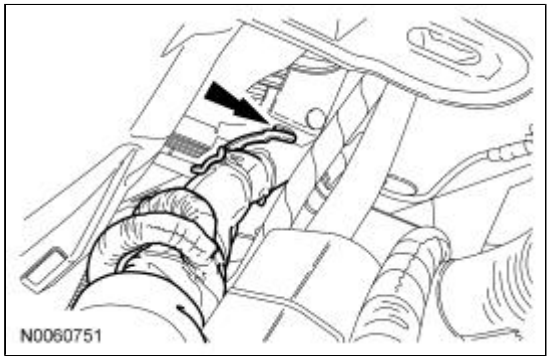
10. If equipped, disconnect the wiring harness position retainer from the vacuum reservoir.



11. If equipped, disconnect the vacuum connectors and the electrical connector on the LH side of the cooling fan shroud and remove the vacuum canister.

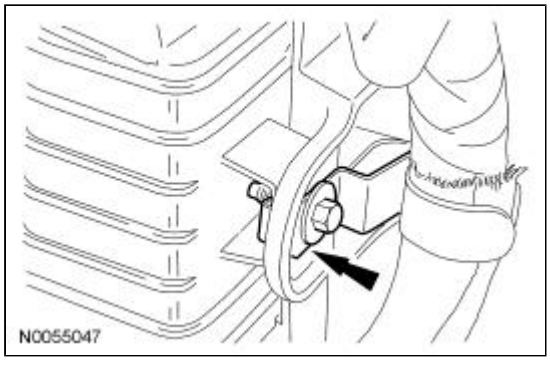


12. Disconnect the wiring harness retainer from the RH side of the radiator.



13. **NOTE:** LH shown, RH similar.

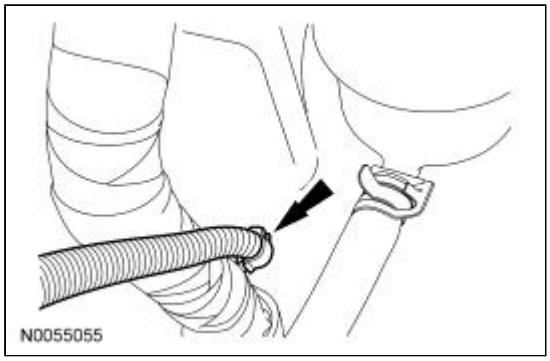
    Remove the 2 cooling fan shroud bolts and the wiring harness retainers.
    - To install, tighten to 10 Nm (89 lb-in).



14. Remove the 4 bolts and position the power distribution box (PDB) and support bracket aside.
    - **NOTE:** Hand start the 4 PDB support bracket bolts or damage to the radiator support can result.

      To install, tighten to 10 Nm (89 lb-in).

15. Disconnect the mass air flow (MAF) sensor electrical harness position retainer.

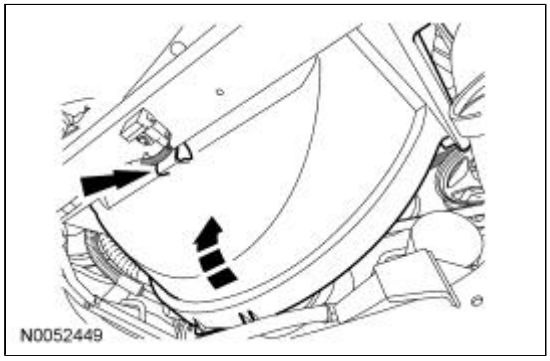


16. Disconnect the power steering fluid hose position retainers from the cooling shroud and radiator support.

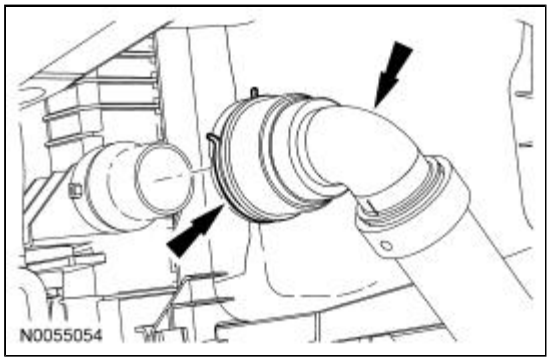
17. Remove the bolt and position the power steering reservoir aside.
    - To install, tighten to 11 Nm (8 lb-ft).

18. Disconnect the degas bottle coolant inlet hose from the radiator.

19. Release the lower cooling fan shroud position tab and rotate the lower cooling fan shroud upwards until the lower tab locks into position.



20. Remove the clip and disconnect the lower radiator hose quick connect coupling from the radiator.



21. Remove the cooling fan shroud.

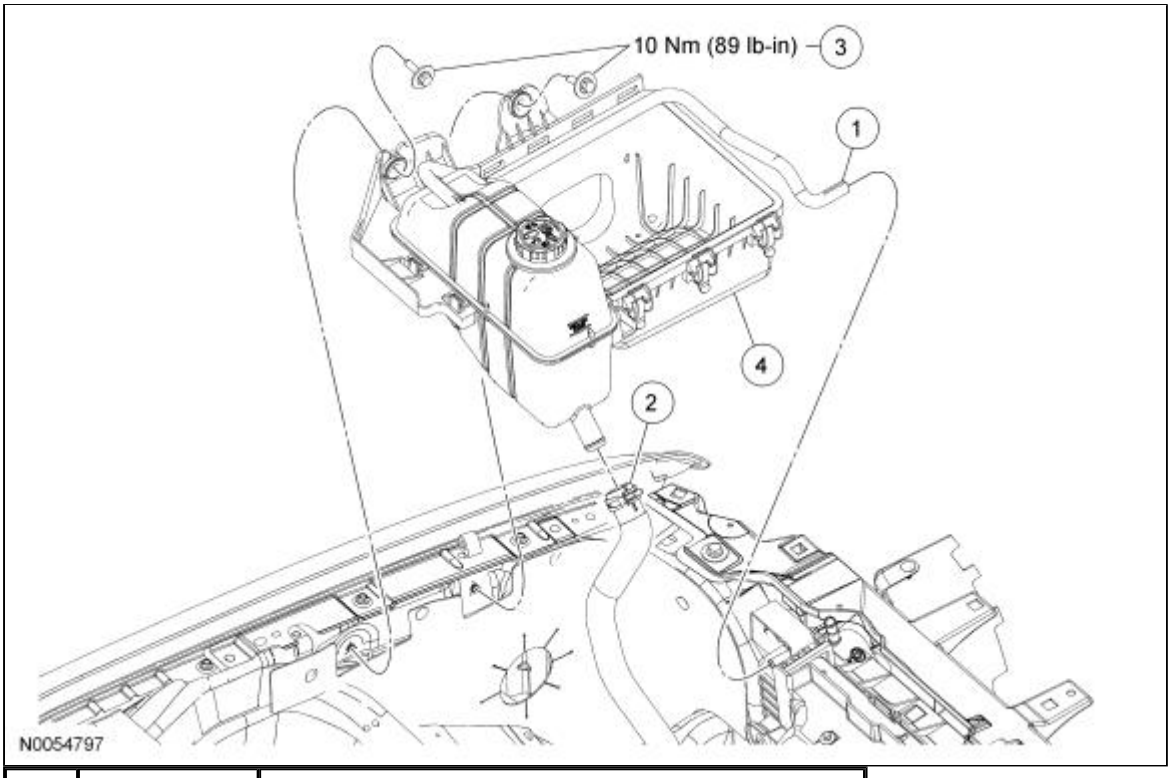
22. To install reverse the removal procedure.

Degas Bottle

Printable View (173 KB)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1



Item	Part Number	Description
1	8W005	Upper degas bottle inlet hose
2	8C351	Lower degas bottle hose
3	N807658	Degas bottle bolts (2 required)
4	8A080	Degas bottle/lower air cleaner housing assembly

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Remove the air cleaner element. For additional information, refer to Section 303-12 .
3. Disconnect the degas bottle inlet coolant hose from the radiato.

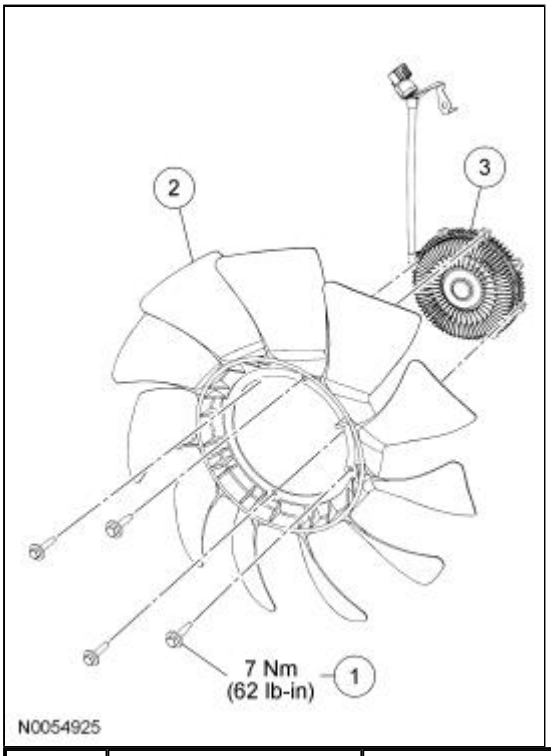
4. Remove the 2 bolts and the degas bottle/lower air cleaner housing assembly.
    - To install, tighten to 10 Nm (89 lb-in).

5. To install, reverse the removal procedure.

Cooling Fan and Cooling Fan Clutch

Printable View (106 KB)

Disassembly and Assembly



Item	Part Number	Description
1	W505425	Fan clutch bolts (4 required)
2	8600	Cooling fan
3	8A616	Fan clutch

1. Remove the cooling fan. For additional information, refer to Cooling Fan in this section.
2. Remove the 4 cooling fan-to-cooling fan clutch bolts and separate the clutch from the cooling fan.
   - To assemble, tighten to 7 Nm (62 lb-in).
3. To assemble, reverse the disassembly procedure.

Printable View (78 KB)

General Specifications

Item	Specification
Lubricants and Chemicals	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Torque Specifications

Description	Nm	lb-in
Air cleaner outlet pipe-to-throttle body (TB) adapter bolt	10	89
Fuel rail bolts	10	89
TB bolts [a]	—	—

[a] Refer to the procedure.

Fuel Charging and Controls

Printable View (82 KB)

Sequential Multi-port Fuel Injection (SFI)

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

The fuel charging and controls system consists of the:

- throttle body.
- fuel injectors.
- fuel rail.

The fuel charging and controls system is:

- a sequential multi-port fuel injection (SFI) system.
- pulse width modulated (PWM).
- mass air flow (MAF) controlled.

Fuel is metered into each intake port in a sequential firing order. Fuel injectors pulse to follow engine firing order, in accordance with engine demand, on a tuned intake manifold.

The basic fuel requirement of the engine is determined from the data supplied to the powertrain control module (PCM) by the MAF sensor, which measures the amount of air being drawn into the engine.

The various sensors detect any changes in the operating conditions and send signals to the PCM. This permits the PCM to control the opening duration (pulse width) of the fuel injectors and maintain optimum exhaust emission control and engine performance for all operating conditions.

Throttle Body

CAUTION: Do not hold the throttle plate open with any object that could scratch the bore or plate while servicing or cleaning the throttle body.

The throttle body:

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.
- must be removed from the vehicle to be cleaned.

Refer to Throttle Body in this section.

Fuel Injectors

The fuel injectors:

- are electronically operated by the PCM.
- atomize the fuel as the fuel is delivered.
- each have an internal solenoid that opens a needle valve, which injects fuel into the intake port in

the cylinder head.
- are deposit resistant.

For removal and installation, refer to Fuel Rail and Fuel Injector — Exploded View and Fuel Rail in this section.

Fuel Rail

CAUTION: The fuel injectors and the fuel rail must be handled with extreme care to prevent damage to sealing areas and sensitive fuel-metering orifices.

The fuel rail:

- receives fuel from the fuel supply tube.
- delivers fuel to the fuel injectors.

For removal and installation, refer to Fuel Rail and Fuel Injector — Exploded View and Fuel Rail in this section.

Fuel Charging and Controls

Printable View (62 KB)

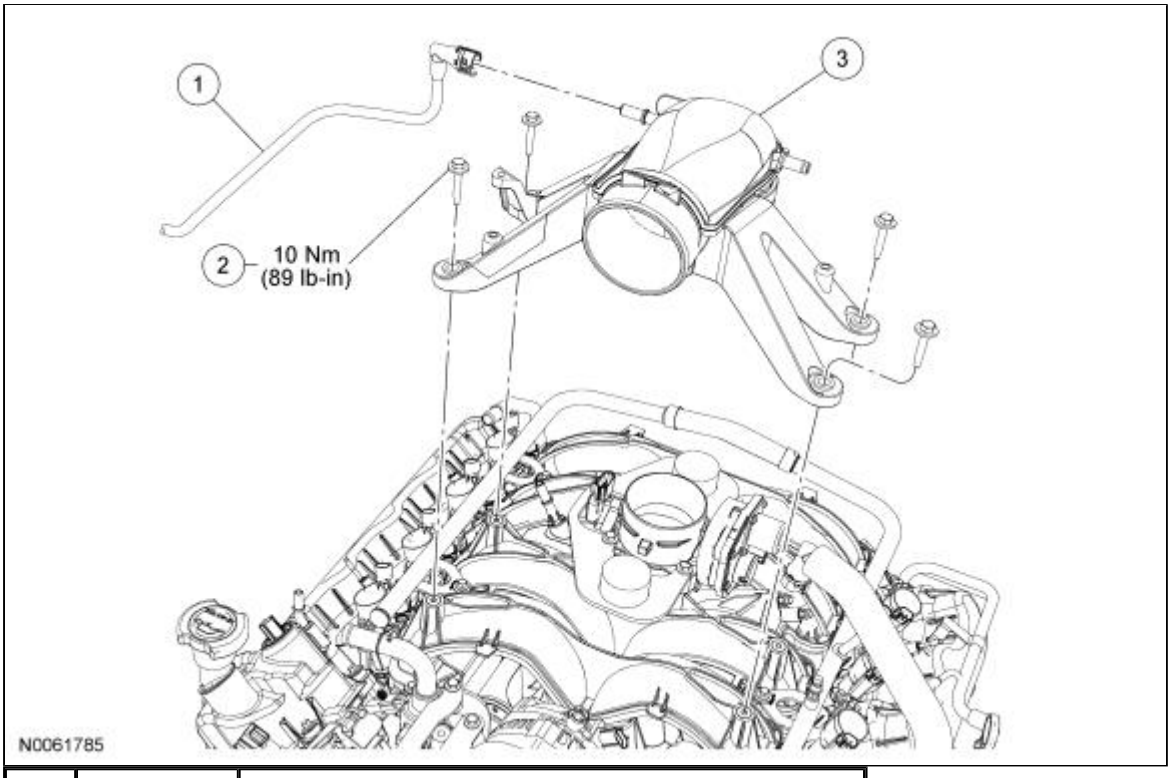
For driveability concerns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Throttle Body

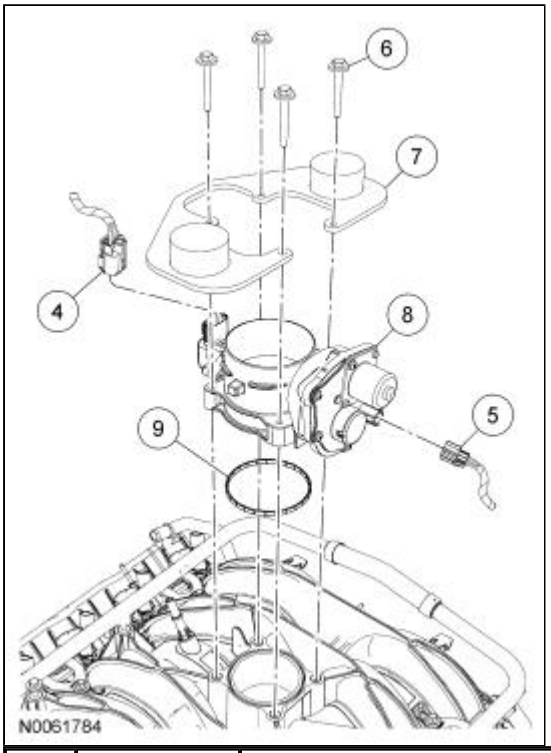
Printable View (331 KB)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1



Item	Part Number	Description
1	6758	Crankcase ventilation tube
2	W505426	Air cleaner outlet pipe-to-throttle body (TB) adapter bolt (4 required)
3	9A589	Air cleaner outlet pipe-to-TB adapter



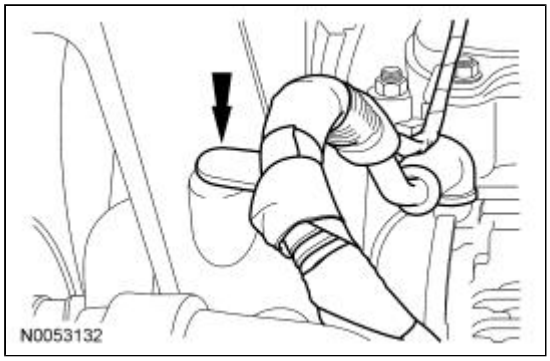
Item	Part Number	Description
4	—	Throttle position (TP) sensor electrical connector (part of 14A464)
5	—	Electronic throttle control electrical connector (part of 14A464)
6	W705438	TB bolt (4 required)
7	9J444	Vibration damper
8	9F991	TB
9	—	TB O-ring (part of 9F991)

Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

CAUTION: The throttle body must be removed from the vehicle to be cleaned. Do not hold the throttle plate open with any object that could scratch the bore or plate while servicing or cleaning the throttle body.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .
3. Disconnect the quick connect couplings and remove the crankcase vent tube. For additional information, refer to Section 310-00 .
4. Disconnect the generator wiring harness retainer from the air cleaner outlet pipe-to-throttle body (TB) adapter.



5. Remove the 4 bolts and position aside the air cleaner outlet tube-to-TB adapter.

6. Disconnect the electronic throttle control electrical connector.

7. Disconnect the throttle position (TP) sensor electrical connector.

8. Remove the 4 bolts and the vibration damper.

9. Remove the TB assembly.
    - Discard the TB O-ring seal.

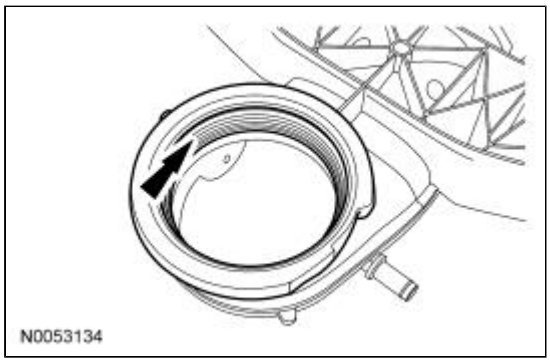
Installation

1. Using a new O-ring seal, position the TB and vibration damper and tighten the 4 bolts in 2 stages.
    - Stage 1: Tighten to 9 Nm (80 lb-in).
    - Stage 2: Tighten an additional 90 degrees.

2. Connect the TP sensor electrical connector.

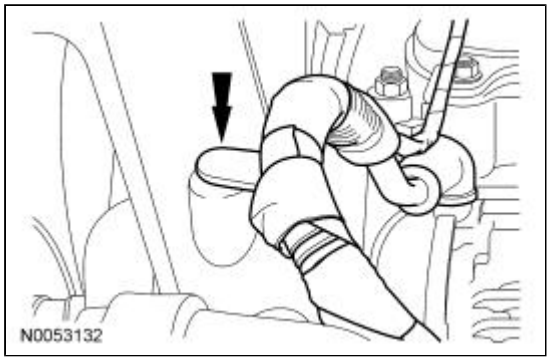
3. Connect the electronic throttle control electrical connector.

4. Lubricate the air cleaner outlet pipe-to-TB adapter seal with clean engine coolant prior to installation.



5. Position the air cleaner outlet pipe-to-TB adapter and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

6. Connect the generator wiring harness retainer to the air cleaner outlet tube-to-TB adapter.



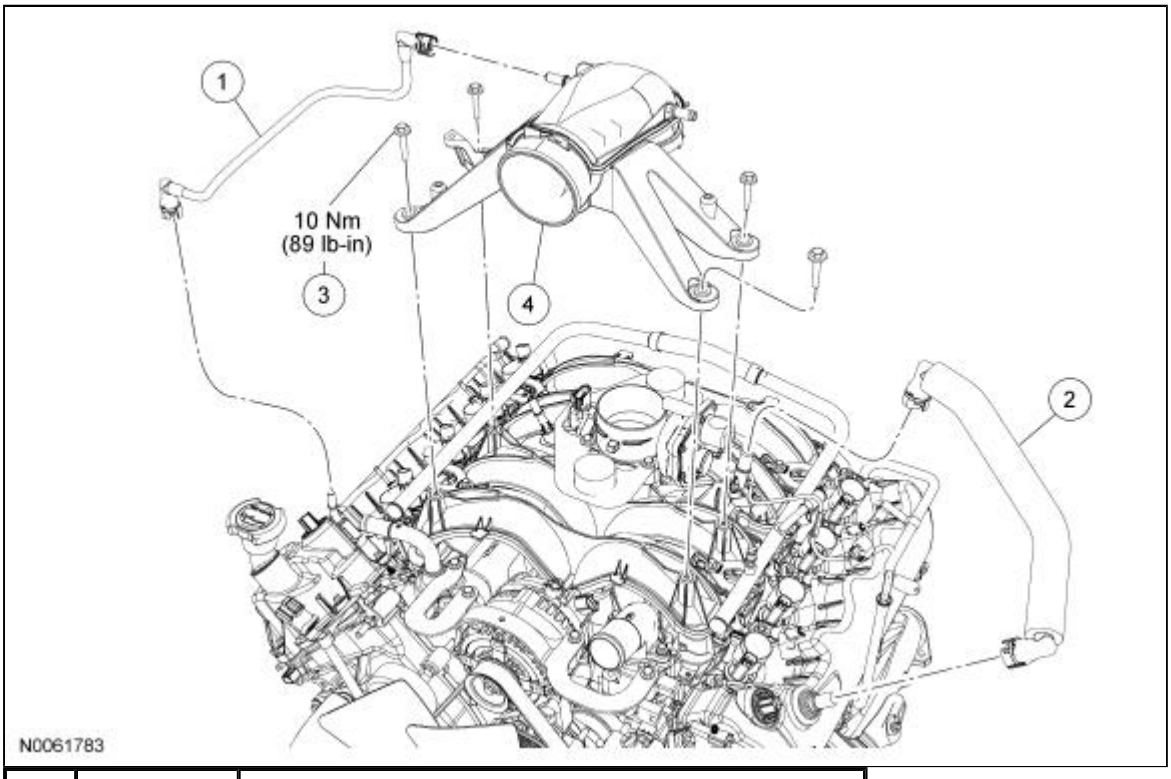
7. Position the crankcase vent tube and connect the quick connect couplings. For additional information, refer to Section 310-00 .

8. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

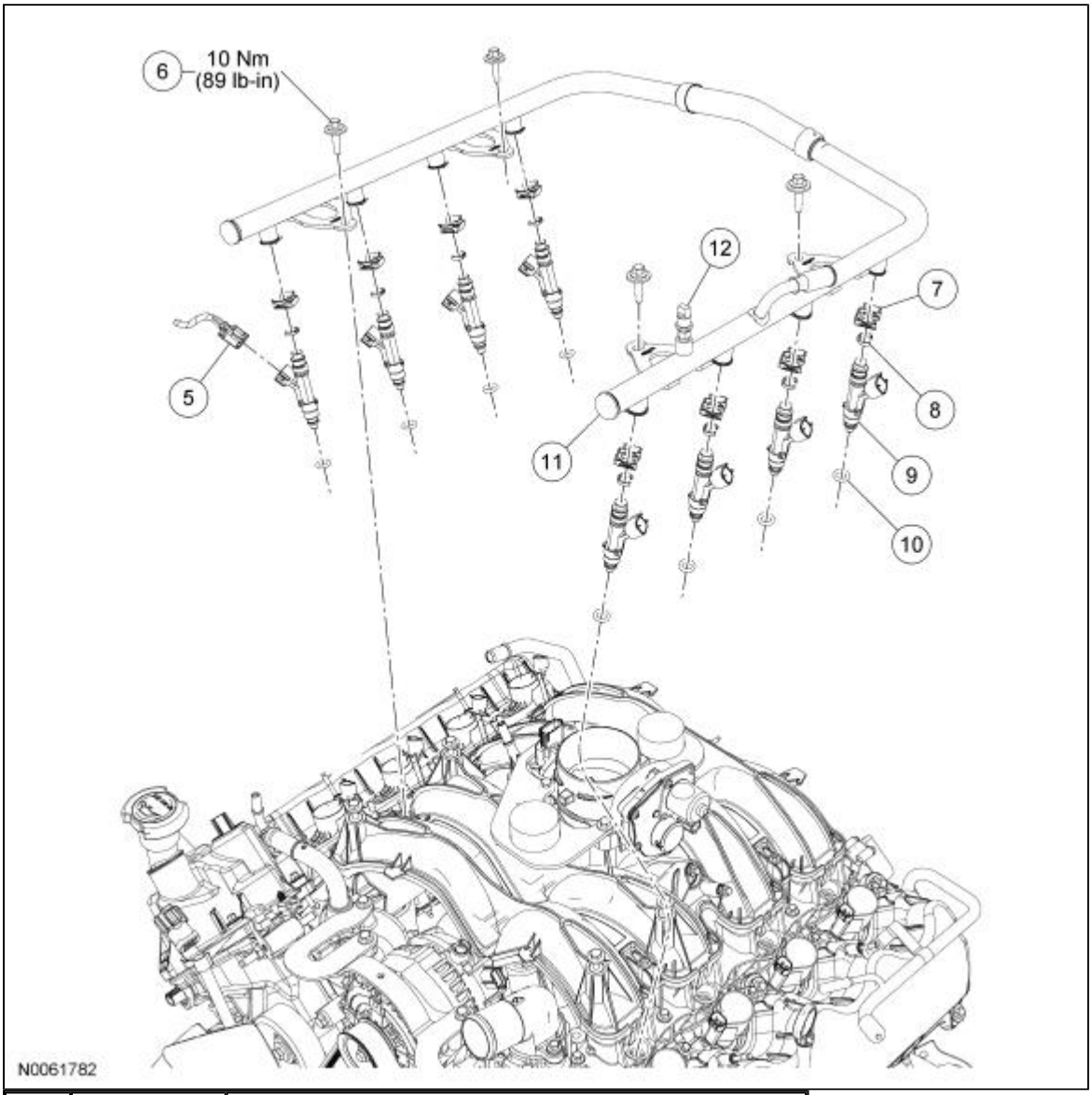
9. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Fuel Rail and Fuel Injector — Exploded View

Printable View (409 KB)



Item	Part Number	Description
1	6758	Crankcase ventilation tube
2	6K817	Positive crankcase ventilation (PCV) tube
3	W505426	Air cleaner outlet pipe-to-throttle body (TB) adapter bolt (4 required)
4	9A589	Air cleaner outlet pipe-to-TB adapter



Item	Part Number	Description
5	14A464	Fuel injector electrical connector (8 required) (part of 12B637)
6	W705438	Fuel rail bolt (4 required)
7	9C995	Fuel injector-to-fuel rail locking clip (8 required)
8	9229	Fuel injector-to-fuel rail O-ring (8 required)
9	9F593	Fuel injector (8 required)
10	9229	Fuel injector-to-intake manifold O-ring (8 required)
11	9F792	Fuel rail
12	—	Schrader valve port (part of 9F792)

1. For additional information, refer to the procedures in this section.

Fuel Rail

Printable View (190 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Removal

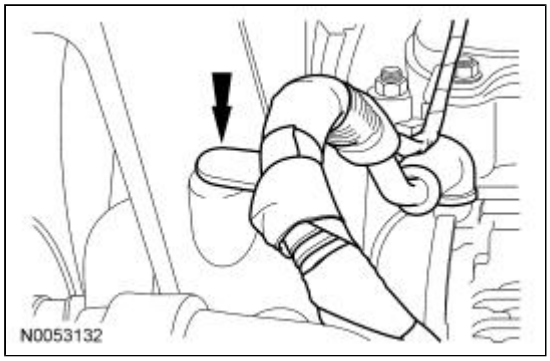
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before working on or disconnecting any of the fuel tubes or fuel system components, the fuel system pressure must be relieved. Failure to follow these instructions may result in personal injury.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

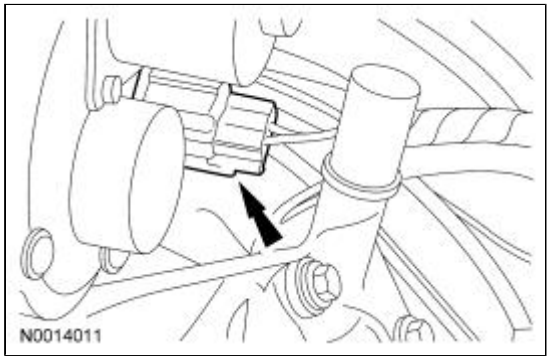
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the fuel supply tube spring lock coupling. For additional information, refer to Section 310-00 .
3. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .
4. Disconnect the quick connect couplings and remove the crankcase vent tube. For additional information, refer to Section 310-00 .
5. Disconnect the generator wiring harness retainer from the air cleaner outlet pipe-to-throttle body (TB) adapter.



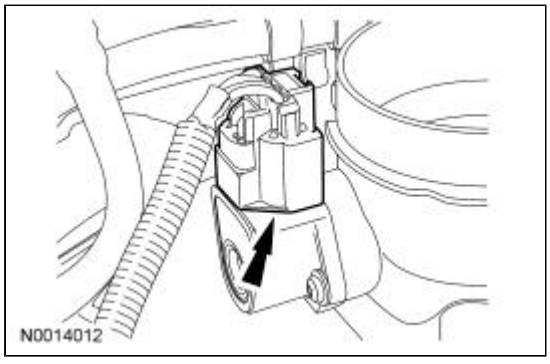
6. Remove the 4 bolts and the air cleaner outlet pipe-to-TB adapter.
    - Lubricate the air cleaner outlet pipe-to-TB adapter seal with clean engine coolant prior to installation.
    - To install, tighten to 10 Nm (89 lb-in).

7. Disconnect the quick connect couplings and remove the positive crankcase ventilation (PCV) tube. For additional information, refer to Section 310-00 .

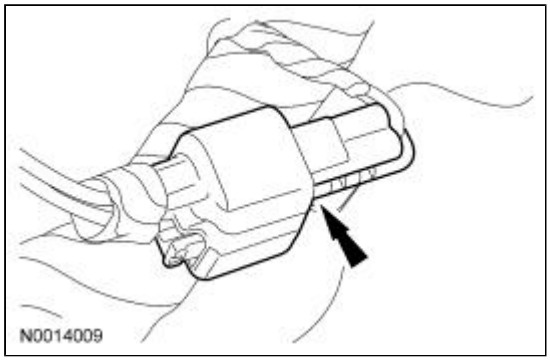
8. Disconnect the electronic throttle control electrical connector.



9. Disconnect the throttle position (TP) sensor electrical connector.



10. Disconnect the heated PCV intake fitting electrical connector.



11. Disconnect the 8 fuel injector electrical connectors.

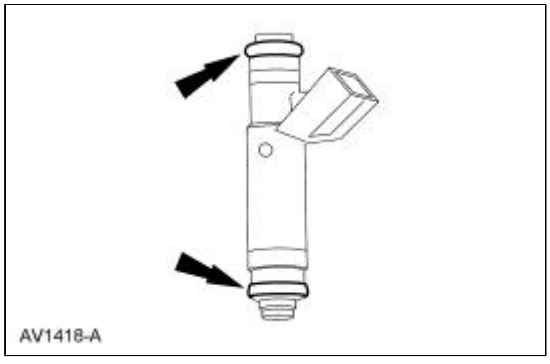
12. Remove the 4 fuel rail bolts.
    - To install, tighten to 10 Nm (89 lb-in).

13. Remove the fuel rail and fuel injectors as an assembly.

14. Remove the 8 fuel injector-to-fuel rail locking clips.

15. **CAUTION: Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals. Lubricate the O-ring seals with clean engine oil prior to installation.**

    Separate the fuel injectors from the fuel rail.
    - Discard the O-ring seals.



16. To install, reverse the removal procedure.
    - Lubricate the new fuel injector O-ring seals with clean engine oil prior to installation.

Printable View (62 KB)

General Specifications

Item	Specification
Accessory drive belt	6 ribs

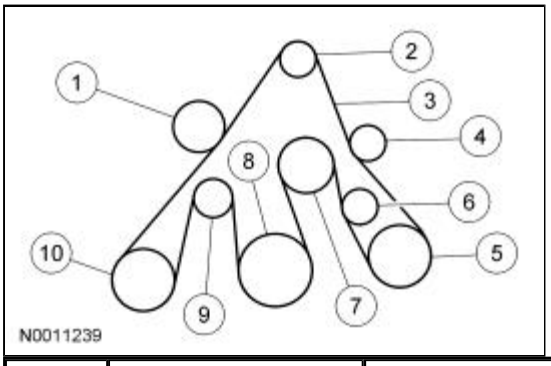
Torque Specifications

Description	Nm	lb-ft
Accessory drive belt tensioner bolts	25	18
Accessory drive belt idler pulley bolt	25	18

Accessory Drive

Printable View (97 KB)

Component Locations 5.4L



Item	Part Number	Description
1	19A216	Belt idler pulley
2	10344	Generator pulley
3	8620	Drive belt
4	19A216	Belt idler pulley
5	3A733	Power steering pump pulley
6	6C348	Belt idler pulley
7	8509	Coolant pump pulley
8	6312	Crankshaft pulley
9	6B209	Drive belt tensioner pulley
10	2E884	A/C compressor pulley

The accessory drive:

- has a single serpentine drive belt (6 ribs).
- has an automatic tensioner.
- is not adjustable.

Accessory Drive

Printable View (157 KB)

Inspection and Verification

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. Verify the customer concern by operating the system.

2. Visually inspect for obvious signs of mechanical damage.

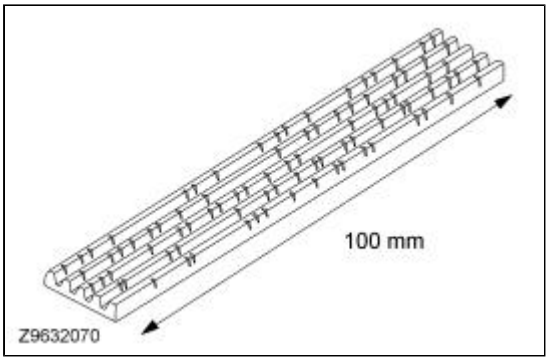
Visual Inspection Chart

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrectly routed belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing)

3. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, power steering cavitations at low temperatures, variable camshaft timing (VCT) tick or generator whine.

4. If a concern is found, correct the condition before proceeding to the next step.

V-Ribbed Serpentine Drive Belt With Cracks Across Ribs



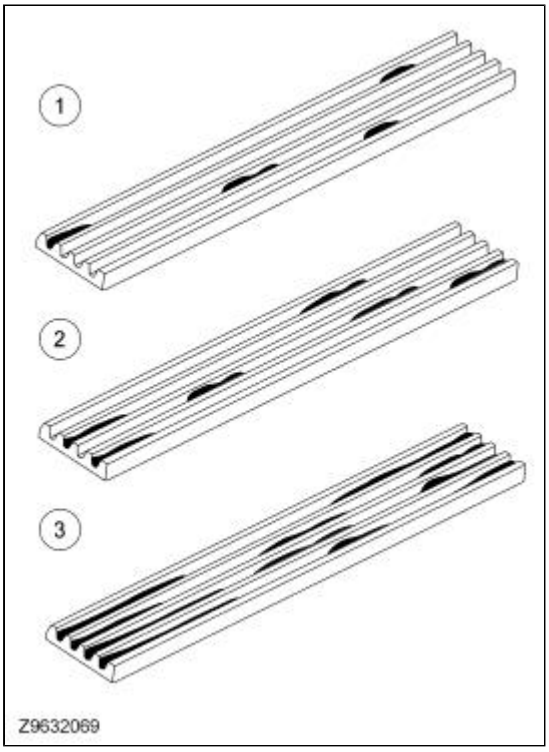
5. **NOTE:** Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If damage exceeds the acceptable limit or any chunks are found to be missing from the ribs, a new belt must be installed.

   Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If cracks exceed this standard, install a new belt.

6. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.
    1. Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.
    2. Longer deposit areas building up to 50% of the rib height. This is not considered a concern but it can result in excessive noise. If noise is apparent, install a new belt.
    3. Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.

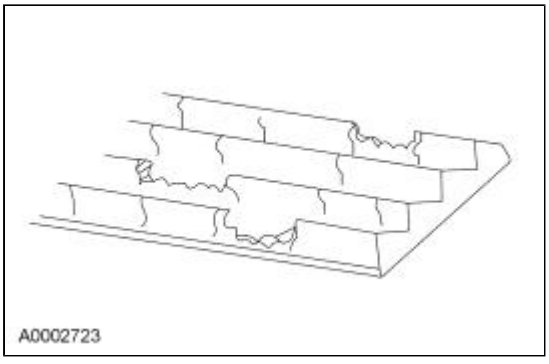
V-Ribbed Serpentine Belt With Piling

NOTE: Piling is an excessive buildup in the V-grooves of the belt.



7. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt.

V-Ribbed Serpentine Belt With Chunks of Rib Missing



8. If the concern is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Accessory drive belt cracking (over 15 cracks in a rib over a distance of 100 mm [4.0 in])	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification in this section. INSTALL a new accessory drive belt as necessary.
• Accessory drive belt chunking	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification in this section. INSTALL a new accessory drive belt as necessary.
• Accessory drive belt noise, squeal, chirping or flutter	• Defective/worn or incorrect accessory drive belt • Misaligned pulley (s) • Pulley runout • Damaged or worn accessories • Fluid contamination of accessory drive belt or pulleys	• REFER to Component Tests, Drive Belt, Noise/Flutter in this section. REPAIR or INSTALL new parts as necessary.
	• Damaged or worn accessory drive belt tensioner	• REFER to Component Tests, Belt Tensioner — Mechanical and Belt Tensioner — Dynamics in this section. INSTALL a new accessory drive belt tensioner as necessary.
• Premature accessory drive belt wear	• Defective accessory drive belt • Misaligned pulley (s) • Pulley runout • Damaged accessories • Incorrectly installed drive belt • Fluid contamination	• REFER to Component Tests, Drive Belt Noise/Flutter and Incorrect Drive Belt Installation in this section. REPAIR or INSTALL new parts as necessary.
• Accessory drive belt does not hold correct tension	• Accessory drive belt has excessive cracking, damage or is worn	• INSPECT the drive belt. REFER to Inspection and Verification in this section. INSTALL a new drive belt as necessary.
	• Drive belt tensioner worn or damaged	• CHECK the drive belt tensioner for damage and correct operation. REFER to the Component Tests, Belt Tensioner — Mechanical and Belt Tensioner — Dynamics in this section. INSTALL a new drive belt tensioner as

		necessary.
	• Incorrect accessory drive belt	• VERIFY the correct accessory drive belt is installed.
	• Accessory drive component failure	• CHECK the accessory drive components. INSTALL new components as necessary.
	• Accessory drive belt idler pulley bearing failure	• INSPECT the accessory drive belt idler pulley for freedom of rotation and damage. INSTALL a new accessory drive belt idler pulley as necessary.

Component Tests

Drive Belt — Noise/Flutter

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

CAUTION: Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start-up and shut down or during very rapid engine acceleration and decelerations, such as:

- wide open throttle 1-2 and 2-3 shifts or 2-3 and 3-4 back out shifts on automatic transmissions.
- wide open throttle 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertias required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur:

- if the A/C discharge pressure goes above specifications:
  - the A/C system is overcharged.
  - the A/C condenser core airflow is blocked.
- if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.
- if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will

release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.

- **NOTE:** The accessory drive belt tensioner arm should rotate freely without binding.

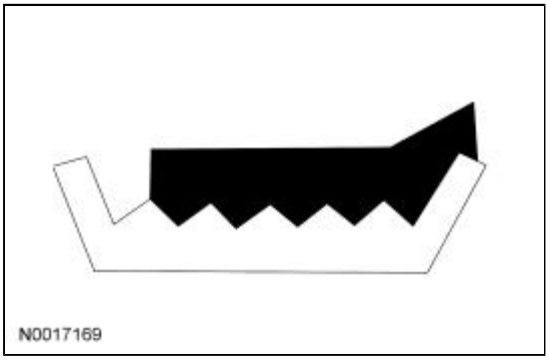
Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

Drive Belt — Incorrect Installation

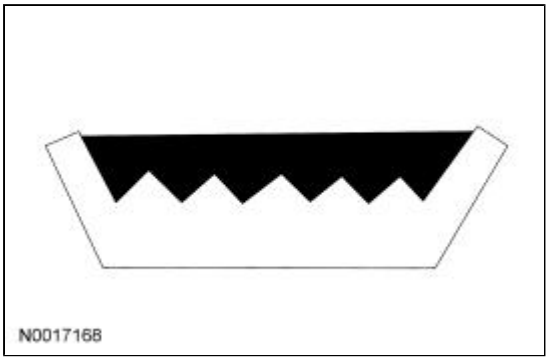
CAUTION: Incorrect accessory drive belt installation will cause excessive drive belt wear and can cause the drive belt to come off the pulleys.

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

Incorrect Installation



Correct Installation



With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following:

- Visually check the accessory drive belt tensioner for damage, especially the mounting pad surface. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. This will result in chirp and squeal noises.
- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
- Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.
- Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner — Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind.

1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under Description and Operation in this section.

2. **NOTE:** The accessory drive belt tensioner spring is very strong and requires substantial force to release.

   Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt in the area of the tensioner.

3. Using a suitable, commercially available serpentine belt tensioner release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.

4. Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition. Install a new accessory drive belt tensioner if necessary.

5. Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks. Install a new accessory drive belt tensioner as necessary.

6. If the accessory drive belt tensioner meets the above criteria, proceed to testing the tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, install a new tensioner.

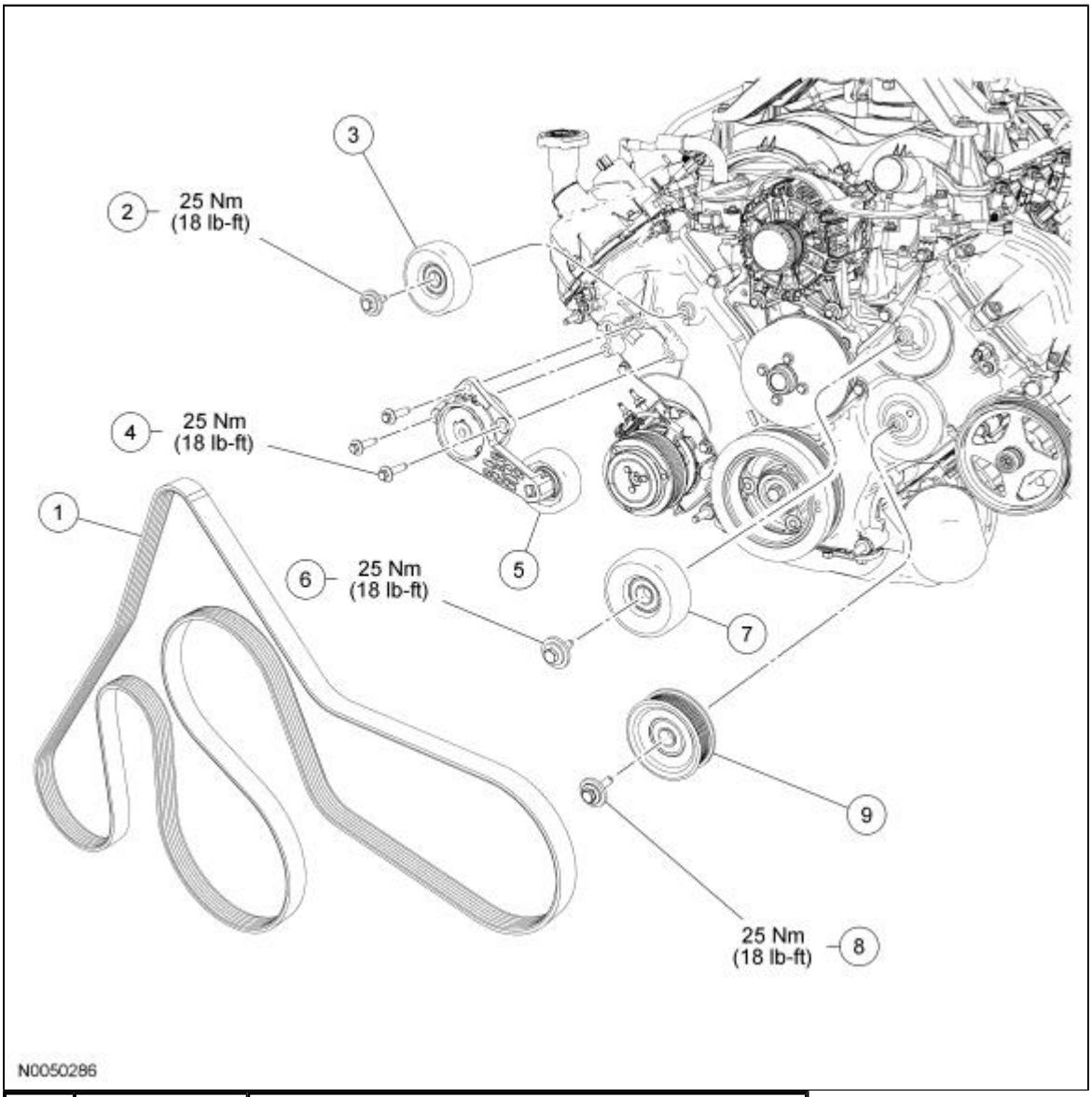
Belt Tensioner — Dynamics

The accessory drive belt tensioner can be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the air conditioning clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without air conditioning clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

Front End Accessory Drive (FEAD) — Exploded View

Printable View (258 KB)



Item	Part Number	Description
1	8620	Accessory drive belt
2	N808102	Accessory drive belt idler pulley bolt
3	19A216	Accessory drive belt idler pulley
4	N808920	Accessory drive belt tensioner bolt (3 required)
5	6B209	Accessory drive belt tensioner
6	W707288	Accessory drive belt idler pulley bolt
7	6C348	Accessory drive belt idler pulley
8	N808102	Accessory drive belt idler pulley bolt
9	19A216	Accessory drive belt idler pulley

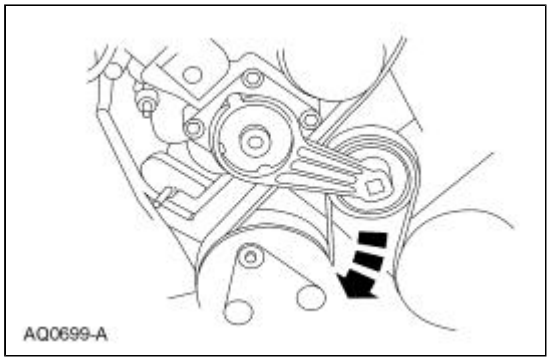
1. For additional information, refer to the procedures in this section.

Accessory Drive Belt

Printable View (102 KB)

Removal and Installation

1. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



2. **NOTE:** Make sure the drive belt is correctly installed on each pulley.

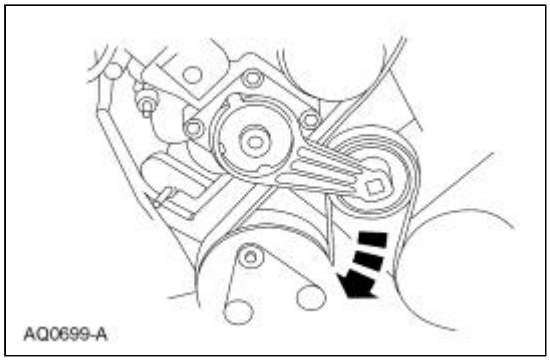
   To install, reverse the removal procedure.
   - Refer to Accessory Drive in Description and Operation for drive belt routing.

Accessory Drive Belt Tensioner

Printable View (86 KB)

Removal and Installation

1. Remove the cooling fan. For additional information, refer to Section 303-03 .
2. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the A/C compressor pulley.



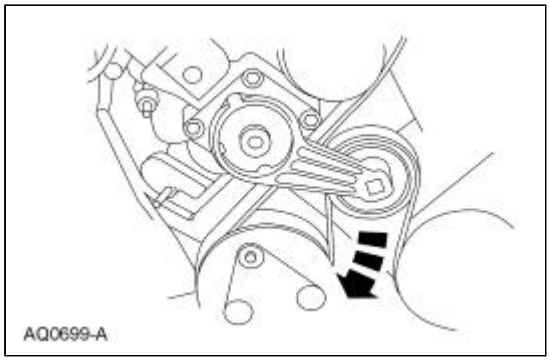
3. Remove the 3 bolts and the accessory drive belt tensioner.
   - To install, tighten to 25 Nm (18 lb-ft).
4. To install, reverse the removal procedure.

Accessory Drive Belt Idler Pulley

Printable View (86 KB)

Removal and Installation

1. Remove the cooling fan. For additional information, refer to Section 303-03 .
2. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the A/C compressor pulley.



3. Remove the bolt and the accessory drive belt idler pulley.
   - To install, tighten to 25 Nm (18 lb-ft).
4. Repeat the previous step for each accessory drive belt idler pulley being serviced.
5. To install, reverse the removal procedure.

Printable View (81 KB)

General Specifications

Item	Specification
Starting System	
Normal engine cranking speed	140-220 rpm
Starter motor armature shaft maximum runout	0.11 mm (0.004 in)
Starter motor brush manufactured length	16.8 mm (0.66 in.)
Starter motor brush spring tension	18 N (65 oz)
Starter motor commutator maximum runout	0.12 mm (0.005 in)
Starter motor diameter	101.6 mm (4.0 in)
Starter motor maximum load	800 amps
Starter motor minimum stall torque (at 5 volts)	14.7 Nm (10.8 lb-ft)
Starter motor no load current draw	60-80 amps
Starter motor normal load current draw	130-220 amps
Starter circuit maximum voltage drop (engine at normal operating temperature)	0.5 volts

Torque Specifications

Description	Nm	lb-ft	lb-in
Starter motor bolts	25	18	—
Starter motor stud bolt	25	18	—
Starter motor ground cable nut	25	18	—
Starter solenoid B terminal nut	12	9	—
Starter solenoid S terminal nut	6	—	53

Starting System

Printable View (62 KB)

The starting system consists of the:

- starter motor.
- starter solenoid.
- starter drive.
- ignition switch.
- digital transmission range (TR) sensor.
- battery.

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start.

Starting System

Printable View (325 KB)

Special Tool(s)

ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
ST2626-A	SABRE Premium Battery and Electrical System Tester 010-00736 or equivalent

Inspection and Verification

WARNING: When servicing the starter motor or carrying out other underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. A protective cap or boot is provided over the terminal of this lead and must be installed after servicing. Failure to follow these instructions may result in personal injury.

WARNING: When working in the area of the starter motor, be careful to avoid touching hot exhaust components. Failure to follow these instructions may result in personal injury.

NOTE: When working on the starter system, make sure the anti-theft system is deactivated, if equipped.

1. Verify the customer concern by operating the starting system.
2. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Starter motor • Brackets • Starter motor bolts • Flexplate	• Battery • Failed power distribution box (PDB) fuse 40 (30A) • Circuitry • Loose or corroded connections

3. If the concern is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The engine does not crank and the relay clicks	• Battery • PDB fuse 40 (30A) • PDB • Starter motor/solenoid • Circuit	• Go To Pinpoint Test A .
• The engine does not crank and the relay does not click	• Powertrain control module (PCM) • Smart power distribution junction box (SPDJB) • PDB • Battery • Starter relay • Ignition switch • Circuit	• Go To Pinpoint Test B .
• The engine cranks slowly	• Battery • Starter motor/solenoid • Circuit	• Go To Pinpoint Test C .
• Unusual starter noise	• Starter mounting • Flexplate • Starter motor	• Go To Pinpoint Test D .
• The starter spins but the engine does not crank	• Starter motor • Damaged flexplate ring gear teeth	• INSPECT the starter motor mounting and engagement. INSTALL a new starter motor. REFER to Starter Motor in this section. • INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as required.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank And The Relay Does Click

Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

Normal Operation

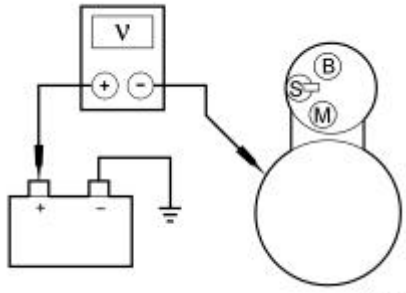
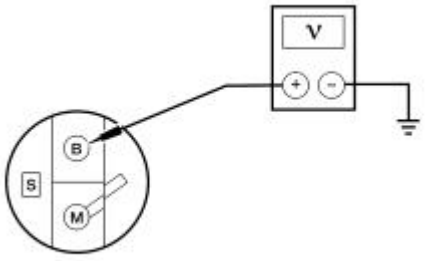
In normal operation, when the ignition switch is placed in the start position voltage is supplied through circuit CDC35 (BU/WH) to the smart power distribution junction box (SPDJB). From the SPDJB, voltage is supplied through circuit CDC38 (WH/VT) to the starter relay coil located in the power distribution box (PDB). The starter relay coil is supplied ground from the powertrain control module (PCM) through circuit CDC12 (YE).

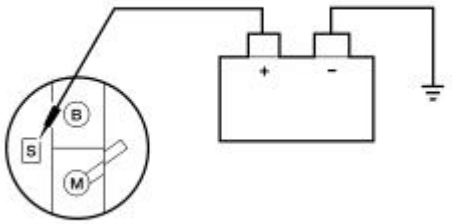
When the starter relay is energized, voltage supplied to the relay switch from PDB fuse 40 (30A) is sent to the starter motor solenoid through circuit CDC25 (BN/GN). Battery voltage is supplied to the starter motor through circuit SDC02 (RD) at all times.

Possible Causes

- Failed PDB fuse 40 (30A)
- An open in circuit CDC25 (BN/GN), SDC04 or SDC02 (RD)
- Starter motor relay
- Starter

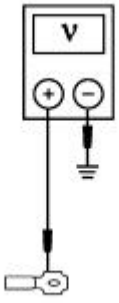
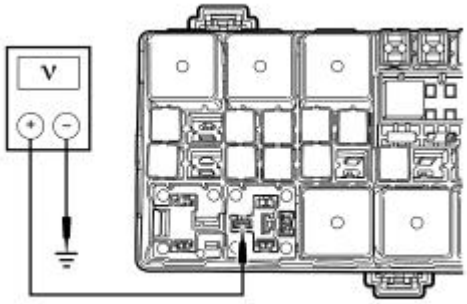
PINPOINT TEST A: THE ENGINE DOES NOT CRANK AND THE RELAY DOES CLICK

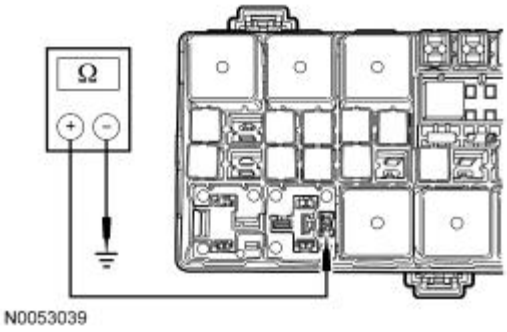
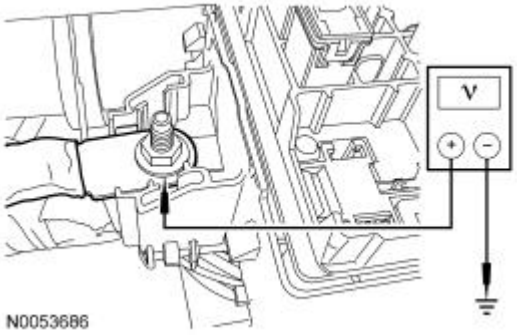
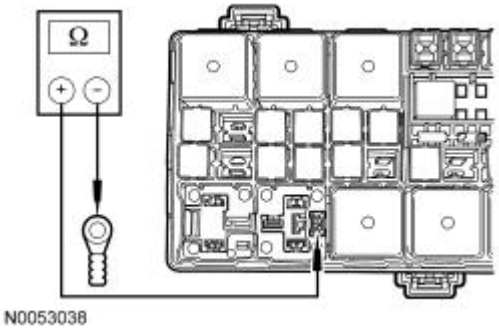
Test Step	Result / Action to Take
A1 CHECK THE STARTER MOTOR GROUND • Measure the voltage between the battery positive post and the starter motor case.  AJ0281-A • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A2 . **No** CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.
A2 CHECK THE VOLTAGE TO THE STARTER MOTOR SOLENOID • Measure the voltage between the starter motor solenoid positive terminal and ground.  J6079-A • **Is the voltage 10 volts or greater?**	**Yes** GO to A3 . **No** REPAIR circuit SDC02 (RD) for an open. TEST the system for normal operation.
A3 MANUALLY JUMP THE STARTER MOTOR • Connect one end of a fused (15A) jumper wire to the positive terminal of the battery and touch the other end to the starter solenoid S-terminal.	**Yes** GO to A4 . **No** INSTALL a new starter motor. REFER to Starter Motor in this section. TEST the system for normal operation.



J6080-A

- **Does the starter solenoid engage and the starter motor crank?**

A4 CHECK START INPUT TO THE STARTER MOTOR	
• Disconnect: Starter S-Connector. • Key in START position. • Measure the voltage at the starter motor solenoid S-terminal.  AJ0285-A • **Is the voltage reading greater than 10 volts?**	**Yes** CLEAN the starter solenoid S-terminal and connector. CHECK the wiring and the starter motor for a loose or intermittent connection. TEST the system for normal operation. **No** GO to A5 .
A5 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY	
• Key in OFF position. • Disconnect: Starter Motor Relay. • Measure the voltage at starter relay connector pin 30.  N0053748 • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A9 . **No** GO to A6 .
A6 CHECK PDB FUSE 40 (30A) FOR AN OPEN	
• Key in OFF position. • Disconnect: PDB Fuse 40 (30A). • Check fuse: PDB Fuse 40 (30A). • **Is PDB fuse 40 (30A) open?**	**Yes** GO to A7 . **No** GO to A8 .
A7 CHECK CIRCUIT CDC25 (BN/GN) FOR A SHORT TO GROUND	
• Disconnect: Starter Solenoid S-Connector. • Measure the resistance of circuit CDC25 (BN/GN)	**Yes** REPAIR circuit CDC25 (BN/GN)

between starter relay connector pin 87 and the starter solenoid S-connector.  N0053039 • **Is the resistance less than 10,000 ohms?**	for a short to ground. INSTALL a new PDB fuse 40 (30A). TEST the system for normal operation. **No** INSTALL a new PDB fuse 40 (30A). TEST the system for normal operation.
A8 CHECK CIRCUIT SDC04 (RD) FOR POWER SUPPLY TO THE PDB	
• Measure the voltage between the PDB power supply terminal, circuit SDC04 (RD) and ground.  N0053686 • **Is the voltage 10 volts or greater?**	**Yes** INSTALL a new PDB. **No** REPAIR circuit SDC04 (RD) for an open. TEST the system for normal operation.
A9 CHECK CIRCUIT CDC25 (BN/GN) FOR AN OPEN	
• Disconnect: Starter Solenoid S-Connector. • Measure the resistance of circuit CDC25 (BN/GN) between starter relay connector pin 87 and the starter solenoid S-connector.  N0053038 • **Is the resistance reading 5 ohms or less?**	**Yes** INSTALL a new starter relay. TEST the system for normal operation. **No** REPAIR circuit CDC25 (BN/GN) for an open. TEST the system for normal operation.

Pinpoint Test B: The Engine Does Not Crank And The Relay Does Not Click

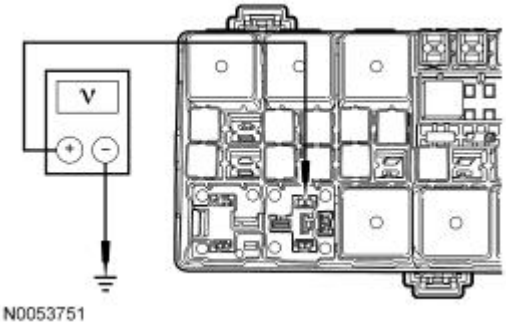
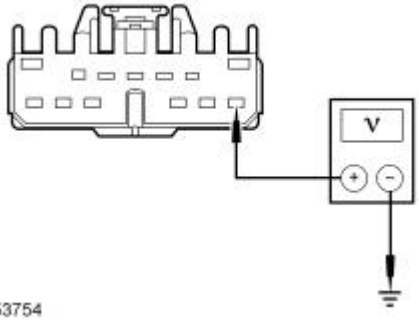
Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

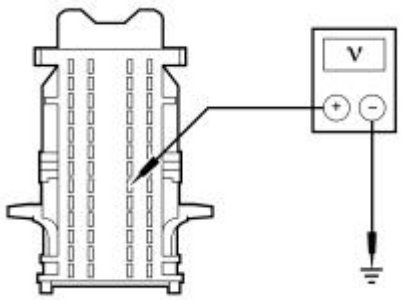
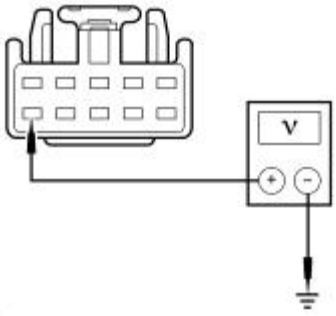
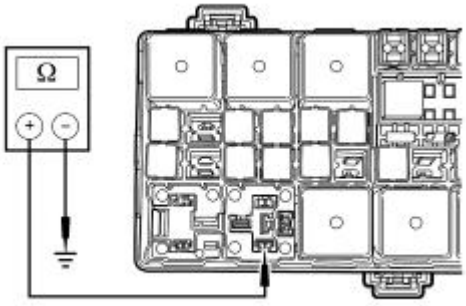
Possible Causes

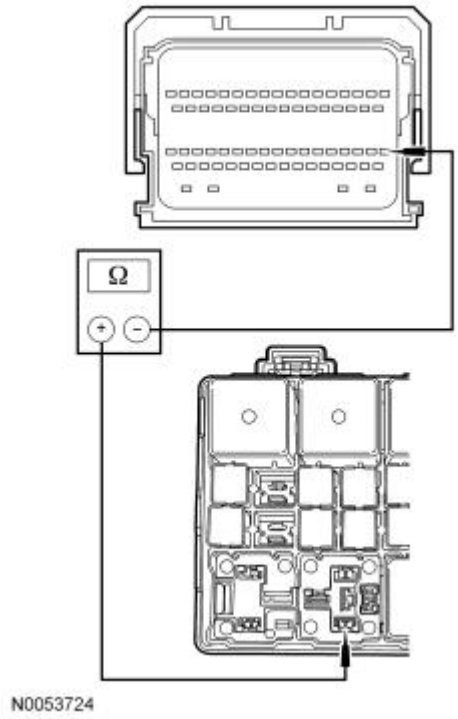
- Battery
- An open in circuit CDC38 (WH/VT), CDC12 (YE) or CDC35 (BU/WH)
- Powertrain control module (PCM)

- Smart power distribution junction box (SPDJB)
- Ignition switch
- Starter motor relay

PINPOINT TEST B: THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK

Test Step	Result / Action to Take
B1 CHECK THE BATTERY	
• Check the battery condition and charge. Refer to Section 414-00 . • **Is the battery OK?**	**Yes** GO to B2 . **No** CHARGE or INSTALL a new battery as required. TEST the system for normal operation.
B2 CHECK CIRCUIT CDC38 (WH/VT) FOR VOLTAGE	
• Disconnect: Starter Motor Relay. • Key in START position. • Measure the voltage between starter motor relay pin 85, circuit CDC38 (WH/VT) and ground while holding the key in the start position.  N0053751 • **Is the voltage greater than 10 volts?**	**Yes** GO to B6 . **No** GO to B3 .
B3 CHECK THE START INPUT FROM THE SPDJB	
• Key in START position. • Disconnect: SPDJB C2280A. • Measure the voltage at SPDJB C2280A pin 8 while holding the key in the start position.  N0053754 • **Is the voltage reading greater than 10 volts?**	**Yes** REPAIR circuit CDC38 (WH/VT) for an open. TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE START INPUT TO THE SPDJB	
• Key in START position. • Disconnect: SPDJB C2280H. • Measure the voltage at SPDJB C2280H pin 32 while	**Yes** INSTALL a new SPDJB. TEST the system for normal

holding the key in the start position.  N0053747 • **Is the voltage reading greater than 10 volts?**	operation. **No** GO to B5
B5 CHECK FOR START INPUT FROM THE IGNITION SWITCH	
• Key in START position. • Measure the voltage at ignition switch C250 pin 10, from the harness side, while holding the key in the start position.  N0053685 • **Is the voltage reading greater than 10 volts?**	**Yes** REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation. **No** REFER to Section 211-05 for diagnosis and testing of the ignition switch.
B6 CHECK THE STARTER RELAY GROUND	
• Key in START position. • Disconnect: Starter Motor Relay. • Measure the resistance between starter relay connector pin 86, circuit CDC12 (YE) and ground while holding the key in the start position.  N0053061 • **Is the resistance reading 5 ohms or less?**	**Yes** INSTALL a new starter relay. TEST the system for normal operation. **No** GO to B7 .
B7 CHECK CIRCUIT CDC12 (YE) FOR AN OPEN	
• Disconnect: PCM C175B. • Measure the resistance between the starter relay connector pin 86, circuit CDC12 (YE) and PCM C175B pin 34.	**Yes** DIAGNOSE the PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** REPAIR circuit CDC12 (YE) for an open. TEST the system for normal operation.



N0053724

- **Is the resistance reading 5 ohms or less?**

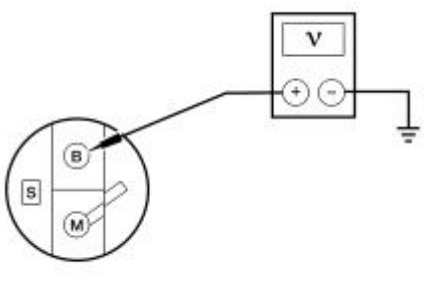
Pinpoint Test C: The Engine Cranks Slowly

Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

Possible Causes

- Circuit CDC25 (RD)
- Ground circuit
- Starter motor

PINPOINT TEST C: THE ENGINE CRANKS SLOWLY

Test Step	Result / Action to Take
C1 CHECK THE VOLTAGE TO THE STARTER • Key in OFF position. • Measure the voltage between the starter motor solenoid positive terminal and ground.  J6079-A • **Is the voltage 12.0 volts or greater?**	**Yes** GO to C2 . **No** REPAIR circuit CDC25 (RD). CLEAN and TIGHTEN the connections at the battery terminals. TEST the system for normal operation.

C2 CHECK THE MOTOR GROUND CIRCUIT	
• Carry out the motor ground circuit test. Refer to Component Tests in this section. • **Is the ground OK?**	**Yes** INSTALL a new starter motor. TEST the system for normal operation. **No** REPAIR the ground circuit as necessary. TEST the system for normal operation.

Pinpoint Test D: Unusual Starter Noise

Possible Causes

- Starter motor mounting
- Starter motor mounting bolts
- Starter motor drive
- Flywheel or flexplate ring gear
- Starter motor

PINPOINT TEST D: UNUSUAL STARTER NOISE

Test Step	Result / Action to Take
D1 CHECK THE STARTER MOTOR MOUNTING	**Yes** GO to D2 . **No** REINSTALL the starter motor correctly. REFER to Starter Motor in this section.
• Inspect the starter motor mounting for cracks. • Check the starter motor mounting bolts for looseness. • **Is the starter motor mounted correctly?**	
D2 INSPECT THE STARTER MOTOR	**Yes** INSTALL a new starter motor. TEST the system for normal operation. **No** CHECK the starter drive. REFER to Component Tests, Starter Drive Test in this section. INSTALL a new starter motor. TEST the system for normal operation.
• Remove the starter motor. Refer to Starter Motor in this section. • Inspect the starter motor for damage. • **Is the starter motor damaged?**	

Component Tests

Starter Motor — Load Test

WARNING: When servicing the starter motor or carrying out other underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. Failure to follow these instructions may result in personal injury.

CAUTION: A protective cap or boot is provided over the battery input terminal on all car lines and must be installed after repair. Be sure to disconnect the battery ground cable before repairing the starter motor.

1. Before carrying out this test inspection, check the battery to determine its state of charge. Carry out a load test of the battery using the Starter, Alternator, Battery, Regulator and Electrical (SABRE) Tester. Refer to Section 414-00 for the test procedure.

2. Disconnect the ignition coil connector from the ignition coil.

3. Connect the SABRE tester to the vehicle using the amperage lead clipped around the positive battery cable.

4. Measure the amperage of the starter motor while activating the starting system.

5. A correctly operating starter motor will draw from 130 to 190 amps of current at room temperature.

Voltage Drop Tests

The following test procedures will be carried out with the starter motor on the vehicle.

Motor Feed Circuit

NOTE: Make all multimeter connections at the component terminal rather than the cable or wiring terminal.

1. Disconnect the ignition coil connector from the ignition coil.

2. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) post.

3. Connect the positive (+) lead of the 73 III Automotive Meter to the battery positive (+) post. Connect the negative (-) lead of the multimeter to the starter solenoid M-terminal.

4. Engage the remote starter switch. The multimeter reading should be 0.5 volt or less.

5. If the voltage at the M-terminal is greater than 0.5 volt, move the multimeter negative (-) lead to the starter solenoid B-terminal and repeat the test.

6. If the voltage reading at the B-terminal is less than 0.5 volt, the problem is either in the connections at the starter solenoid or the starter solenoid.

7. Remove the wires at the starter solenoid B-, S- and M-terminals. Clean the connections and install the cables. Repeat Steps 1 through 5 above. If the reading is still higher than 0.5 volt at the M-terminal and 0.5 volt or lower at the B-terminal, the problem is in the starter solenoid. Install a new starter motor. Refer to Starter Motor in this section.

8. If the voltage taken at the starter solenoid B-terminal is greater than 0.5 volt, the problem is either the positive (+) battery cable connection or the positive (+) battery cable.

Motor Ground Circuit

NOTE: Make all multimeter connections at the component terminal rather than the cable or wiring terminal.

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Disconnect the ignition coil connector from the ignition coil.

2. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.

3. Connect the positive (+) lead of a 73 III Automotive Meter to the starter motor housing. The connection must be clean and free of rust or grease. Connect the negative (-) lead to the negative (-) battery terminal.

4. Engage the remote starter switch and read the voltage. The reading should be 0.5 volt or less.

5. If the voltage drop is greater than 0.5 volt, clean the negative (-) battery cable connections at the battery and chassis. Also, clean the engine ground cable connection at the cable mounting bracket. If the voltage drop is still excessive, repair or install a new battery ground cable.

Starter Drive Test

1. Remove the starter motor. Refer to Starter Motor in this section.

2. Secure the starter motor in a vise.

3. Connect the battery ground cable of a fully charged battery to the case of the starter motor.

4. **CAUTION: Do not leave the positive lead of the battery connected to the starter motor S-terminal for more than 10 seconds.**

   Touch the positive lead from the battery to the S-terminal and verify that the starter drive ejects.

5. Remove the positive lead from the starter motor. The ejected starter drive should return to its original position.

6. If the starter drive does not eject and return to position, install a new starter motor.

7. Check the starter drive. It should turn freely in one direction, and positively engage to the armature when turned in the opposite direction. If not as specified, install a new starter motor.

No Load Test

The starter No Load Test will identify open or shorted windings and a possible rubbing starter motor armature or bent starter motor armature shaft.

1. **WARNING: Make sure that the starter motor is securely mounted on a bench because the starter motor may move or jump when it is energized. Failure to follow these instructions may result in personal injury.**

   Connect a fully charged battery, a Starter, Alternator, Battery, Regulator and Electrical (SABRE) Tester and a remote starter switch to the starter motor. Connect the remote starter switch between the battery positive (+) post and the starter motor S-terminal. Connect the starter motor B-terminal to the battery positive (+) post. Connect the SABRE positive (+) terminal and negative (-) terminal to the corresponding battery post. Make sure that the battery and starter motor are grounded.

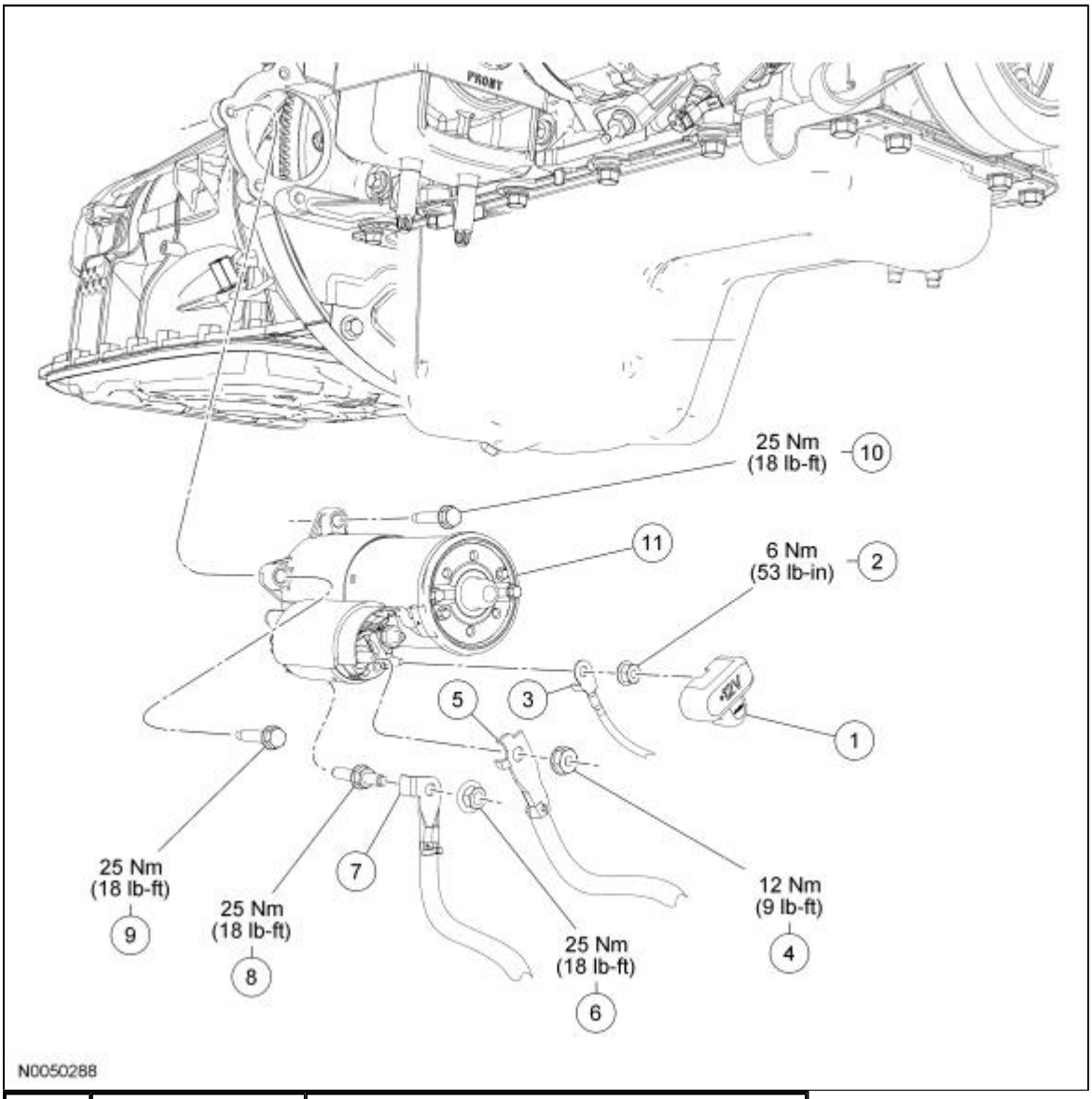
2. Engage the remote starter switch.

3. The starter motor should eject the starter drive and run smoothly. If the starter motor does not run smoothly, install a new starter motor.

4. While the starter motor is running, check the voltmeter and ammeter.
5. The amperage should be no more than 84 amps.
6. If the amperage is higher than 84 amps, install a new starter motor.

Starter Motor

Printable View (217 KB)



Item	Part Number	Description
1	11N087	Terminal cover
2	N805320	Starter solenoid S-terminal nut
3	14463	Starter solenoid S-terminal eyelet
4	W706414	Starter solenoid B-terminal nut
5	14463	Starter solenoid B-terminal eyelet
6	N805024	Starter motor ground cable nut
7	14463	Starter motor ground cable eyelet
8	W704941	Starter motor mounting stud bolt
9	W704942	Starter motor mounting bolt
10	W704942	Starter motor mounting bolt

11	11000	Starter motor

Removal

WARNING: When carrying out maintenance on the starting system, be aware that the heavy gauge leads are connected directly to the battery. Make sure the protective caps are in place when maintenance is completed. Failure to follow these instructions may result in personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the starter terminal cover and remove the nut and the solenoid S-terminal electrical connection.
4. Remove the nut and the solenoid B-terminal electrical connection.
5. Remove the nut and the starter battery ground cable from the stud.
6. Remove the 2 bolts, the stud bolt and the starter motor.

Installation

1. Position the starter and install the 2 bolts and the stud bolt in 3 stages.
   - Stage 1: Install the 2 starter bolts and the stud bolt finger tight.
   - Stage 2: Tighten the upper bolt to 25 Nm (18 lb-ft).
   - Stage 3: Tighten the lower bolt and stud bolt to 25 Nm (18 lb-ft).
2. Position the starter battery ground cable onto the stud and install the nut.
   - Tighten to 25 Nm (18 lb-ft).
3. Connect the solenoid B-terminal electrical connection and install the nut.
   - Tighten to 12 Nm (9 lb-ft).
4. Connect the solenoid S-terminal electrical connection and install the nut and the starter terminal cover.
   - Tighten to 6 Nm (53 lb-in).
5. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Printable View (78 KB)

General Specifications

Item	Specification
Lubricants and Chemicals	
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Engine Ignition	
Base timing	10° BTDC
Firing order	1-3-7-2-6-5-4-8
Spark plug [a]	PZT-2F

[a] Spark plug gap is not adjustable.

Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil retaining bolt	6	—	53
Spark plug	34	25	—

Engine Ignition

Printable View (63 KB)

The electronic ignition system is a coil-on-plug ignition system. The coil-on-plug ignition system consists of the:

- crankshaft position (CKP) sensor.
- ignition coils.
- spark plugs.

The CKP sensor:

- is a variable reluctance sensor.
- is triggered by a 36-minus-1 tooth sensor ring mounted on the crankshaft.
- provides base timing and crankshaft speed (rpm) to the powertrain control module (PCM).

The 8 separate ignition coils:

- change low voltage signals from the PCM to high voltage pulses.
- produce the high voltage pulses to the spark plugs.
- are connected directly to each spark plug.

The spark plugs:

- change high voltage pulses into a spark which ignites the fuel and air mixture.
- originally equipped on the vehicle have a platinum-enhanced active electrode for long life.

Engine Ignition

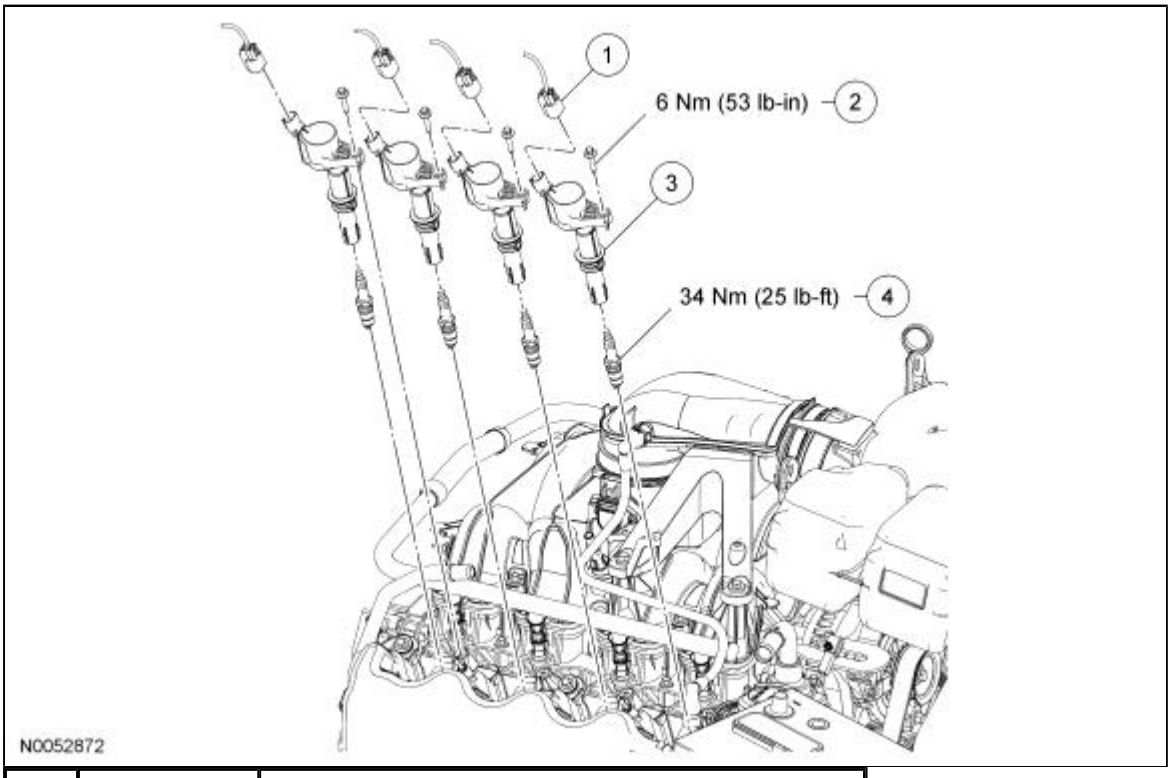
Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Engine Ignition Components — Exploded View

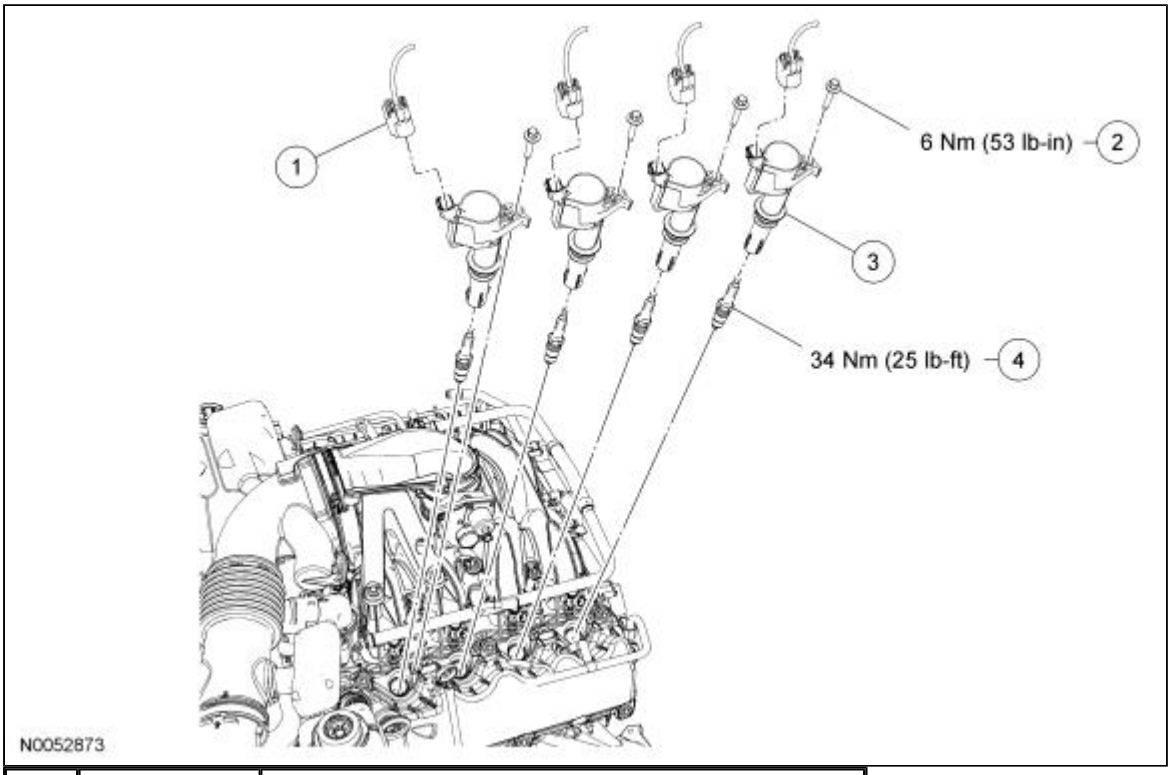
Printable View (296 KB)

Engine Ignition - RH



Item	Part Number	Description
1	14A464	RH ignition coil electrical connectors (4 required)
2	W706175	RH ignition coil retaining bolts (4 required)
3	12A366	RH ignition coils (4 required)
4	12405	RH spark plugs (4 required)

Engine Ignition - LH



Item	Part Number	Description
1	14A464	LH ignition coil electrical connectors (4 required)
2	W706175	LH ignition coil retaining bolts (4 required)
3	12A366	LH ignition coils (4 required)
4	12405	LH spark plugs (4 required)

1. For additional information, refer to the procedures in this section.

Ignition Coil-On-Plug

Printable View (79 KB)

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the ignition coil electrical connector.
3. Remove the bolt and the ignition coil.
   - Remove the ignition coil, using a twisting motion while pulling up on the ignition coil.
   - To install, tighten to 6 Nm (53 lb-in).
4. **NOTE:** Verify that the ignition coil spring is correctly located inside the ignition coil boot and that there is no damage to the tip of the boot.

   To install, reverse the removal procedure.
   - Apply a light coat of dielectric compound to the inside of the ignition coil boots.

Spark Plugs

Printable View (80 KB)

Removal and Installation

1. Remove the ignition coil-on-plug. For additional information, refer to Ignition Coil-On-Plug in this section.

2. **CAUTION: Do not remove the spark plugs when the engine is hot or cold soaked. Spark plug thread or cylinder head damage can occur. Make sure the engine is warm (hand touch after cooling down) prior to spark plug removal.**

   CAUTION: Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.

   NOTE: Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

   NOTE: If an original spark plug is used, make sure it is installed in the same cylinder from which it was taken. New spark plugs can be used in any cylinder.

   Remove the spark plugs.
   - To install, tighten to 34 Nm (25 lb-ft).

3. Inspect the spark plugs. Install new spark plugs as necessary. For additional information, refer to Section 303-00 .

4. To install, reverse the removal procedure.

Printable View (78 KB)

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Torque Specifications

Description	Nm	lb-in
Positive crankcase ventilation (PCV) heater element bolts	6	53

Engine Emission Control

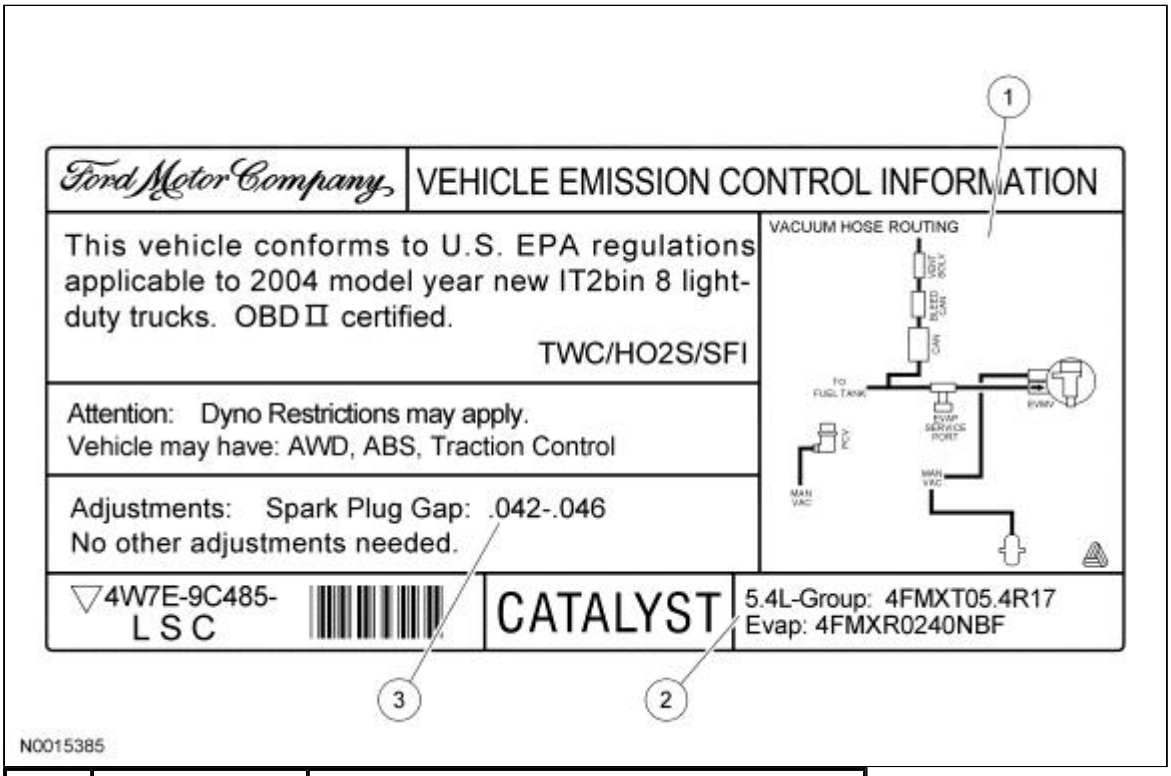
Printable View (137 KB)

CAUTION: Do not remove any part of the engine emission control system. Operating the engine without the engine emission control system will reduce fuel economy and engine ventilation. This will weaken engine performance and shorten engine life.

The engine emission control system consists of the:

- positive crankcase ventilation (PCV) system.

Typical Vehicle Emission Control Information (VECI) Decal



Item	Part Number	Description
1	—	Engine vacuum hose routing (typical)
2	—	Engine type
3	—	Spark plug gap specifications

The Vehicle Emission Control Information (VECI) decal shows:

- components of the emission control system.
- the correct vacuum hose routing.
- the color stripe of the vacuum hoses.

Refer to Section 100-01 .

The heated PCV system uses intake manifold vacuum to ventilate the crankcase and return the fumes to

the intake manifold for combustion.

The PCV valve:

- controls the amount of ventilating air and blow-by gases going to the intake manifold.
- is an integral part of the LH valve cover.
- is not serviceable.

The PCV heater element:

- heats the ventilating air and blow-by gases going to the intake manifold.

Engine Emission Control

Printable View (62 KB)

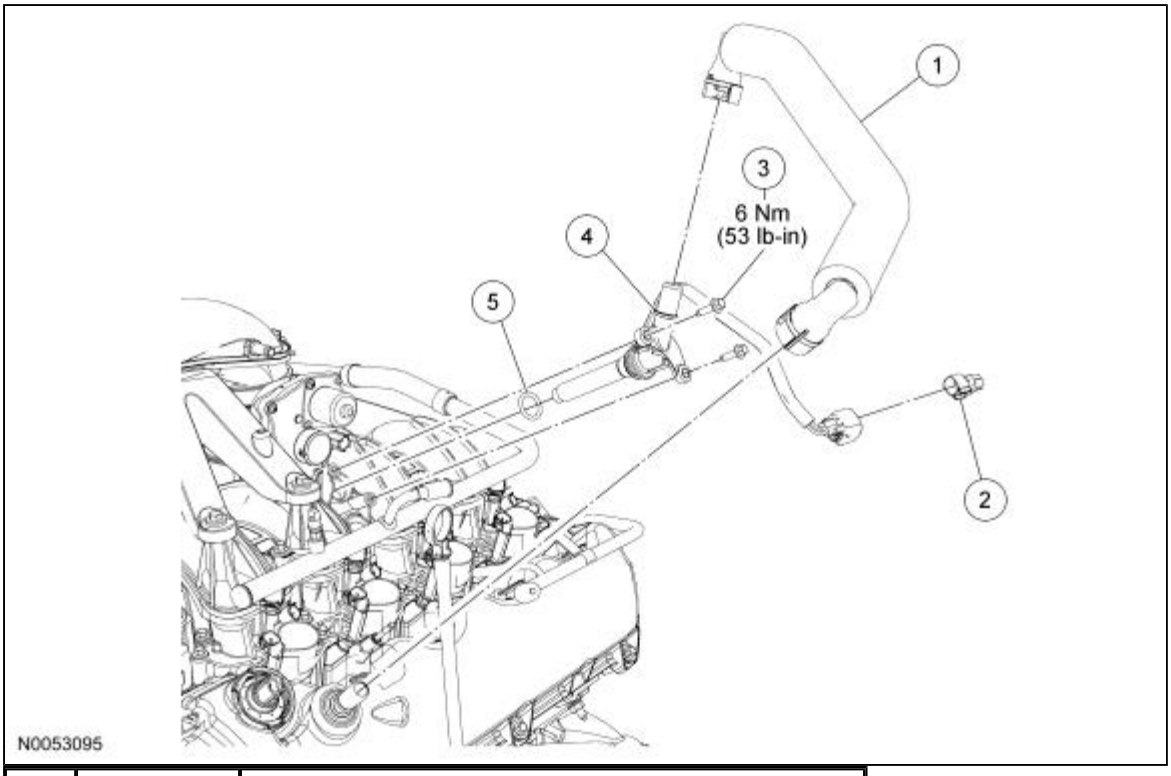
Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Positive Crankcase Ventilation (PCV) Heater Element

Printable View (173 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	6K817	Positive crankcase ventilation (PCV) tube
2	—	Heated PCV heater element electrical connector (part of 14A624)
3	W505416	PCV heater element bolt (2 required)
4	9F624	PCV heater element
5	—	PCV heater element O-ring seal (part of 9F624)

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the positive crankcase ventilation (PCV) heater element electrical connector.

3. Disconnect the quick connect couplings and remove the PCV tube. For additional information, refer to Section 310-00 .

4. Remove the 2 bolts and the PCV heater element.
    - Discard the O-ring seal.

Installation

1. **NOTE:** Lubricate the O-ring seal with clean engine oil prior to installation.

   Using a new O-ring seal, install the PCV heater element and the 2 bolts.
    - Tighten to 6 Nm (53 lb-in).

2. Position the PCV tube and connect the quick connect couplings. For additional information, refer to Section 310-00 .

3. Connect the PCV heater element electrical connector.

4. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Air cleaner outlet pipe clamp	4	35
Engine appearance cover bolts	5	44
Mass air flow (MAF) sensor bolts	6	53

Intake Air Distribution and Filtering

Printable View (63 KB)

The air intake system consists of the:

- air cleaner housing.
- air cleaner element.
- mass air flow (MAF) sensor.
- air cleaner outlet tube.

The air intake system:

- cleans intake air with a replaceable, air cleaner element.
- measures airflow with a MAF sensor. For additional information, refer to Section 303-14 .

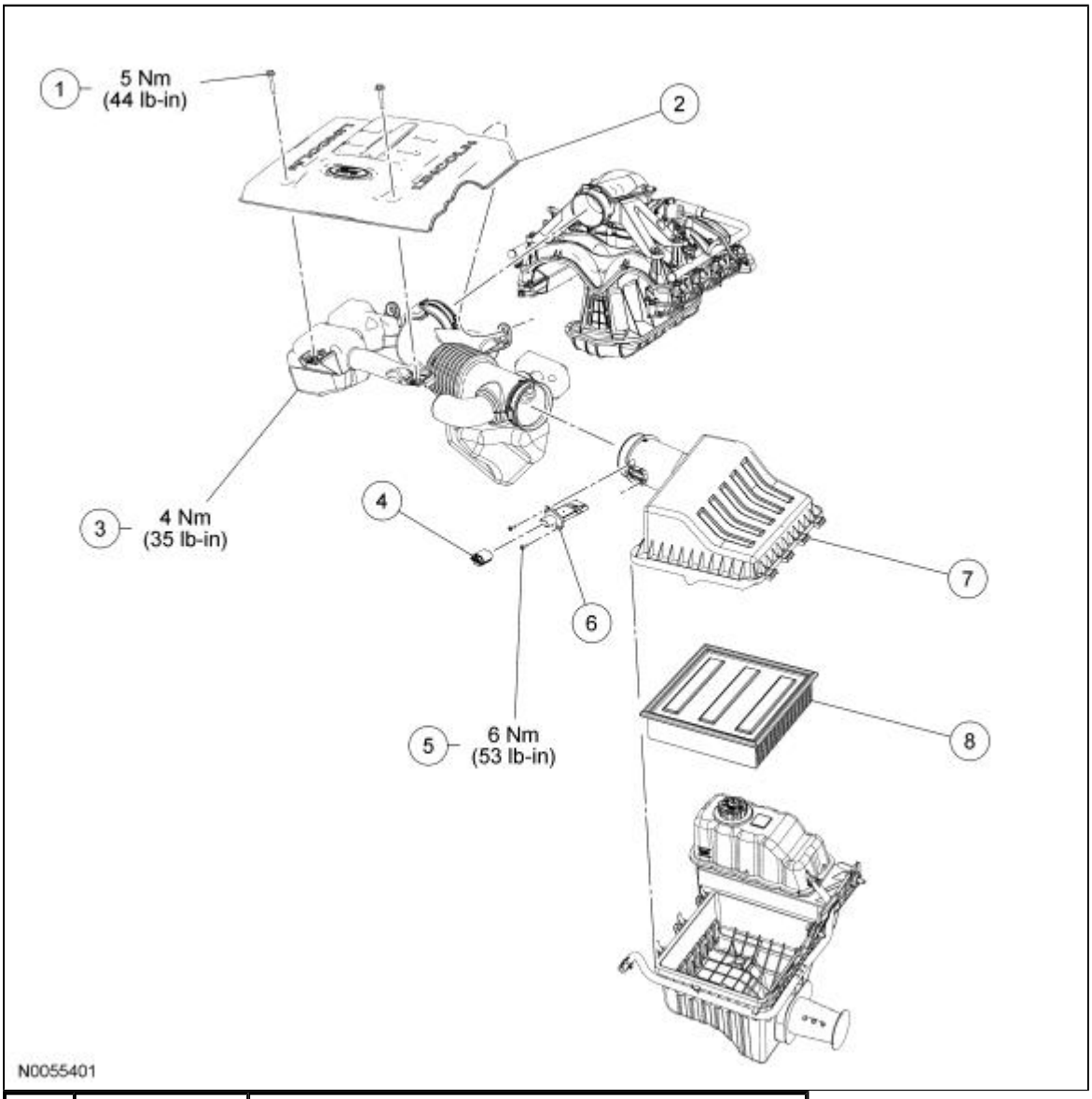
Intake Air Distribution and Filtering

Printable View (62 KB)

Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Intake Air System Components — Exploded View

Printable View (176 KB)



Item	Part Number	Description
1	N806201	Engine appearance cover bolt (2 required)
2	0310	Engine appearance cover
3	9F805	Air cleaner outlet pipe and resonator assembly
4	14A464	Mass air flow (MAF) electrical connector
5	W709287	MAF sensor bolts (2 required)
6	12B579	MAF sensor
7	9661	Air cleaner housing cover
8	9A600	Air cleaner element

1. For additional information, refer to the procedures in this section.

Air Cleaner Element

Printable View (80 KB)

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the air cleaner outlet pipe from the air cleaner cover.
   - To install, tighten the clamps to 4 Nm (35 lb-in).
3. Disconnect the mass air flow (MAF) sensor electrical connector.
4. Release the retaining clips and position the air cleaner cover aside.
5. Remove the air cleaner element.

Installation

1. **CAUTION: The air cleaner element must be fully seated into the air cleaner housing. Failure to do so will result in unusual engine noise.**

   To install, reverse the removal procedure.

Air Cleaner

Printable View (63 KB)

Removal and Installation

1. The air cleaner housing is an integral part of the degas bottle and cannot be serviced separately. For additional information, refer to Section 303-03 .

Air Cleaner Outlet Pipe

Printable View (111 KB)

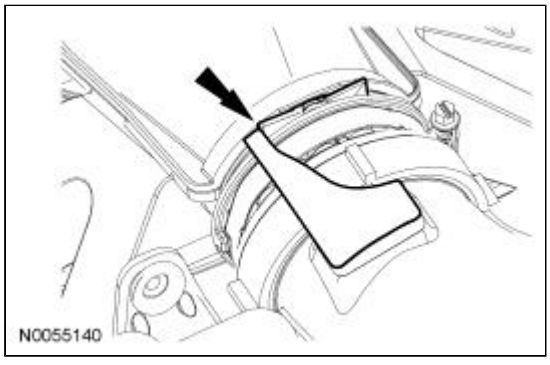
Removal

1. Remove the 2 bolts and the engine appearance cover.
2. Loosen the 2 air cleaner outlet pipe clamps.
3. Remove the air cleaner outlet pipe.

Installation

1. **CAUTION: The air cleaner intake pipe should be securely sealed to prevent unusual engine noise.**

   Position the air cleaner outlet pipe with the alignment indicator positioned as shown and tighten the 2 clamps.
   - Tighten to 4 Nm (35 lb-in).



2. Position the engine appearance cover and install the 2 bolts.
   - Tighten to 5 Nm (44 lb-in).

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Evaporative emission (EVAP) canister assembly bracket-to-frame rail bolts	20	15	—
EVAP canister assembly bracket and exhaust Y-pipe-dual catalytic converter heat shield-to-transmission crossmember bolt	20	15	—
EVAP canister assembly bracket-to-EVAP canister bolts	6	—	53

Evaporative Emissions

Printable View (79 KB)

The evaporative emissions (EVAP) system:

- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canister that are generated during vehicle operation or hot soak, until they can be consumed by the engine during normal engine operation.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the powertrain control module (PCM), which uses various sensor inputs to calculate the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the EVAP canister purge valve.

The fuel vapors are routed:

- from the fuel tank through the fuel vapor/grade vent valves.
- to the EVAP canister through a vapor line.
- to the engine when the EVAP canister purge valve is opened by the PCM.

The fuel tank pressure (FTP) sensor:

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the OBD II leak test.

The EVAP canister:

- is located in front of the fuel tank.
- contains activated carbon.
- stores fuel vapors.

The fuel tank filler cap:

- relieves system vacuum below 3.8 kPa (15.26 inches H_2O).

The canister vent solenoid:

- is normally open.
- seals the evaporative emissions system for the OBD II leak and pressure tests.
- is mounted to the EVAP canister.
- is repaired through removal/replacement of the canister vent solenoid and dust separator assembly. The canister vent solenoid must not be serviced separately from the canister vent solenoid and dust separator assembly.

The EVAP canister purge valve:

- is normally closed.
- regulates the purging of the EVAP canister.
- is controlled by the PCM.

Evaporative Emissions

Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Evaporative Emission System Leak Test

Printable View (92 KB)

Special Tool(s)

ST2817-A	VACUTEC Smoke Machine Fuel EVAP Emissions System Tester 218-0002 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Phase 1 — Leak Verification

1. Using the scan tool, run the evaporative emissions (EVAP) system test.
2. **NOTE:** Some small leaks may not be detected using the EVAP system test. If the system has passed the test but a leak is still suspected, then proceed to Phase 2.

   If the EVAP system failed the EVAP system test then proceed to Phase 2.

Phase 2 — System Leak Check

1. Disconnect the upper fuel vapor tube quick connect coupling from the EVAP canister purge valve. For additional information, refer to Section 310-00 .
2. Connect the smoke machine emissions tester to the upper EVAP canister purge valve fitting. For additional information, refer to the manufacturer's instruction.
3. **NOTE:** In the scan tool, the EVAP canister purge valve is referred to as the EVMV.

   Using the scan tool, turn on the EVAP canister purge valve.
4. **CAUTION: The canister vent solenoid must not be energized for more than 9 minutes at one time. Once the canister vent solenoid is energized and de-energized, adequate time must be allowed for the component to cool adequately. Failure to allow the component to cool may create a false failure in the diagnostics, causing unnecessary repairs.**

   Using the scan tool, close the canister vent solenoid.
5. Introduce smoke from the smoke machine emissions tester into the EVAP system. For additional information, refer to the manufacturer's instructions.
6. Use the halogen light provided with the smoke machine emissions tester to look for smoke coming from the EVAP system. This will indicate a leak point.

7. Repair any leaks as necessary.
8. Repeat the leak test until the system passes.

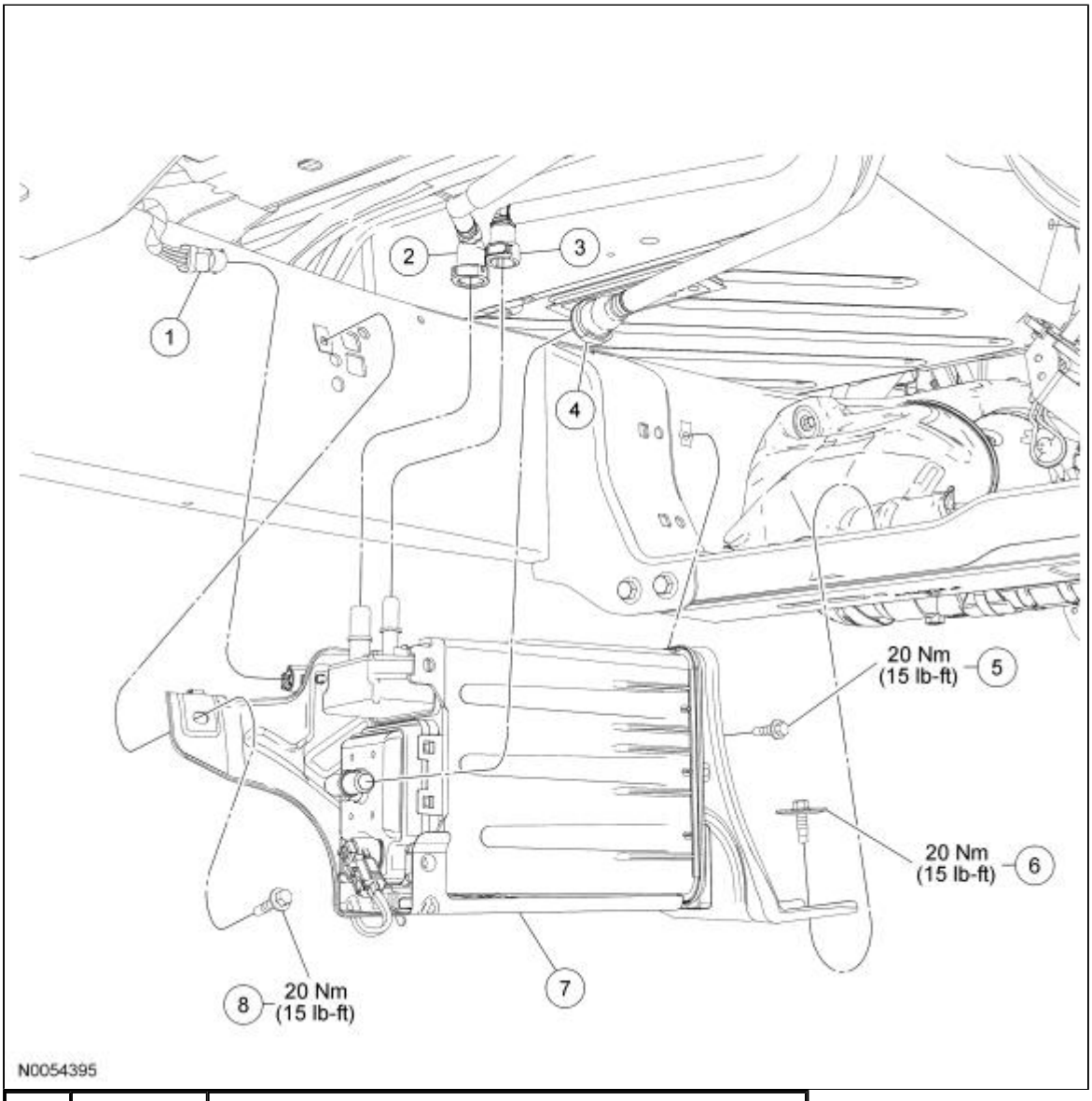
Evaporative Emission Repair Verification Drive Cycle

Printable View (62 KB)

1. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

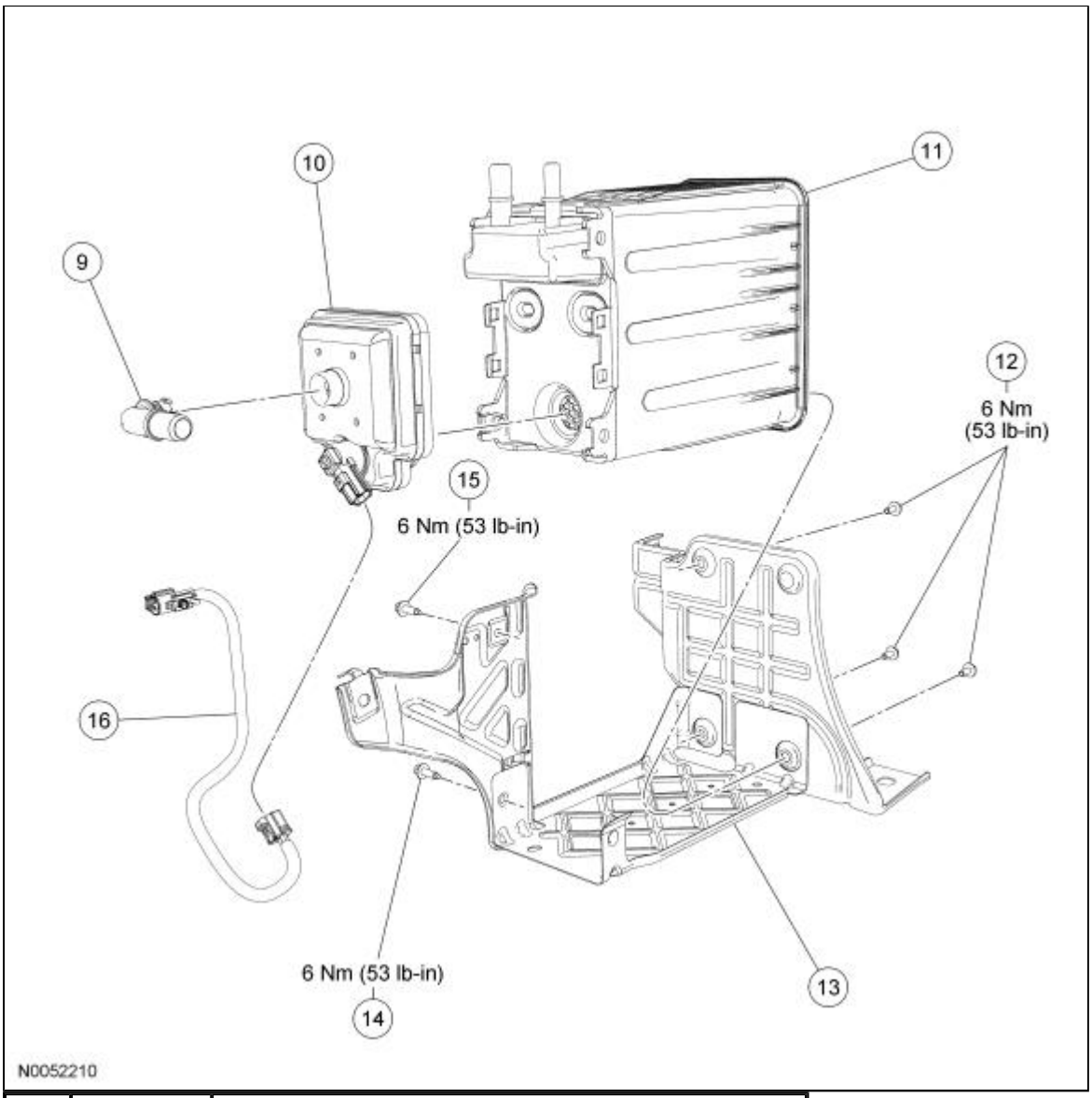
Evaporative Emission (EVAP) System Components — Exploded View

Printable View (306 KB)



Item	Part Number	Description
1	—	Evaporative emissions (EVAP) canister vent solenoid electrical connector (part of 14405)
2	—	Fuel tank pressure sensor and vapor tube assembly-to-EVAP canister quick connect coupling (part of 9C016)
3	—	EVAP canister purge valve vapor tube-to-EVAP canister quick connect coupling (part of 9D676)
4	—	Fresh air tube-to-canister vent solenoid and dust separator assembly quick connect coupling
5	W506423	EVAP canister assembly bracket-to-frame rail bolt

6	W707959	EVAP canister assembly bracket and exhaust Y-pipe-dual catalytic converter heat shield-to-transmission crossmember bolt
7	9E857	EVAP canister assembly
8	W506423	EVAP canister assembly bracket-to-frame rail bolt



Item	Part Number	Description
9	—	Canister vent solenoid and dust separator assembly quick connect coupling fitting
10	—	Canister vent solenoid and dust separator assembly
11	9D653	EVAP canister
12	—	EVAP canister assembly bracket-to-EVAP canister bolts
13	—	EVAP canister assembly bracket
14	—	EVAP canister assembly bracket-to-EVAP canister bolt

15	—	EVAP canister assembly bracket-to-EVAP canister bolt
16	—	EVAP canister vent solenoid electrical jumper

1. For additional information, refer to the procedures in this section.

Evaporative Emission Canister

Printable View (84 KB)

Removal and Installation

WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

NOTE: The evaporative emission canister vent solenoid and dust separator are an assembly.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the EVAP canister vent solenoid electrical jumper from the wiring harness.
4. Disconnect the fuel tank pressure sensor and vapor tube assembly-to-EVAP canister quick connect coupling. For additional information, refer to Section 310-00 .
5. Disconnect the EVAP canister purge valve vapor tube-to-EVAP canister quick connect coupling. For additional information, refer to Section 310-00 .
6. Disconnect the fresh air tube-to-canister vent solenoid and dust separator assembly quick connect coupling. For additional information, refer to Section 310-00 .
7. Remove the EVAP canister assembly bracket-to-frame rail bolt in the rear.
   - Tighten to 20 Nm (15 lb-ft).
8. Remove the EVAP canister assembly bracket-to-frame rail bolt in the front.
   - Tighten to 20 Nm (15 lb-ft).
9. Remove the EVAP canister assembly bracket and exhaust Y-pipe-dual catalytic converter heat shield-to-transmission crossmember bolt and remove the EVAP canister assembly from the vehicle.
   - Tighten to 20 Nm (15 lb-ft).
10. **NOTE:** Lowering the corner of the EVAP canister assembly bracket will aid in disconnecting the EVAP canister vent solenoid electrical connector.

    Disconnect the EVAP canister vent solenoid electrical connector.
11. Remove the EVAP canister-to-EVAP canister assembly bracket bolts.
    - Tighten to 6 Nm (53 lb-in).

12. Remove the EVAP canister assembly from the EVAP canister assembly bracket.

13. Remove the canister vent solenoid and dust separator assembly from the EVAP canister.

14. To install, reverse the removal procedure.
    - Leak test the system. For additional information, refer to Evaporative Emission System Leak Test in this section.
    - Carry out the evaporative emissions repair verification drive cycle. For additional information, refer to Evaporative Emission Repair Verification Drive Cycle in this section.

Evaporative Emission Canister Vent Solenoid

Printable View (106 KB)

Removal and Installation

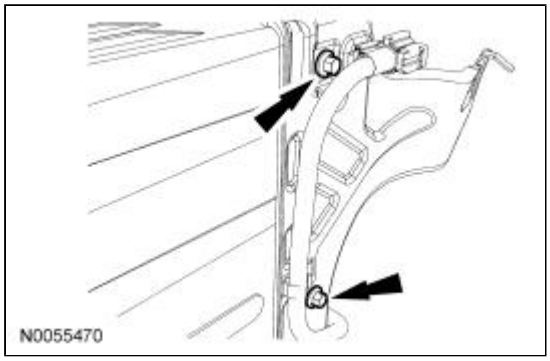
WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

NOTE: The evaporative emission canister vent solenoid and dust separator are an assembly.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the EVAP canister vent solenoid electrical jumper from the wiring harness.
4. Disconnect the fuel tank pressure sensor and vapor tube assembly-to-EVAP canister quick connect coupling. For additional information, refer to Section 310-00 .
5. Disconnect the EVAP canister purge valve vapor tube-to-EVAP canister quick connect coupling. For additional information, refer to Section 310-00 .
6. Disconnect the fresh air tube-to-canister vent solenoid and dust separator assembly quick connect coupling. For additional information, refer to Section 310-00 .
7. Remove the EVAP canister assembly bracket-to-frame rail bolt in the rear.
   - Tighten to 20 Nm (15 lb-ft).
8. Remove the EVAP canister assembly bracket-to-frame rail bolt in the front.
   - Tighten to 20 Nm (15 lb-ft).
9. Remove the EVAP canister assembly bracket and exhaust Y-pipe-dual catalytic converter heat shield-to-transmission crossmember bolt and remove the EVAP canister assembly from the vehicle.
   - Tighten to 20 Nm (15 lb-ft).
10. **NOTE:** Lowering the corner of the EVAP canister assembly bracket will aid in disconnecting the EVAP canister vent solenoid electrical connector.

    Disconnect the EVAP canister vent solenoid electrical connector.
11. Remove the EVAP canister-to-EVAP canister assembly bracket bolts in the front of the canister.
    - Tighten to 6 Nm (53 lb-in).



12. Remove the canister vent solenoid and dust separator assembly from the EVAP canister.

13. To install, reverse the removal procedure.
    - Leak test the system. For additional information, refer to Evaporative Emission System Leak Test in this section.
    - Carry out the evaporative emissions repair verification drive cycle. For additional information, refer to Evaporative Emission Repair Verification Drive Cycle in this section.

Dust Separator

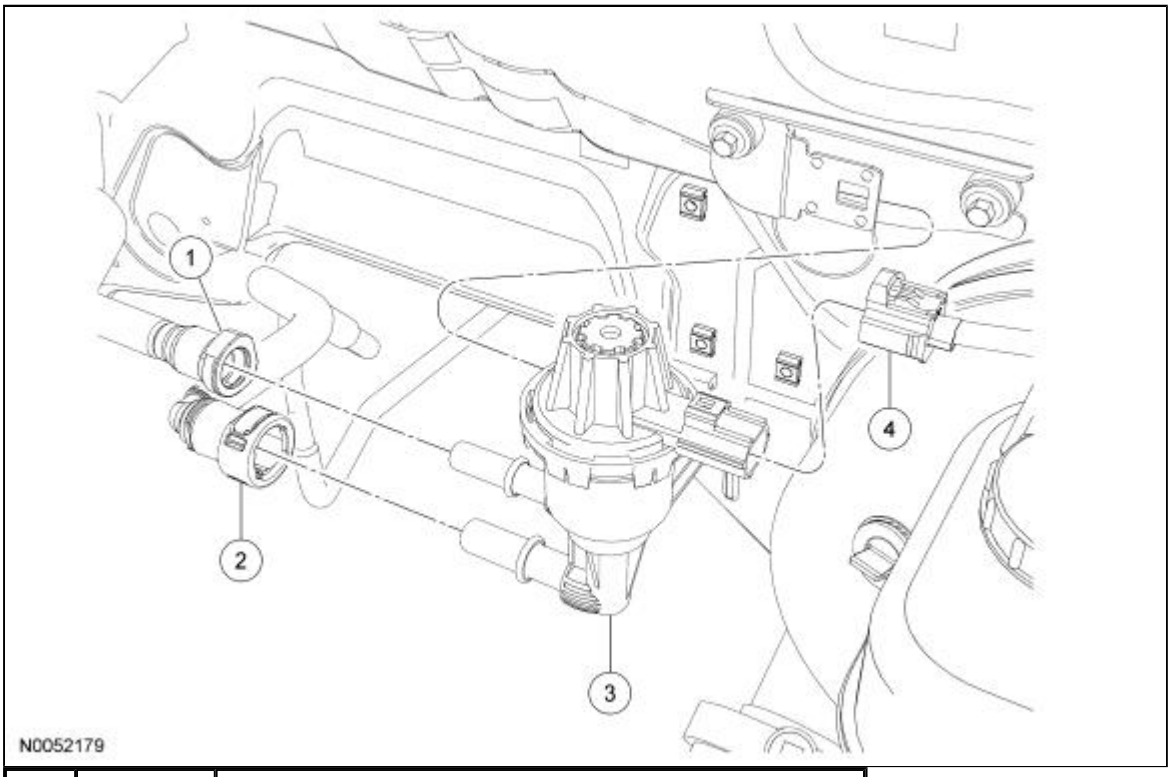
Printable View (78 KB)

1. **NOTE:** The evaporative emission canister vent solenoid and dust separator are an assembly. This assembly is removed with the evaporative emission canister vent solenoid.

   Refer to Evaporative Emission Canister Vent Solenoid in this section.

Evaporative Emission Canister Purge Valve

Printable View (199 KB)



Item	Part Number	Description
1	—	Intake manifold-to-evaporative emission (EVAP) canister purge valve vapor tube quick connect coupling (part of 9D289)
2	—	EVAP canister-to-EVAP canister purge valve vapor tube quick connect coupling (part of 9J337)
3	9G641	EVAP canister purge valve
4	—	EVAP canister purge valve electrical connector (part of 12B637)

Removal and Installation

WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

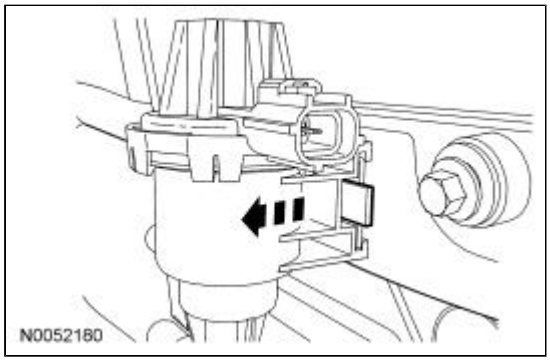
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Disconnect the evaporative emissions (EVAP) canister purge valve electrical connector.

3. Disconnect the intake manifold-to-EVAP canister purge valve vapor tube quick connect coupling. For additional information, refer to Section 310-00 .

4. Disconnect the EVAP canister-to-EVAP canister purge valve vapor tube quick connect coupling. For additional information, refer to Section 310-00 .

5. Pull the EVAP canister purge valve release tab and slide the EVAP canister purge valve off the bracket.



6. To install, reverse the removal procedure.
    - Leak test the system. For additional information, refer to Evaporative Emission System Leak Test in this section.
    - Carry out the evaporative emissions repair verification drive cycle. For additional information, refer to Evaporative Emission Repair Verification Drive Cycle in this section.

Fuel Tank Pressure Sensor

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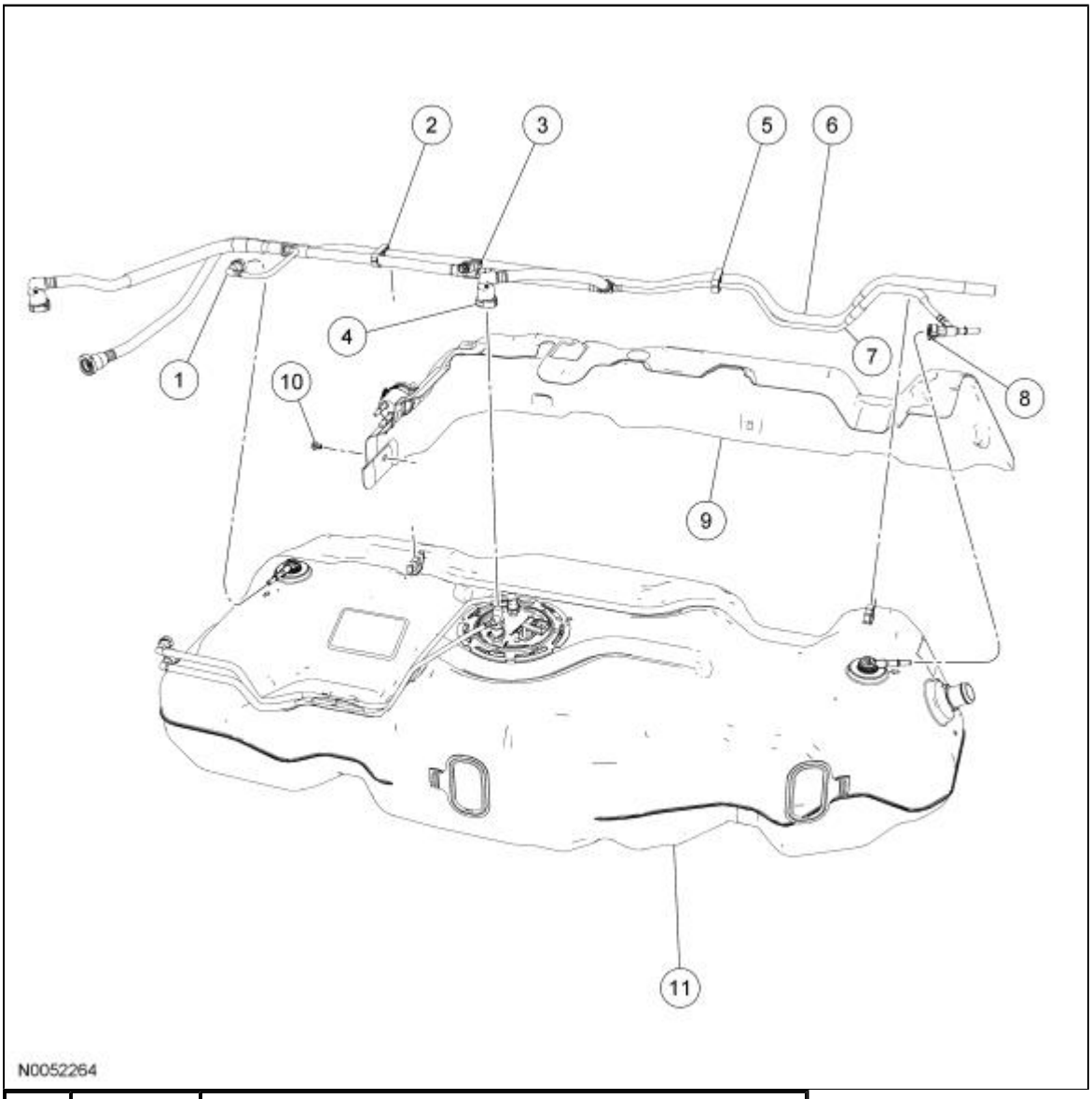
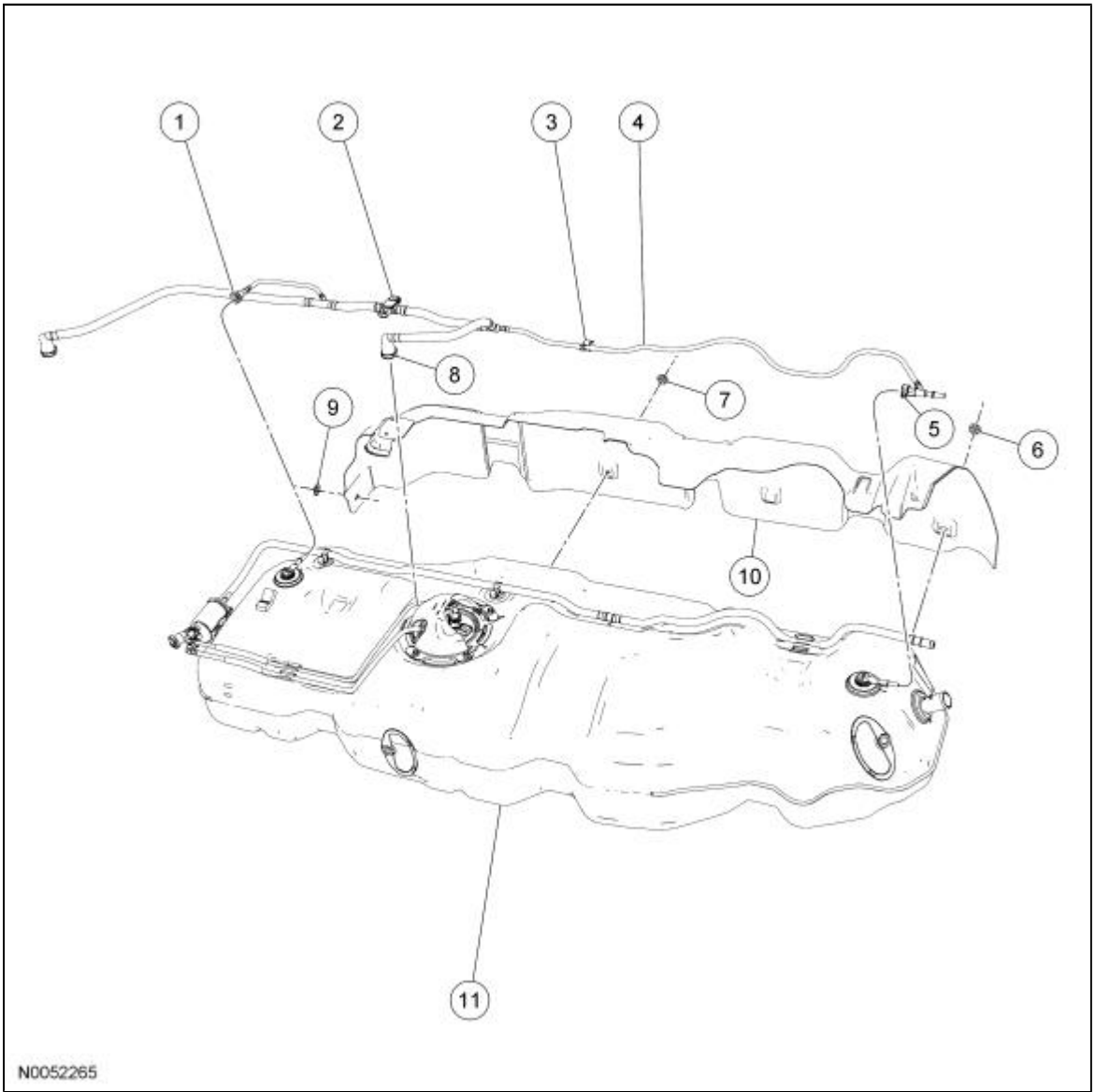
106L (28 Gallon) Fuel Tank



Item	Part Number	Description
1	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel vapor/grade vent valve quick connect coupling (part of 9G271)
2	—	Retainer (part of 9G271)
3	—	Fuel tank pressure sensor (part of 9G271)
4	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel pump module quick connect coupling (part of 9G271)
5	—	Retainer (part of 9G271)

6	9G271	Fuel tank pressure sensor and vapor tube assembly (part of 9G271)
7	—	Fresh air tube (part of 9G271)
8	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel vapor/grade vent valve quick connect coupling (part of 9G271)
9	9A032	Heat shield
10	9K111	Heat shield retainer
11	9002	Fuel tank

125L (33 Gallon) Fuel Tank



N0052265

Item	Part Number	Description
1	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel vapor/grade vent valve quick connect coupling (part of 9G271)
2	—	Fuel tank pressure sensor (part of 9G271)

3	—	Retainer
4	9G271	Fuel tank pressure sensor and vapor tube assembly
5	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel vapor/grade vent valve quick connect coupling (part of 9G271)
6	—	Heat shield retainer
7	—	Heat shield retainer
8	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel pump module quick connect coupling (part of 9G271)
9	—	Heat shield retainer
10	9A032	Heat shield
11	9002	Fuel tank

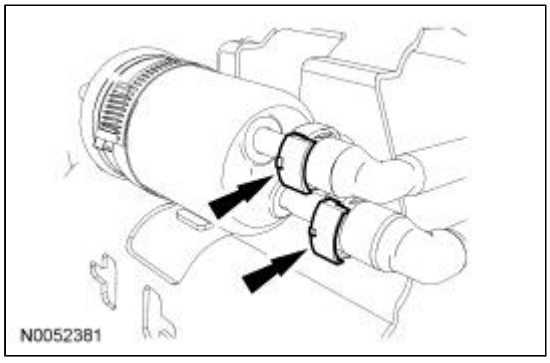
Removal and Installation

All fuel tanks

1. Remove the fuel tank. For additional information, refer to Section 310-01 .

106 L (28 gal.) fuel tank

2. Disconnect the supply and return fuel tubes quick connect couplings from the fuel filter. For additional information refer to Section 310-00 .



All fuel tanks

3. Remove the fuel tank heat shield retainer(s) and remove the fuel tank heat shield.

4. Disconnect the fuel tank pressure sensor and vapor tube assembly-to-fuel vapor/grade vent valves quick connect couplings. For additional information, refer to Section 310-00 .

5. Disconnect the fuel tank pressure sensor and vapor tube assembly-to-fuel pump module quick connect coupling. For additional information, refer to Section 310-00 .

106 L (28 gal.) fuel tank

6. **NOTE:** For the 106 L (28 gal.) fuel tank the fuel tank pressure sensor and vapor tube assembly and fresh air tube are serviced as an assembly.

   Remove the fuel tank pressure sensor and vapor tube assembly with the fresh air tube from the fuel tank.

125 L (33 gal.) fuel tank

7. Remove the fuel tank pressure sensor and vapor tube assembly from the fuel tank.

All fuel tanks

8. To install, reverse the removal procedure.
    - Leak test the system. For additional information, refer to Evaporative Emission System Leak Test in this section.
    - Carry out the evaporative emission repair verification drive cycle. For additional information, refer to Evaporative Emission Repair Verification Drive Cycle in this section.

Printable View (81 KB)

General Specifications

Item	Specification
Lubricants and Chemicals	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada) or equivalent	WSS-M2C930-A
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	—
Camshaft position (CMP) sensor bolt	10	—	89
Crankshaft position (CKP) sensor bolt	10	—	89
Cylinder head temperature (CHT) sensor	10	—	89
Catalyst monitor sensor	46	34	—
Heated oxygen sensor (H2OS)	46	34	—
Knock sensor (KS) bolt	20	15	—
Mass air flow (MAF) sensor bolts	7	—	62
Charge motion control valve (CMCV) bolts	10	—	89
CMCV stud	10	—	89
Powertrain control module (PCM) bolts	7	—	62
Throttle position (TP) sensor screws	3	—	27
Variable camshaft timing (VCT) oil control solenoid bolt	5	—	44

Electronic Engine Controls

Printable View (67 KB)

The electronic engine controls consist of the following:

- Powertrain control module (PCM)
- Throttle position (TP) sensor
- Cylinder head temperature (CHT) sensor
- Camshaft position (CMP) sensor
- Crankshaft position (CKP) sensor
- Mass air flow (MAF) sensor
- Heated oxygen sensors (HO2S)
- Catalyst monitor sensors
- Knock sensor (KS)
- Charge motion control valve (CMCV)
- Variable camshaft timing (VCT) oil control solenoid

The PCM carries out the following functions:

- accepts input from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range.
- outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The TP sensor:

- sends the PCM a signal indicating the throttle plate angle.
- is the main input to the PCM from the driver.

The CHT sensor:

- is mounted into the wall of the cylinder head and is not connected to any coolant passages.
- sends the PCM a signal indicating cylinder head temperature.
    - if the temperature exceeds approximately 121°C (250°F), the PCM disables half of the fuel injectors at a time. The PCM will alternate which fuel injectors are disabled every 32 engine cycles. The cylinders that are not being fuel injected act as air pumps to aid in engine cooling.
    - if the temperature exceeds approximately 166°C (330°F), the PCM disables all of the fuel injectors until the engine temperature drops below approximately 154°C (310°F).

The CMP sensor:

- sends the PCM a signal indicating camshaft position used for fuel synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- uses a hot wire sensing element to measure the amount of air entering the engine. Air passing

over the hot wire causes it to cool.

The HO2S:

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The catalyst monitor sensors:

- monitors oxygen content after it flows through the catalytic converter.
- provides a voltage to the PCM used to calculate catalytic converter integrity.

The KS:

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal which retards the ignition timing, as necessary.

The CMCV:

- improves the upper rpm power.

The variable camshaft timing (VCT) oil control solenoid:

- The VCT oil control solenoid is an electrically controlled hydraulic valve that directs engine oil to the variable camshaft. Once the PCM transmits a signal, the solenoid moves a valve spool, directing oil into the camshaft phaser cavity. This action changes valve timing by either inducing an advance or retard condition. The camshaft is, thereby repositioned in relation to crankshaft timing and allows for optimum engine performance and lower emissions.

Electronic Engine Controls

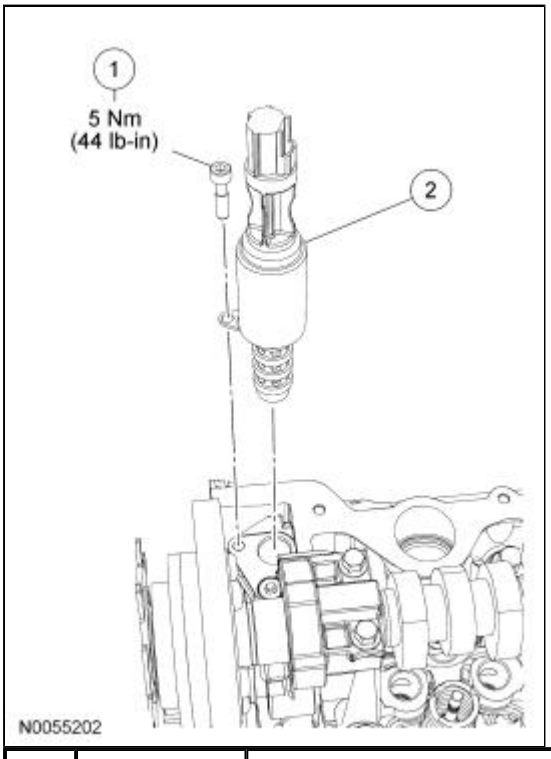
Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Variable Camshaft Timing (VCT) Oil Control Solenoid

Printable View (123 KB)

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	6C260	Variable camshaft timing (VCT) oil control solenoid bolt
2	6C297	VCT oil control solenoid

Removal and Installation

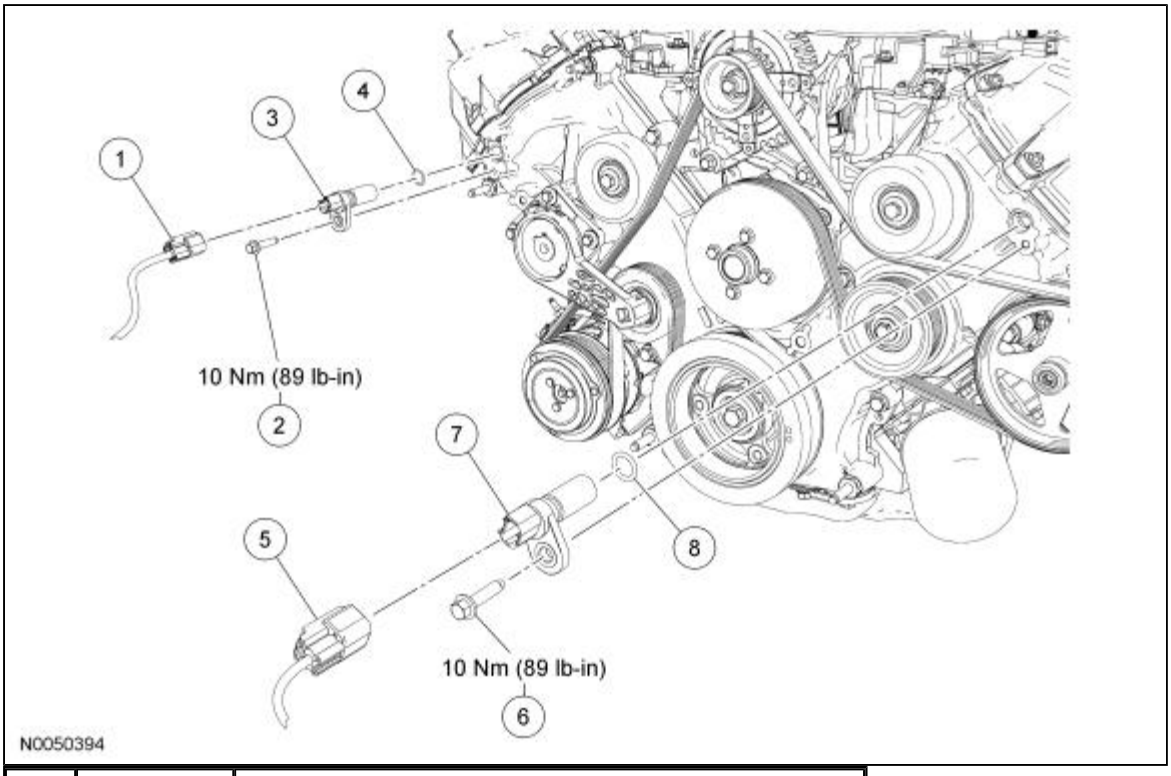
1. Remove the valve cover. For additional information, refer to Section 303-01 .
2. Remove the bolt and the variable camshaft timing (VCT) oil control solenoid.
   - To install, tighten to 5 Nm (44 lb-in).
3. To install, reverse the removal procedure.

Camshaft Position (CMP) Sensor

Printable View (204 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	—	RH camshaft position (CMP) sensor electrical connector (part of 12B637)
2	N806155	RH CMP sensor bolt
3	6B288	RH CMP sensor
4	—	RH CMP sensor O-ring seal (part of 6B288)
5	—	LH CMP sensor electrical connector (part of 12B637)
6	N806155	LH CMP sensor bolt
7	6B288	LH CMP sensor
8	—	LH CMP sensor O-ring seal (part of 6B288)

Removal and Installation

LH camshaft position (CMP) sensor

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

All CMP sensors

2. Disconnect the CMP sensor electrical connector.

3. Remove the bolt and the CMP sensor.
    - To install, tighten to 10 Nm (89 lb-in).
    - Lubricate the O-ring seal with clean engine oil prior to installation.

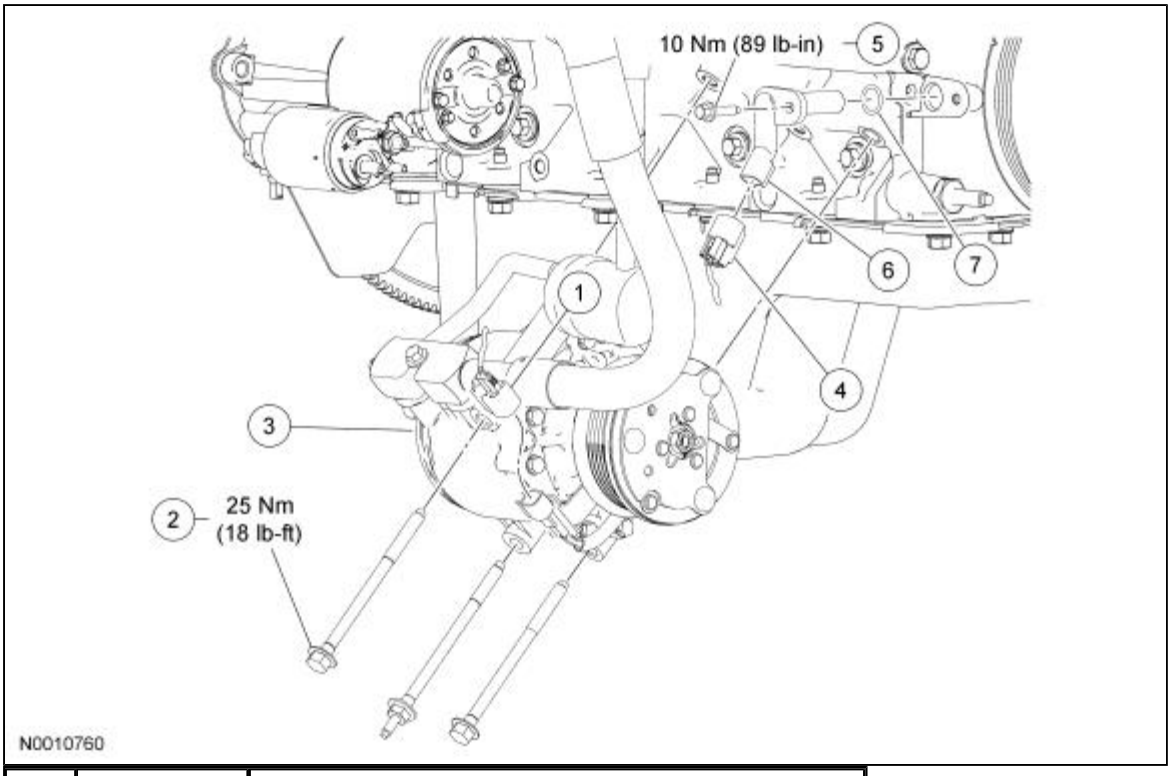
4. To install, reverse the removal procedure.

Crankshaft Position (CKP) Sensor

Printable View (153 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	19703	A/C compressor electrical connector
2	N806184	A/C compressor bolt (3 required)
3	19703	A/C compressor
4	14A464	Crankshaft position (CKP) sensor electrical connector
5	N806155	CKP sensor bolt
6	6C315	CKP sensor
7	—	CKP sensor O-ring seal

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

3. Disconnect the A/C compressor electrical connector.

4. Remove the 3 bolts and position the A/C compressor aside.
   - To install, tighten to 25 Nm (18 lb-ft).

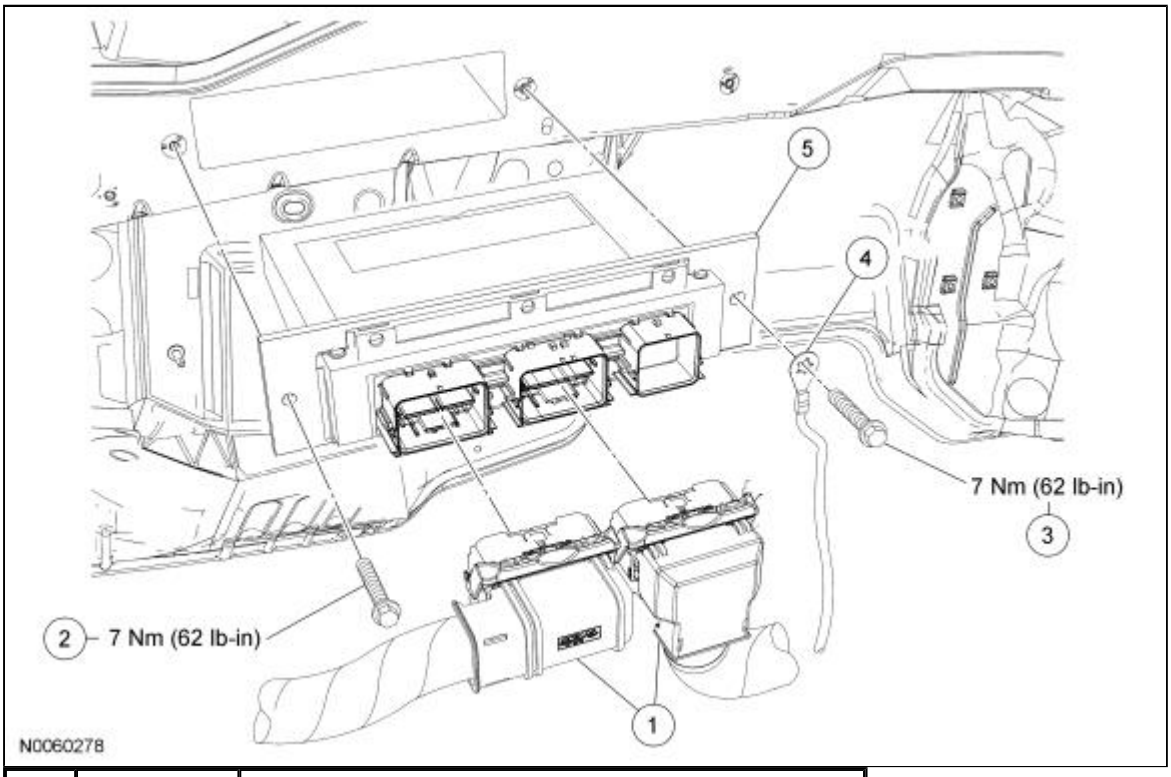
5. Disconnect the crankshaft position (CKP) sensor electrical connector.

6. Remove the bolt and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).
   - Lubricate the O-ring seal with clean engine oil prior to installation.

7. To install, reverse the removal procedure.

Powertrain Control Module (PCM)

Printable View (200 KB)



Item	Part Number	Description
1	14A464	Powertrain control module (PCM) electrical connectors (2 required)
2	W505428	PCM bolt
3	W505428	PCM bolt
4	W505428	Ground cable
5	AAA1001	PCM

Removal and Installation

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. For additional information, refer to Section 418-01
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the 2 PCM electrical connectors.
4. Remove the 2 bolts and the ground cable.
   - To install, tighten to 7 Nm (62 lb-in).
5. Remove the PCM.
6. To install, reverse the removal procedure.

Installation

1. Install the PCM.

2. Position the ground cable and install the 2 bolts.
   - Tighten to 7 Nm (62 lb-in).

3. Connect the 3 PCM electrical connectors.

4. Connect the battery ground cable. For additional information, refer to Section 414-01 .

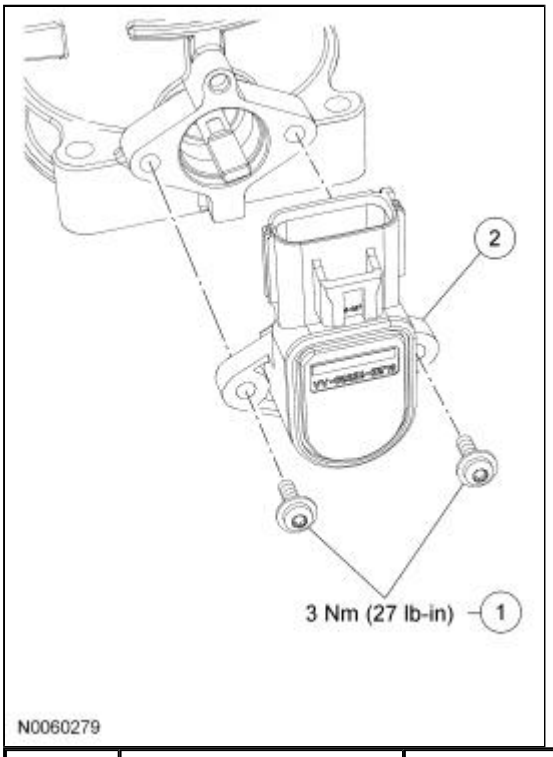
5. **NOTE:** When a new PCM is installed, the air bag warning indicator will illuminate when the ignition switch is ON. The warning indicator will remain on until PCM configuration is restored

   NOTE: Clear all restraints control module (RCM) continuous diagnostic trouble codes (DTCs) after Programmable Module Installation procedure has been completed on the PCM.

   Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation procedure. For additional information, refer to Section 418-01

Throttle Position (TP) Sensor

Printable View (120 KB)



Item	Part Number	Description
1	W707535	TP screws (2 required)
2	9E928	TP sensor

Removal

1. Remove the throttle body (TB). For additional information, refer to Section 303-04 .
2. **CAUTION: Failure to remove the TP sensor screws in the following manner will result in damage to the screws. First loosen the screws 1-2 full turns using a hand tool and then use a suitable high speed driver to complete the removal.**

   Remove and discard the 2 screws and the TP sensor.

Installation

1. **CAUTION: Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.**

   CAUTION: Do not use a high speed driver to install the new screws or damage to the TP sensor can occur.

   NOTE: When installing the new TP sensor, make sure that the radial locator tab on the TP sensor is aligned with the radial locator hole on the throttle body.

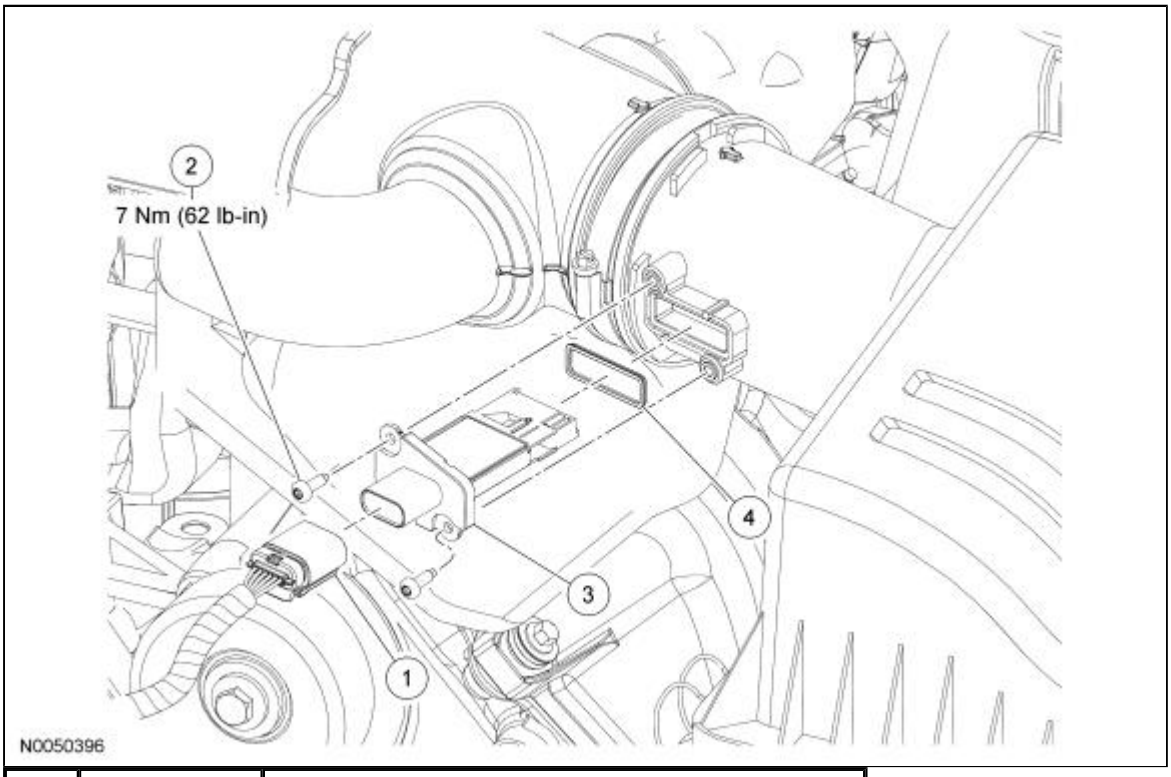
Position the new TP sensor and install the 2 new screws.

- Tighten to 3 Nm (27 lb-in).

2. Install the TB. For additional information, refer to Section 303-04 .

Mass Air Flow (MAF) Sensor

Printable View (182 KB)



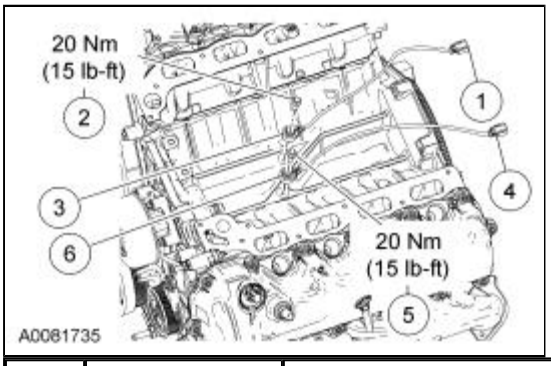
Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector
2	W505562	MAF sensor bolts (2 required)
3	12B579	MAF sensor
4	—	MAF sensor seal (part of 12B579)

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector.
2. Remove the 2 bolts and the MAF sensor.
   - To install, tighten to 7 Nm (62 lb-in).
3. To install, reverse the removal procedure.

Knock Sensor (KS)

Printable View (116 KB)



Item	Part Number	Description
1	14A464	RH knock sensor (KS) electrical connector
2	W500225	RH KS bolt
3	12A699	RH KS
4	14A464	LH KS electrical connector
5	W500225	LH KS bolt
6	12A699	LH KS

Removal and Installation

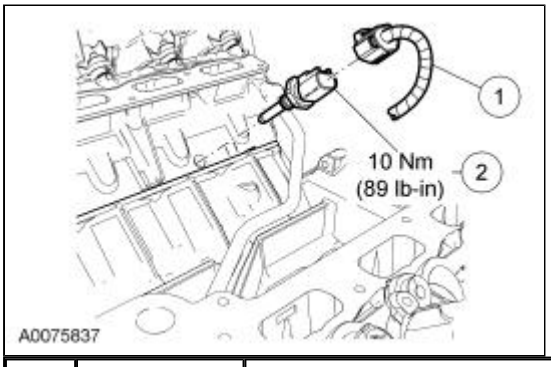
1. Remove the intake manifold. For additional information, refer to Section 303-01 .
2. Disconnect the knock sensor (KS) electrical connectors.
3. Remove the 2 bolts and the 2 knock sensors.
   - To install, tighten to 20 Nm (15 lb-ft).
4. To install, reverse the removal procedure.

Cylinder Head Temperature (CHT) Sensor

Printable View (100 KB)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M99B176-A



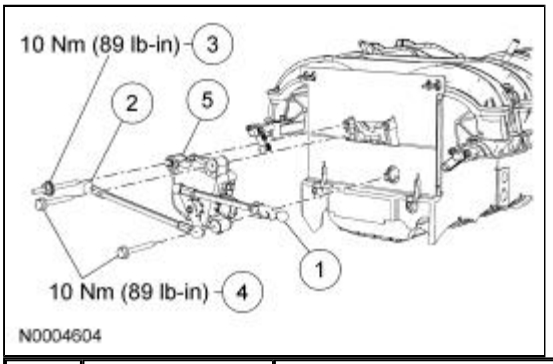
Item	Part Number	Description
1	14B102	Cylinder head temperature (CHT) sensor jumper harness
2	6G004	CHT sensor

Removal and Installation

1. Remove the intake manifold. For additional information, refer to Section 303-01 .
2. Disconnect the cylinder head temperature (CHT) sensor jumper harness electrical connector.
3. Remove and discard the CHT sensor.
   - To install, tighten to 10 Nm (89 lb-in).
   - Coat the CHT sensor threads with high temperature nickel anti-seize lubricant prior to installation.
4. To install, reverse the removal procedure.

Charge Motion Control Valve (CMCV)

Printable View (94 KB)



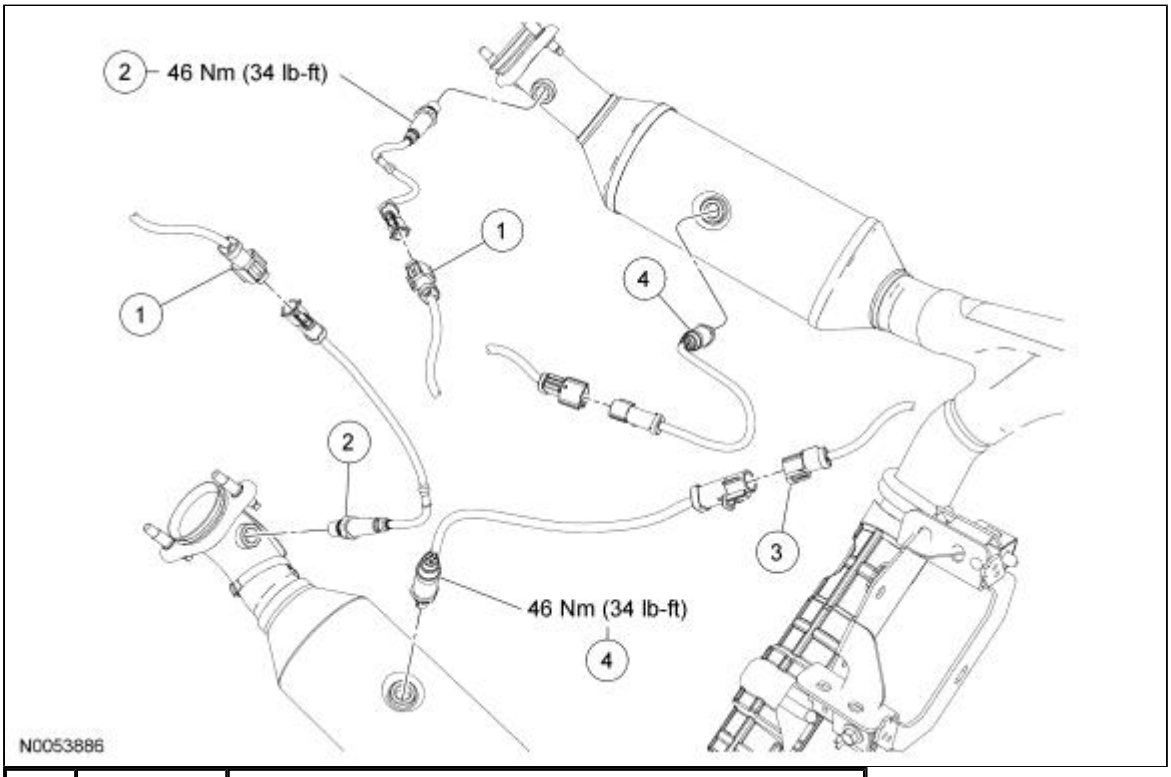
Item	Part Number	Description
1	9B841	Charge motion control valve (CMCV) RH rod
2	9B842	CMCV LH rod
3	W709084	CMCV stud bolt
4	W708165	CMCV bolts (2 required)
5	9L490	CMCV

Removal and Installation

1. Remove the intake manifold. For additional information, refer to Section 303-01 .
2. Disconnect the charge motion control valve (CMCV) RH and LH rods from the intake manifold.
3. Remove the stud bolt, the 2 bolts and the CMCV.
   - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.

Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor — Exploded View

Printable View (141 KB)



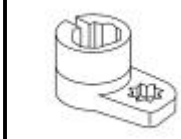
Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connectors (part of 12B637) (2 required)
2	9F472	HO2S (2 required)
3	—	Catalyst monitor sensor electrical connectors (part of 12B637) (2 required)
4	9G444	Catalyst monitor sensor (2 required)

1. For additional information, refer to the procedures in this section.

Heated Oxygen Sensor (HO2S)

Printable View (102 KB)

Special Tool(s)

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	—

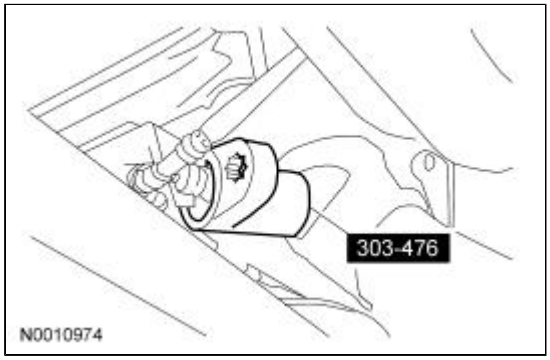
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the heated oxygen sensor (HO2S) electrical connector.

3. **NOTE:** If necessary, lubricate the HO2S with penetrating and lock lubricant to aid in removal.

   Using the special tool, remove the HO2S.
   - To install, tighten to 46 Nm (34 lb-ft).

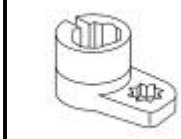


4. To install, reverse the removal procedure.
   - Apply a light coat of nickel anti-seize lubricant to the threads of the HO2S.

Catalyst Monitor Sensor

Printable View (102 KB)

Special Tool(s)

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

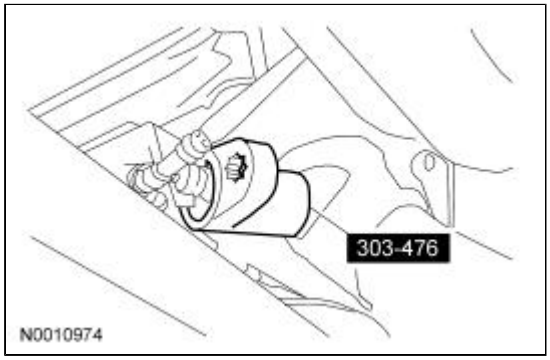
Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	—

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the catalyst monitor sensor electrical connector.
3. **NOTE:** If necessary, lubricate the HO2S with penetrating and lock lubricant to aid in removal.

   Using the special tool, remove the catalyst monitor sensor.
   - To install, tighten to 46 Nm (34 lb-ft).



4. To install, reverse the removal procedure.
   - Apply a light coat of nickel anti-seize lubricant to the threads of the HO2S.

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General Specifications

Item	Specification
Fluid	
CAUTION: MERCON®, MERCON® V and MERCON® SP are not interchangeable transmission fluids. The use of any other fluid or cleaning agents will cause internal transmission damage.	
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Fluid Capacities	
All	9L (9.5 quarts)
Fluid Filter	
Internal to the transmission.	—
Lubricants	
Multi-Purpose Grease XG-4 and/or XL-5	ESB-MIC93-B
Automatic Transmission/Power Steering Dye 164-R3701 or equivalent	—

Clutch Application Chart

Gear	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
Park				X	
Reverse		X		X	
Neutral				X	
First Gear Manual	X			X	
Second Gear Manual	X		X		
Third Gear Manual	X	X			
First Gear D	X			X	
Second Gear D	X		X		
Third Gear D	X	X			
Fourth Gear D	X				X
Fifth Gear D		X			X
Sixth Gear D			X		X

Clutch Application Chart

Gear	SS A (EDS1)	SS B (EDS2)	SS C (EDS3)	SS D (EDS4)	PC A (EDS5)	TCC (EDS6)	SS E (MV1)	REV (MV3) [a]
Park				X	a			
Reverse		X		X				b

					a			
Neutral				X	a			
First Gear Manual	X			X	a	a		
Second Gear Manual	X		X		a	a		
Third Gear Manual	X	X			a	a		
First Gear D	X			X	a	a		
Second Gear D	X		X		a	a		
Third Gear D	X	X			a	a		
Fourth Gear D	X			X	a	a	X	
Fifth Gear D		X		X	a	a	X	
Sixth Gear D			X	X	a	a	X	

[a] TCM Controlled
[b] Reverse back up lamps

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Stall Speed

Min	Max
2,231	2,631

End Play

Item	Specifications
Forward Clutch (A)	0.71-1.10 mm (0.028-0.043 in)
Direct Clutch (B)	0.50-1.30 mm (0.020-0.051 in)
Intermediate Clutch (C)	0.71-1.10 mm (0.028-0.043 in)
Low/Reverse Clutch (D)	5.08-5.73 mm (0.200-0.226 in)
Overdrive Clutch (E)	0.50-0.90 mm (0.020-0.035 in)

Clutch Plate Quantity

Component	Number of Frictions	Number of Separator Plates	Separator Plate Thickness	Number of Pressure Plates	Pressure Plate Thickness
Forward Clutch (A)	5	6	3.0 mm (0.11 in)	1	3.0 mm (0.11 in)
Direct Clutch (B)	5	5	2.1 mm (0.08 in)	1	3.9 mm (0.15 in)
Intermediate Clutch (C)	5	5	3.0 mm (0.11 in)	1	3.9 mm (0.15 in)
Low/Reverse (D)	7	7	2.1 mm (0.08 in)	Select	5.4 mm (0.21 in)
				Select	5.7 mm (0.22 in)
			2.1 mm (0.08 in)	Select	6.0 mm (0.23 in)
Overdrive Clutch (E)	6	6	3.0 mm (0.11 in)	1	3.0 mm (0.11 in)

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet.
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	MPH	Km/H
Light Throttle	1-2	7-11	11-18
	2-3	18-22	29-36
30% Pedal Travel	3-4	25-29	40-46
	4-5	35-40	56-64
APP_D = 30	5-6	42-46	68-76
Closed Throttle	6-5	38-44	61-71
	5-4	28-34	45-55
	4-3	18-24	29-38
	3-2	3-8	5-13
	2-1	1-4	1-6
Wide Open Throttle	1-2	20-28	32-45
(WOT)	2-3	45-59	72-94
	3-4	76-88	120-140

Output Shaft End Play

Item	Specifications
End Play	0.15-0.35 mm (0.006-0.013 in)

Input Shaft End Play

Item	Specifications
End Play	0.2-0.4 mm (0.008-0.015 in)

Forward Clutch Pack (A)

Item	Specifications
Clearance	0.71-1.10 mm (0.028-0.043 in)

Direct Clutch Pack (B)

Item	Specifications
Clearance	0.50-1.30 mm (0.020-0.051 in)

Intermediate Clutch Pack (C)

Item	Specifications
Clearance	0.71-1.10 mm (0.028-0.043 in)

Low/Reverse Clutch Pack (D)

Item	Specifications
Clearance	5.08-5.73 mm (0.200-0.266 in)

Overdrive Clutch Pack (E)

Item	Specifications
Clearance	0.50-0.90 mm (0.020-0.035 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Detent spring bolts [a]	—	—	—
Dual converter Y-pipe bolts	40	30	—
Evaporative emissions canister assembly bolt	15	11	—
Exhaust flange nuts	40	30	—
Exhaust heat shield	15	11	—

Flexplate inspection cover	35	26	—
Front pump bolts (inner)	15	11	—
Front pump bolts (outer)	10	—	89
Front pump stator-to-cover outer bolts	15	11	—
Ground wire nut	23	17	—
Mechatronic bolts [a]	—	—	—
Output shaft flange nut	80	59	—
Park pawl actuating plate	10	—	89
Park pawl pin bolt	35	26	—
Rear fuel line bracket bolt	25	18	—
Rear transmission crossmember-to-frame nuts and bolts	90	66	—
Selector lever cable bracket bolts	48	35	—
Starter B+ cable	12	9	—
Starter cable (small)	6	—	53
Starter motor bolts	26	19	—
Torque converter nuts	35	26	—
Transmission case bolts	48	35	—
Transmission fluid cooler tube bracket nut	27	20	—
Transmission fluid cooler tubes bracket bolt	23	17	—
Transmission fluid fill plug	35	26	—
Transmission fluid pan bolts	12	9	—
Transmission insulator bolts	90	66	—
Transmission insulator nuts	103	76	—

[a] Specific tightening sequence is required. See the procedure in this section.

Transmission Description

Printable View (108 KB)

This transmission uses planetary gears with hydraulic electronic controls. The transmission control module (TCM) and the main control valve body units form a composite element that is installed as a single unit inside the automatic transmission.

This transmission has the following features:

- Six forward speeds
- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear set
- Double planetary gear set
- Two fixed multi-disc clutches
- Three multi-plate clutches

All hydraulic functions are directed by electronic solenoids to control:

- engagement feel.
- shift feel.
- shift scheduling.
- modulated torque converter clutch (TCC) applications.

This transmission has a mechatronic unit also referred to as a transmission control module (TCM) which contains:

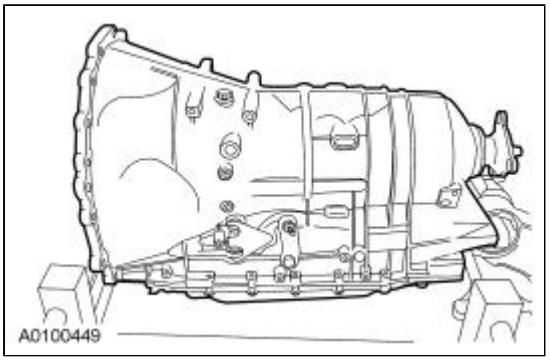
- Turbine shaft speed (TSS) sensor
- Output shaft speed (OSS) sensor
- An internal P, R, N, D selector shaft position sensor
- Transmission fluid temperature (TFT) sensor

Engine power reaches the transmission by a torque converter with an integral converter clutch. The 6 forward gears and one reverse gear are obtained from single planetary sets.

This automatic transmission is a 6-speed electronically controlled transmission comprising the basic elements of a TCM, main control valve body unit, torque converter, one solenoid valve and 6 pressure regulators. Gear selection is achieved by the control of automatic transmission fluid flow to operate various internal clutches. The TCM operates the electrical components and provides for the control of gear selection shift pressure which increases refinement and torque converter slip.

In the event of a system fault, the TCM also provides for failure mode effect management (FMEM) to maintain maximum functional operation of the transmission with a minimum reduction in driver, passenger or vehicle safety. In the event of a total loss of control or electrical power, the basic transmission functions PARK, REVERSE, NEUTRAL and DRIVE are retained. Also 3rd or 5th gear is retained by the hydraulic system. The gear retained is dependent upon the gear selected at the time of the failure.

Automatic Transmission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Identification Tags

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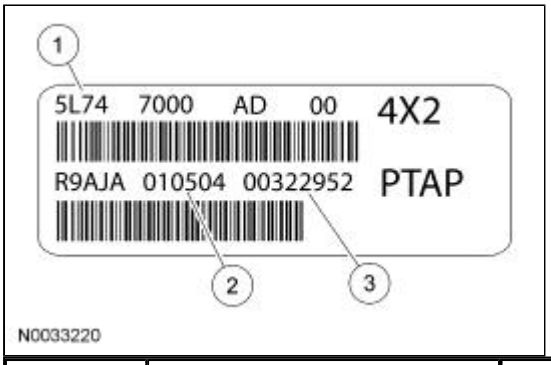
The identification tag is located on the left side of the case just rearward of the manual control lever.



Item	Part Number	Description
1	—	Part number
2	—	Build date
3	—	Serial number

Range Selection

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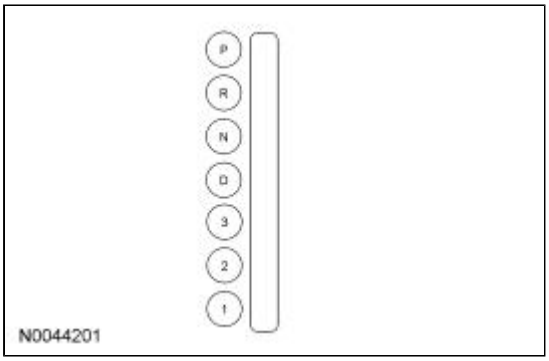
The transmission has 7 range positions: P, R, N, D, 3, 2 and 1.



Park

In the PARK position:

- there is no power flow through the transmission.
- the parking pawl locks the output shaft to the case.
- the engine can be started.
- the ignition key can be removed.

Reverse

In the REVERSE position:

- the vehicle can be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine can be started.

D

The D is the normal position for most forward driving.

The D position provides:

- automatic shifts 1-6 and 6-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in all gears.

Manual 3 Position

This position provides:

- manual 3rd gear.
- engine braking in 3rd gear.

Manual 2 Position

This position provides:

- manual 2nd gear.
- engine braking in 2nd gear.

Manual 1 Position

This position provides:

- manual 1st gear.
- engine braking for descending steep grades.

Shift Patterns

Printable View (64 KB)

Downshifts

Under certain conditions, the transmission will downshift automatically to a lower gear range (without moving the range selector lever). There are 3 categories of automatic downshifts:

- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Torque Converter

Printable View (63 KB)

The torque converter is a 3-element unit containing a dual-plate clutch. The clutch can be controlled and engaged in any gear 1st to 6th. Calibration parameters may be set to allow lock-up in a higher gear only. The clutch is applied by removing fluid pressure from one side of the plate. The torque converter transmits and multiplies torque. The torque converter includes the following 3 elements:

- Impeller assembly
- Turbine assembly
- Reactor assembly

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

Torque Converter Clutch

The torque converter clutch is a device that reduces slip in the torque converter and, therefore, helps to keep fuel consumption to a minimum.

The torque converter clutch is engaged and released by the control system.

Pressure at the torque converter clutch piston is determined by an electronic pressure control valve.

Geartrain

Printable View (64 KB)

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Clutches are used to hold and drive certain combinations of gearsets. This results in 6 forward ratios and 1 reverse ratio which are transmitted to the output shaft and differential. The ratios are as follows:

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Single Planetary Gearset

The single planetary gear overdrive carrier is driven by the input shaft. The single planetary gear set consists of the following components:

- One sun gear
- Four planetary gears meshing with the sun gear
- One planetary carrier
- One ring gear

Ravigenaux Planetary Gearset

The ravigenaux planetary gearset is splined to the output shaft and consists of the following components:

- Two sun gears of different sizes
- Three short planetary gear pinions meshing with the sun gears
- Three long planetary gear pinions meshing with the sun gears
- One planetary carrier
- One ring gear

Output Shaft

The output shaft provides torque to the driveshaft and rear axle assembly. It is driven by the ring gear of the planetary gearset.

Apply Components

Printable View (65 KB)

Shift Elements

In addition to the torque converter, the other shift elements are:

- three rotating multi-plate clutches: forward, direct and overdrive.
- two fixed multi-disc brakes: intermediate and overdrive.

All gear shifts from 1st to 6th or from 6th to 1st are power-on overlapping shifts. That is, during the shift one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The transmission fluid pressure builds up between the cylinder and the piston, pressing the clutches together.

The purpose of these shift elements is to carry out in-load shifts with no interruption to traction.

Multi-plate clutches, forward, direct and overdrive, supply power from the engine to the planetary geartrain. Multi-disc brakes intermediate and low/reverse press against the transmission housing in order to achieve a torque reaction effect.

Multi-Plate Clutch

Clutches, overdrive, forward and direct, are balanced in terms of dynamic pressure. That is, their piston is exposed to the transmission fluid flow on both sides, in order to prevent pressure buildup in the clutch as speed increases. This equalization process is achieved by a baffle plate and pressure-free transmission fluid supply by a lubricating passage, through which the space between piston and baffle plate is filled with transmission fluid.

The advantages of this dynamic pressure equalization are:

- reliable clutch engagement and release in all speed ranges.
- improved shift refinement.

Shift Overlap Control

The electronic-hydraulic shift action is obtained by means of various valves in the transmission control module (TCM) and main control valve body, actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

Hydraulic Systems

Fluid Pump

The torque converter is supported in the fluid pump by a needle roller bearing. The fluid pump is driven directly from the engine by the torque converter shell and supplies transmission fluid to the transmission and the hydraulic control unit.

The fluid pump draws in transmission fluid through a filter and delivers it at high pressure to the main pressure valve in the main control valve body unit. The valve adjusts the pressure and returns excess transmission fluid to the fluid pan.

Fluid Pan, Gasket and Filter

This transmission has a unique steel pan with 2 magnets. A single use pan gasket that seals the pan to the case. All transmission fluid is drawn from the transmission fluid pan by the fluid pump and passes through the filter.

Transmission Electronic Control System

Printable View (74 KB)

Transmission Electronic System

The transmission control module (TCM) and its input/output network control the following operations:

- Shift timing
- Clutch pressure (shift feel)
- Line pressure (shift feel)
- Torque converter clutch

In addition, the TCM receives input signals from certain transmission-related sensors. The TCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the TCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimize shift feel. To accomplish this, the TCM uses 6 pressure control solenoids and 1 shift solenoid to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Transmission Control Module (TCM) and Main Control Valve Body

The TCM and main control valve body are a combination of hydraulic and electronic control units. Both of these modules are installed in the transmission inside the transmission fluid pan.

Transmission Control Module (TCM)

The TCM for the transmission is mounted on top of the main control valve body. The control module for the transmission has been designed to operate correctly in the environment in which the TCM is located.

The TCM is activated and deactivated by the ignition supply and is connected to the transmission link harness by a 16-pin connector.

The TCM controls the operation of the transmission. The TCM processes information in both analog and digital forms, such as:

- transmission input speed.
- transmission output speed.
- throttle position.
- gear selection.
- engine torque.
- engine speed.
- transmission fluid temperature.
- brake pedal position.
- engine oil temperature.
- engine coolant temperature.
- ABS wheel speed.

The information is then used by the TCM to decide which shift pattern to select and for shift energy

management. Electro-hydraulic solenoid valves and pressure regulators control the transmission gear changes.

Five pressure regulators and one solenoid valve are used to control direct transmission fluid flow to select internal clutches and control the fluid pressure at the clutch. A separate pressure regulator is used exclusively for torque converter clutch control.

The TCM monitors all TCM inputs and outputs to confirm correct system operation. If a fault occurs, the TCM is able to carry out default action. It informs the driver of the problem through the instrument cluster diagnostic MIL light.

The TCM will shut down if the TCM hardware temperature rises above a predetermined temperature. Prior to shutting down, the TCM will log a fault code and enter a mechanical limp home mode.

Solenoids

The hydraulic module contains 1 solenoid valve. The solenoid valve is activated by the TCM and is either open or closed. It is used to switch the position valve.

There are 6 electronic pressure control valves, which convert an electronic current into a proportional hydraulic pressure. They are energized by the TCM and actuate the valves belonging to the relevant switching elements.

Controller Area Network (CAN) Interface

For the transmission control module (TCM) to carry out shift point and shift quality management, a number of external signals are required. For shift point management alone, the TCM requires output speed sensor, throttle pedal position, brake pedal status, gear selection position, transmission fluid temperature, four wheel drive (4WD) position, traction control, engine speed and engine torque. The controller area network (CAN) bus is used to share information between control modules.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the TCM when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects the temperature of the engine coolant and supplies the information to the TCM. The ECT is installed in the heater outlet fitting or cooling passage on the engine. For engine control applications, the ECT signal is used to modify ignition timing, EGR flow and air-to-fuel ratio as a function of engine coolant temperature.

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal. The APP sensor detects the position of the accelerator pedal and inputs this information as a voltage to the powertrain control module (PCM). The PCM broadcasts the APP on the CAN bus. The transmission control module (TCM) reads APP off the CAN message. The PCM uses the APP sensor information to aid in determining shift scheduling and torque converter (TCC) control.

Turbine Shaft Speed (TSS) Sensor

The turbine shaft speed (TSS) sensor is a Hall-effect type sensor.

The sensor is mounted internally and is located on the transmission control module.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a Hall-effect type sensor.

The sensor is mounted internally and is located on the transmission control module.

Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is located on the TCM. The TCM uses the sensor input to activate various shift strategies. The sensor is in the form of a temperature-dependent resistor.

The resistance value of the transmission fluid temperature (TFT) sensor varies with temperature change. The TCM monitors the voltage across the TFT to determine the temperature of the transmission fluid.

The TCM uses this initial signal to determine whether a cold start shift schedule is necessary. The TCM also inhibits torque converter clutch operation at low transmission fluid temperatures.

Transmission Range (TR) Sensor

The TCM uses the position of this switch, housed in the TCM, to determine the selected gear range from the range selector lever.

The sensor completes the start circuit in PARK and NEUTRAL, and the back-up lamp circuit in REVERSE. The sensor also opens/closes a set of switches that are monitored by the TCM to determine the position of the manual lever (P, R, N, D, 3, 2 and 1).

Transmission Operational Strategies

Adaptive Shift Strategy

Adaptive shift strategy is comprised of:

- Shift Energy Management — this function involves reducing or increasing engine output torque during shifting.
    - Reduces excessive energy of the friction packs
    - Increases transmission service life
    - Improves shift quality
    - Unique shift schedules are selected based on vehicle operation conditions and environmental conditions
    - Trailer towing mode
- Pressure Modulation — this function monitors the hydraulic pressure in a shift. This pressure must be matched accurately to the transmission input torque to better provide shift comfort.
- Shift Quality Adapts — is used to provide a higher quality and consistent shift feel. Monitoring and adapting shift pressures and shift energy to overcome hardware variability over time achieve this.
- The TCM has the ability to control the engine output torque during the shift, synchronized with the operation of the transmission clutches.
- Trailer towing mode uses a different shift and converter map. This new map reduces the number of gearshifts when towing, climbing steep hills and while driving at higher altitudes.

TCM Monitoring Functions

The TCM monitors all transmission input and output to identify possible transmission failures. If a fault is detected, the TCM takes the appropriate action to make sure that the transmission enters a safe mode of operation.

- Voltage Supply — this function monitors the vehicle battery voltage.
- Watchdog Monitoring — the watchdog monitoring has 2 functions:
    - Checks for faults in the driver circuits by activating each driver.
    - Checks to see if the safety circuit is functioning correctly.

- TCM Temperature — If the TCM temperature rises above a predetermined temperature, the TCM will shut down. Prior to shutting down, the TCM will log a fault code during shutdown. The transmission will enter a mechanical limp home mode.
- Pressure Regulator/Solenoid — Each pressure regulator and solenoid is monitored for open and short circuits. The TCM also checks that the current being delivered to each solenoid valve or pressure regulator is within limits.
- Torque Converter Control — The TCM checks and verifies that the torque converter has been engaged correctly. If the torque converter has not engaged correctly, the TCM will carry out the fail-safe action of opening the converter clutch.

Diagnostic Strategy

Printable View (80 KB)

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- OASIS Messages
- Technical Service Bulletins (TSBs)
- Wiring Diagram

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check shift linkages for correct adjustment.
- Check TSBs and OASIS messages regarding the concern.

Diagnostics

- Carry out on-board diagnostic procedures Key On/Engine Off (KOEO) and Key On/Engine Running (KOER).
- Record all diagnostic trouble codes (DTCs).
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, go to Diagnosis By Symptom in this section for additional information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Printable View (66 KB)

Prior to carrying out the flow test, the following items should be checked:

- Know and understand the customer concerns.
- Check the fluid level and condition.
- Verify the concern by operating the vehicle.
- Check for non-factory-installed items and verify correct installation.
- Check the shift linkage adjustments.
- Check TSBs and OASIS messages for vehicle concerns.
- Carry out quick test both KOER and KOEO.
- Record all codes.
- Verify that the vehicle transmission control module (TCM) is at the latest calibration release level.

Diagnostic Flow Chart		
1) Did you record any diagnostic trouble codes (DTCs)?	Yes	· REPAIR all hard DTCs. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first, then this workshop manual, then GO to Step 2.
	No	· REFER to Diagnosis By Symptom in this section, then GO to Step 5.
2) Are any continuous test memory codes present?	Yes	· CLEAR codes and CARRY OUT drive cycle test, then GO to Step 3.
	No	· GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	· REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, then this workshop manual, then GO to Step 4.
	No	· GO to Step 4.
4) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	· REFER to Diagnosis By Symptom in this section to diagnose and repair the concern, then GO to Step 5.
5) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	· GET assistance from Technical Hotline.

Preliminary Inspection

Printable View (86 KB)

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions, including when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to Verification of Condition.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The torque converter clutch not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshifting
- Downshifting
- Coasting
- Engagement
- Noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent.

Check Fluid Level and Condition

Fluid Level Check

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure could result.

NOTE: The transmission fluid temperature must not be allowed to exceed 50°C (122°F) when checking the fluid level. The fluid temperature should be between 30°C-50°C (86°F-122°F) closer to 50°C (122°F) when checking the fluid level.

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and can result in transmission failure.

Under normal circumstances, the fluid level should not be checked during normal maintenance. If the transmission starts to slip, shifts slowly or shows signs of fluid leaking, the fluid level should be checked.

1. With the transmission in PARK, the engine at idle (550-750 rpm) and foot pressed on the brake, move the range selector lever through each gear and allow engagement of each gear. Place the transmission range selector lever in the PARK position.

2. With the engine idling (550-750 rpm) in PARK, position it on a hoist.

3. Remove the fluid fill plug located on the side of the transmission case.

4. Partially add fluid until fluid starts to come out. Wait until the fluid stops or just drips from the hole.

5. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).

High Fluid Level

CAUTION: A fluid level that is too high can cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission failure.

If an overfill reading is indicated, drain and refill the transmission.

Low Fluid Level

A low fluid level can result in poor transmission engagement, slipping or failure. This may also indicate a leak in one of the transmission seals or gaskets.

Adding Fluid

CAUTION: The use of any other type of transmission fluid than specified can result in transmission failure.

If fluid must be added, add fluid in 0.5 liter (1/2 quart) increments through the fluid fill plug. Do not overfill the fluid. For fluid type, refer to the specification chart.

Fluid Condition Check

1. Check the fluid level.

2. Remove the fluid fill plug and allow the fluid to drip onto a facial tissue and examine the stain.

3. **NOTE:** The transmission fluid could be 2 different colors. The factory fill fluid is amber. The replacement fluid is red.

   Observe the color and the odor. The color under normal circumstances should be dark reddish or clear, not black or have a burnt odor.

4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

5. If the stain is a foamy pink color, this may indicate coolant in the transmission. The engine cooling system should also be inspected at this time.

6. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the fluid pan, the transmission must be disassembled and completely cleaned. This includes the torque converter and fluid cooler tubes. A new oil-to-air cooler must be installed.

Shift Point Road Test

Printable View (66 KB)

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with transmission range selector lever in DRIVE position.
3. Apply minimum throttle and observe speeds at which upshift occurs and torque converter engages. Refer to the Shift Speeds chart in this section.
4. With the transmission in DRIVE, move the range selector lever into the 3 position. The transmission should downshift to 4th gear. Release the accelerator pedal; engine braking should occur.
5. Press the accelerator pedal to the floor, wide open throttle (WOT). Transmission should shift from 4th to 3rd, depending on vehicle speed. The torque converter clutch should disengage and then reapply.
6. With the transmission in DRIVE position and speed above 80 km/h (50 mph) and less than half throttle, move the transmission range selector lever from DRIVE position to manual 2 position and remove pressure from the accelerator pedal. The transmission should downshift into 2nd gear. With the vehicle remaining in manual 2 position, move the transmission range selector lever into manual 1 position and release the accelerator pedal. The transmission should downshift into 1st gear at speeds below approximately 45-56 km/h (28-35 mph).
7. If the transmission fails to upshift/downshift or the torque converter clutch does not apply and release, refer to Diagnosis By Symptom in this section.

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet.
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	MPH	Km/H
Light Throttle	1-2	7-11	11-18
	2-3	18-22	29-36
30% Pedal Travel	3-4	25-29	40-46
APP_D = 30	4-5	35-40	56-64
	5-6	42-46	68-76
Closed Throttle	6-5	38-44	61-71
	5-4	28-34	45-55
	4-3	18-24	29-38
	3-2	3-8	5-13

	2-1	1-4	1-6
WOT	1-2	20-28	32-45
	2-3	45-59	72-94
	3-4	76-88	120-140

Torque Converter Diagnosis

Printable View (84 KB)

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary inspection.
2. Know and understand the customer's concern.
3. Verify the condition — carry out the torque converter operation test.
4. Carry out diagnostic procedures.

- Carry out On-Board Diagnostics. Refer to Diagnostics in this section.
  - Repair all non-transmission related diagnostic trouble codes (DTCs) first.
  - Repair all transmission DTCs.
  - Rerun on-board diagnostic to verify repair.
- Carry out Stall Speed Test. Refer to Special Testing Procedures in this section.
- Carry out Diagnostic Routines. Refer to Diagnosis By Symptom in this section.
  - Use the Diagnosis by Symptom to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and repair as required before changing the torque converter.

Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

1. Carry out Quick Test with scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Check for DTCs.
2. Connect a tachometer to the engine.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in DRIVE position.
4. After normal operating temperature is reached, maintain a constant speed of about 80 km/h (50 mph) and tap the brake pedal with the left foot.
5. Engine rpm should increase when the brake pedal is tapped and decrease about 5 seconds after the pedal is released. If this does not occur, see Torque Converter Operation Concerns. Refer to Diagnosis By Symptom in this section.
6. If the vehicle stalls in DRIVE or at idle with the vehicle at a stop, move the transmission range selector lever to the manual 1 position. If the vehicle stalls, see Torque Converter Operation Concerns. Refer to Diagnosis By Symptom in this section. If the vehicle does not stall in DRIVE, refer to Diagnosis By Symptom in this section.

NOTE: The following is a list of common vehicle concerns that have been misdiagnosed as torque converter clutch shudder. For diagnosis of the following items, refer to the appropriate sections of the workshop manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

- Spark plugs — check for cracks, high resistance or broken insulators
- Plug wires
- Fuel injector — filter may be plugged
- Fuel contamination — engine driveability concerns
- Exhaust gas recirculation (EGR) valve — valve may let in too much exhaust gas and cause engine to run lean
- Vacuum leak — engine will not get correct air/fuel mixture
- Manifold absolute pressure (MAP)/mass air flow (MAF) sensor — incorrect air/fuel mixture
- Heated oxygen sensor (HO2S) — too rich/lean air/fuel mixture
- Fuel pressure — may be too low
- Engine mounts — loose/damaged mounts can cause vibration concerns
- Axle joints — check for vibration

Visual Inspection

Printable View (65 KB)

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - Air conditioning
  - Generator (alternator)
  - Engine turbo
  - Cellular telephone
  - Cruise control
  - CB radio
  - Linear booster
  - Backup alarm signal
  - Computer
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module (PCM), transmission control module (TCM) or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.

- Leaks; refer to Leakage Inspection in this section.
- Correct linkage adjustments; refer to Section 307-05 .

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those of the manual lever in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 for shift linkage adjustment.

Check TSBs and OASIS

Refer to all technical service bulletins (TSB) and OASIS messages that pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using the scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostics

Printable View (96 KB)

Special Tool(s)

ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73 III Automotive Meter 105-R0057 or equivalent

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. One of the most important things to remember is that there is a definite procedure to follow. DO NOT TAKE SHORTCUTS OR ASSUME THAT CRITICAL CHECKS OR ADJUSTMENTS HAVE ALREADY BEEN MADE. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics With Scan Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool, refer to the scan tool tester manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual. These quick tests should be used to diagnose the powertrain control module (PCM) and should be carried out in order.

- **Quick Test 1.0 — Visual Inspection**
- **Quick Test 2.0 — Set Up**
- **Quick Test 3.0 — Key On, Engine Off (KOEO)**
- **Quick Test 4.0 — Continuous Memory**
- **Quick Test 5.0 — Key On, Engine Running (KOER)**
  - Special Test Mode
  - Wiggle Test
  - Output Test Mode
  - PCM Reset Mode
  - Clearing DTCs
  - OBD II Drive Cycle
- **Other Scan Tool Features**

For information on other diagnostic testing features using the scan tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Other diagnostic methods include the following:

- Parameter Identification (PID) Access Mode
- Freeze Frame Data Access Mode
- Oxygen Sensor Monitor Mode

Diagnostic Parameters Identification (PID) Chart

Printable View (72 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnostic PID Chart

PID No.	PID Name	Units
ECT	Engine coolant temperature	Degrees
VSS	Vehicle speed sensor— low resolution	MPH
TP	Absolute throttle position sensor	Percent full throttle
VBAT	VPWR: Control module voltage	Volts
APP_A	APP_D: Accelerator pedal position D	Percent
SSA_AMP	Commanded current for shift solenoid A	Amperes
SSB_AMP	Commanded current for shift solenoid B	Amperes
SSC_AMP	Commanded current for shift solenoid C	Amperes
SSD_AMP	Commanded current for shift solenoid D	Amperes
PCA_AMP	Commanded current for pressure control A	Amperes
TCC_AMP	Commanded current for torque converter clutch pressure control	Amperes
SSE_DC	Shift solenoid E duty cycle	Percent
RPM	Engine speed	RPM
VBAT	Battery voltage	Volts
GEAR	Gear commanded (1, 2, 3, 4, 5 and 6)	1, 2, 3, 4, 5 and 6
TCCMACT	Absolute value of slip across torque converter	RPM
RAT_CMD	Current transmission gear ratio commanded	1, 2, 3, 4, 5 and 6
RAT_MES	Current transmission gear ratio measured (input speed/output speed)	1, 2, 3, 4, 5 and 6
TFT	Transmission fluid temperature	Degrees
DSS_SRC	Output shaft speed (OSS) — raw signal	RPM
TSS	Turbine shaft speed (TSS) — raw signal	RPM
TR	PRNDL position	—

Transmission Drive Cycle Test

Printable View (82 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur 4 times consecutively for shift error diagnostic trouble code (DTC) to be set, and 5 times consecutively for continuous torque convertor clutch (TCC) code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, refer to the Solenoid Application Chart for correct solenoid operation.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in DRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into 6th gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in 6th gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stop lamps. Then, hold speed and throttle steady for a minimum of 5 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat Steps 4 through 6 at least 5 times.
8. Carry out Quick Test and record continuous DTCs.
    - If the DTCs are still present, refer to the Diagnostic Trouble Code Chart. Repair all non-transmission DTCs first, as they can directly affect the operation of the transmission. Repeat the Quick Test and the Road Test to verify the correction. Erase the DTCs, carry out the Drive Cycle Test and repeat the Quick Test after completing the repair on the DTC.
    - If the continuous test passes and a concern is still present, refer to Diagnosis By Symptom in this section, OASIS messages and TSBs for concerns.

After On-Board Diagnostic

NOTE: The vehicle wiring harness, powertrain control harness (PCM) and non-transmission sensors

may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Use the Diagnostic Trouble Code chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Diagnostic Trouble Code (DTC) Charts

Printable View (161 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnostic Trouble Code Chart

Five Digit DTC	Component	Description	Condition	Symptom	Action
P0218	TFT	Transmission fluid over temperature condition.	TCM has detected a TFT that has exceeded a set temperature.	Aggressive lock-up schedule.	Carry out normal diagnostic for an overheating condition. Refer to Diagnosis By Symptom in this section.
P0219	PCM	Engine speed signal on CAN too high.	Engine speed signal on CAN too high.	• May turn on MIL • Only 5th Gear • TCC will not engage	Clear all DTCs. Test the system for normal operation. If the DTC returns, refer to the PCED.
P0562	Battery	System voltage low.	TCM has detected a voltage level below minimum voltage to operate solenoids. Maintains current solenoid state.	• No engagements • No adaptive strategy • No self learning strategy • May turn on MIL • Mechanical limp-home mode • Battery voltage below 9 volts	Monitor the appropriate Parameter Identification (PID) to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0563	Battery	System voltage high.	TCM has detected a voltage level above maximum voltage.	• No adaptive strategy • No self learning strategy • May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section and the

				• Battery voltage above 16 volts	Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0603	TCM	Powertrain control module EEPROM error.	TCM has detected an internal software concern with KAM.	—	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0605	TCM	The PCM ROM has been corrupted.	PCM has detected an internal software concern with ROM.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0613	TCM	TCM Processor.	TCM has detected an internal software issue.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the

					new mechatronics unit, it must be reflashed to the latest level calibration.
P0634	TCM	TCM module temperature.	Internal temperature within TCM too high.	• May turn on MIL • Mechanical limp-home mode • Default to 3rd or 5th gear	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0641	TCM	TCM module sensor voltage failed.	Sensor reference voltage A circuit open.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0657	TCM	Actuator supply voltage A circuit open.	Power supply actuators open circuit.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit.

					After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0658	TCM	Actuator supply voltage A circuit low.	Power supply actuators short circuit to ground.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0659	TCM	Actuator supply voltage A circuit high.	Actuator power supply short circuit to power before key ON.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0667	TCM-TFT	PCM, ECM, TCM internal temperature sensor range operation.	Substrate temperature sensor.	• Transmission will shut down or will not shift due to a transmission fluid over temperature condition • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new

					mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0701	Transmission control system	Transmission control system. Range operation.	TCM has detected a concern with the operational strategy.	• Dual DTC code causing transmission default to a hydraulic limp-home mode • May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. Reflash the TCM first. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0705	TR sensor	TR sensor circuit error.	TCM has detected a TR signal (P, R, N, D, 3, 2 or 1) is out of normal range.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0711	TFT sensor	No change in TFT during operation.	PCM has detected no TFT change during operation. TFT valve stuck at some normal reading.	• Firm shift • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the

					DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0712	TFT sensor	TFT sensor circuit grounded.	PCM has detected a voltage drop across TFT sensor, exceeds scale set for temperature (grounded circuit).	• Firm shift • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0713	TFT sensor	TFT sensor circuit short to power.	TCM has detected a voltage drop across TFT sensor, exceeds scale set for temperature.	—	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0714	TFT sensor	TFT intermittent error.	TCM has detected no TFT intermittent operation.	—	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal

					operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0715	TSS sensor	TSS sensor circuit error.	TSS has detected a short circuit to power.	• No TCC engagements • May turn on MIL • Mechanical limp-home mode in 3rd gear • Max line pressure • No adaptive learning strategy • Automatic mode only	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0716	TSS sensor	TSS range or operation insufficient input from TSS.	PCM has detected a loss or noisy TSS signal during operation.	• No TCC engagements • May turn on MIL • Mechanical limp-home mode in 3rd gear • Max line pressure • No adaptive learning strategy • Automatic mode only	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0717	TSS sensor	No TSS signal.	PCM has not detected a TSS signal. No TSS signal when OSS signal is present.	• No TCC engagements • May turn on MIL • Mechanical limp-home mode in 3rd gear • Max line pressure	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the

				• No adaptive learning strategy • Automatic mode only	system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0720	OSS sensor	No OSS signal.	PCM has detected an OSS short circuit to power.	• No TCC engagements • Substitute wheel speed for OSS • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0721	OSS sensor	OSS range or operation insufficient input from OSS.	PCM has detected a loss or noisy OSS signal during operation.	• Harsh shifts • Substitute wheel speed for OSS • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0722	OSS sensor	No OSS signal.	PCM has not detected an OSS signal. No OSS signal when OSS signal is present.	• Harsh shifts • Substitute wheel speed for OSS • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all

					DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0723	OSS sensor	No OSS signal intermittent.	PCM has detected an intermittent signal.	• Harsh shifts • No TCC engagements • Hold in gear currently selected • Max line pressure • No adaptive learning strategy • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0729	Transmission	Sixth gear ratio error.	No 6th gear ratio detected by the TCM.	• No 6th gear • No TCC engagements • May turn on MIL • No adaptive learning strategy • No self learning strategy • Mechanical limp-home mode in 5th gear	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0731	Transmission	First gear ratio error.	No 1st gear ratio detected by the TCM.	• No 1st gear • No TCC engagements • May turn on MIL • No adaptive	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present.

				learning strategy • No self learning strategy • Mechanical limp-home mode in 3rd gear • Max line pressure	Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0781	Transmission	1-2 shift error.	Incorrect ratio calculated during shift 1-2.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 3rd, 2nd or 1st gear • May turn on MIL	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0782	Transmission	2-3 shift error.	Incorrect ratio calculated during shift 2-3.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 4th, 3rd	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the

				or 2nd gear • May turn on MIL	latest level calibration.
P0783	Transmission	3-4 shift error.	Incorrect ratio calculated during shift 3-4.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 4th or 3rd gear • May turn on MIL	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0784	Transmission	4-5 shift error.	Incorrect ratio calculated during shift 4-5.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 5th or 4th gear • May turn on MIL	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0732	Transmission	Second gear ratio error.	No 2nd gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all

					DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0733	Transmission	Third gear ratio error.	No 3rd gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 5th gear	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0734	Transmission	Fourth gear ratio error.	No 4th gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 5th gear	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0735	Transmission	Fifth gear ratio error.	No 5th gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning	Follow preliminary diagnostics. Monitor the appropriate PID to

				strategy • Max line pressure • May turn on MIL • Hold in 5th gear	validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0736	Transmission	Reverse gear ratio error.	No reverse gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 4th gear	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must be reflashed to the latest level calibration.
P0829	Transmission	5-6 shift error.	Incorrect ratio calculated during shift 5-6.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • Mechanical limp-home in 3rd gear	Follow preliminary diagnostics. Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new transmission. After installing the new transmission, the TCM module must

				• Mechanical limp-home in 2nd gear • May turn on MIL	be reflashed to the latest level calibration.
P0960	PC A	PC A circuit or solenoid failure or open circuit.	PC A circuit or solenoid (EDS5) failed during operation.	• No adaptive strategy • No self learning strategy • Max line pressure	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0962	PC A	PC A solenoid signal or ground circuits either short or open solenoid circuit failure.	Voltage through PC A solenoid (EDS5) is checked. An error will be noted if tolerance is exceeded.	May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0963	PC A	PC A solenoid short to power circuit failure.	Voltage through PC A solenoid (EDS5) is checked. An error will be noted if tolerance is exceeded.	• Max line pressure • Deactivate clutch adaptations	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit.

					After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0972	SS A	SS A circuit or solenoid failure.	SS A (EDS1) circuit or solenoid failure.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0973	SS A	SS A solenoid or circuit shorted to ground or open.	Voltage through SS A solenoid (EDS1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0974	SS A	SS A solenoid or circuit shorted to power or open.	Voltage through SS A solenoid (EDS1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new

					mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0975	SS B	SS B circuit shorted to ground or open.	SS B (EDS2) circuit or solenoid failure.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0976	SS B	SS B solenoid or circuit shorted to ground or open.	Voltage through SS B solenoid (EDS2) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0977	SS B	SS B solenoid or circuit shorted to power or open.	Voltage through SS B solenoid (EDS2) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install

					a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0978	SS C	SS C circuit shorted to ground or open.	SS C (EDS3) circuit or solenoid failure.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0979	SS C	SS C solenoid or circuit shorted to ground or open.	Voltage through SS C solenoid (EDS3) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0980	SS C	SS C solenoid or circuit shorted to power or open.	Voltage through SS C solenoid (EDS3) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the

					DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0981	SS D	SS D circuit shorted to ground or open.	SS D (EDS4) circuit or solenoid failure.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0982	SS D	SS D solenoid or circuit shorted to ground or open.	Voltage through SS D solenoid (EDS4) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0983	SS D	SS D solenoid or circuit shorted to power or open.	Voltage through SS D solenoid (EDS4) is checked. An error will be noted if tolerance is exceeded. Short to ground failure	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal

			detected.		operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0770	SS E	SS E circuit or solenoid failure.	SS E (MV1) circuit or solenoid failure.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0985	SS E	SS E solenoid signal circuit shorted to ground or open.	Voltage through SS E solenoid (MV1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P0986	SS E	SS E solenoid or circuit shorted to power or open.	Voltage through SS E solenoid (MV1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure	• Mechanical limp-home mode • May turn on MIL	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the

			detected.		system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P1707	Transmission	Park/neutral switch circuit failure.	Circuit or sensor failure.	Engine will not crank in PARK or NEUTRAL or engine will crank in all gears.	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P1719	PCM	Engine torque signal is inaccurate.	TCM received an inaccurate signal via CAN.	• May turn on MIL • No shifts • TCC will not engage • Harsh engagements	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1910	Reverse lamp circuit	Reverse solenoid circuit failure.	Reverse solenoid (MV3) circuit failed open.	• Park lock or interlock switched OFF • Reverse lamps may be on at all times • Reverse may not come on	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all the DTCs. Test system for normal operation. If DTC returns, refer to

					Section 417-01 .
P1911	Reverse lamps	Reverse solenoid signal circuit shorted to ground. Circuit low.	Reverse solenoid (MV3) circuit fails to provide voltage drop across solenoid.	—	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all the DTCs. Test system for normal operation. If DTC returns, refer to Section 417-01 .
P1912	Reverse lamps	Reverse solenoid circuit shorted to power. Circuit high.	Reverse solenoid (MV3) circuit fails to provide voltage drop across solenoid. Circuit shorted to power.	Park lock or interlock switched OFF.	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all the DTCs. Test system for normal operation. If DTC returns, refer to Section 417-01 .
P0740	TCC solenoid	TCC solenoid circuit failure.	TCC solenoid (EDS6) circuit fails. Circuit open.	• May turn on MIL • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P2763	TCC	TCC solenoid signal circuit shorted to ground. Circuit high.	TCC solenoid (EDS6) circuit fails to provide voltage drop across solenoid. Circuit shorted to power.	• No TCC engagements • May turn on MIL • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal

					operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
P2764	TCC	TCC solenoid circuit shorted to power. Circuit low.	TCC solenoid (EDS6) circuit fails to provide voltage drop across solenoid.	• No TCC engagements • May turn on MIL • No adaptive learning strategy	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all DTCs. Test the system for normal operation. If the DTC returns, install a new mechatronics unit. After installing the new mechatronics unit, it must be reflashed to the latest level calibration.
U0073	CAN	CAN communication link error.	CAN communication bus OFF, short circuit CAN high to CAN low.	May turn on MIL	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a].
U0155	CAN	TCM communication link error.	CAN link error detected by TCM and IP.	• No communication with instrument panel cluster (IPC). • May turn on MIL	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a].
U0100	CAN	TCM communication link error.	CAN link error detected by PCM, between TCM and ECM.	• Mechanical limp-home mode in 3rd gear • Max line pressure • No adaptive learning strategy • May turn on MIL	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a].
U0121	CAN	TCM communication link error.	PCM/TCM have detected an error in the CAN wheel RPM information	—	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a].

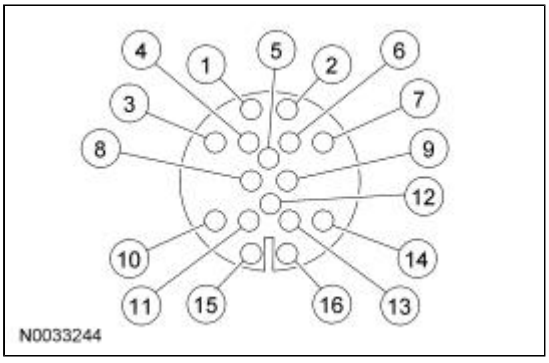
			from the ABS system.		
P0219	RPM	Engine RPM for CAN.	Engine RPM signal from CAN to high.	• No TCC engagements • May turn on MIL • Hold in 5th gear	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P062F	TCM	TCM EEPROM error.	Internal PCM error with EEPROM.	• May turn on MIL • Mechanical limp-home mode	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0741	TCC	TCC solenoid circuit stuck open.	TCC solenoid (EDS6), clutch or circuit open.	• No TCC engagements • May turn on MIL	Carry out normal diagnostics for TCC.
P1934	VSS	VSS input signal error.	VSS input does not match OSS signal.	Possible installation of wrong tire or axle. Wrong ratio.	Monitor the appropriate PID to validate that an error is present. Refer to Diagnostic Parameters Identification (PID) Chart in this section. Clear all the DTCs. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P2544	PCM	Torque management request input signal A.	Data received from the PCM or engine components are not correct for the vehicle operating conditions. Incorrect engine torque calculation may result.	Transmission may enable limp-home strategies or increase pressures. Engine components and PCM may or may not set additional DTCs. P2544, fuel monitor error, ETC sensor failure and MAF sensor failures may be present. MIL may illuminate.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0140	PCM/ABS/BCM	CAN timeout of	TCM received	May turn on MIL or	Clear all DTCs. For

		PCM, ABS or BCM.	incorrect information from other modules due to CAN timeout from PCM, ABS or BCM.	TCIL	PCM, ABS or PCM systems. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0401	PCM/TCM	Invalid data received from the PCM or engine components.	Data received from the PCM or engine components is not correct for the vehicle operating conditions.	Transmission may enable limp-home strategies or increase pressures. Engine components and PCM may or may not set additional DTCs. P2544, fuel monitor error, ETC sensor failure and MAF sensor failures may be present. MIL may illuminate.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Transmission Connector Layouts

Printable View (98 KB)

Transmission Vehicle Harness Connector



Pin Number	Circuit	Circuit Function
1	—	M (manual gear)
2	—	CAN low
3	—	K-LINE
4	—	Tip -
5	—	Tip +
6	—	CAN high
7	—	UDRV supply of reverse relay (backup relay high)
8	—	NOT USED
9	—	Term 15 (ignition)
10	—	Park/neutral signal (to PCM TRSW-PN T-18)
11	—	Ground
12	—	NOT USED
13	—	Term 31 (ground)
14	—	Term 30 (battery voltage)
15	—	Low side of reverse light relay (keylock) (back-up relay low)
16	—	Terminal 31 (ground)

Special Testing Procedures

Printable View (133 KB)

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

Stall Speed Test

WARNING: Apply the service and parking brakes firmly while carrying out each stall test.

CAUTION: Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur.

NOTE: The stall test should only be carried out with the engine and transmission at normal operating temperatures.

The stall test checks the operation of the following items:

- Torque converter one-way clutch
- Forward clutch
- Low one-way clutch
- Reverse clutch
- Overdrive one-way clutch
- Direct clutch
- Engine driveability concerns

1. Connect a tachometer to the engine.

2. After testing each of the following ranges, D, 3, 2, 1 and R, move the transmission range selector lever to NEUTRAL and run the engine for about 15 seconds to allow the torque converter to cool before testing the next range.

3. **CAUTION: If the engine rpm recorded by the tachometer exceeds the maximum specified rpm, release the accelerator pedal immediately. Clutch slippage is indicated.**

   CAUTION: Do not maintain wide-open throttle (WOT) in any gear range for more than 5 seconds or damage to the transmission may occur.

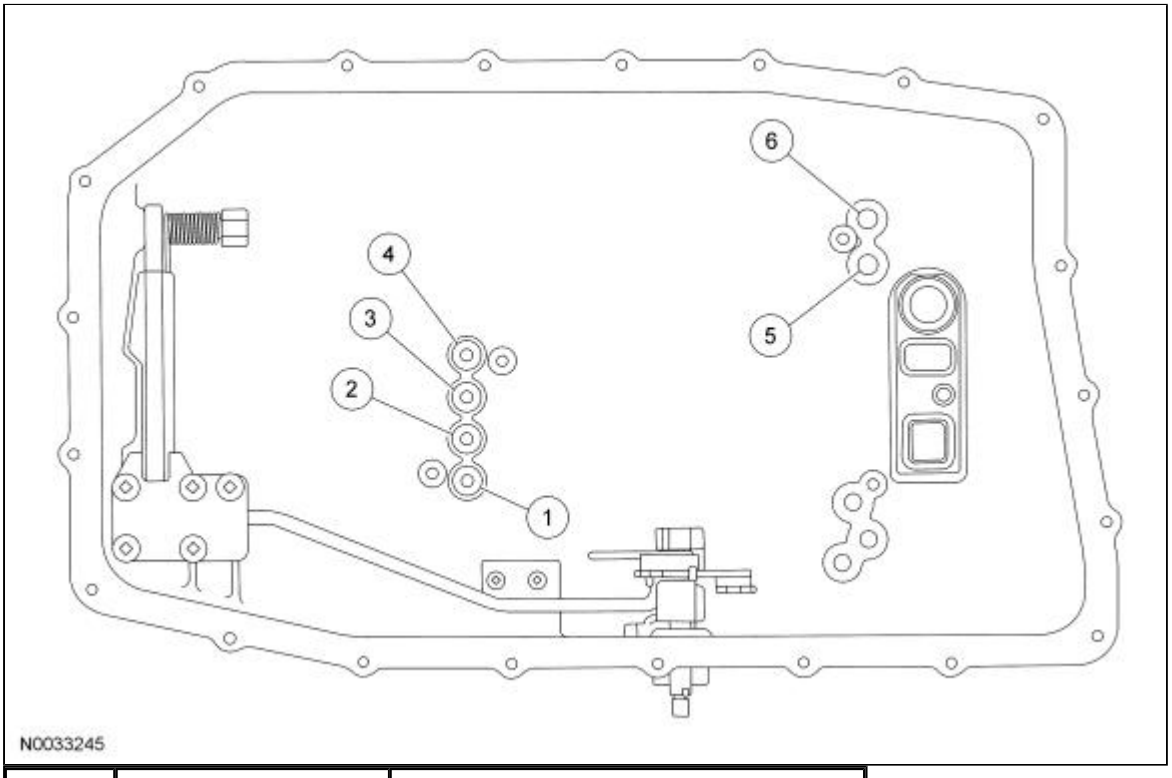
   Press the accelerator pedal to the floor (WOT) in each range. Record the rpm reached in each range. Stall speeds should be in the appropriate range.

Stall Speed Chart

Min.	Max.
2,231	2,631

If the stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If the stall speeds were too low, check engine tune-up. If the engine is OK, remove the torque converter and check the torque converter reactor one-way clutch for slippage.

Air Pressure Test



Item	Part Number	Description
1	—	Clutch (C) port
2	—	Clutch (D1) port
3	—	Clutch (D2) port
4	—	Direct clutch (B) port
5	—	Overdrive clutch (E) port
6	—	Forward clutch (A) port

A no-drive condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. Refer to the Clutch Application Chart to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

Example: When the transmission range selector lever is in a forward gear range (D, 3, 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.

2. Remove the filter and seal assembly and the mechatronics unit.

3. The inoperative clutches can be located by applying air pressure into the appropriate clutch port.

4. Apply air pressure to the appropriate clutch port. A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing may be heard.

5. If the clutches fail to operate during the air check:
    - the piston seals are not seated, damaged or not installed correctly.
    - plugged feed holes for clutch apply in the case and/or clutch cylinder.
    - damaged piston and/or clutch cylinder.

6. Service as required and recheck.

Leakage Inspection

Printable View (94 KB)

Special Tool(s)

ST1300-A	UV Leak Detector Kit 164-R0756 or equivalent

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Automatic Transmission/Power Steering Dye 164-R3701 or equivalent	—

The transmission has the following parts to prevent external fluid leakage:

- Gaskets
- Lip-type seals
- O-ring seals
- Seal rings
- Seal grommets
- Seal washers
- Thread sealant

Leakage at the transmission pan-to-case gasket often can be stopped by tightening the retaining bolts to specification. Refer to Torque Specifications in this section.

When fluid is found to be leaking between the case and the cooler tube fitting, tighten the fitting to maximum specification.

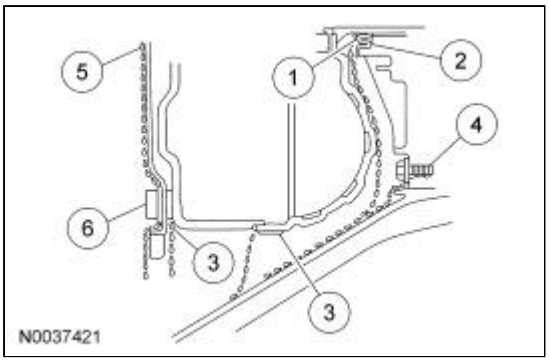
If leakage is found at the manual control lever shaft, install a new seal.

Check for fluid leaking from the end of the extension housing. Leakage can result from a damaged seal, missing garter spring or worn extension bushing. Install a new seal assembly, bushing or both, as necessary.

Fluid Leakage in Torque Converter Area

Leakage at the front of the transmission, as evidenced by fluid around the torque converter housing part of the case, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of the leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5

numbers in the illustration correspond with the 5 flow path steps.



Leak Path	Symptom	Possible Source
1, 2 and 4	Leak at front of transmission	Pump lip seal
1, 2 and 4	Leak at front of transmission	Vent
1, 2 and 4	Leak at front of transmission	Converter hub weld
1, 2 and 4	Leak at front of transmission	External pump seal (large)
1, 2 and 4	Leak at front of transmission	Pump to case screws
1, 2 and 4	Leak at front of transmission	Pump gasket
3	Leak at front of transmission	Torque converter seal weld
5	Leak at front of transmission	Engine oil leak; rear main seal
5	Leak at front of transmission	Engine valve cover
5	Leak at front of transmission	Oil galley
5	Leak at front of transmission	Pump lip seal
5	Leak at front of transmission	Engine oil pressure sensor
6	Leak at front of transmission	Torque converter rivet

Transmission Leak Check Test Procedure

Automatic Transmission/Power Steering Dye 164-R3701 or equivalent (specifically formulated for ATF) is used to detect a transmission fluid leak. Use one ounce of dye for every 3.8 liters (4 quarts) of transmission fluid. Add any additional transmission fluid to bring it to the correct level. Such dyes can be used to determine whether an engine fluid or transmission fluid leak is present, or if the fluid in the transmission fluid cooler hose leaks into the engine coolant system. An ultraviolet light must be used to detect the fluorescent dye solution.

1. Remove the fluid level fill plug and note the color of the fluid that drips out. Original factory fill fluid is clear and red if the fluid has been exchanged.

2. Clean off any fluid from the top and bottom of the torque converter housing, front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable non-flammable solvent and blow-dry with compressed air.

3. Wash out the torque converter housing and the front of the flexplate. The torque converter housing may be washed out using clean solvent and a squirt-type oil can. Blow-dry all washed areas with compressed air.

4. Start and run the engine until the transmission reaches its normal operating temperature. Shift the transmission through all the gear ranges to make sure that the dye has circulated through the transmission. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Observe the front of the flexplate, back of the cylinder block (in as far

as possible) and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined. Repair as required.

External Fluid Leaks

Leak Path	Possible Source
Leaks at the fluid pan to case	• Pan bolts not tightened to specification. • Pan gasket damaged. • Case pan rail damaged.
Fluid cooler tubes or O-rings leaking	• Cooler tube(s), cooler tube O-rings damaged. • Cooler tube hold-down plate damaged.
Leaks at the fluid cooler	• Fluid cooler damaged. • Cooler tube O-rings damaged.
Leaks at the manual control lever	• Manual control lever seal missing or damaged.
Mechatronic harness connector	• O-ring on connector missing or damaged.

Transmission Fluid Cooler Tube Replacement

For installation of new transmission fluid cooler tube, refer to Section 307-02 .

Transmission Fluid Cooler

Printable View (79 KB)

CAUTION: Whenever a transmission has been disassembled to install new parts, the transmission fluid cooler and transmission fluid cooler tubes must be cleaned and backflushed. Use a torque converter/oil cooler cleaner.

NOTE: Cleaning and backflushing the transmission fluid cooling system, along with following all the normal cleaning and inspection procedures during disassembly and reassembly, will keep contaminants from entering the transmission, causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back into use.

Diagnosis By Symptom

Printable View (166 KB)

The Diagnosis By Symptom gives the technician diagnostic information and direction, and suggests possible components using a symptom as a starting point. All routines start out with any potential electrical components that can cause or contribute to the symptom described. The routines then list all possible hydraulic or mechanical components that can cause or contribute the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom, select the condition that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the fluid levels.
    4. carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

   NOTE: When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The transmission control module (TCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the TCM.

   Begin with the ROUTINES, if indicated. Follow the reference or action required statements. Always carry out the on-board diagnostic tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.

5. The list contains only possible hydraulic or mechanical components that may cause or contribute to the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure that repairs are complete.

Diagnosis by Symptom Index

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Diagnostic Routines

Engagement Concerns: No Forward in D

Possible Component	Reference/Action
201 — ROUTINE	
Fluid	
・Incorrect fluid level	・Check the fluid level. Adjust fluid to correct level. Refer to Preliminary

	Inspection in this section.
Shift Linkage	
· Shift linkage — damage or incorrectly adjusted	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector lever cable as necessary.
Mechatronics	
· Defective manual valve	· Inspect connection to shift linkage.
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Engagement Concerns: No Reverse

Possible Component	Reference/Action
202 — ROUTINE	
Fluid Level	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
Shift Linkage	
· Shift linkage — damage or incorrectly adjusted	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector cable as necessary.
Mechatronics	
· Defective direct clutch (B) or low/reverse clutch (D) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
Pump	

· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Engagement Concerns: Harsh Reverse

Possible Component	Reference/Action
203 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Driveline	
· Engine driveline looseness in the driveshaft, U-joints or the engine mounts	· Repair as required.

Engagement Concerns: Harsh Forward Only

Possible Component	Reference/Action
204 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
Mechatronics	
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Driveline	
· Engine driveline looseness in the driveshaft, U-joints or the engine	· Repair as required.

mounts	

Engagement Concerns: Delayed/Soft Reverse Only

Possible Component	Reference/Action
205 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Engagement Concerns: Delayed/Soft Forward Only

Possible Component	Reference/Action
206 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Engagement Concerns: No Forward and No Reverse

Possible Component	Reference/Action
207 — ROUTINE	
Fluid	

· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
Mechatronics	· Inspect connection to shift linkage.
· Defective manual valve	
Pump	· Install a new pump assembly. Refer to Pump Assembly in this section.
· Pump gear — failure	

Engagement Concerns: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses, solenoids, transmission range (TR) sensor, SSA solenoid, PCA solenoid	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Multiple shifts missing (more than one gear)	· If some shifts are missing, determine which shifts do not occur. Refer to clutch and solenoid application charts in this section. Monitor appropriate PIDs as listed in diagnostics. Refer to routine 210.
Mechatronics	
· Gears 4-6 default to 5th gear and gears 1-3 default to 3rd gear	· Retrieve DTC codes.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Engagement Concerns: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage Damaged or Incorrectly Adjusted	
· External selector lever cable	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector lever cable as necessary.
Forward Clutch (A) Assembly (No Shifts)	
· Seals, piston — damaged	· Inspect for damage. Repair as required.
· Friction elements — damaged or worn	· Inspect for damage. Repair as required.
· Return springs — damaged	· Inspect for damage. Repair as required.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses, solenoids, transmission range (TR) sensor, SSA solenoid, PCA solenoid	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Multiple shift missing (more than one gear)	· If some shifts are missing, determine which shifts do not occur. Refer to clutch and solenoid application charts in this section. Monitor appropriate PIDs as listed in diagnostics.

Shift Concerns: Timing — Early/Late

Possible Component	Reference/Action
211 — ROUTINE	
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Engine driveability concerns	· Refer to Section 303-00 .
Mechatronics	
· Bolts not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Incorrect Pressures	
· Application pressures are incorrect	· Incorrect application pressures may be due to non-transmission components, mechatronic assembly or internal transmission damage. Repair all non-transmission components then continue with this routine.

Other	
· Tire size change, axle ratio change	· Verify that the vehicle has the original equipment. Refer to the certification label. Changes in tire size and axle ratio will affect shift timing.

Shift Concerns: Timing — Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 — ROUTINE	
Fluid	
· Incorrect level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Condition	· Carry out the fluid level check in Preliminary Inspection in this section.
· Fluid over temperature condition	· Refer to transmission overheating.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Torque Converter Concerns	
· Torque converter clutch	· Refer to torque converter clutch operation concern: cycling shutter chatter.

Shift Concerns: Feel — Soft or Slipping (Some or All)

Possible Component	Reference/Action
213 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Transmission Fluid Temperature (TFT) Sensor Damaged	
· Mechatronic assembly	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Bolts not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stick or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Shift Concerns: Feel — Harsh (Some/All)

Possible Component	Reference/Action
214 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Re-flash mechatronic assembly to the latest level calibration. Carry out road test — adaptive drive cycle, refer to Shift Point Road Test in this section. Road test and carry out on-board diagnostic test again.
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	

Shift Concerns: No 1st Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ROUTINE	
Powertrain Control System	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	
Incorrect Gear	· Determine which gear the transmission is in. Refer to the Clutch and Solenoid Application Charts in this section.
· Mechatronic failure	

Shift Concerns: No 1st Gear Manual

Possible Component	Reference/Action
216 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage	· Inspect and repair as necessary.
· External selector lever cable system — damaged, misaligned	
Mechatronics	
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control System	· Carry out on-board diagnostic tests. Repair as required.
· PCM electrical inputs/outputs,	

TCM, external vehicle wiring harnesses	Clear DTCs. Road test and carry out on-board diagnostic test again.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Shift Concerns: No 2nd Gear Manual

Possible Component	Reference/Action
217 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage	
· External selector lever cable system — damaged, misaligned	· Inspect and repair as necessary.
Mechatronics	
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Shift Concerns: No 3rd Gear Manual

Possible Component	Reference/Action
218 — ROUTINE	

Shift Linkage	
· External selector lever cable system — damaged, misaligned	· Inspect and repair as necessary.
Mechatronics	
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure.	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Shift Concerns: No 1-2 Shift

Possible Component	Reference/Action
220 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Clutch Plates	
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the intermediate clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.

Shift Concerns: No 2-3 Shift

Possible Component	Reference/Action
221 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the intermediate clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 3-4 Shift

Possible Component	Reference/Action
222 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (E) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.

· Defective solenoid multiplex valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSE (SS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Overdrive clutch (E) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Overdrive Clutch Assembly in this section.

Shift Concerns: No 4-5 Shift

Possible Component	Reference/Action
270 — ROUTINE	
Mechatronics	
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.

Shift Concerns: No 5-6 Shift

Possible Component	Reference/Action
272 — ROUTINE	

Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 6-5 Shift

Possible Component	Reference/Action
273 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 5-4 Shift

Possible Component	Reference/Action

271 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.

Shift Concerns: No 4-3 Shift

Possible Component	Reference/Action
223 — ROUTINE	
Mechatronics	
· Defective overdrive clutch (E) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective overdrive clutch (E) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Solenoid multiplex valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Drive enable valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Overdrive clutch (E) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Overdrive Clutch Assembly in this section.

Shift Concerns: No 3-2 Shift

Possible Component	Reference/Action
224 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 2-1 Shift

Possible Component	Reference/Action
225 — ROUTINE	
Mechatronics	
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective low/reverse clutch (D) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Clutch Plates	
· Direct clutch (C) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.

Torque Converter Clutch Operation Concerns : Does Not Apply

Possible Component	Reference/Action
240 — ROUTINE	
Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective torque converter apply regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective torque converter release regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Mechatronic assembly bolts — not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Torque Converter	
· Torque converter components	· Remove the transmission. Inspect for damage. install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Clutch Operation Concerns : Cycling/Chatter

Possible Component	Reference/Action
241 — ROUTINE	
Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective torque converter apply regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Main Control Valve Body in this section.
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Mechatronic assembly bolts — not	· Tighten to specification.

tightened to specification	
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Torque Converter	
· Torque converter components	· Remove the transmission. Inspect for damage. Install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Clutch Operation Concerns : Always Applied/Stalls Vehicle

Possible Component	Reference/Action
242 — ROUTINE	
Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
· Mechatronic assembly bolts — not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Main Control Valve Body in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Torque Converter	
· Torque converter components	· Remove the transmission. Inspect for damage. install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Other Concerns: External Leaks

Possible Component	Reference/Action

252 — ROUTINE	
Fluid	
· Incorrect level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Transmission case vent — damaged, case porosity	· Inspect for damage. If damaged, repair as necessary.
· Leakage at gaskets, seals, bulkhead connector	· Refer to Leakage Inspection , Fluid Leakage in the Torque Converter Area and Transmission Leak Check Test Procedures in this section for potential leak locations. Remove all traces of lubricant on exposed surface of the transmission. Repair as necessary.
Fluid Cooler Tubes	
· Cooler tube fittings	· Locate leak source. Repair as required. Refer to Section 307-02 .
· Cooler tube O-rings, cooler tubes	· Locate leak source. Repair as required. Refer to Section 307-02 .
Fluid Pump	
· Fluid pump O-ring	· Install a new O-ring. Refer to Pump Assembly in this section.
· Fluid pump seal ring	· Install a new seal ring. Refer to Pump Assembly in this section.
Transmission Case	
· Case — leaking	· Install a new transmission case. Refer to Transmission in this section.
· Transmission electrical bulkhead connector	· Install a new transmission electrical bulkhead connector O-ring.
· Fluid fill plug	· Install a new fill plug.
· Output shaft seal	· Install a new seal. Refer to Output Shaft Seal in this section.
· Manual control lever seal	· Install a new seal.
· Transmission fluid pan seal (gasket)	· Install a new seal.
Torque Converter	
· Torque converter studs	· Install a new torque converter.
· Torque converter hub seal	· Install a new torque converter hub seal.
· Torque converter weld	· Install a new torque converter.

Noise/Vibration in Forward or Reverse

Possible Component	Reference/Action
254 — ROUTINE	
Torque Converter	
· Check the torque converter components/balance weight	· Locate source of disturbance. Repair as required.
Fluid	
· Fluid level (low) pump cavitation.	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.

Engine Driveline	
· Engine drive accessories	· Refer to Section 303-00 .
Fluid Cooler Tubes	
· Cooler line grounding out	· Adjust or reposition cooler tubes.

Noise/Vibration that changes with vehicle speed

Possible Component	Reference/Action
255 — ROUTINE	
Engine Driveline	
· Engine mounts — loose or damaged	· Locate source of disturbance. Repair as required.
· Driveline concerns: ■ U-joints ■ Rear axle ■ Suspension ■ Modifications	· Inspect and repair as required.
· First gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Second gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Third gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Fourth gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Fifth gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Sixth gear: ■ Torque converter ■ Gearset ■ Friction elements	
· Reverse gear: ■ Gearset	

■ Friction elements	
Other Noise/ Vibrations	
· Main control valve resonance	· Locate source of disturbance. Repair as required.
· Output shaft splines — worn or damaged	· Install a new output shaft seal. Refer to Output Shaft Seal in this section.
· Selector lever cable: ■ Vibration ■ Grounding	· Inspect and repair as required.
· Cooler lines: ■ Grounding	· Inspect and repair as required.

Engine Will Not Crank

Possible Component	Reference/Action
257 — ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, TCM, vehicle wiring harnesses, engine starting system, TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. Check PIDs for TR park and neutral positions. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again
Vehicle Starter	
· Starter system concerns	· Inspect and repair as necessary. Refer to Section 303-06 .
External Selector Lever Cable System	
· Cable system — damaged, misaligned	· Inspect and repair as necessary. Refer to Section 307-05 .
TR Sensor Assembly	
· TR Assembly — damaged	· Inspect and repair as necessary.
Torque Converter	
· Flexplate — damaged	· Inspect for damage. Repair as necessary.
Fluid Pump Assembly	
· Internal parts seized	· Inspect for damage. Repair as necessary.

No Park Range

Possible Component	Reference/Action
258 — ROUTINE	
Selector Lever Cable	
· Cable system — damaged, misaligned	· Inspect and repair as necessary.
· Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged, park pawl pin loose or damaged, park rod actuating plate loose, damaged or missing	· Inspect for damage. If damaged, repair as necessary.

· Transmission case assembly	· Inspect for damage. If damaged, repair as necessary.
· Park gear, parking pawl, parking pawl return spring, part or guide, parking actuating rod, parking pawl shaft, manual lever	· Inspect for damage. If damaged, repair as necessary.
· External linkages/brackets — damaged	· Inspect for damage. If damaged, repair as necessary.
TR Assembly Damaged, Manual Lever Detent Spring Damaged	
· TR assembly	· Install a new mechatronic assembly. Refer to Main Control Valve Body in this section.

Transmission Overheating

Possible Component	Reference/Action
259 — ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, TCM, vehicle wiring harnesses, TCC solenoid	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. Check PIDs for TR park and neutral positions. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Fluid	
· Incorrect level	· Check fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection .
· Fluid condition	· Carry out the fluid level check. Refer to Preliminary Inspection in this section.
Case Vent Damaged	
· Transmission case assembly	· Inspect for damage. If damaged, repair as necessary.
Torque Converter Clutch Not Engaging	
· Torque converter	· Install a new torque converter.
Other	
· Restriction in transmission cooling system	· Check transmission cooling system efficiency. Refer to Section 307-02 for automatic transmission cooling system diagnostic procedures.
· Excessive trailer tow load	· Refer to the Owner Guide for specifications on trailer towing.
· Vehicle heat shield — missing or damaged	· Inspect for damage. If damaged, repair as necessary.
· Vehicle airflow is restricted	· Inspect for damage. If damaged, repair as necessary.

Fluid Venting/Foaming

Possible Component	Reference/Action

260 — ROUTINE	
Incorrect Level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Fluid	
Case Vent Damaged	· Inspect for damage. If damaged, repair as necessary.
· Transmission case assembly	

Transmission Fluid Cooler — Backflushing and Cleaning

Printable View (80 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

CAUTION: When internal damage occurs in the transmission, metal particles and clutch plate material can travel into the torque converter and the transmission fluid cooler. These contaminates are a major cause of recurring transmission concerns. To prevent further concerns, remove these contaminates from the cooler lines and install a new cooler before placing the transmission in use.

1. Install a new transmission fluid cooler if any fluid leaks are indicated or a major metallic failure is indicated.

2. Using a suitable torque converter/fluid cooler cleaner, flush the fluid cooler and lines.

3. **NOTE:** Rubber hoses must be attached to the ends of the fluid cooler tubes, to aid in connecting them to the fluid cooler cleaner.

   Connect the cleaner pressure and return lines appropriately.
   1. Connect the pressure line to the fluid cooler inlet tube.
   2. Connect the return line to the fluid cooler outlet tube.
   3. Place the outlet end of the return line in the fluid tank reservoir.

4. **NOTE:** Cycling the fluid pump on and off will help dislodge contaminants in the cooler system.

   Switch the fluid pumps on. Allow the fluid to circulate a minimum of 5 minutes.

5. Switch the fluid pump off.

6. Disconnect the cleaner pressure line at the fluid cooler tube.

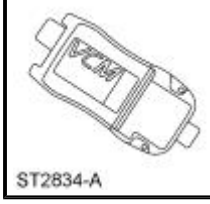
7. Using compressed air, blow through the fluid cooler inlet tube until all fluid is removed.

8. Remove the rubber hoses from the fluid cooler tubes.

Transmission Fluid Drain and Refill

Printable View (256 KB)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

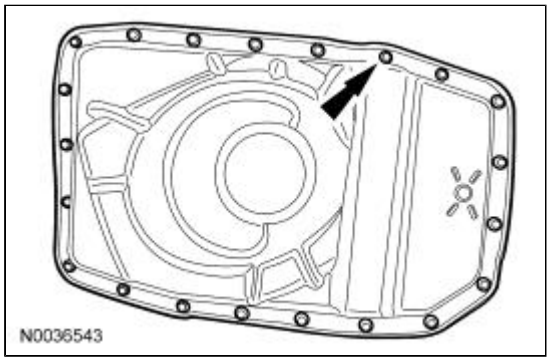
Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

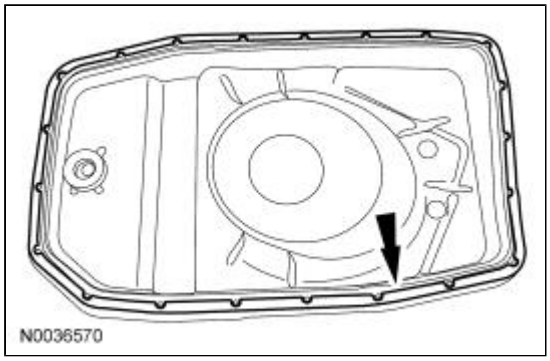
Drain

CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.

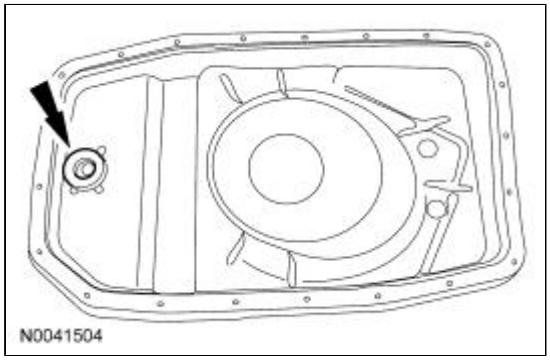
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the transmission fluid pan and allow the fluid to drain.



3. Remove the fluid pan gasket.

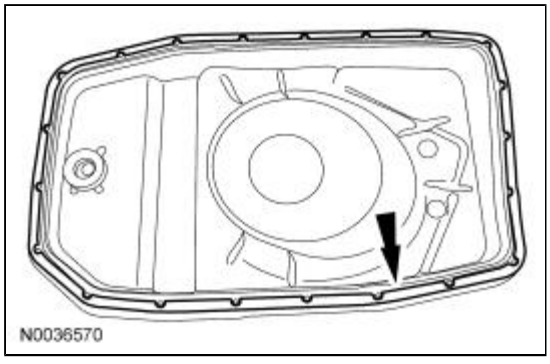


4. Clean and inspect the transmission fluid pan and magnet.

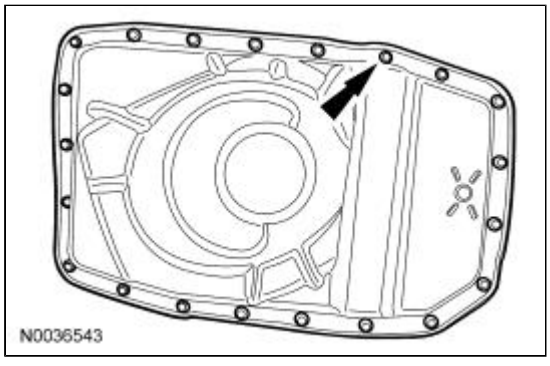


Refill

1. Install the fluid pan gasket.



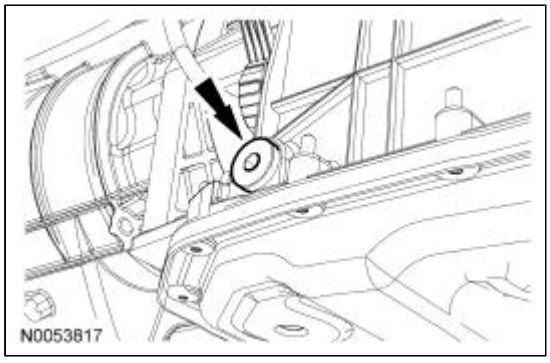
2. Install the fluid pan and bolts.
    - Tighten to 12 Nm (9 lb-ft).



3. **CAUTION: The fluid fill plug located on the side of the transmission is near the**

exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.

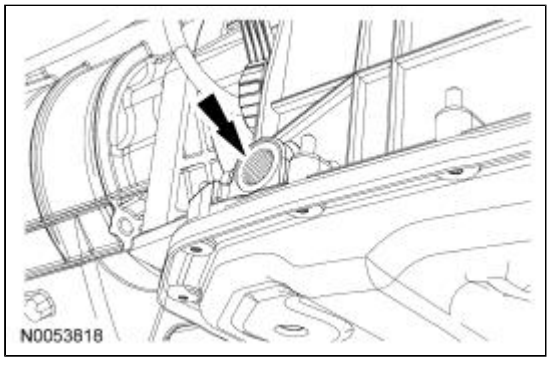
Remove the fluid fill plug located on the RH rear side of the case, near the transmission electrical connector.



4. **CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.**

   CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.

   Fill the transmission.
   - Add 4.7 liters (5 quarts) of clean automatic transmission fluid to the transmission through the fluid fill hole. Stop when the fluid runs out of the bottom of the hole.

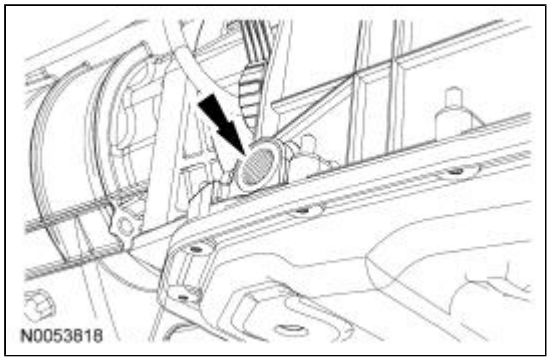


5. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

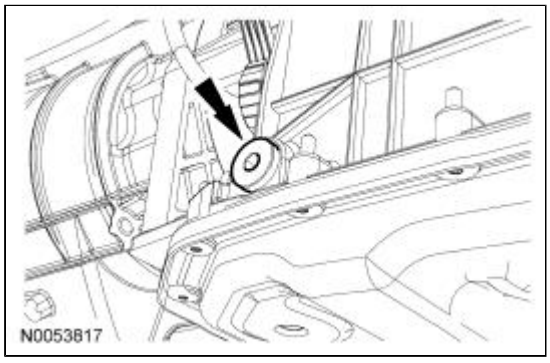
6. With the special tool connected, the engine idling (550-750 rpm) in PARK and the transmission temperature at 30°C-50°C (86°F-122°F), check and adjust the transmission fluid level.

7. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

   Fill with clean automatic transmission fluid until the fluid runs out of the bottom of the hole.



8. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



Torque Converter

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1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - Converter stud or studs, impeller hub or bushing are damaged.
    - Discoloration (due to overheating).
    - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
        - Major metallic failure.
        - Multiple clutches or clutch plate failures.
        - Sufficient component wear which results in metallic contamination.
        - Internal torque converter contamination present. For additional information, refer to Torque Converter Contamination Inspection in this section.

Torque Converter Contamination Inspection

Printable View (80 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

CAUTION: Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission, damage will occur. Use only clean automatic transmission fluid designated for the transmission and converter being serviced.

1. If a new or remanufactured torque converter is not being installed, the following steps must be completed.
2. With the torque converter on a bench, pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter and examine the fluid.
3. **NOTE:** The factory fill fluid is clear, the exchange fluid will be red.

   Observe the color and odor of the fluid. The fluid should be clear or red, not brown or black. Odor may indicate an overheating condition such as clutch disc or band failure.
4. Examine the stain on the tissue for evidence of particles (specks of any kind). Examine the fluid level indicator for signs of antifreeze (gum or varnish). If particles are present in the fluid, a new torque converter must be installed.
5. If there are no particles or contamination present, drain the remainder of the transmission fluid from the torque converter.
6. Add 1.9 liter (2 quarts) of clean automatic transmission fluid into the converter and agitate by hand.
7. Thoroughly drain the fluid.

Main Control Valve Body

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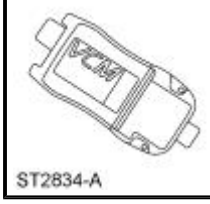
Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

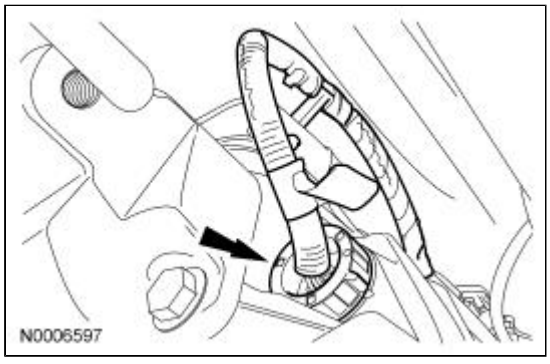
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Removal

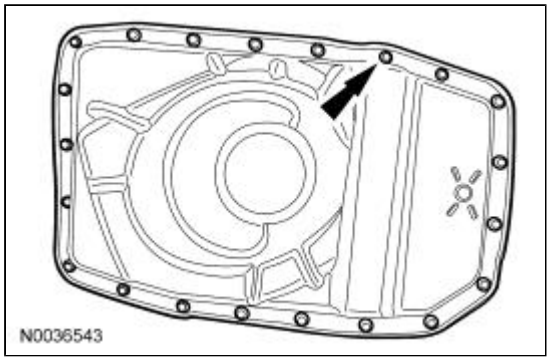
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

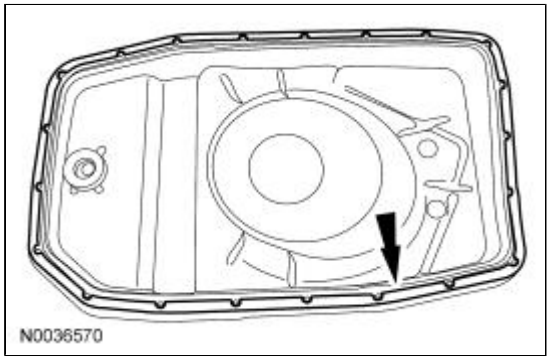
   Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.

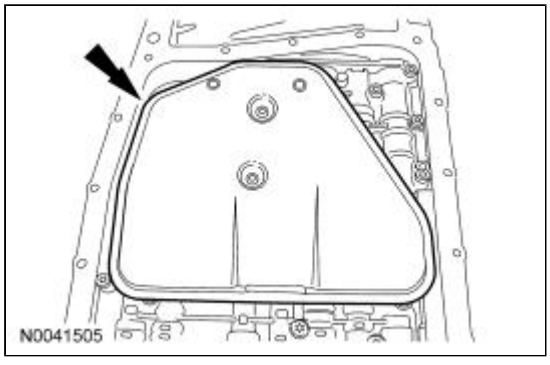
3. Remove the transmission fluid pan and allow the fluid to drain.



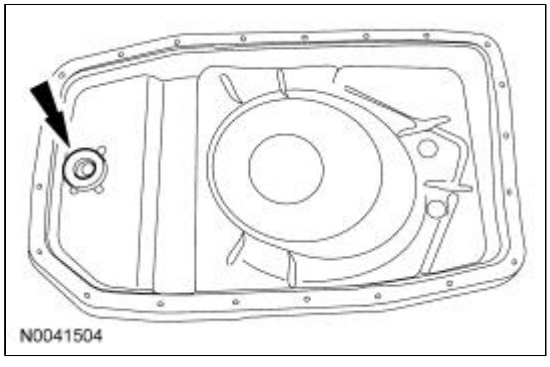
4. Remove the fluid pan gasket.



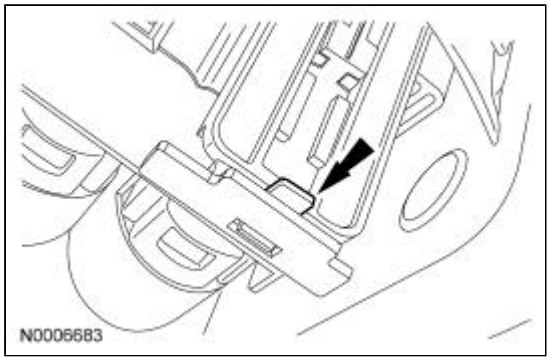
5. Remove and discard the transmission fluid filter.



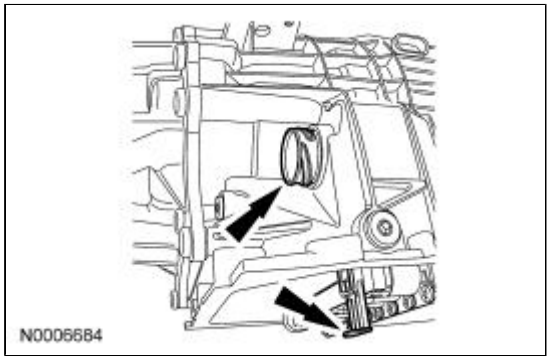
6. Clean and inspect the transmission fluid pan and magnet.



7. Press the release tab and pull down on the bulkhead connector retainer.

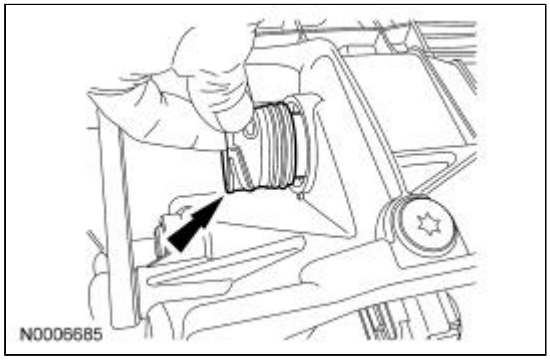


8. With the release tab down, pull the outer shell of the bulkhead electrical connector.



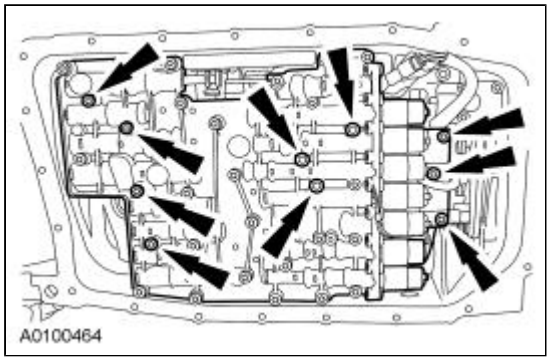
9. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

   Pull the outer shell of the bulkhead electrical connector out of the transmission.



10. **NOTE:** During removal of the mechatronic assembly, the thermal bypass valve, pump adapter seal and one or more center support seals may become dislodged. Save these components for reuse during assembly.

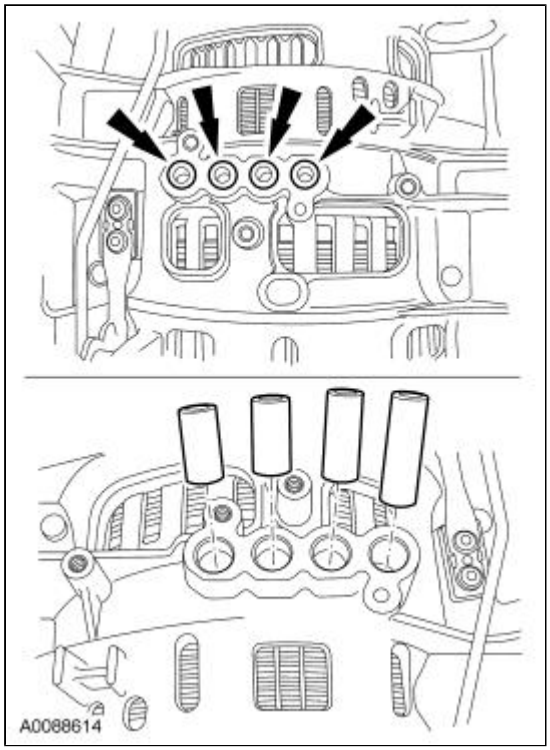
    Remove the 10 bolts from the mechatronic assembly and remove the mechatronic assembly.



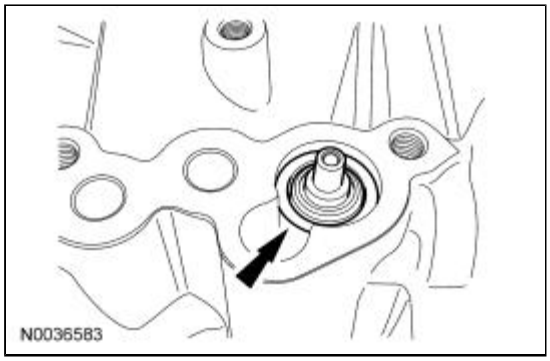
Installation

1. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

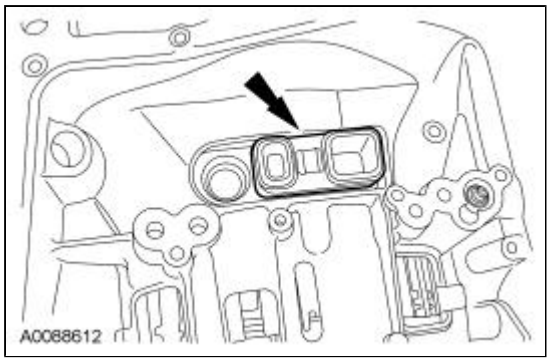
   Verify the 4 rubber feed tubes for the center support are in place.



2. Verify the thermal bypass valve is in the case.

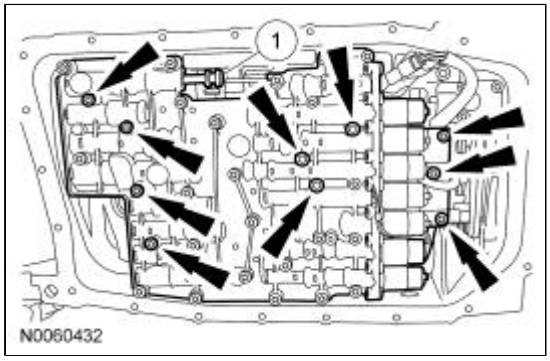


3. Verify the rubber adapter is in place.

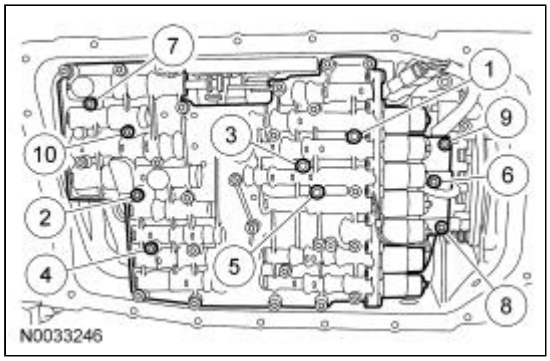


4. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission control module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

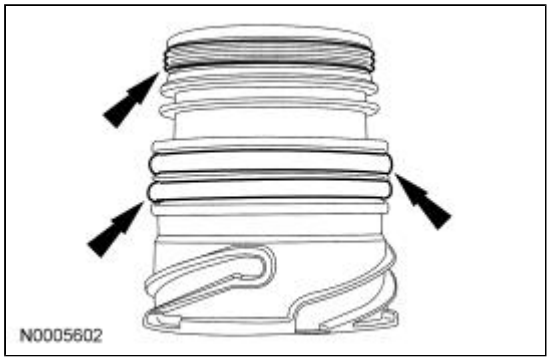
   Position the mechatronic assembly in place and loosely install the 10 bolts.
   1. Align the manual valve and control lever linkage.



5. Tighten the mechatronic bolts in the sequence shown.
   - Tighten to 8 Nm (71 lb-in).

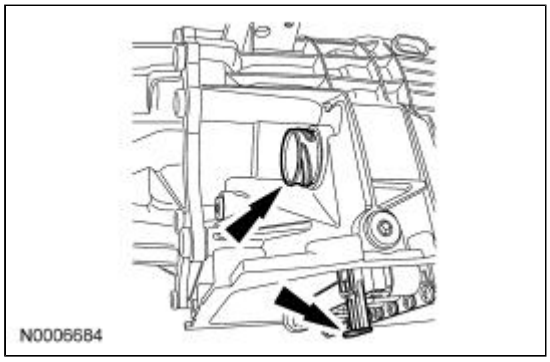


6. Install new O-rings seals on the outer shell of the bulkhead electrical connector.

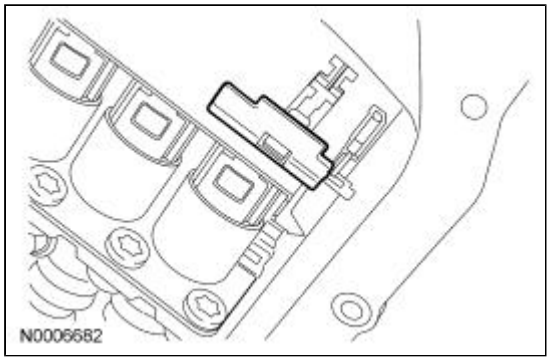


7. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

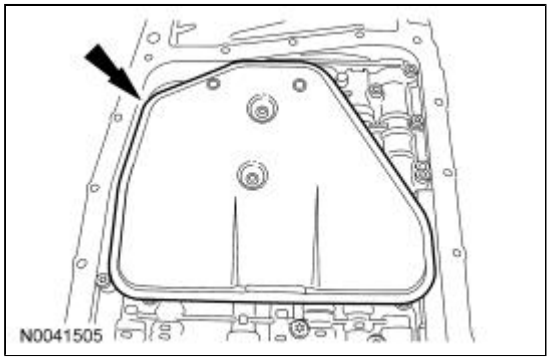
   With the release tab down, push the outer shell of the bulkhead electrical connector into the transmission.



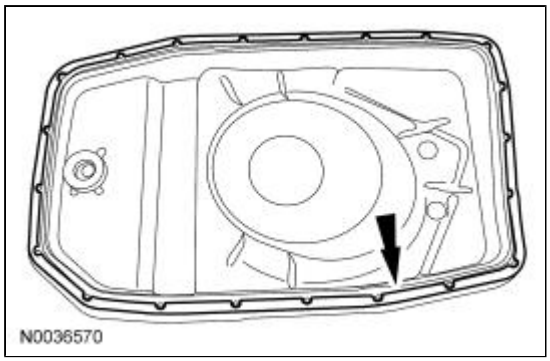
8. Press up on the tab and lock the outer shell of the bulkhead electrical connector in place.



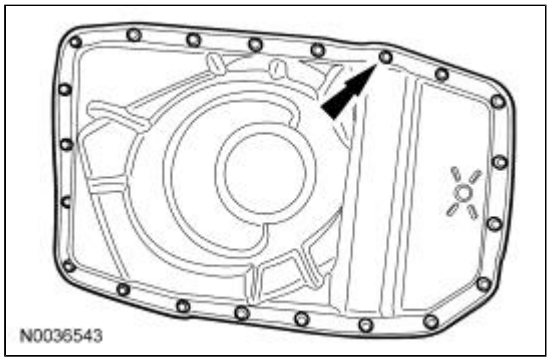
9. Install a new transmission fluid filter.



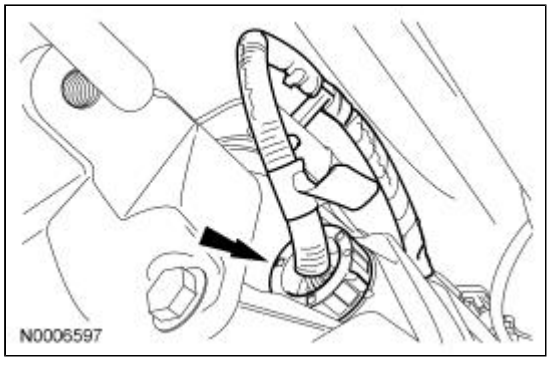
10. Install the fluid pan gasket.



11. Install the fluid pan and bolts.
    - Tighten to 12 Nm (9 lb-ft).

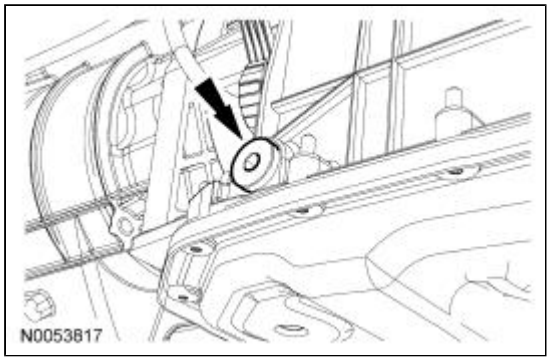


12. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.



13. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

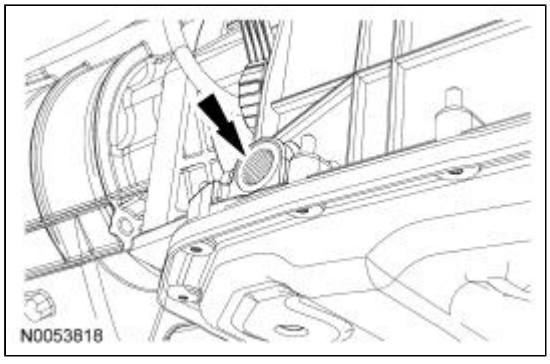
    Remove the fluid fill plug located on the RH rear side of the case near the transmission electrical connector.



14. **CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate correctly or transmission failure.**

    CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.

    Fill the transmission.
    - Add 4.7 liters (5 quarts) of clean automatic transmission fluid to the transmission through the fluid fill hole. Stop when the fluid runs out of the bottom of the hole.

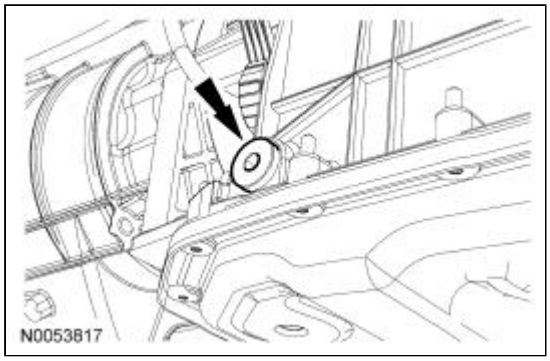


15. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

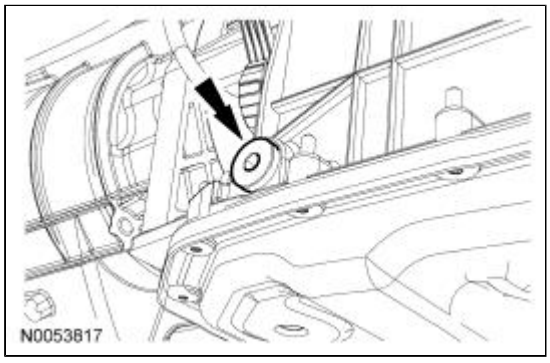
16. With the special tool connected, the engine idling (550-750 rpm) in PARK and the transmission temperature at 30°C-50°C (86°F-122°F), check and adjust the transmission fluid level.

17. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

    Fill with clean automatic transmission fluid until the fluid runs out of the bottom of the hole.



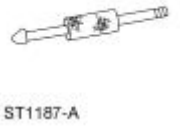
18. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



Output Shaft Seal

Printable View (543 KB)

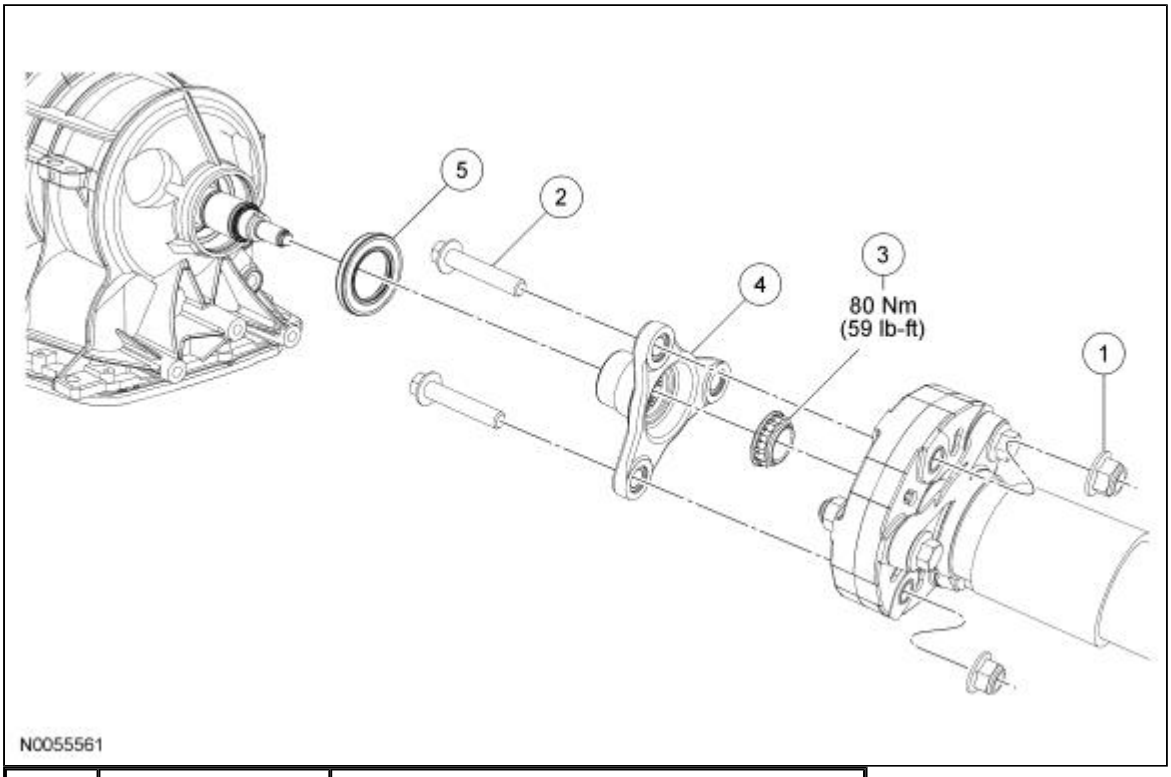
Special Tool(s)

ST2888-A	Installer, Transmission Extension Housing Fluid Seal 307-560
ST2887-A	Installer, Fluid Pump Seal 307-556
ST2381-A	Remover, Input Shaft Oil Seal 308-375
 ST1187-A	Slide Hammer 100-001 (T50T-100-A)
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	—	Rear driveshaft nuts (3 required)
2	—	Rear driveshaft bolts (3 required)
3	7K440	Output shaft flange nut
4	7A021	Output shaft flange
5	7052	Output shaft seal

Removal

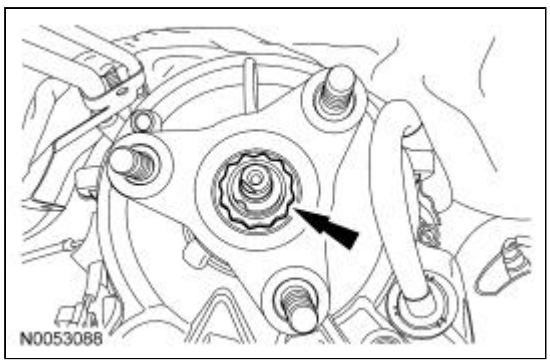
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

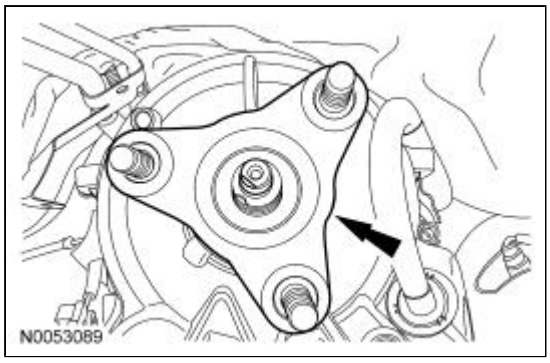
RWD vehicles

2. Remove the rear driveshaft. For additional information, refer to Section 205-01 .

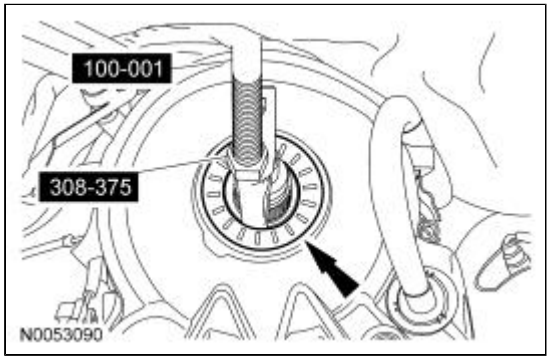
3. Remove and discard the output shaft flange nut.



4. Remove the output shaft flange.



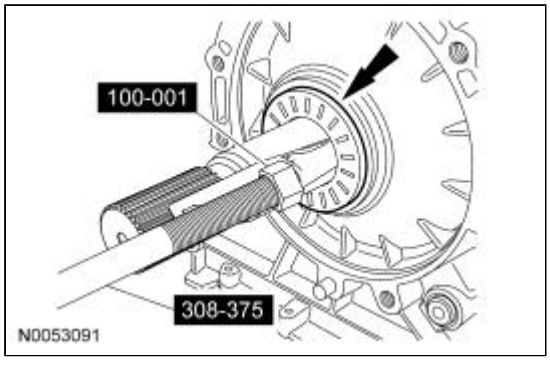
5. Using the special tools, remove the output shaft seal.



4WD vehicles

6. Remove the transfer case. For additional information, refer to Section 308-07B .

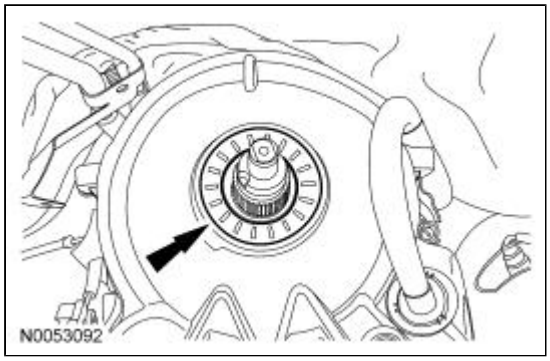
7. Using the special tools, remove the output shaft seal.



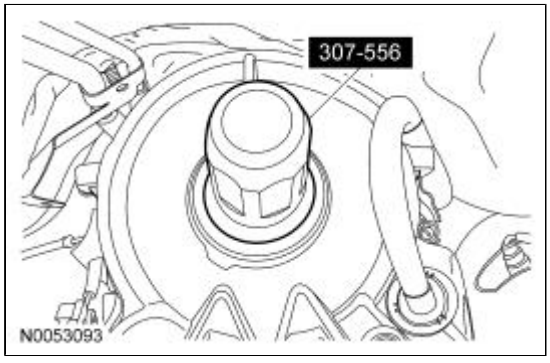
Installation

RWD vehicles

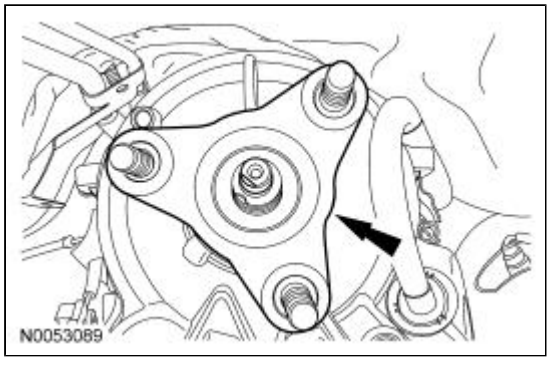
1. Position a new output shaft seal.



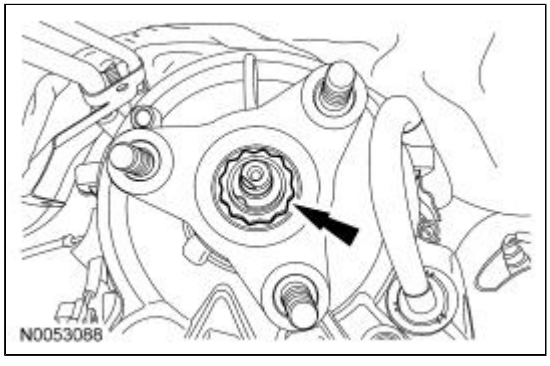
2. Using the special tool, install the output shaft seal.



3. Install the output shaft flange.



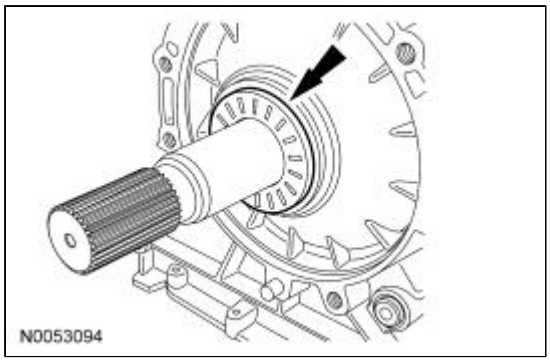
4. Install a new output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).



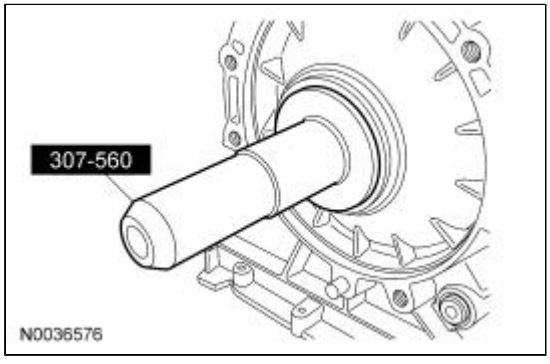
5. Install the rear driveshaft. For additional information, refer to Section 205-01 .

4WD vehicles

6. Position the output shaft seal.



7. Using the special tool, install a new output shaft seal.

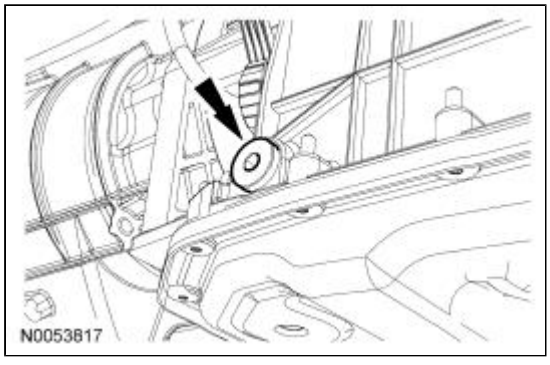


8. Install the transfer case. For additional information, refer to Section 308-07B .

All vehicles

9. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

   Remove the fluid fill plug located on the RH rear side of the case near the transmission electrical connector.



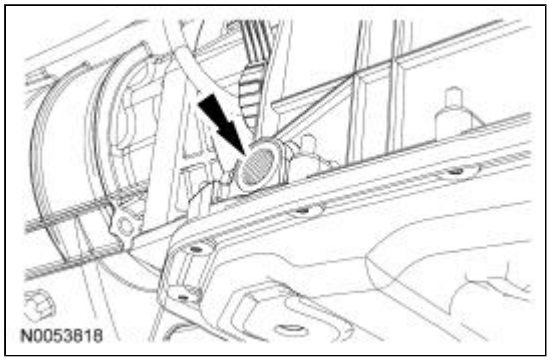
10. **CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate correctly or transmission failure.**

    CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when

working near the exhaust and the heat shields.

Fill the transmission.

- Add 4.7 liters (5 quarts) of clean automatic transmission fluid to the transmission through the fluid fill hole. Stop when the fluid runs out of the bottom of the hole.

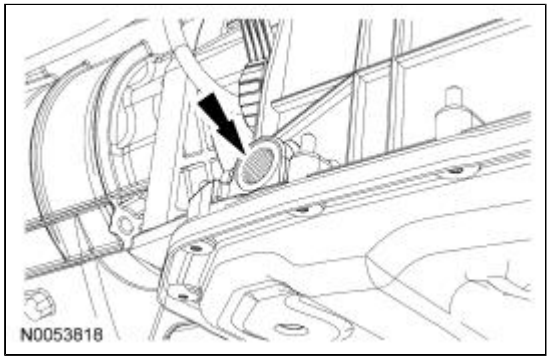


11. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

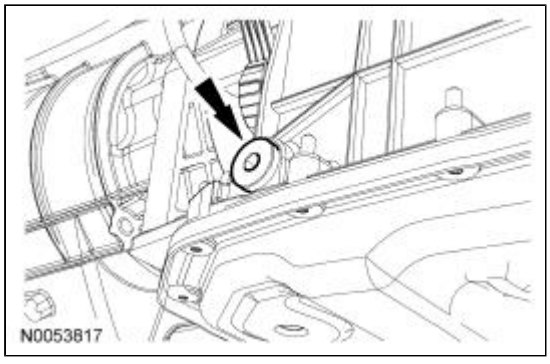
12. With the special tool connected, the engine idling (550-750 rpm) in PARK and the transmission temperature at 30°C-50°C (86°F-122°F), check and adjust the transmission fluid level.

13. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

    Fill with clean automatic transmission fluid until the fluid runs out of the bottom of the hole.



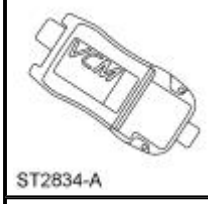
14. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



Manual Control Lever Shaft and Seal

Printable View (893 KB)

Special Tool(s)

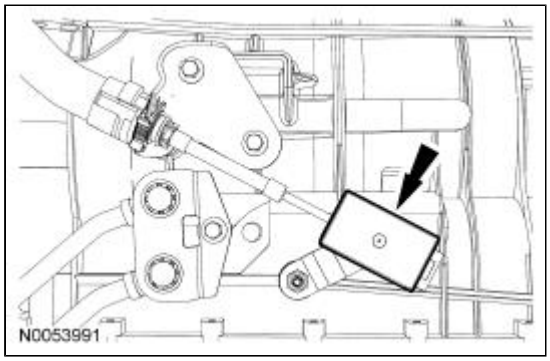
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2890-A	Installer, Shift Shaft Fluid Seal 307-559

Material

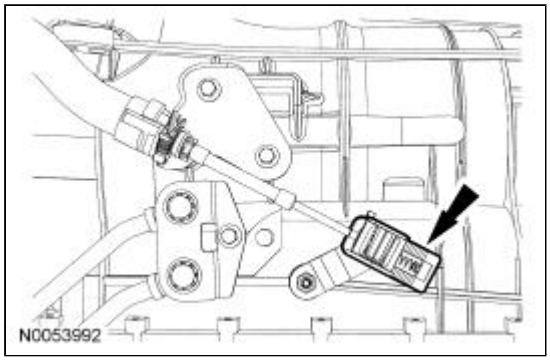
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If equipped, remove the heat shield.

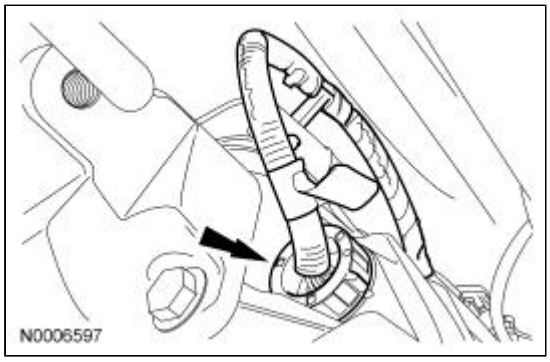


3. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.

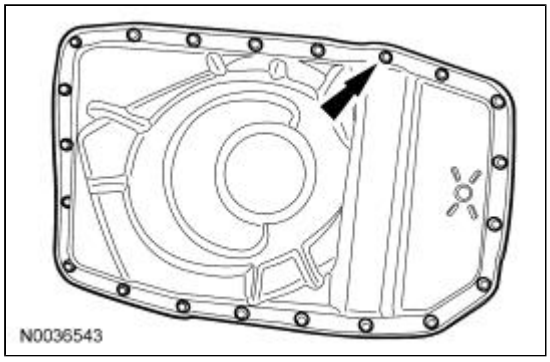


4. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

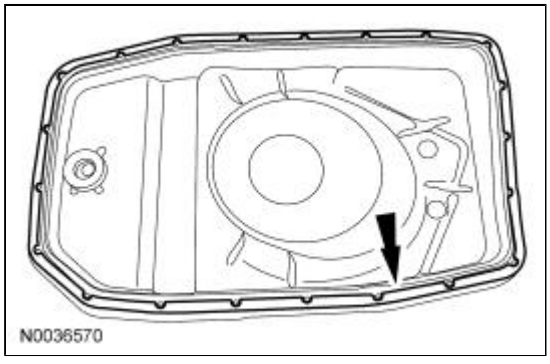
   Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.



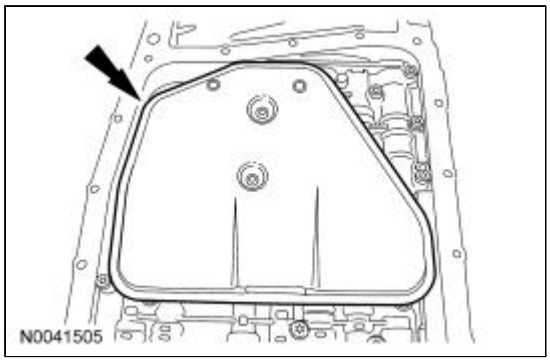
5. Remove the transmission fluid pan and allow the fluid to drain.



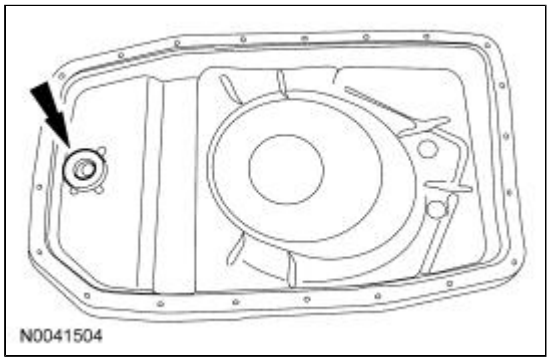
6. Remove the fluid pan gasket.



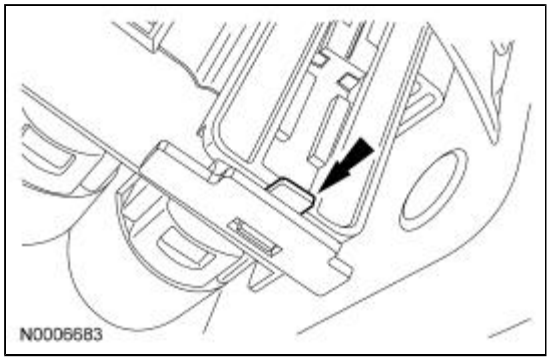
7. Remove and discard the transmission fluid filter.



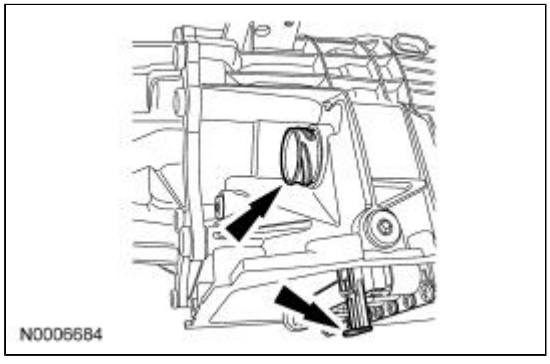
8. Clean and inspect the transmission fluid pan and magnet.



9. Press the release tab and pull down on the bulkhead connector retainer.

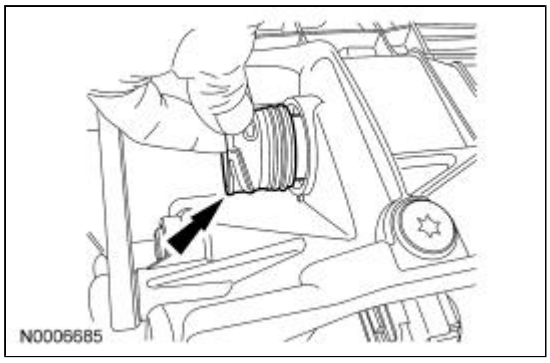


10. With the release tab down, pull the outer shell of the bulkhead electrical connector.



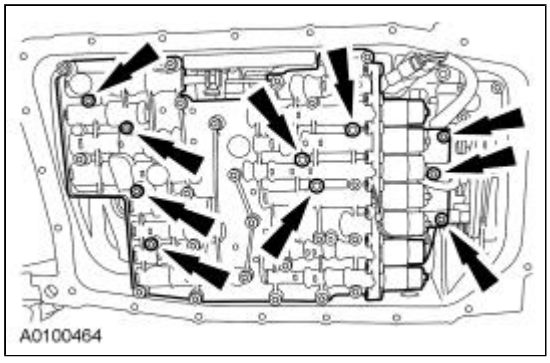
11. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

Pull the outer shell of the bulkhead electrical connector out of the transmission.

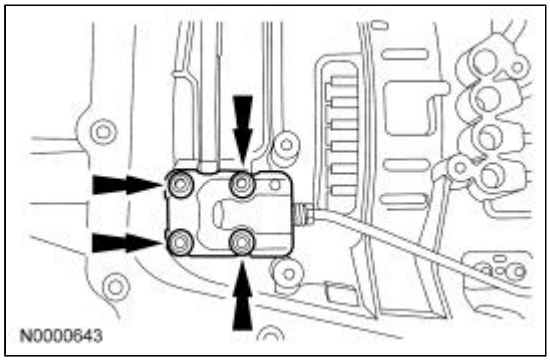


12. **NOTE:** During removal of the mechatronic assembly, the thermal bypass valve, pump adapter seal and one or more center support seals may become dislodged. Save these components for reuse during assembly.

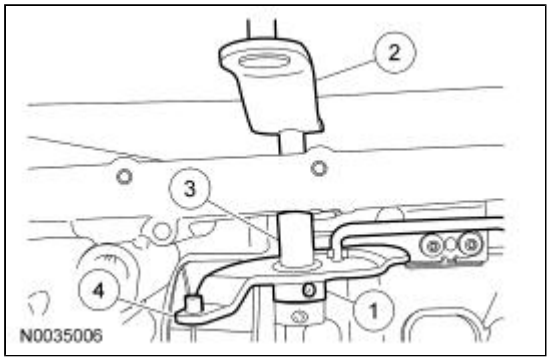
    Remove the 10 bolts from the mechatronic assembly and remove the mechatronic assembly.



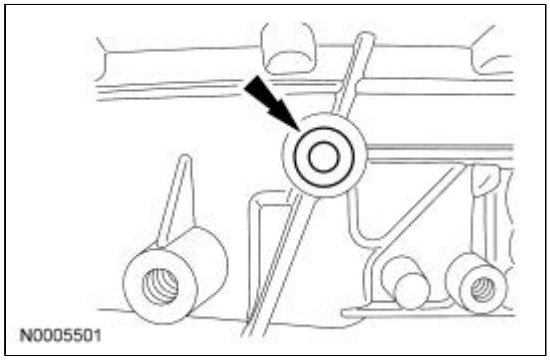
13. Remove the park rod actuating plate.



14. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the spacer to keep it from falling out of the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.

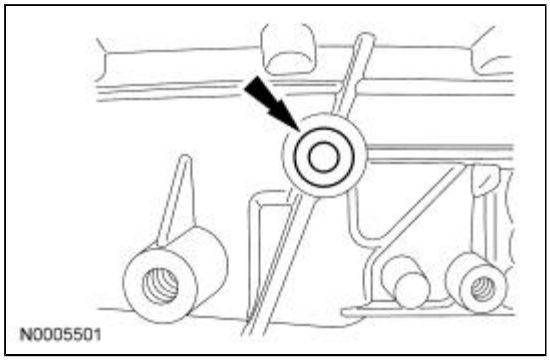


15. Remove and discard the manual control lever seal.

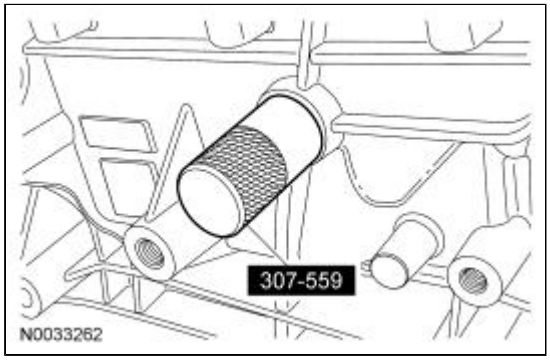


Installation

1. Position a new manual control lever seal in place.

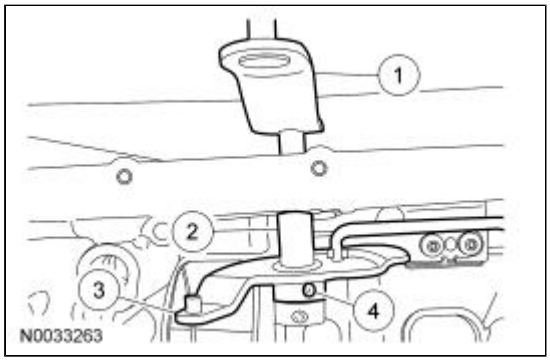


2. Using the special tool, install a new manual control lever shaft seal.



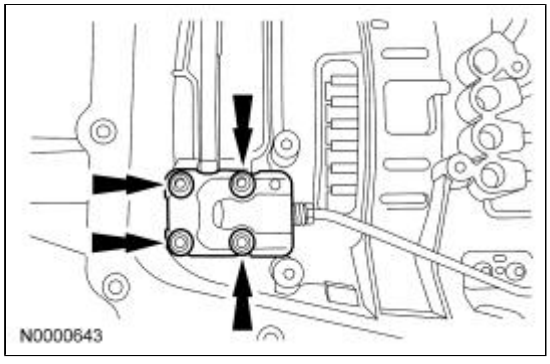
3. Install the manual lever in the case.
    1. Slide the manual lever in the case.
    2. Position the spacer in place while sliding the manual lever into the spacer.

3. Position the manual valve inner lever while sliding the manual lever and lining up the roll pin hole.
4. Install the roll pin.



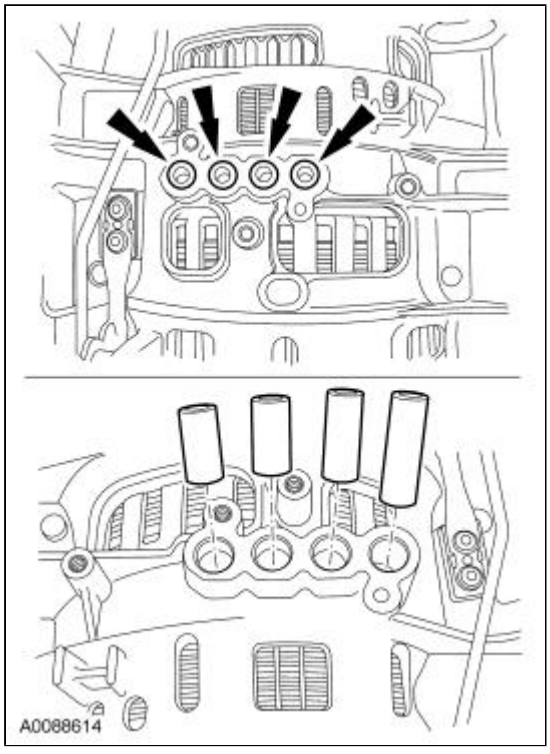
4. Position the park rod in place. Push down on the park pawl and position the park rod in place.

5. While holding the park rod down, install the park rod actuating plate.
   - Tighten to 10 Nm (89 lb-in).

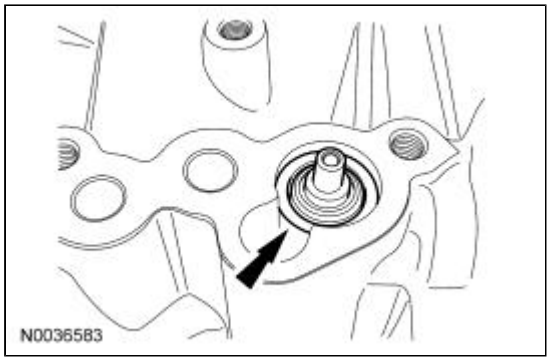


6. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

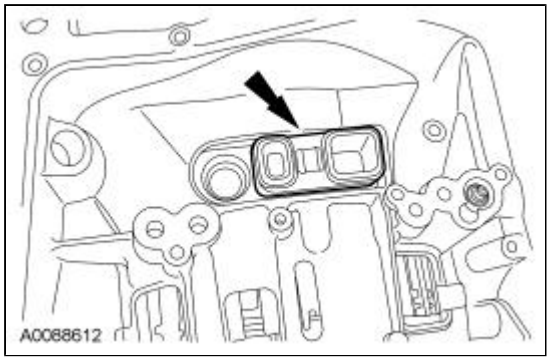
   Verify the 4 rubber feed tubes for the center support are in place.



7. Verify the thermal bypass valve is in the case.



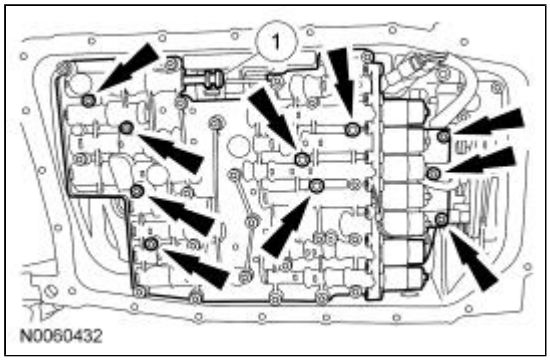
8. Verify the rubber adapter is in place.



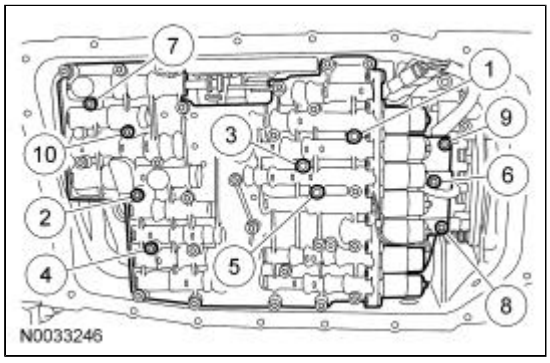
9. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission control module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

Position the mechatronic assembly in place and loosely install the 10 bolts.

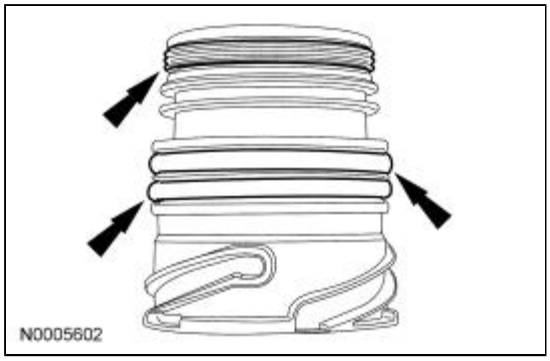
1. Align the manual valve and control lever linkage.



10. Tighten the mechatronic bolts in the sequence shown.
    - Tighten to 8 Nm (71 lb-in).

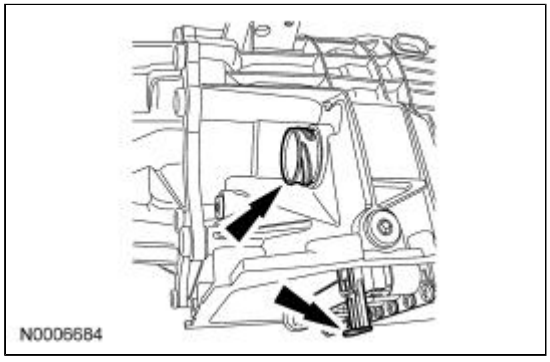


11. Install new O-rings on the outer shell of the bulkhead electrical connector.

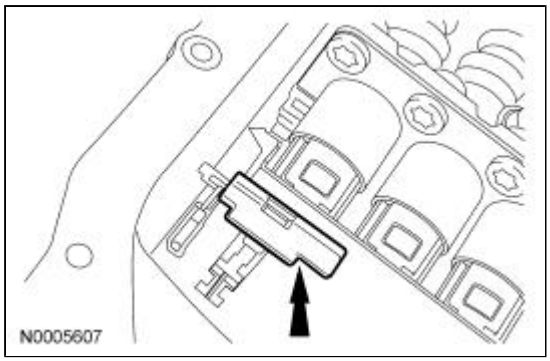


12. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

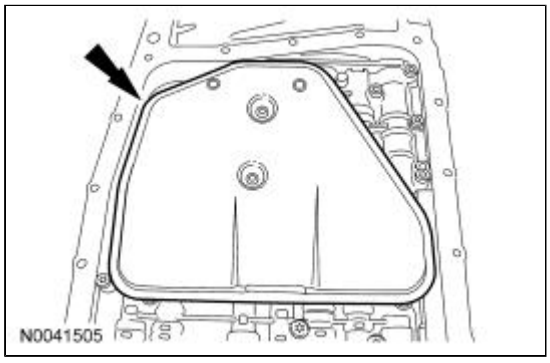
    With the release tab down, push the outer shell of the bulkhead electrical connector into the transmission.



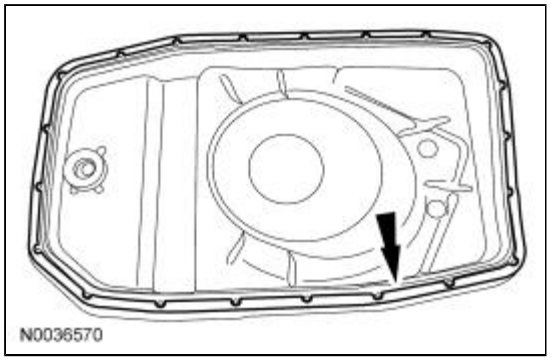
13. Press up on the tab and lock the outer shell of the bulkhead electrical connector in place.



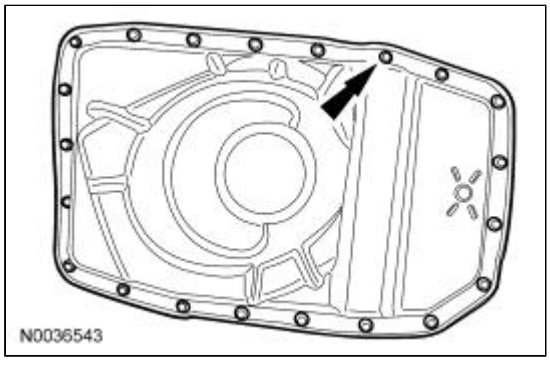
14. Install a new transmission fluid filter.



15. Install the fluid pan gasket.

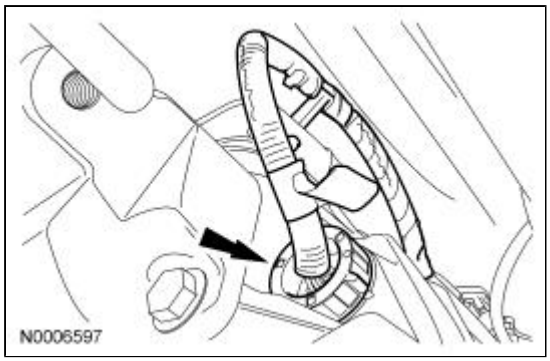


16. Install the fluid pan and bolts.
    - Tighten to 12 Nm (9 lb-ft).



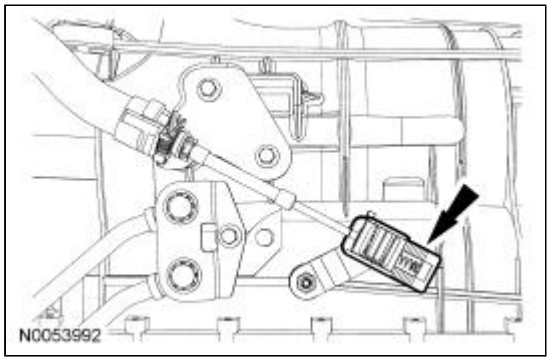
17. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to

lock it in place.

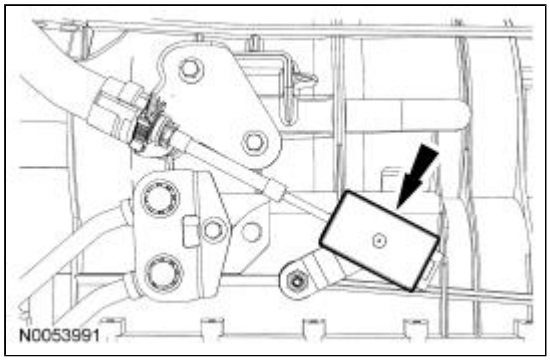


18. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

    Connect the selector lever cable onto the ball stud and move the locking tab down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.

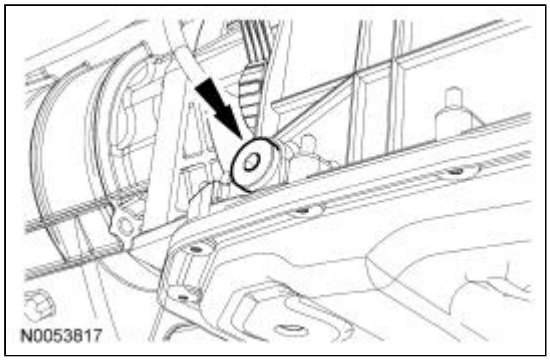


19. If equipped, install the heat shield.



20. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

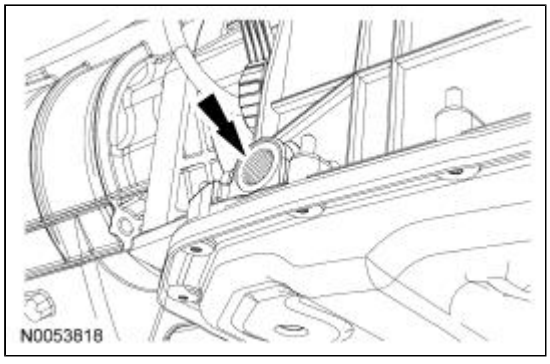
    Remove the fluid fill plug located on the RH rear side of the case near the transmission electrical connector.



21. **CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate correctly or transmission failure.**

    CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.

    Fill the transmission.
    - Add 4.7 liters (5 quarts) of clean automatic transmission fluid to the transmission through the fluid fill hole. Stop when the fluid runs out of the bottom of the hole.

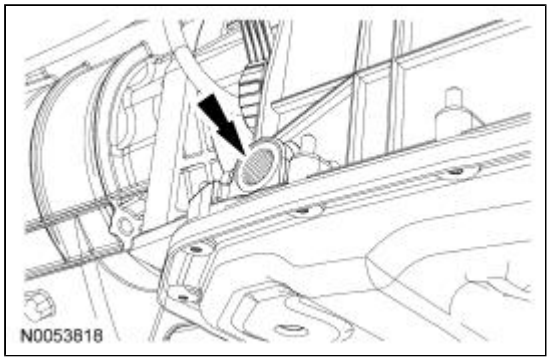


22. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

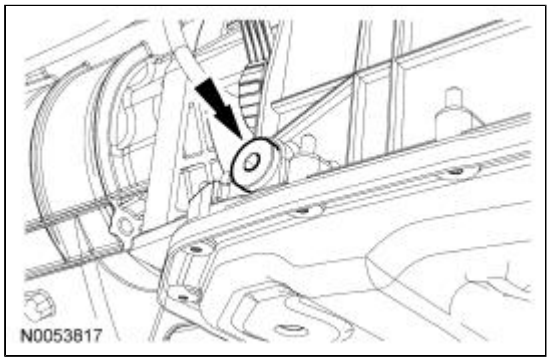
23. With the special tool connected, the engine idling (550-750 rpm) in PARK and the transmission temperature at 30°C-50°C (86°F-122°F), check and adjust the transmission fluid level.

24. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

    Fill with clean automatic transmission fluid until the fluid runs out of the bottom of the hole.



25. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



Transmission — Four Wheel Drive (4WD)

Printable View (702 KB)

Special Tool(s)

ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

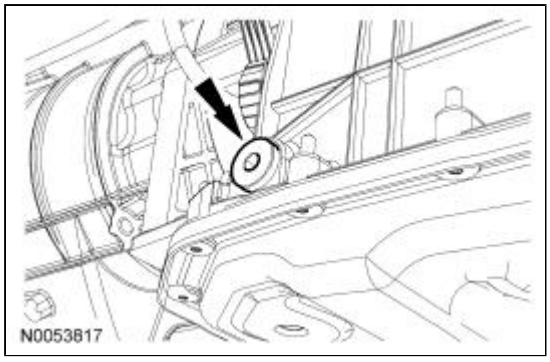
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

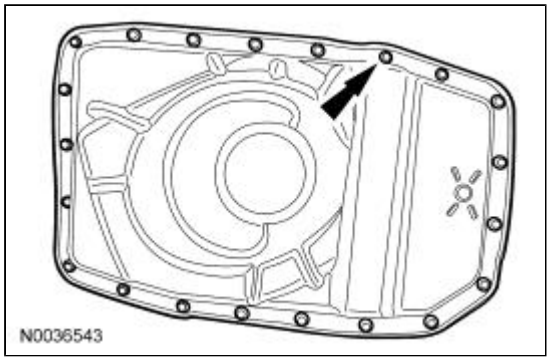
3. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

   Remove the fluid fill plug located on the passenger side rear portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.

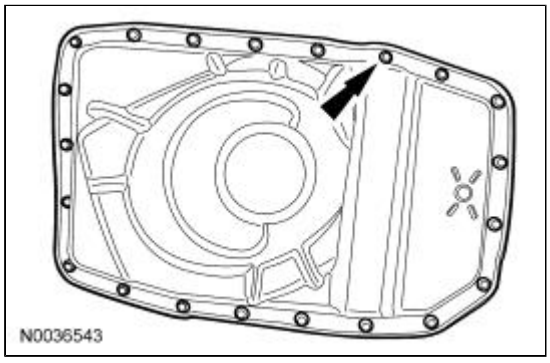


4. **NOTE:** If transmission disassembly or installation of a new transmission is necessary, the transmission fluid will need to be drained.

   Remove the transmission fluid pan and allow the fluid to drain.

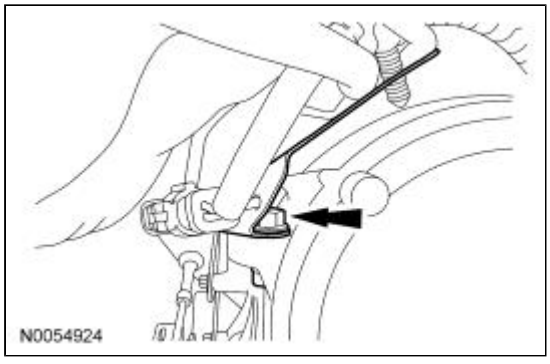


5. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 12 Nm (9 lb-ft).

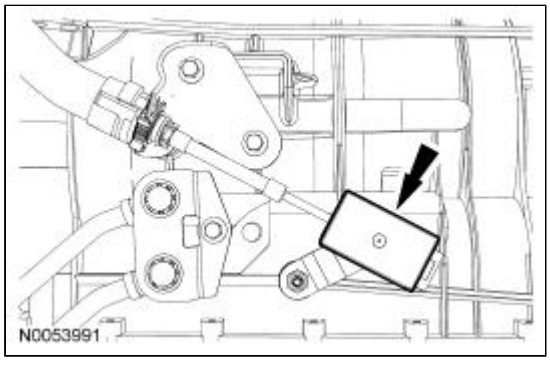


6. Remove the transfer case. For additional information, refer to Section 308-07B .

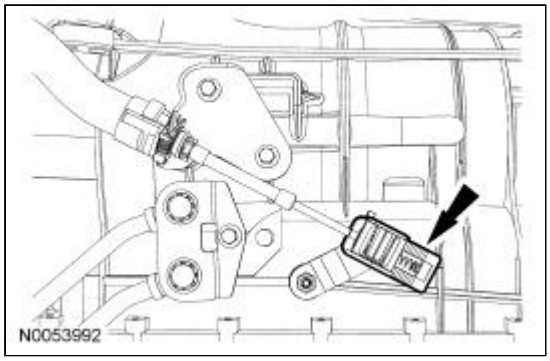
7. Remove the fuel line bracket bolt and position the bracket and lines aside.



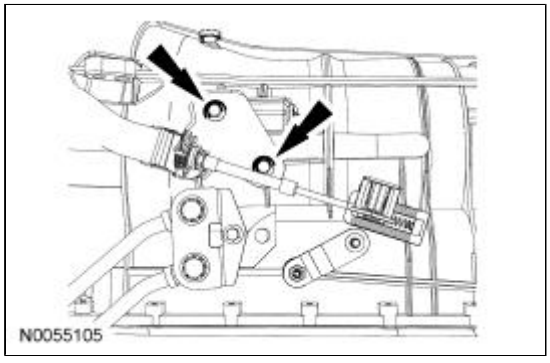
8. If equipped, remove the heat shield.



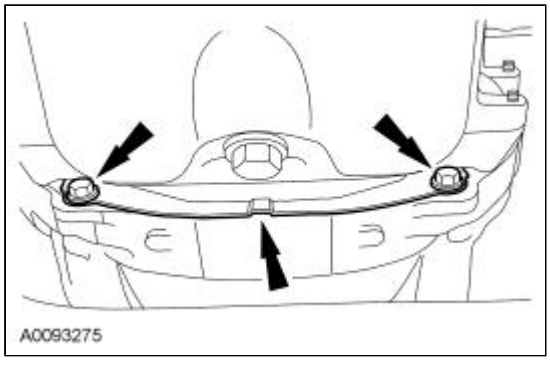
9. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.



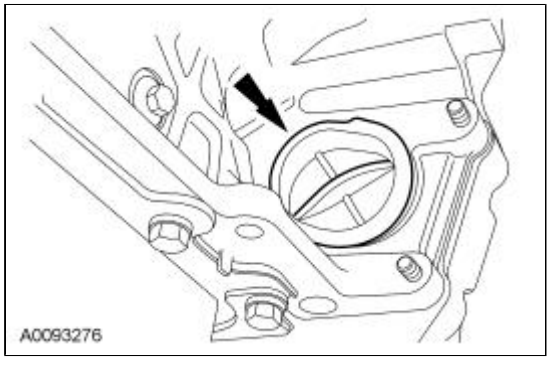
10. Remove the selector lever bracket bolts and remove the bracket.



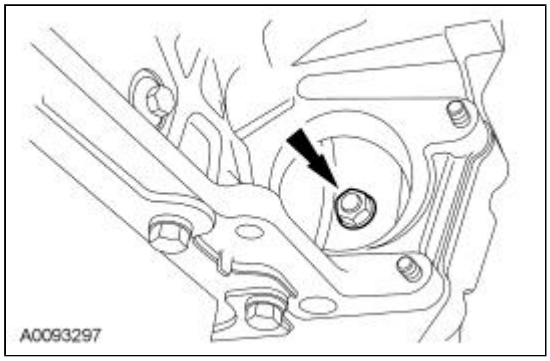
11. Remove the flexplate inspection cover bolts and the inspection cover.



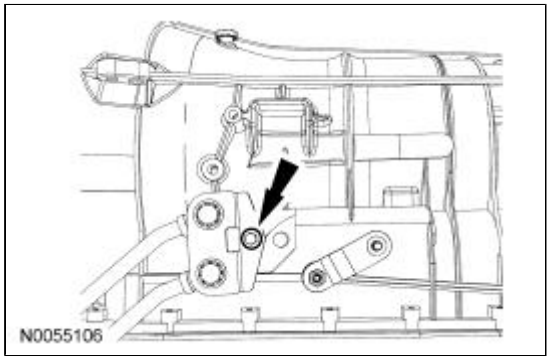
12. Remove the rubber torque converter nut access plug.



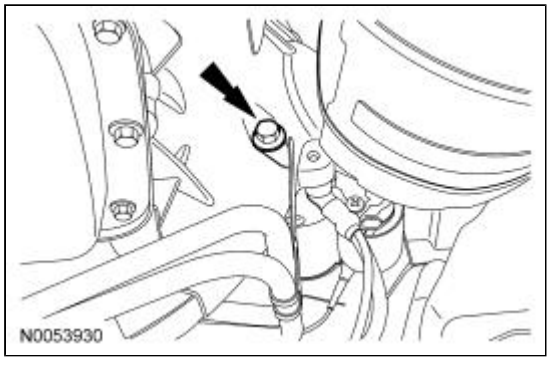
13. Remove and discard the 4 flexplate-to-torque converter nuts.



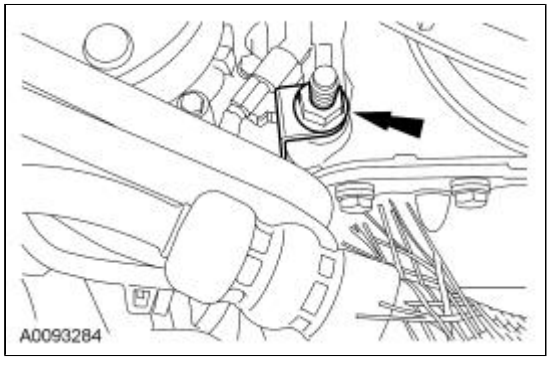
14. Remove the transmission cooler tube bracket bolt.



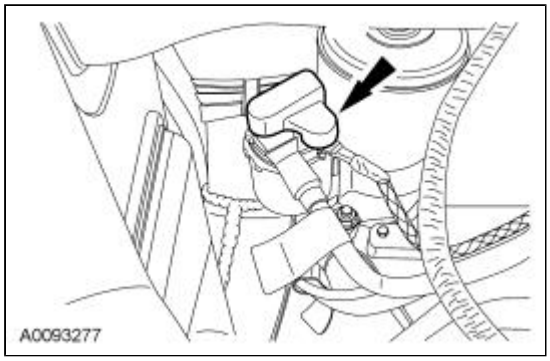
15. Remove the transmission case bolt.



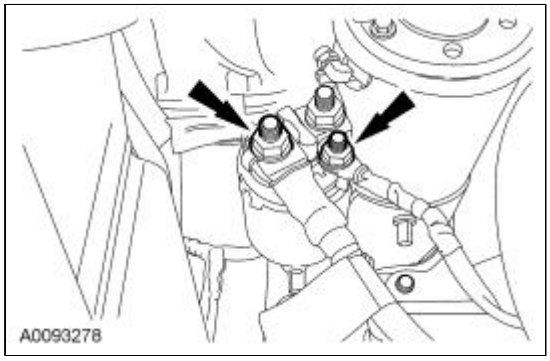
16. Remove the transmission fluid cooler tube bracket nut and position the bracket and tubes aside.



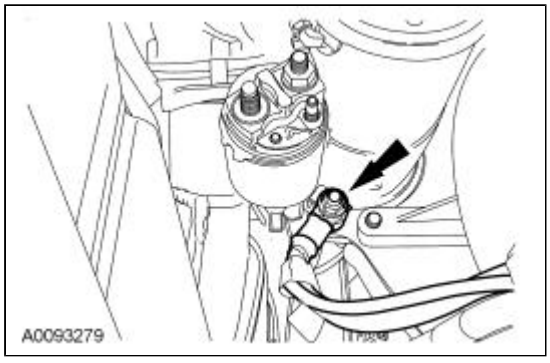
17. Remove the plastic starter motor electrical connector cap.



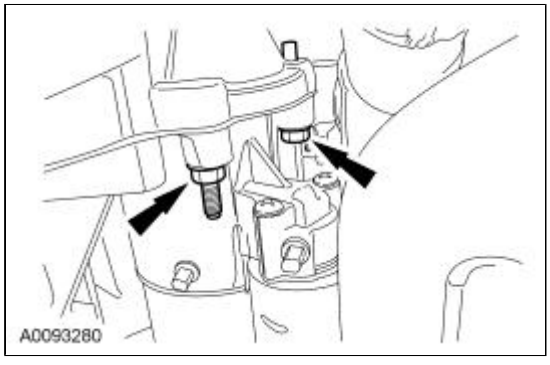
18. Remove the starter motor electrical connectors.



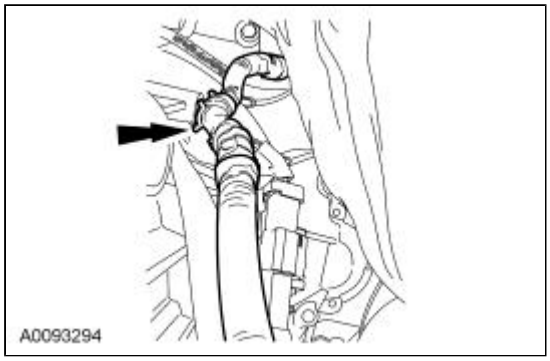
19. Remove the ground wire from the stud.



20. Remove the 3 starter motor bolts and the starter motor.

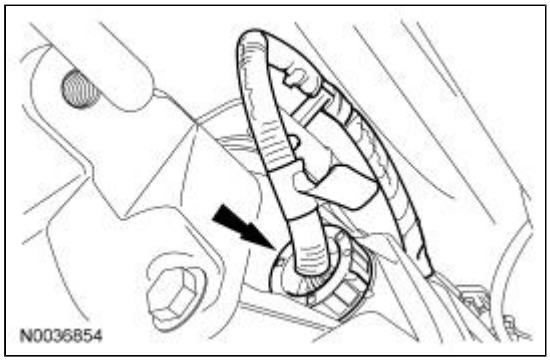


21. Disconnect the wiring harness from the top of the transmission.



22. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

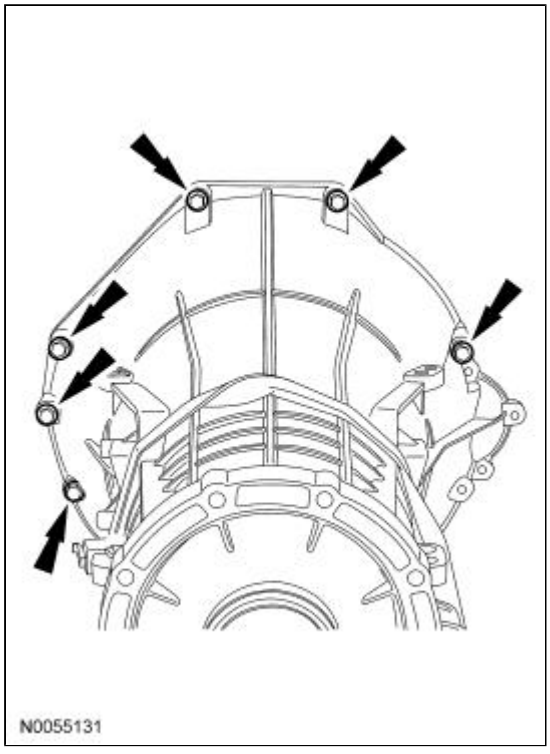
    Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.



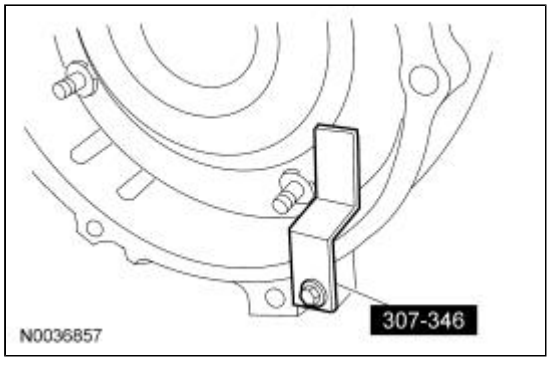
23. **NOTE:** The top 2 transmission case bolts need to be removed prior to removing the rest of the bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission case bolts.



24. Slide the transmission back enough to install the special tool.



25. Remove the transmission from the vehicle.

26. If the transmission is to be overhauled or if installing a new transmission, carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Transmission — Rear Wheel Drive (RWD)

Printable View (971 KB)

Special Tool(s)

ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

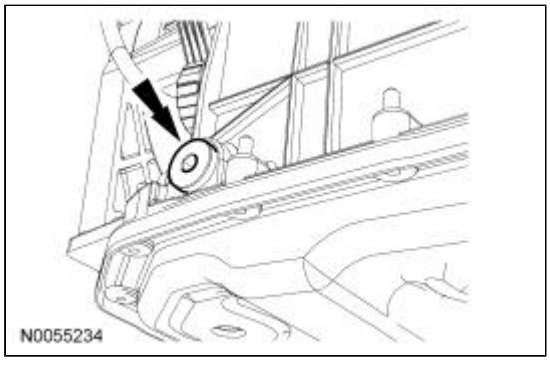
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Remove the driveshaft. For additional information, refer to Section 205-01 .

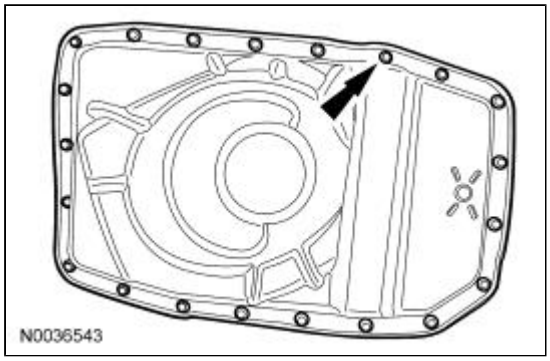
3. **CAUTION: The fluid fill plug located on the side of the transmission is near the exhaust system. The exhaust will be extremely hot during this procedure. Use care when working near the exhaust and the heat shields.**

   Remove the fluid fill plug located on the passenger side rear portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.

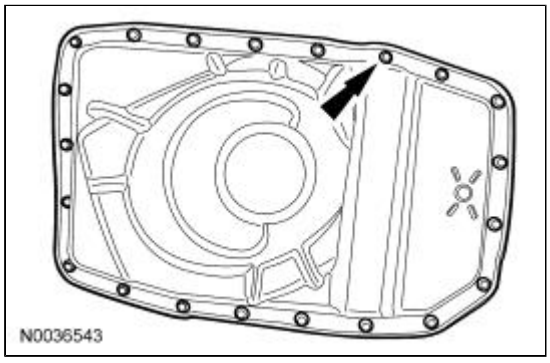


4. **NOTE:** If transmission disassembly, or installation of a new transmission is necessary, the transmission fluid will need to be drained.

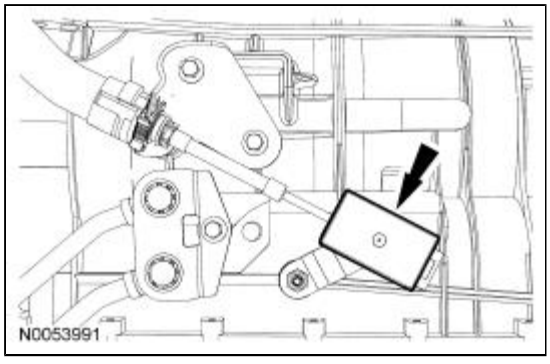
   Remove the transmission fluid pan and allow the fluid to drain.



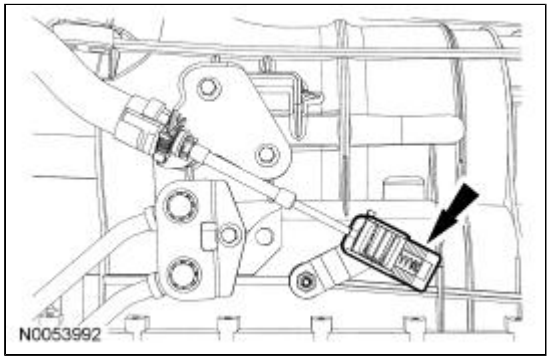
5. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 12 Nm (9 lb-ft).



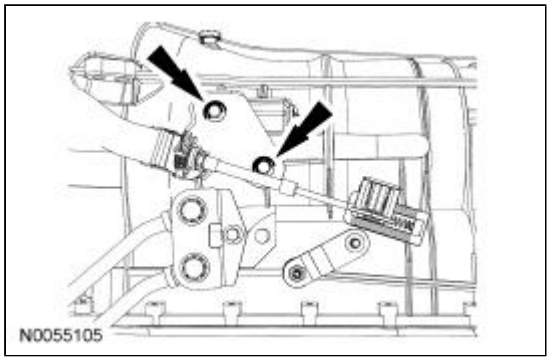
6. If equipped, remove the heat shield.



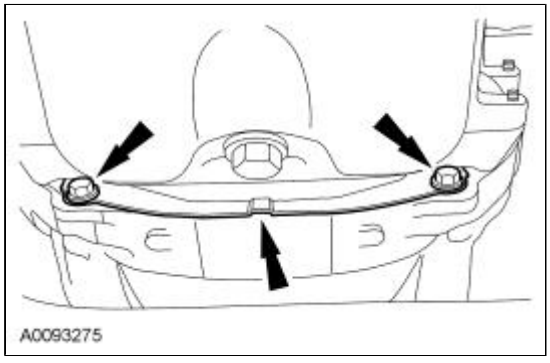
7. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.



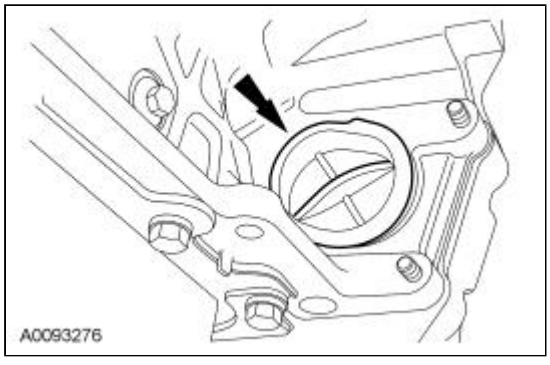
8. Remove the selector lever bracket bolts and remove the bracket.



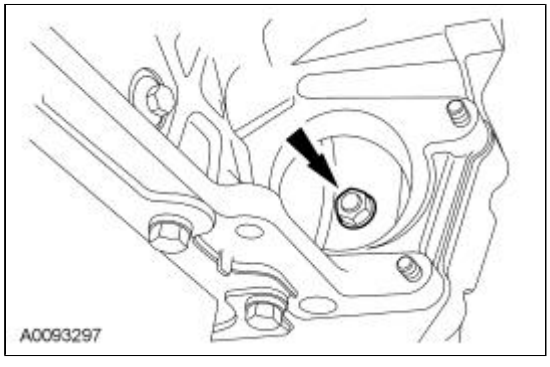
9. Remove the flexplate inspection cover bolts and the inspection cover.



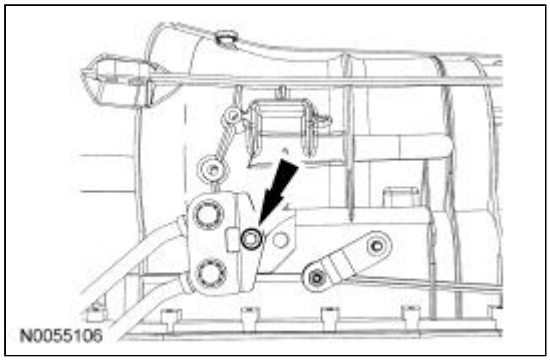
10. Remove the rubber torque converter nut access plug.



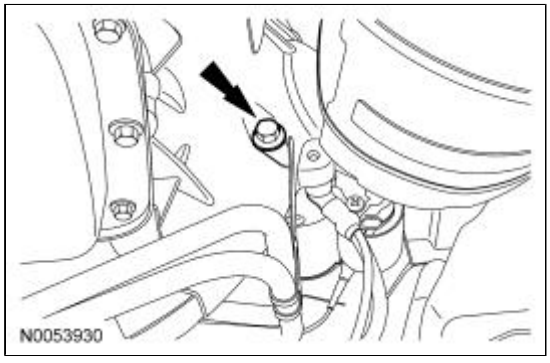
11. Remove and discard the 4 flexplate-to-torque converter nuts.



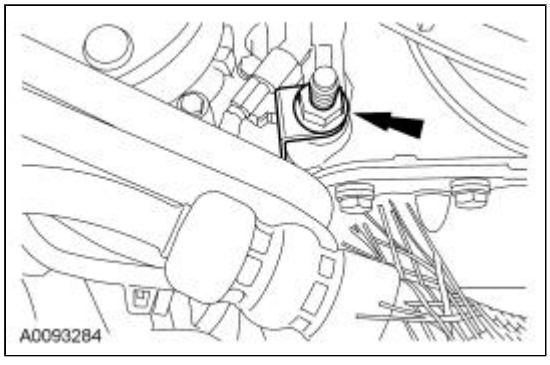
12. Remove the transmission cooler tube bracket bolt.



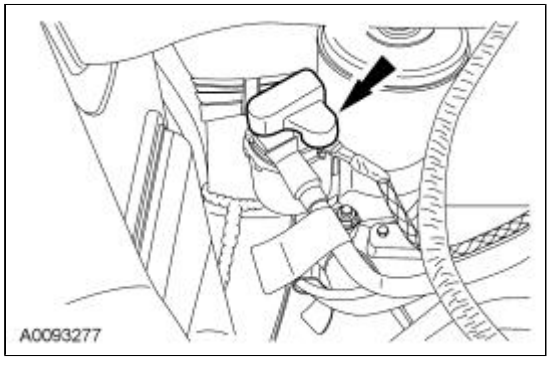
13. Remove the transmission case bolt.



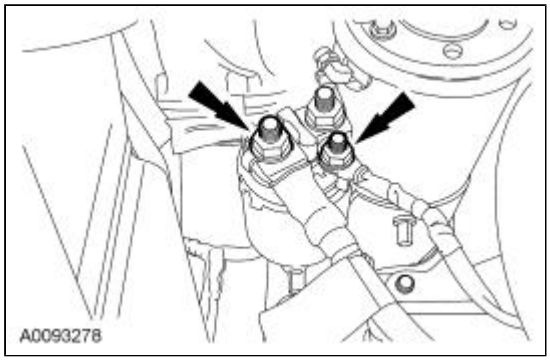
14. Remove the transmission fluid cooler tube bracket nut and position the bracket and tubes aside.



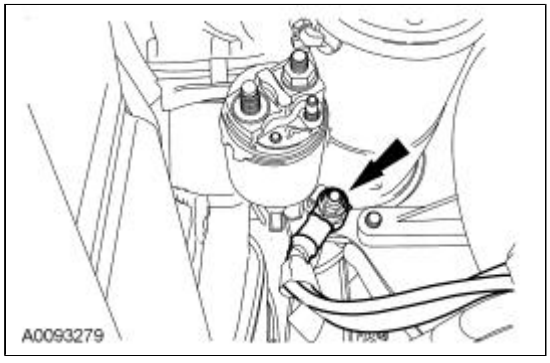
15. Remove the plastic starter motor electrical connector cap.



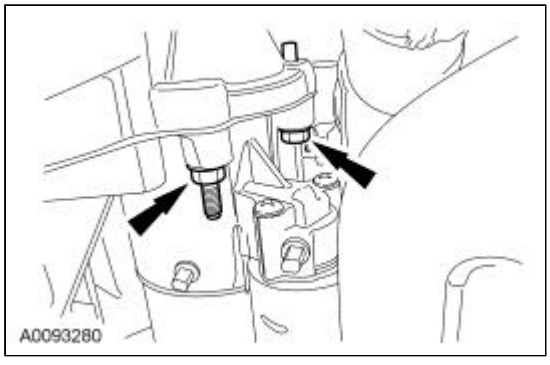
16. Remove the starter motor electrical connectors.



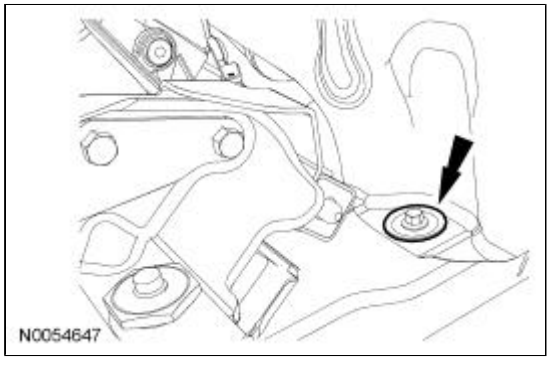
17. Remove the ground wire from the stud.



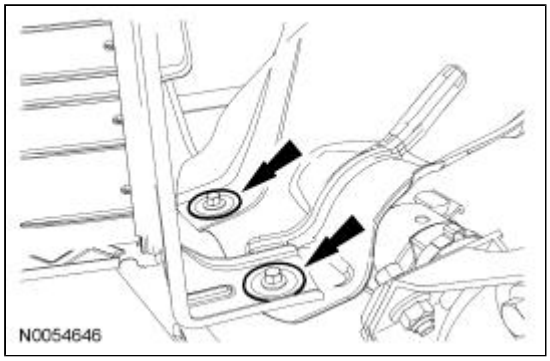
18. Remove the starter motor bolts and the starter motor.



19. Remove the RH exhaust heat shield bolt.

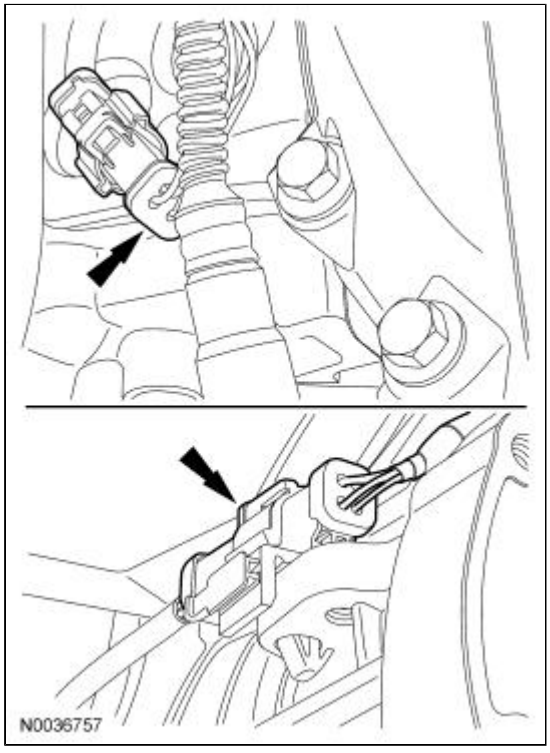


20. Remove the LH exhaust heat shield and evaporative emissions canister assembly bolts.

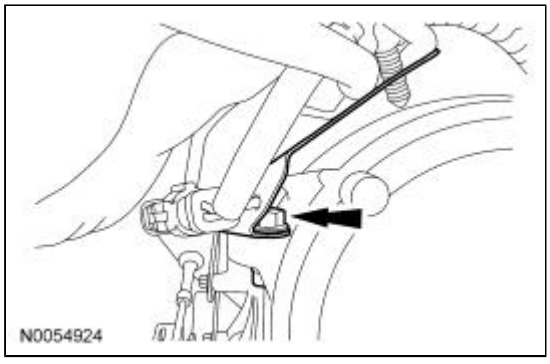


21. **NOTE:** LH shown, RH similar.

    Disconnect the RH and LH heated oxygen sensors (HO2S) and the catalyst monitor sensor (CMS) electrical connectors.



22. Remove the fuel line bracket bolt and position the bracket and lines aside.

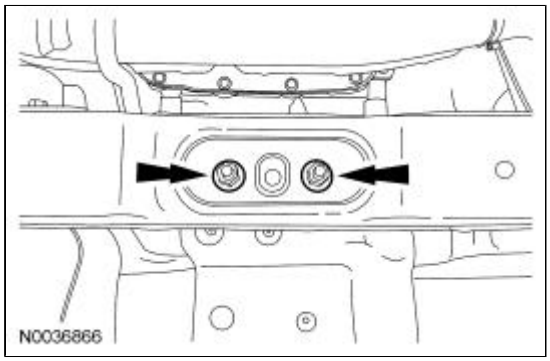


23. **NOTE:** Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

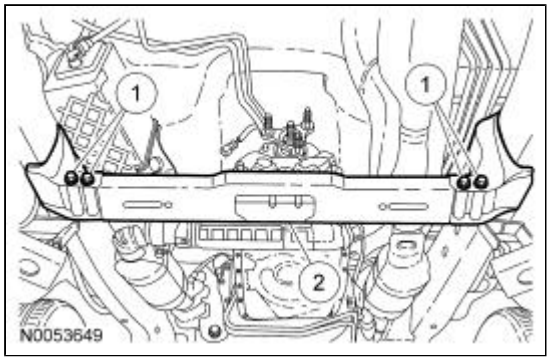
    NOTE: Make sure that the transmission is securely fastened to the transmission jack.

Position a suitable high-lift transmission jack under the transmission.

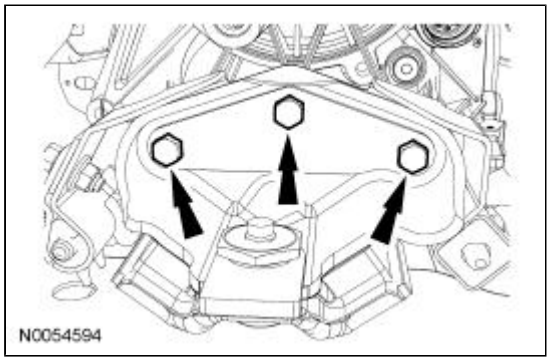
24. Remove the 2 rear crossmember nuts.



25. Remove the rear crossmember.
    1. Remove the 4 crossmember bolts and nuts.
    2. Remove the crossmember.

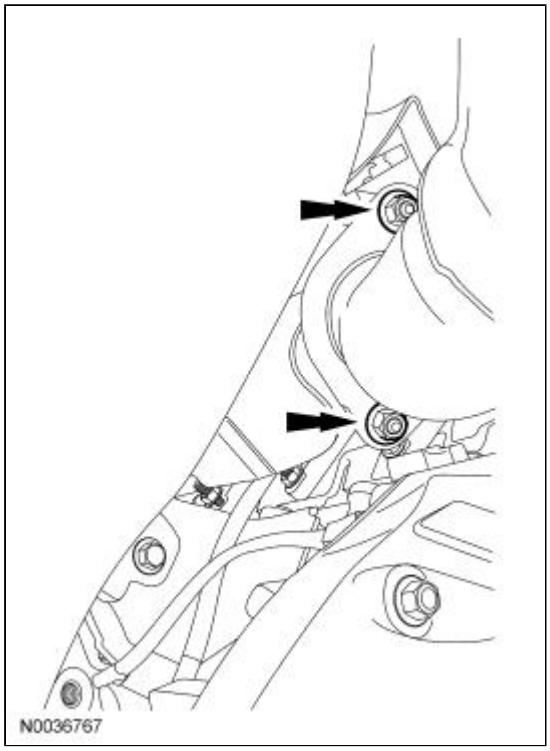


26. Remove the 3 bolts and remove the insulator.

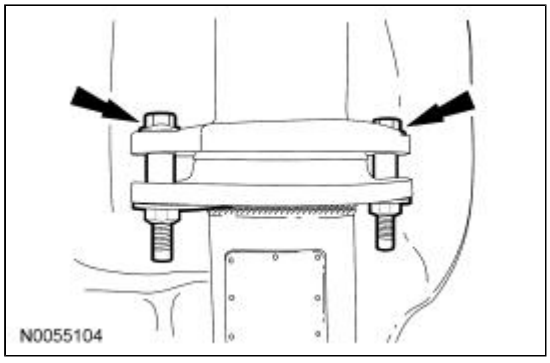


27. **NOTE:** LH shown, RH similar.

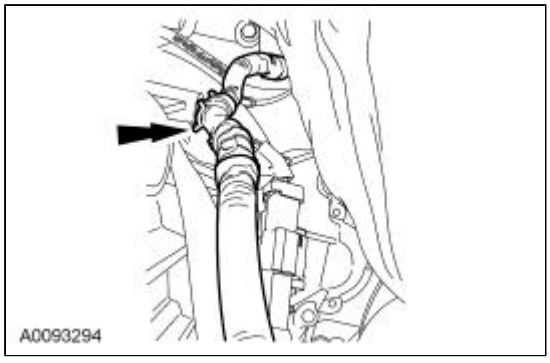
    Remove the RH and LH exhaust flange nuts.



28. Remove the 2 dual converter Y-pipe bolts and the dual converter Y-pipe.

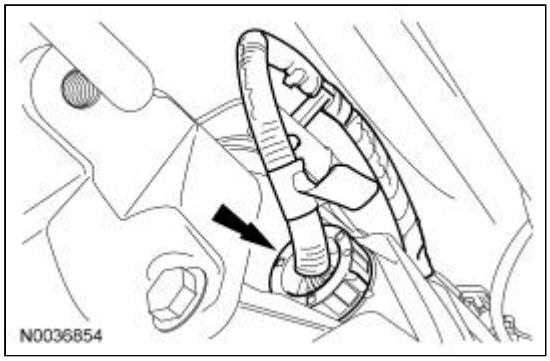


29. Disconnect the wire harness from the top of the transmission.



30. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

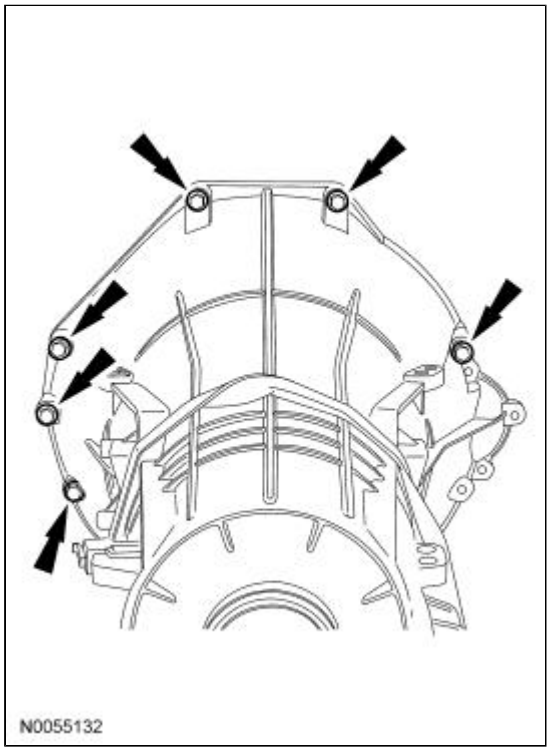
    Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.



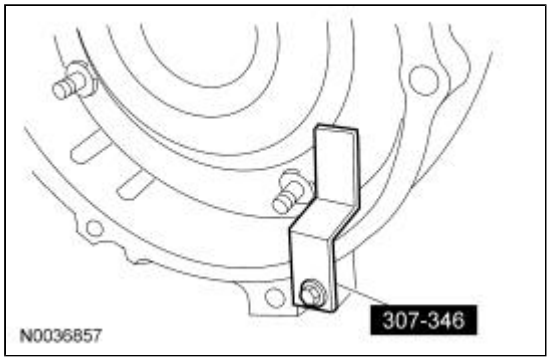
31. **NOTE:** The top 2 transmission-to-engine bolts need to be removed prior to removing the rest of the bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission case bolts.



32. Slide the transmission back far enough to install the special tool.



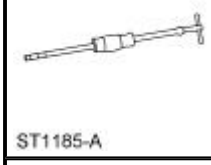
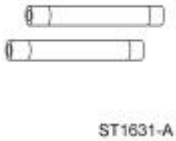
33. Remove the transmission from the vehicle.

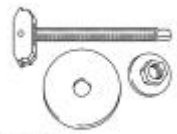
34. If the transmission is to be overhauled or if installing a new transmission, carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Transmission

Printable View (1618 KB)

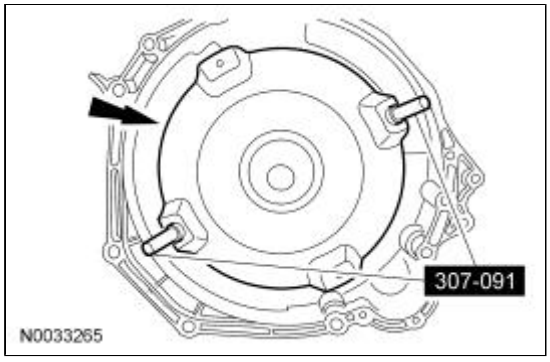
Special Tool(s)

 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
ST2381-A	Remover, Input Shaft Oil Seal 308-375
ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)
ST1608-A	Collet, 1-1/4 to 1-1/24 Inch 303-D022 (D80L-100T) or equivalent
ST1606-A	Actuator Pin 303-D012 (D80L-100-H) or equivalent
ST2891-A	Remover, Transmission Fluid Pump 307-553
	Remover, Bearing 307-562 (includes 307-562/1

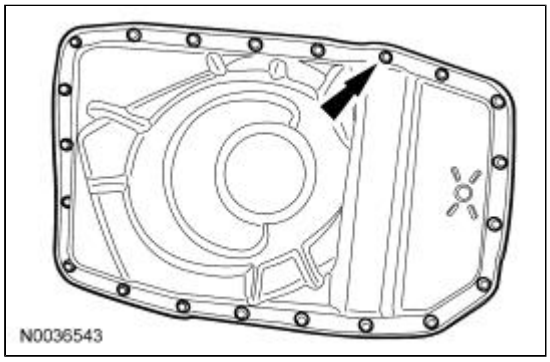
 ST2932-A	and 307-562/2)

All vehicles

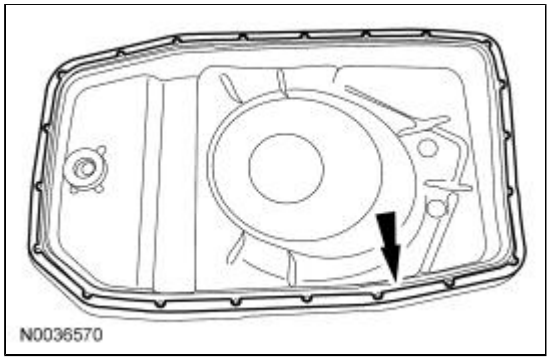
1. Using the special tools, remove the torque converter.



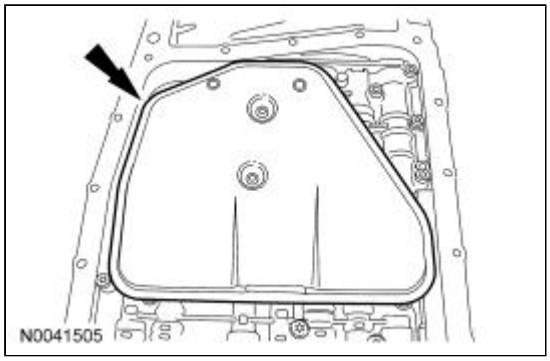
2. Remove the transmission fluid pan.



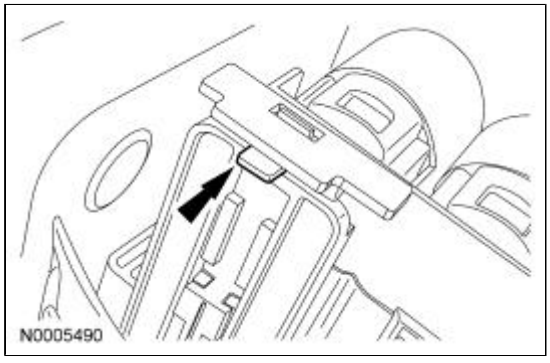
3. Remove the fluid pan gasket.



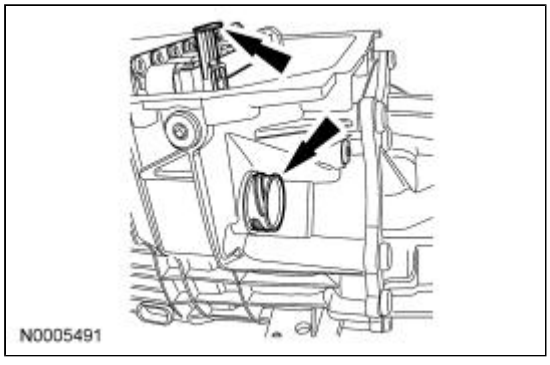
4. Remove and discard the transmission fluid filter.



5. Press the release tab and lift up on the bulkhead connector retainer.

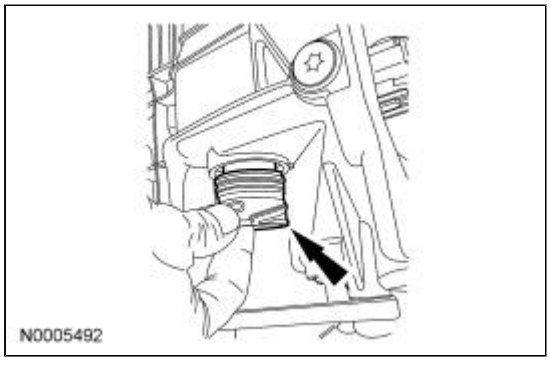


6. With the release tab up, pull the outer shell of the bulkhead electrical connector.

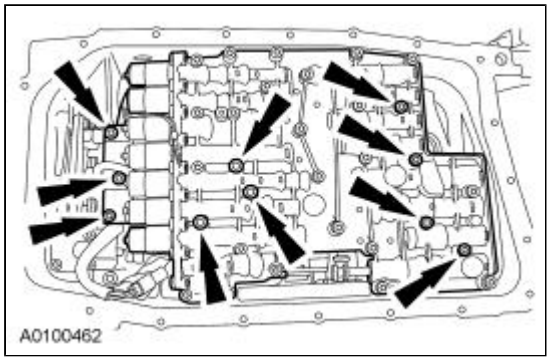


7. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

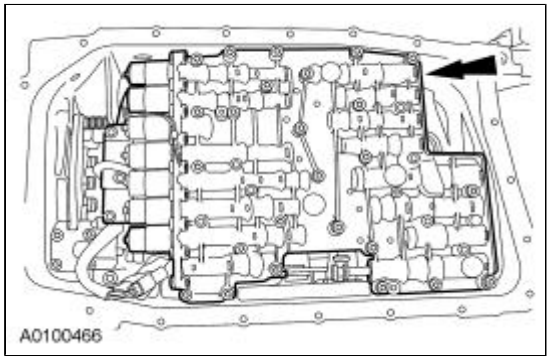
   Pull the outer shell of the bulkhead electrical connector out of the transmission.



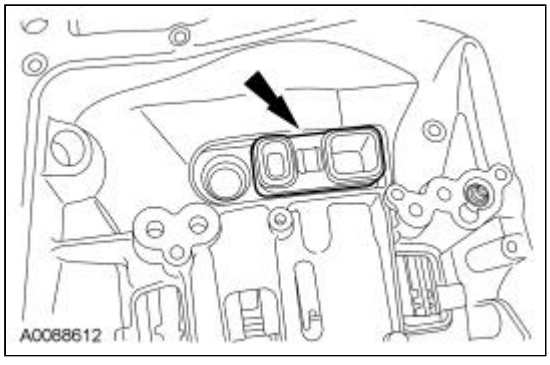
8. Remove the 10 bolts from the mechatronic assembly.



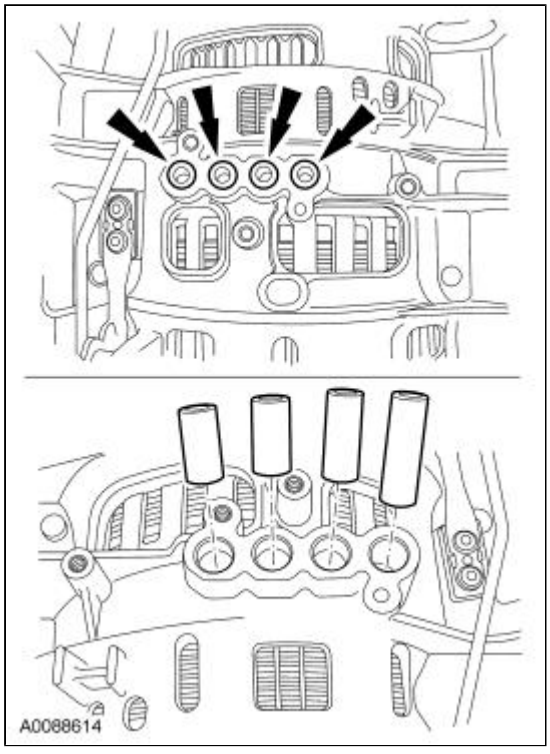
9. Remove the mechatronic assembly.



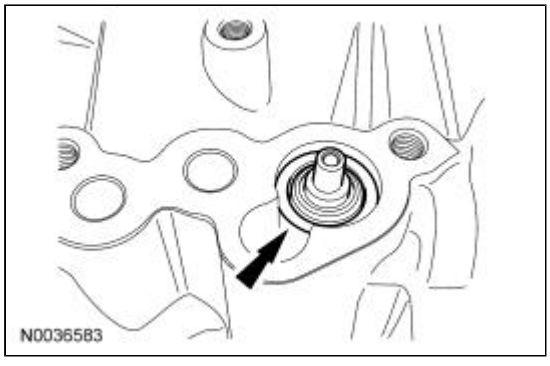
10. Remove the rubber adapter and the fluid filter seal.



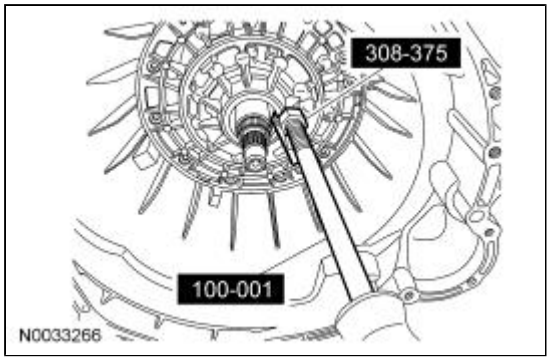
11. Remove and discard the 4 rubber feed tubes for the center support. Note the size and location while removing for correct installation.



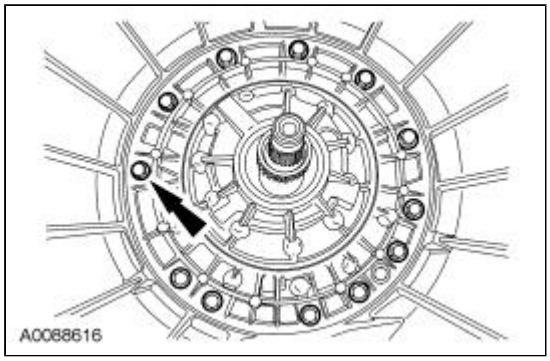
12. Remove the thermal bypass valve.



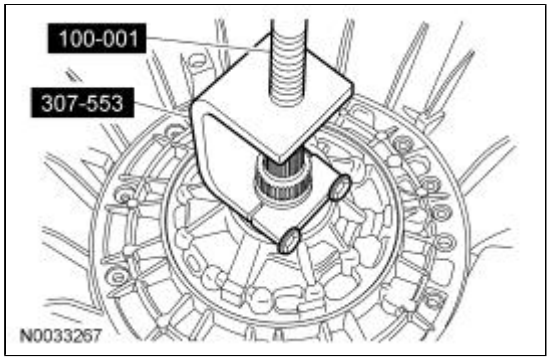
13. Using the special tools, remove and discard the front pump seal.



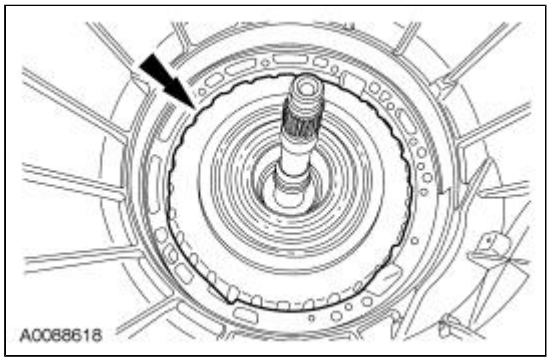
14. Remove and discard the front pump bolts.



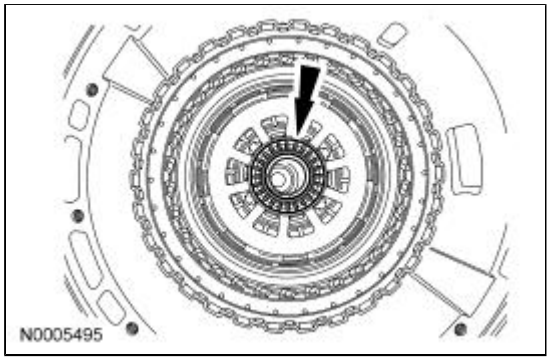
15. Using the special tools, remove the front pump support. Make sure that the selective shim is on the back side of the pump.



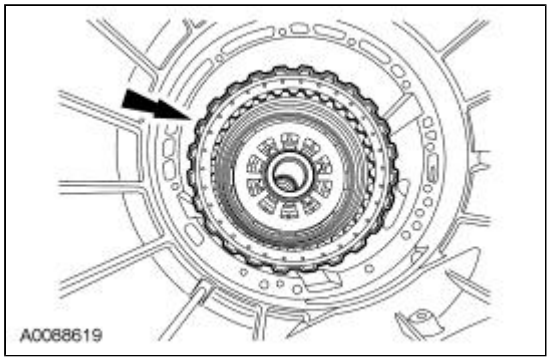
16. Remove the forward (clutch A)/overdrive (clutch E) clutch assembly.



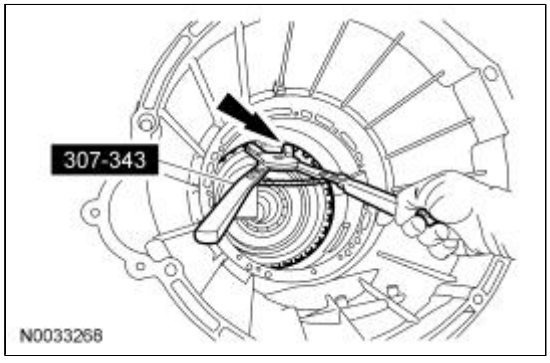
17. Remove the roller bearing.



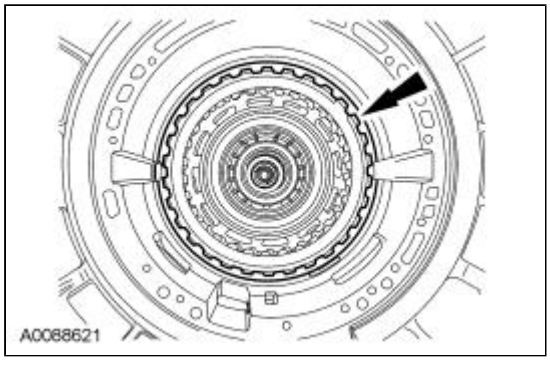
18. Remove the direct clutch assembly.



19. Using the special tool, remove the center support snap ring.

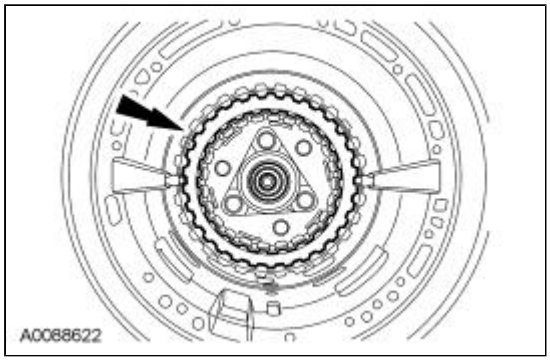


20. Remove the center support.

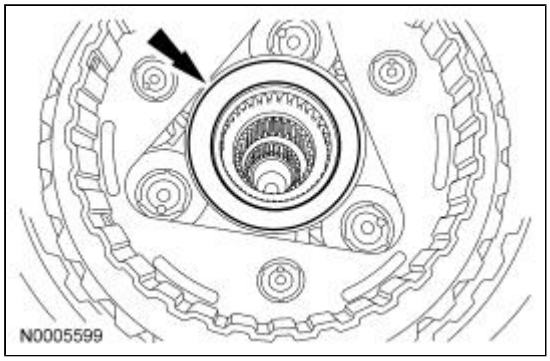


21. **NOTE:** When removing the planet carrier and the low/reverse clutch pack, some of the clutch plates may stay in the case. Try to keep all the clutches together.

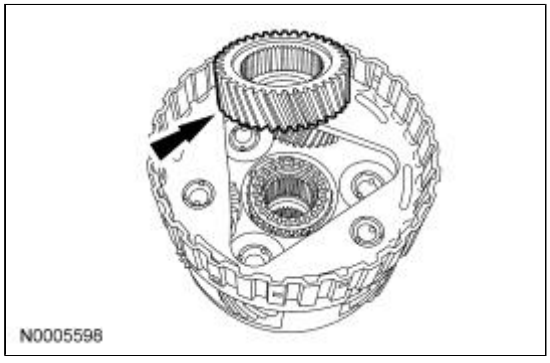
    Remove the planet carrier and the low/reverse clutch pack as an assembly.



22. Remove the low/reverse bearing race.

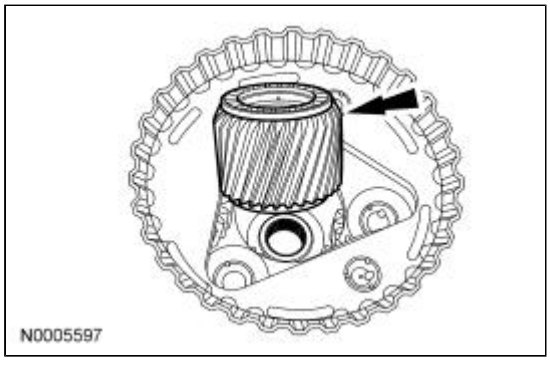


23. Remove the low/reverse sun gear.

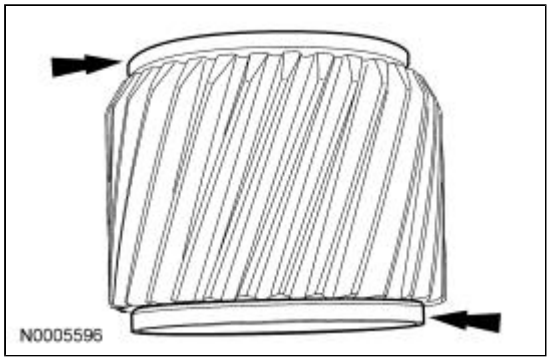


24. **NOTE:** When removing the sun gear, take note that the taper edge is facing up toward the torque converter housing.

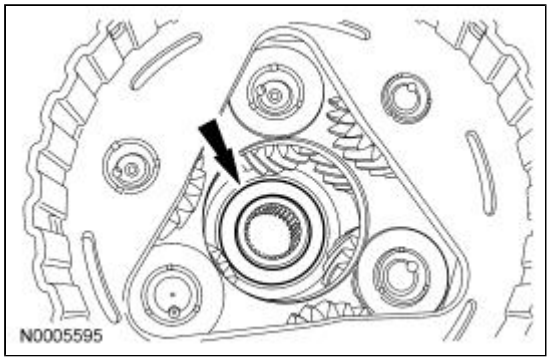
    Remove the sun gear into the planet assembly.



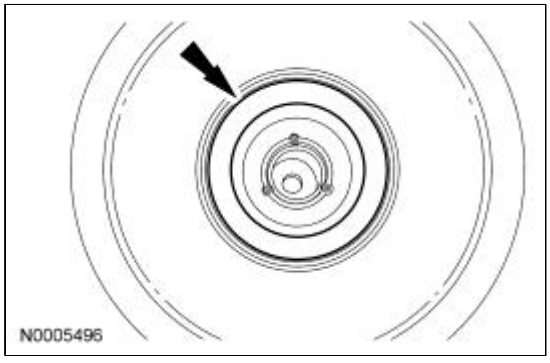
25. Remove the top and the bottom roller bearings from the sun gear.



26. Remove the roller bearing race in the bottom of the carrier.

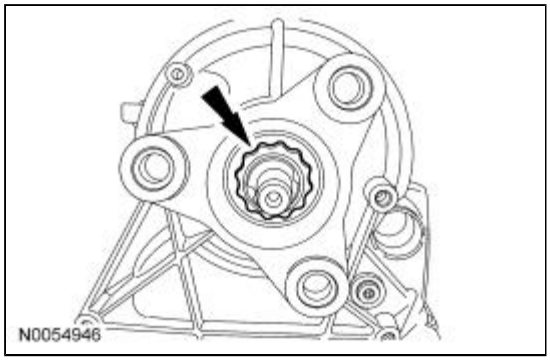


27. Remove the washer.

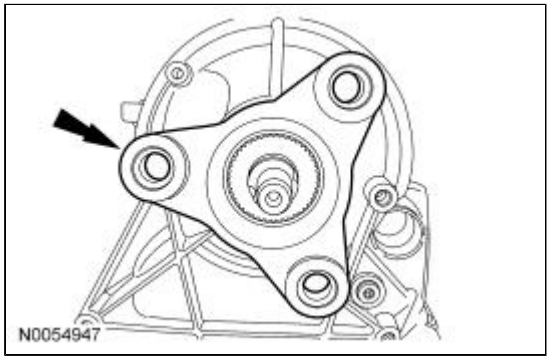


Rear wheel drive (RWD) vehicles

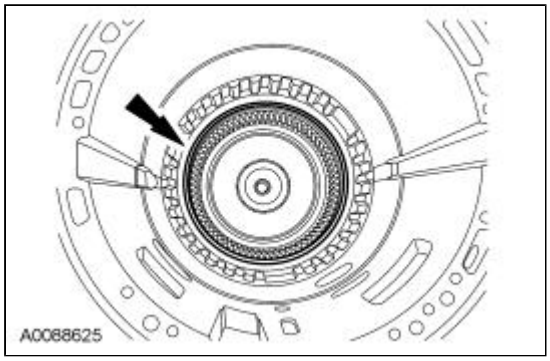
28. Remove and discard the output shaft flange nut.



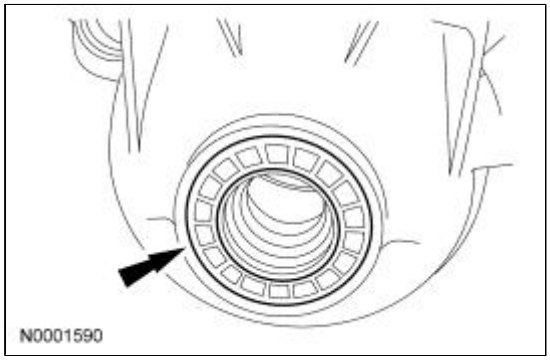
29. Remove the output shaft flange.



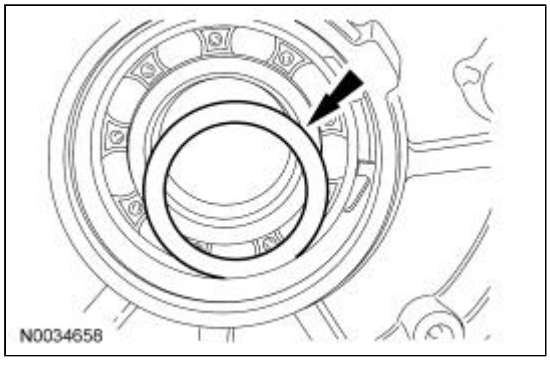
30. Remove the planet carrier hub and output shaft assembly.



31. Remove the output shaft seal.

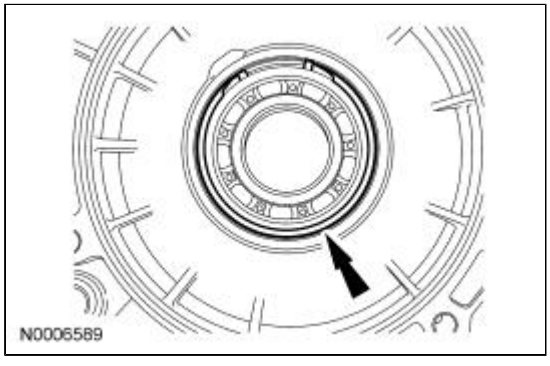


32. Remove the anti-click washer.



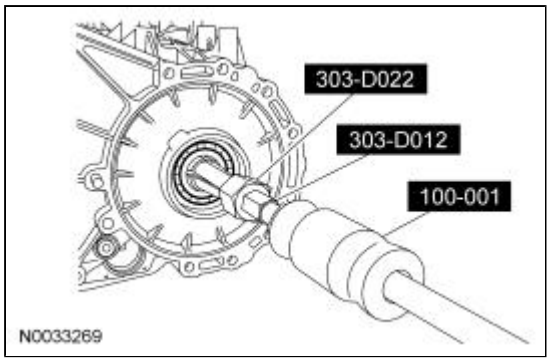
33. **NOTE:** Four wheel drive (4WD) case shown, RWD case similar.

    Remove the snap ring from the case.

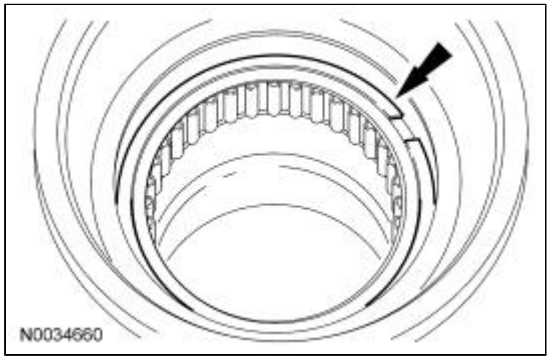


34. **NOTE:** 4WD case shown, RWD case similar.

Using the special tools, remove the roller bearing.

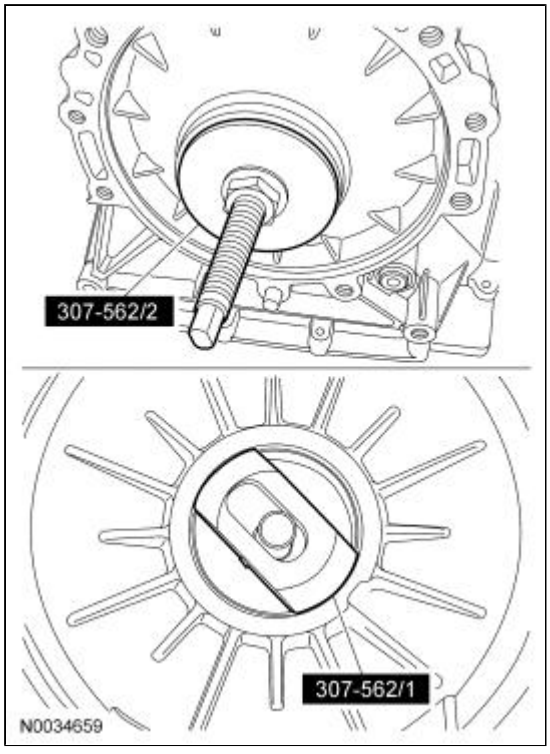


35. Using a small pick, remove the snap ring.



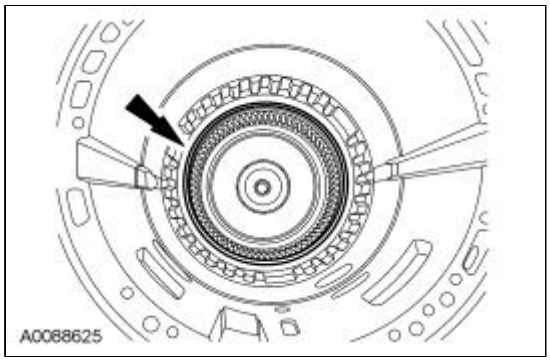
36. **CAUTION: Use care when installing the special tool. Look inside the transmission case to make sure that the tool contacts the bearing only and not the lip of the case, or damage to the case will result.**

Using the special tool, remove the bearing assembly.

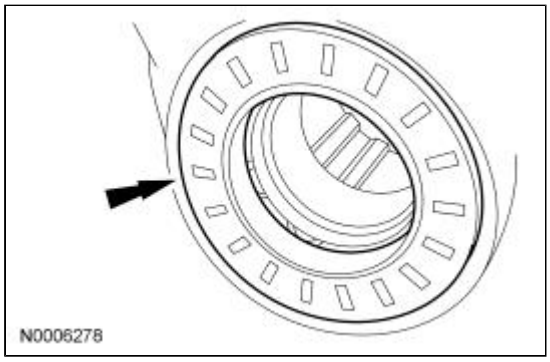


4WD vehicles

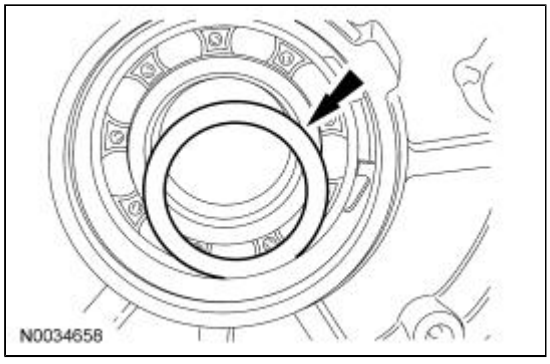
37. Remove the planet carrier hub and output shaft assembly.



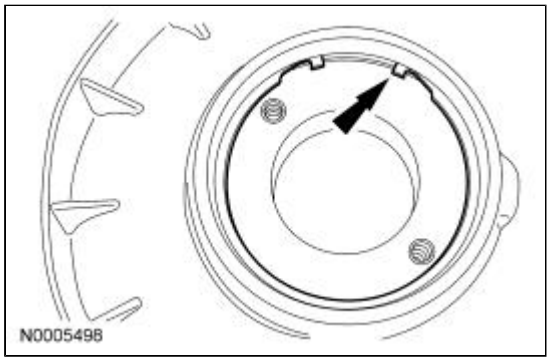
38. Remove and discard the output shaft seal.



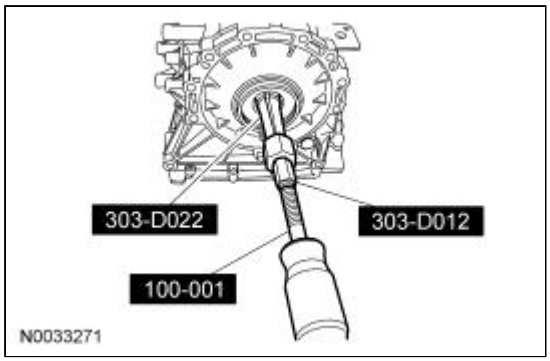
39. Remove the anti-click washer.



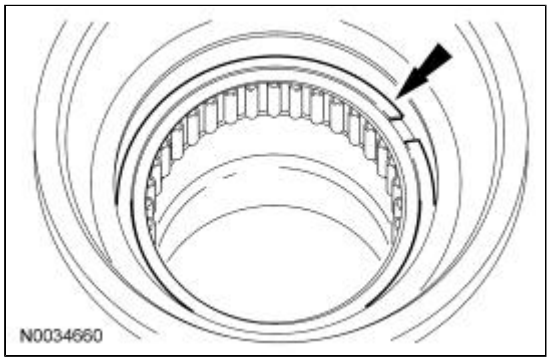
40. Remove the snap ring from the case.



41. Using the special tools, remove the bearing spacer.

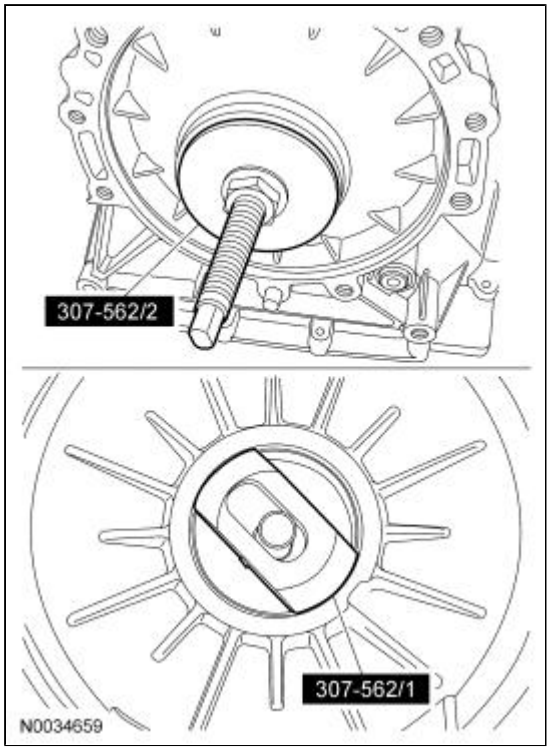


42. Using a small pick, remove the snap ring.



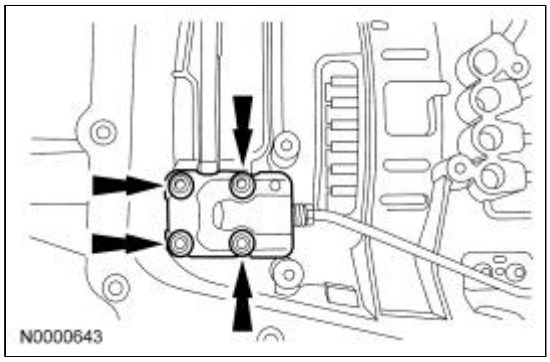
43. **CAUTION: Use care when installing the special tool. Look inside the transmission case to make sure that the tool contacts the bearing only and not the lip of the case, or damage to the case will result.**

Using the special tool, remove the bearing assembly.

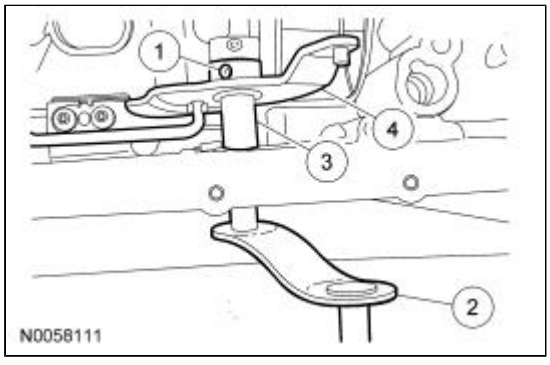


All vehicles

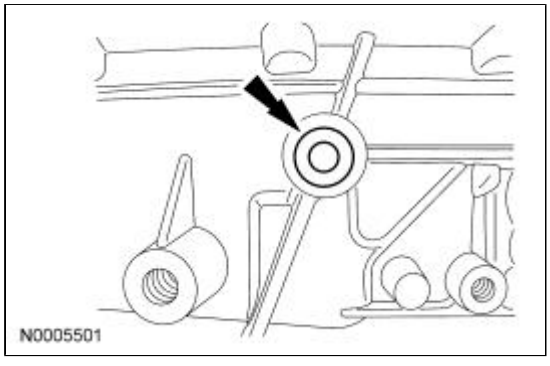
44. Remove the park rod actuating plate.



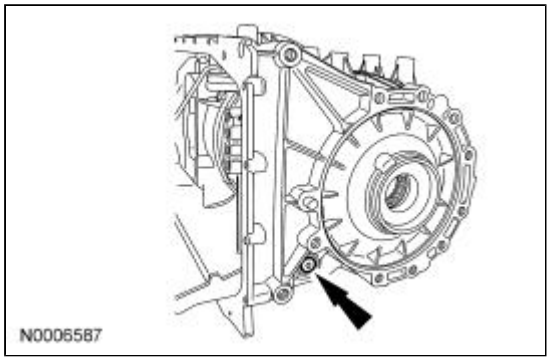
45. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the spacer to keep it from falling into the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.



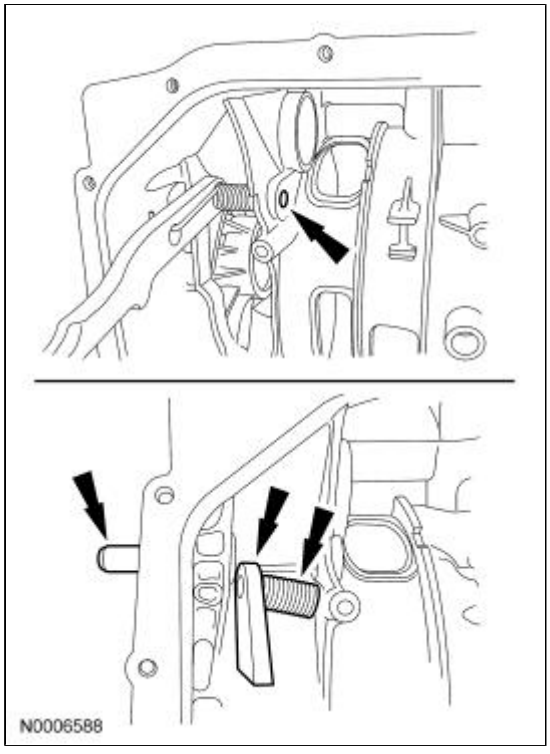
46. Remove and discard the manual control lever seal.



47. Remove the bolt from the back of the case to gain access to the park pawl pin.



48. From inside the case, push the park pawl pin out toward the back side of the case, while holding the spring and the park pawl. Remove the park pawl pin, then remove the park pawl and spring.



Forward/Overdrive Clutch Assembly — Disassembly

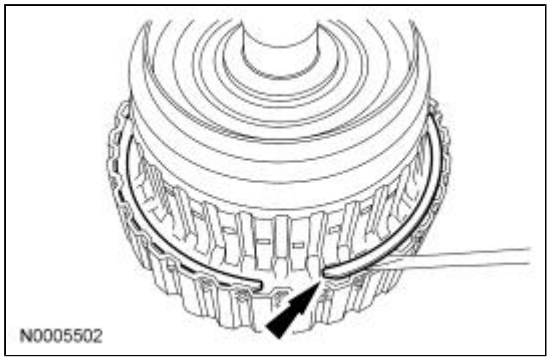
Printable View (244 KB)

Material

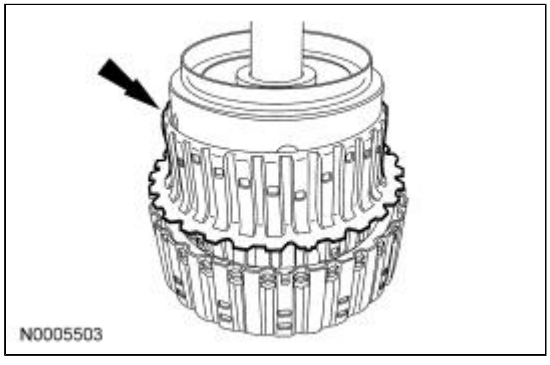
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Disassembly

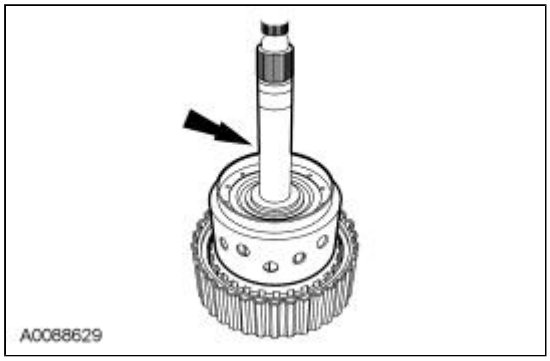
1. Remove the direct clutch outer shell retaining ring.



2. Remove the direct clutch outer shell.

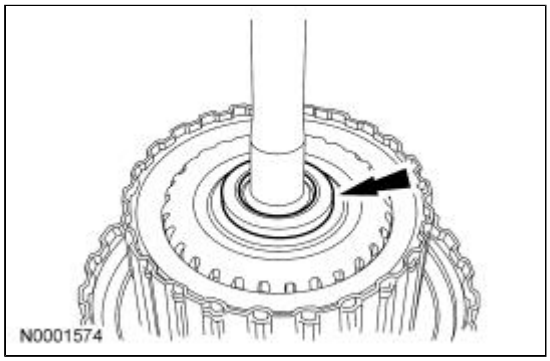


3. Remove the forward clutch drum.

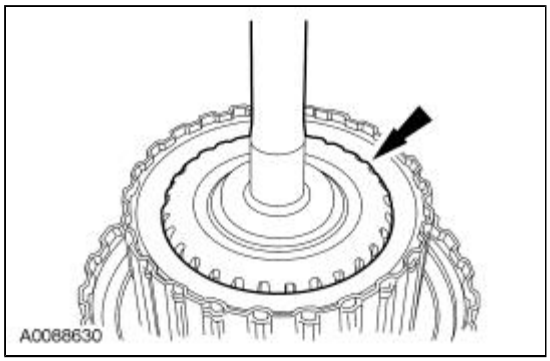


4. **NOTE:** The bearing may stick in the forward clutch drum.

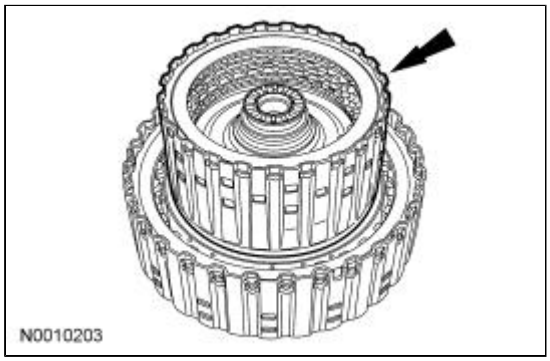
   Remove the intermediate shaft bearing.



5. Remove the intermediate shaft assembly.



6. Remove the overdrive clutch pack from the forward clutch pack.



Forward Clutch Assembly

Printable View (731 KB)

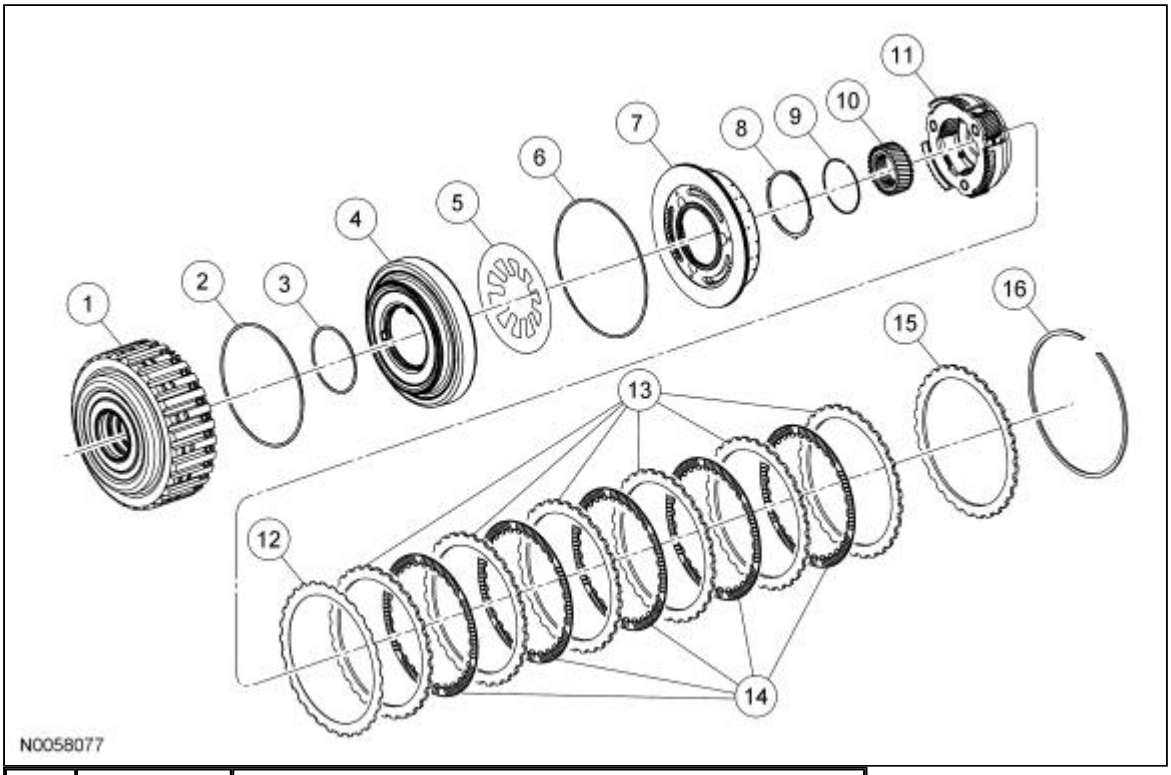
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2881-A	Piston Spring Compressor 307-525
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

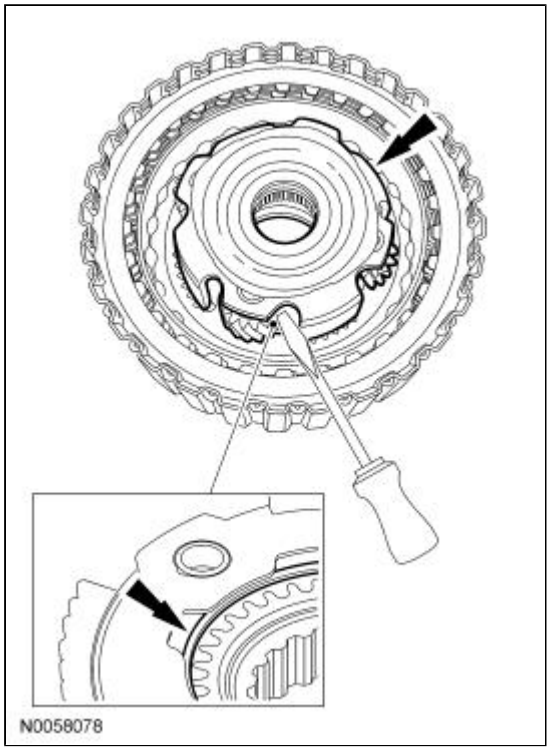
Forward Clutch Assembly (A clutch)



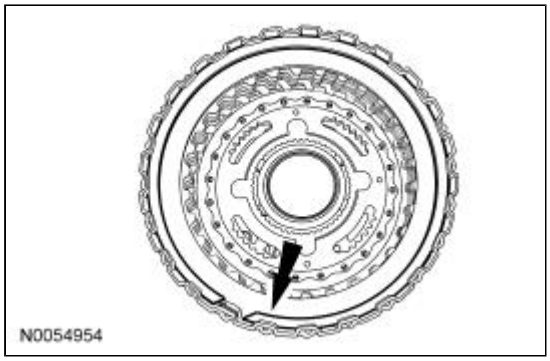
Item	Part Number	Description
1	7J011	Forward clutch drum
2	7F227	Forward clutch piston outer O-ring seal
3	7G242	Forward clutch piston inner O-ring seal
4	7L140	Forward clutch piston
5	7F230	Forward clutch piston return spring
6	7F227	Forward clutch balance dam O-ring seal
7	7J032	Forward clutch balance dam
8	—	Forward clutch balance dam retaining ring
9	7H356	Sun gear retaining ring
10	7G231	Sun gear
11	7G219	Planetary gear
12	7E457	Forward clutch wave spring
13	7E314	Forward clutch external splined steel plates (quantity model dependent)
14	7B164	Forward clutch internal splined friction plates (quantity model dependent)
15	—	Forward clutch pressure plate
16	7B421	Forward clutch plate retaining ring.

Disassembly

1. Remove the sun gear from the forward clutch assembly.
    - With a small screwdriver inserted into the sun gear push on the retaining ring in 3 places while lifting up on the sun gear to remove.

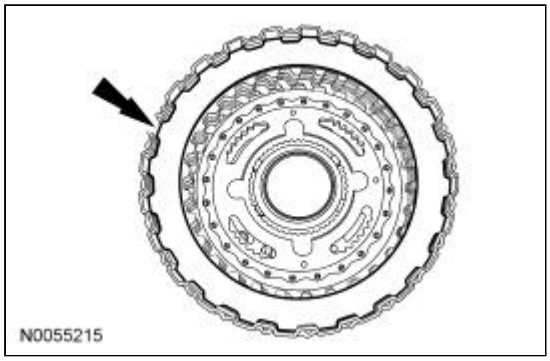


2. Remove the forward clutch pack snap ring.



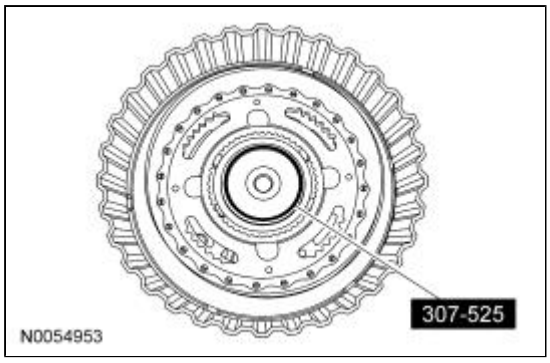
3. **NOTE:** Inspect the drum, friction plates and steel plates for damage.

   Remove the steel and friction forward clutch plates. Inspect the steel and friction plates for damage. If damage is indicated a new forward clutch assembly will be required.
   - If no damage is indicated the forward clutch can be re-assembled.



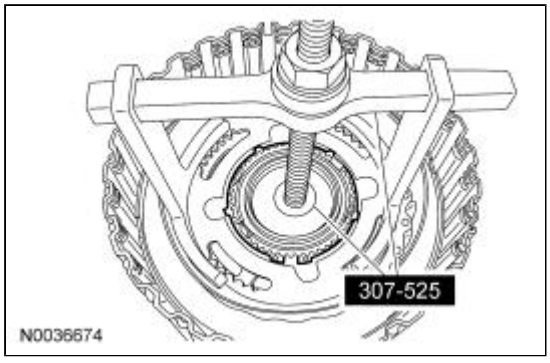
4. **NOTE:** The bottom of the special tool will need to be installed from the back side of the forward clutch assembly.

Install the special tool under the forward clutch drum.

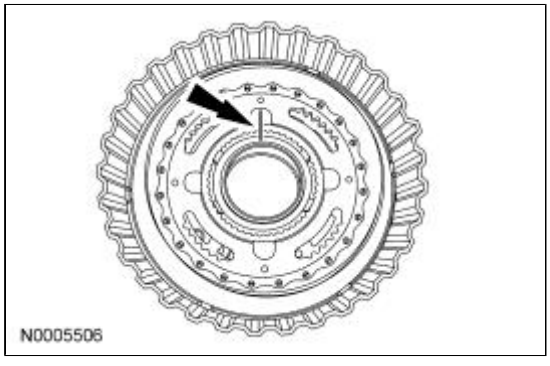


5. **NOTE:** The bottom of the special tool will need to be installed from the back side of the forward clutch assembly.

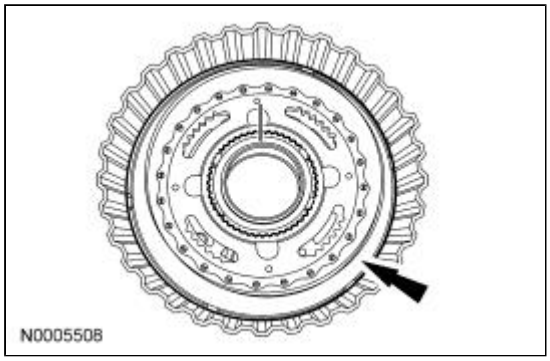
   Using the special tool, slightly collapse the balance dam to gain access to the retaining ring. Remove the retaining ring.



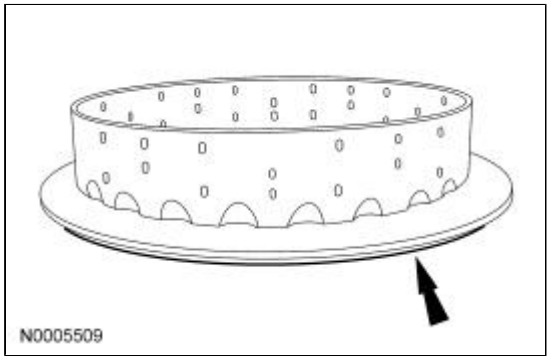
6. Prior to removing the balance dam, make an identifying mark on the balance dam and the center part of the housing. This is for correct alignment during the assembly.



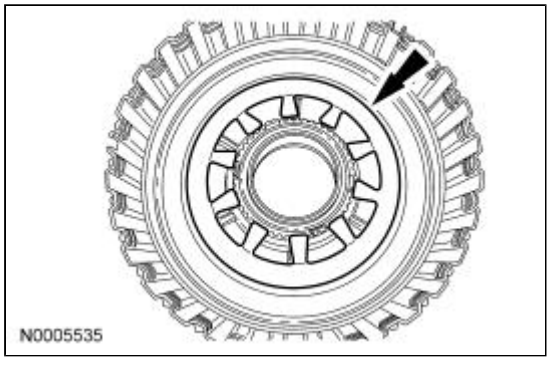
7. Remove the balance dam.



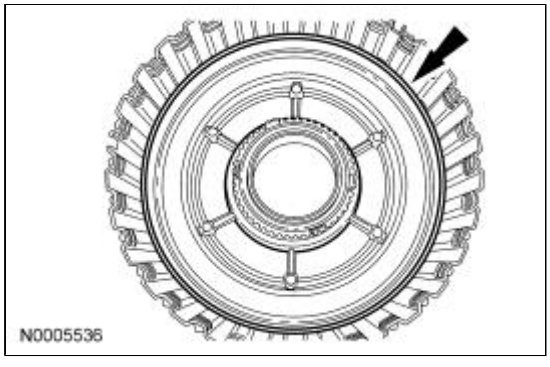
8. Remove and discard the O-ring seal from the balance dam.



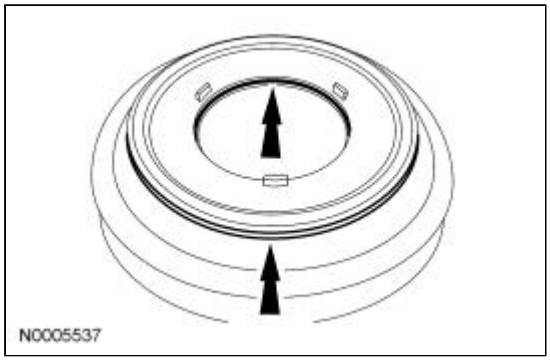
9. Remove the forward clutch return spring.



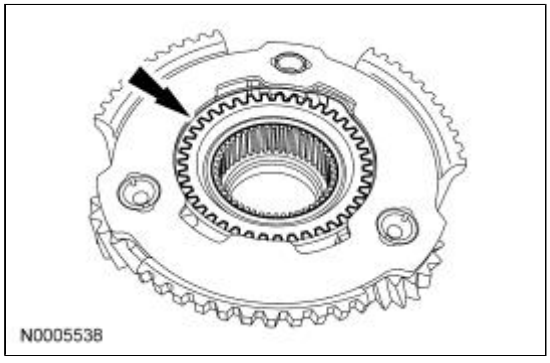
10. Remove the forward clutch piston.



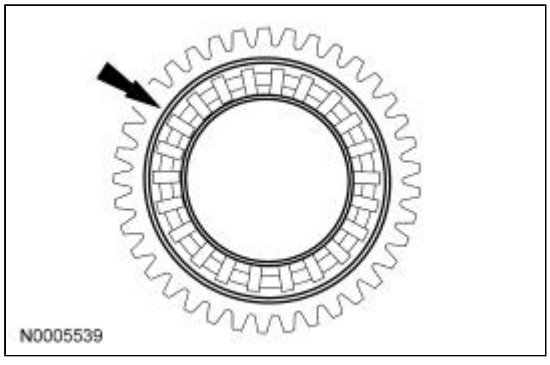
11. Remove and discard the inner and outer piston O-ring seals.



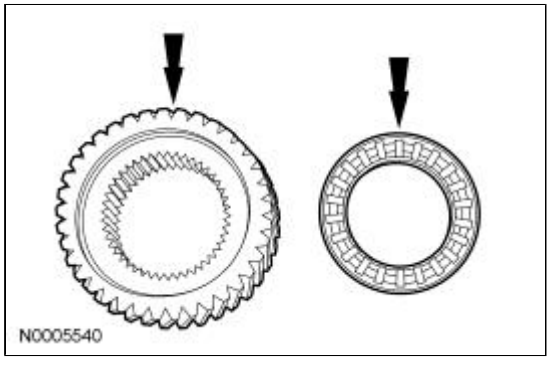
12. Remove the sun gear from the planet assembly.



13. Remove the bearing from the sun gear.

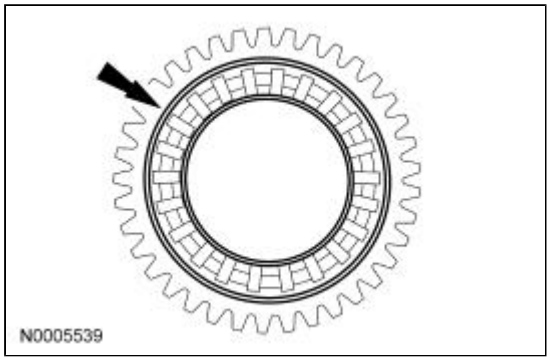


14. Inspect the sun gear and bearing for damage. Install new components if damage is indicated.

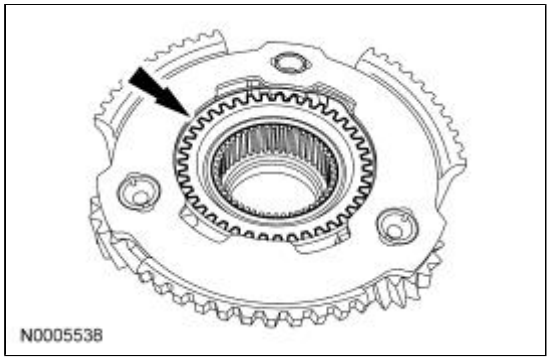


Assembly

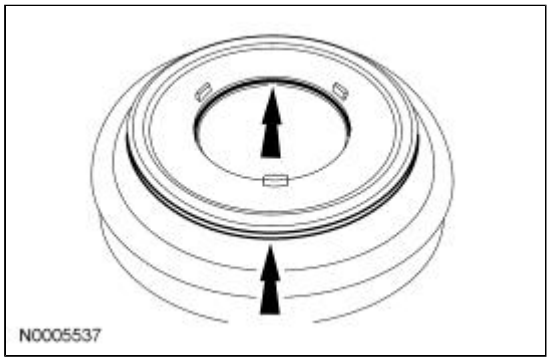
1. Install the bearing onto the sun gear.



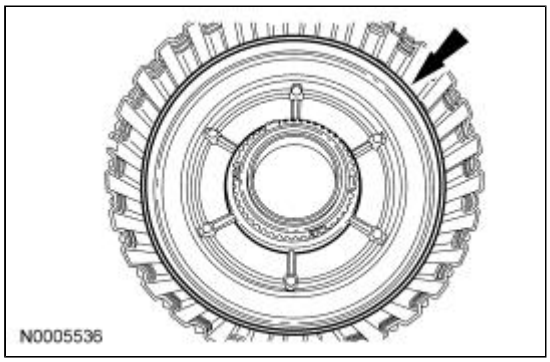
2. Install the sun gear into the planet assembly with the bearing facing down and the recess part of the gear up.



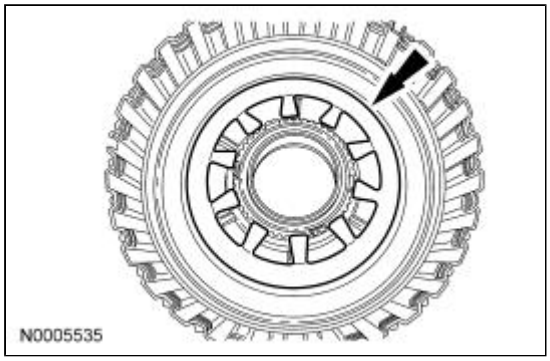
3. Install new O-ring seals onto the forward clutch piston.



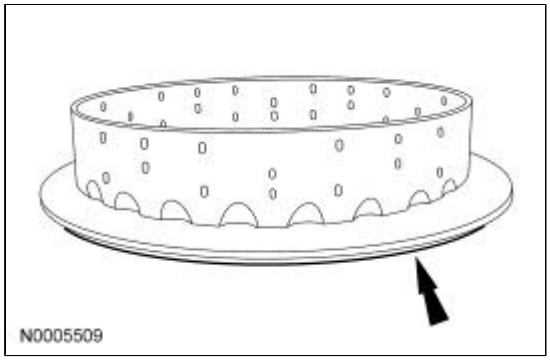
4. Lightly coat the O-ring seals with clean transmission fluid and install the forward clutch piston into the forward clutch drum.



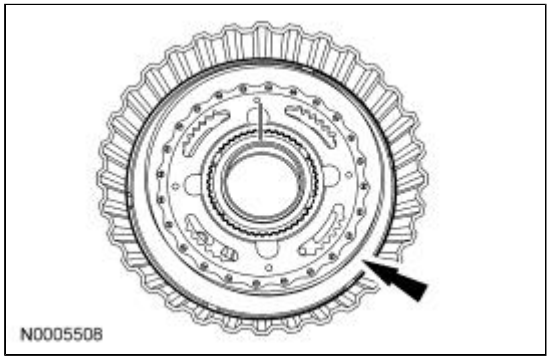
5. Install the forward clutch return spring.



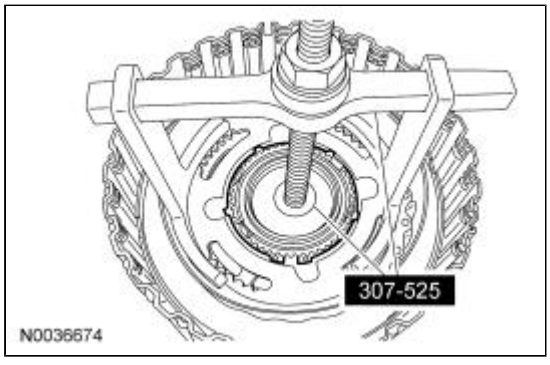
6. Install a new O-ring seal onto the forward clutch balance dam. Lightly coat the O-ring seal with clean transmission fluid.



7. Align the marks made during disassembly and install the balance dam into the forward clutch drum.

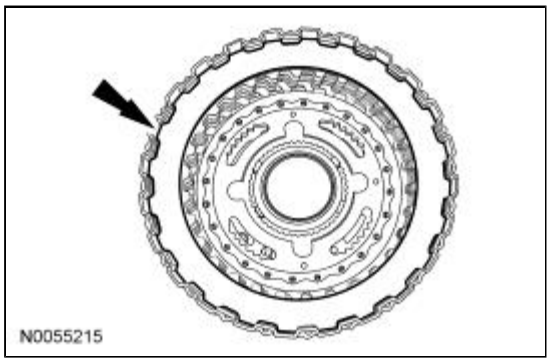


8. Using the special tool, slightly collapse the balance dam to install the retaining ring. Install the retaining ring.

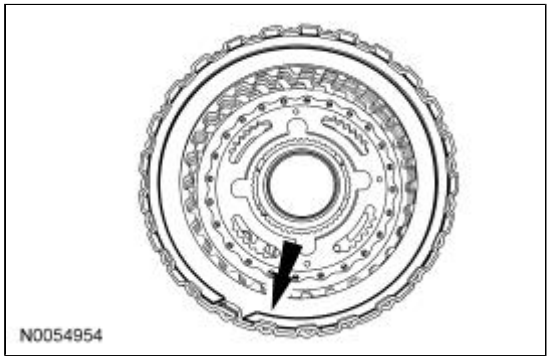


9. **NOTE:** Before assembly, soak the new clutch plates in clean automatic transmission fluid.

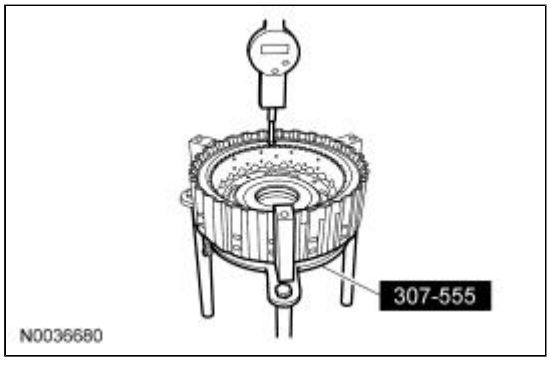
Install the new forward clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending up with the pressure plate.



10. Install the forward clutch plate snap ring.



11. Install the forward clutch assembly into the special tool.



12. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

13. Rotate the forward clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

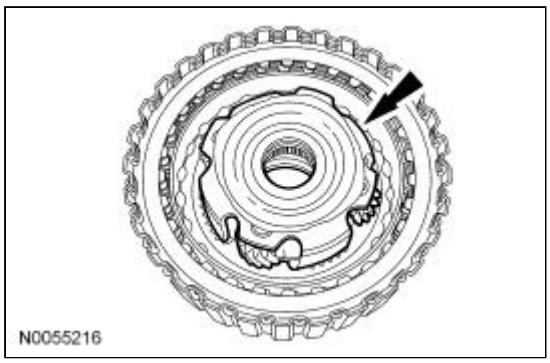
Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

14. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

- 5.4L engine — 0.71-1.10 mm (0.028-0.043 in).

If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

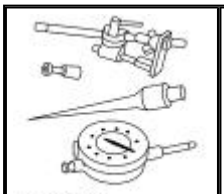
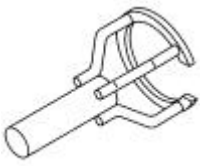
15. Install the sun gear into forward clutch drum. Make sure that it snaps and locks in place.



Overdrive Clutch Assembly

Printable View (532 KB)

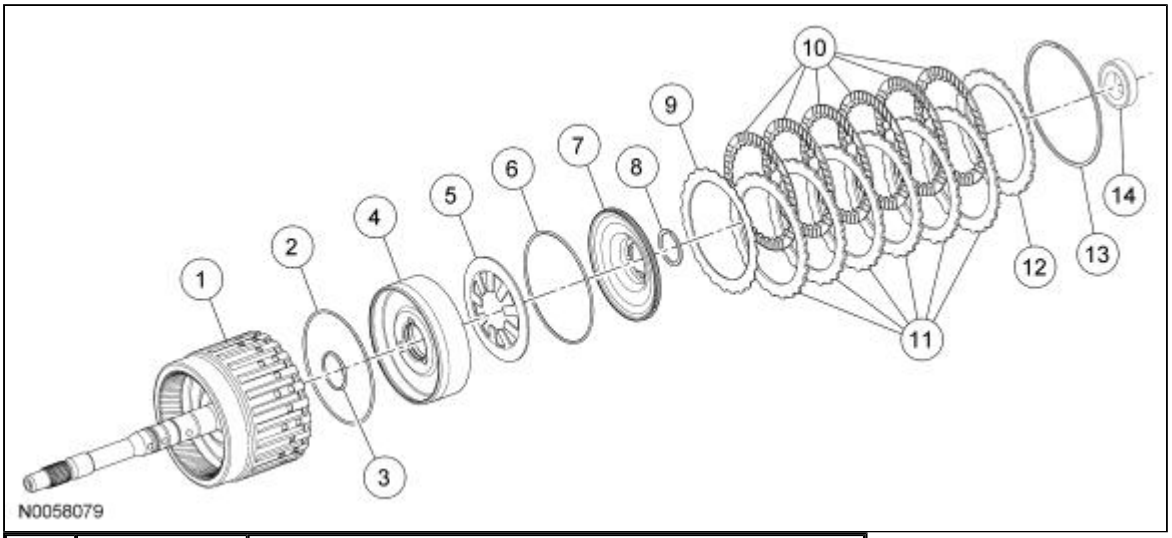
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2497-A	Compressor, Spring Washer 307-209
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

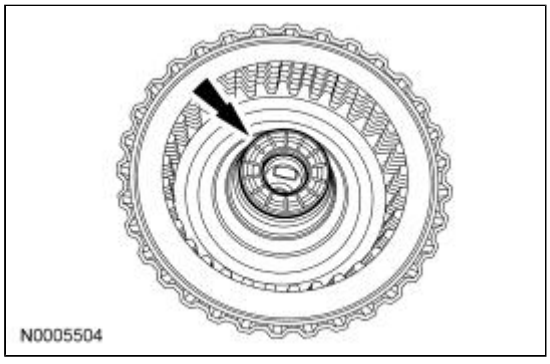
Overdrive Clutch Assembly



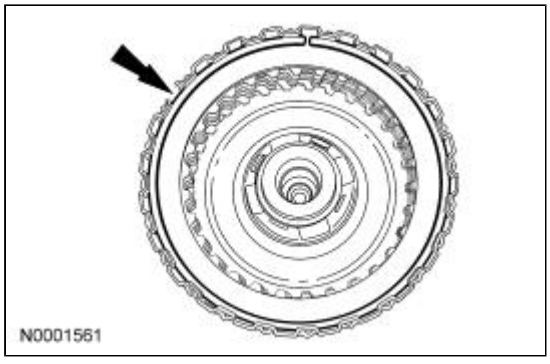
Item	Part Number	Description
1	7J006	Input shaft
2	7J008	Overdrive clutch piston outer seal
3	7G007	Overdrive clutch piston inner seal
4	7G418	Overdrive clutch piston
5	7N529	Overdrive clutch piston spring
6	7J009	Overdrive balance piston outer seal
7	7J029	Overdrive balance piston
8	7J010	Overdrive balance piston snap ring
9	7N572	Overdrive clutch cushion plate
10	7B164	Overdrive clutch internal splined clutch plates (friction)
11	7B442	Overdrive clutch external splined clutch plates (steel)
12	7C576	Overdrive pressure plate
13	7M157	Overdrive clutch retaining ring
14	7A453	Bearing T3

Disassembly

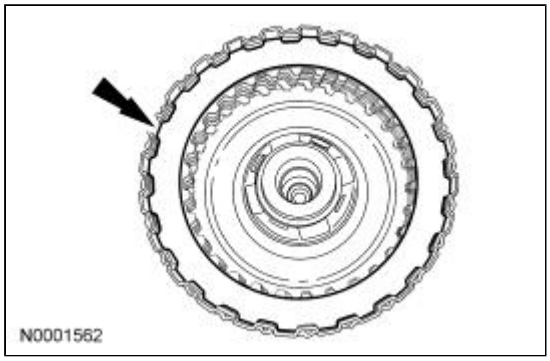
1. Remove the roller bearing.



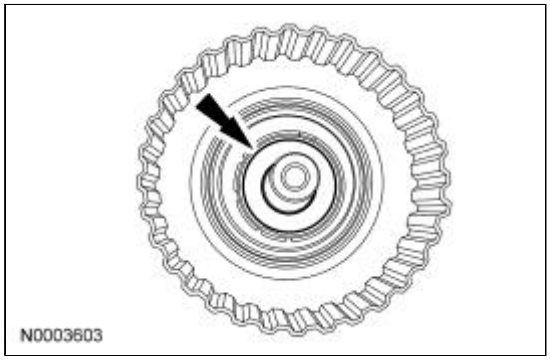
2. Remove the overdrive clutch pack snap ring.



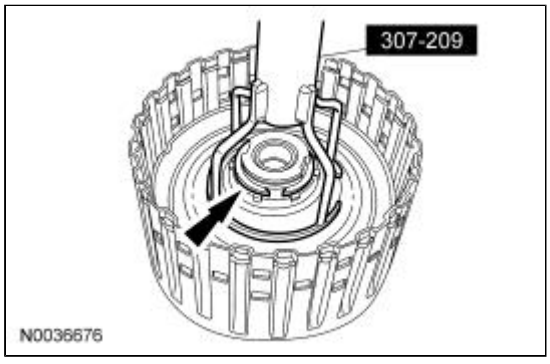
3. Remove the overdrive clutch pack.



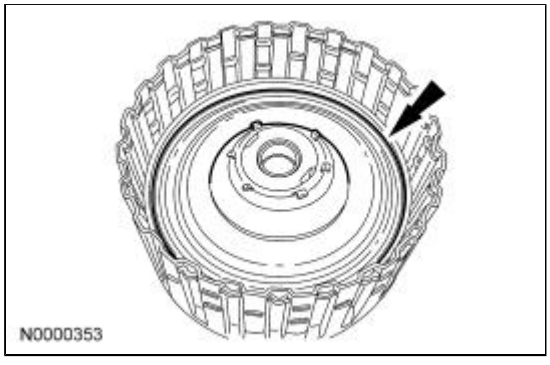
4. If equipped, remove the overdrive clutch thrust washer.



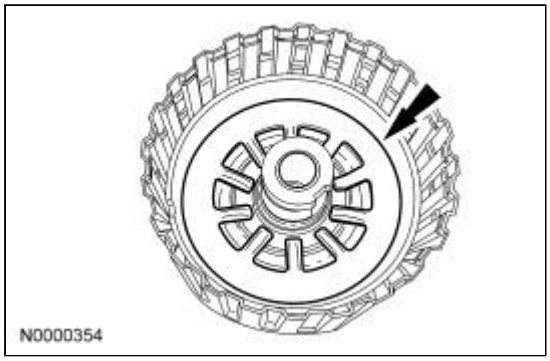
5. Using the special tool and a press, remove the overdrive clutch balance piston retaining ring and spacer.



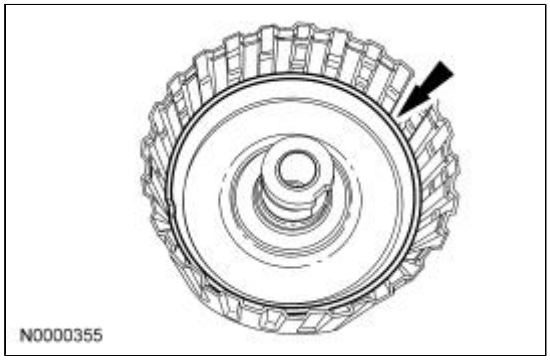
6. Remove the overdrive clutch balance piston.



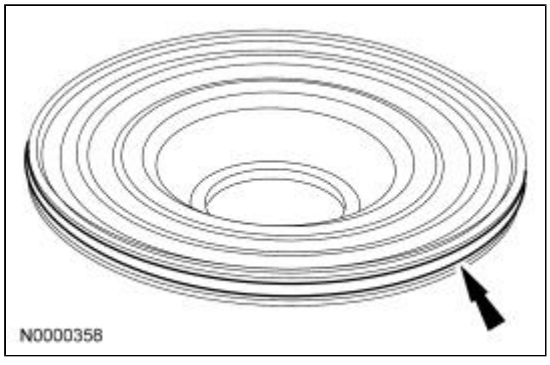
7. Remove the overdrive clutch return spring.



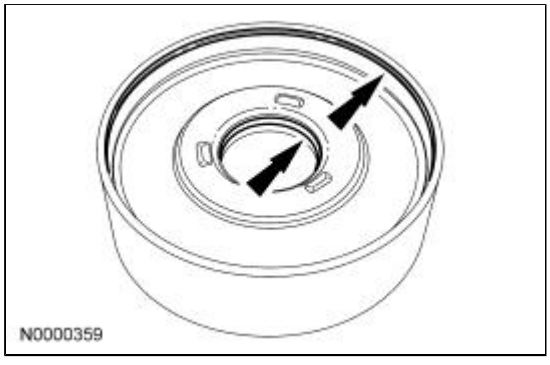
8. Remove the overdrive clutch apply piston.



9. Remove and discard the outer O-ring seal on the overdrive clutch balance piston.

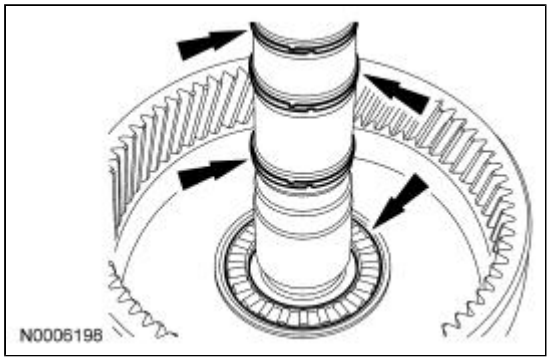


10. Remove and discard both the inner (one large and one small) O-ring seals on the overdrive clutch apply piston.



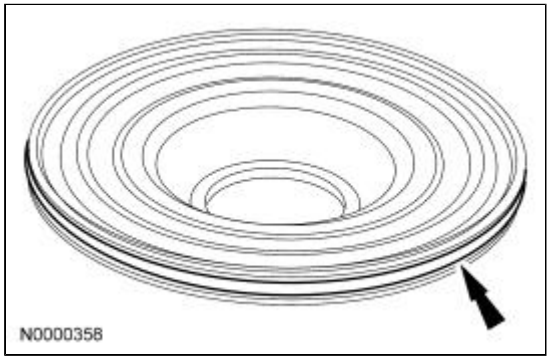
11. **NOTE:** The roller bearing may stick to the forward clutch assembly.

    Remove and discard the 3 square cut seals and the roller bearing.

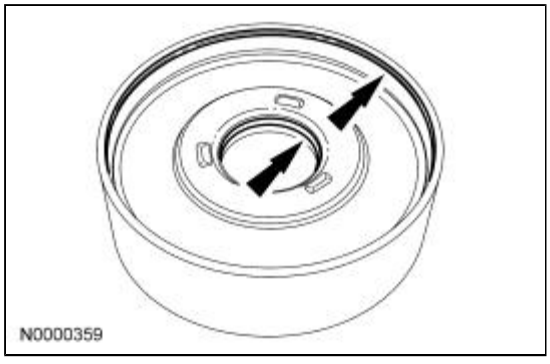


Assembly

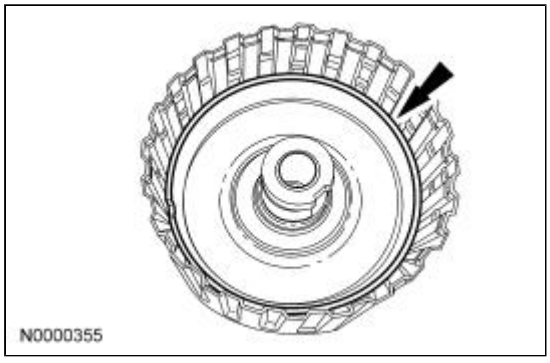
1. Install a new outer O-ring seal on the overdrive clutch balance piston.



2. Install 2 new inner O-ring seals on the overdrive clutch apply piston.

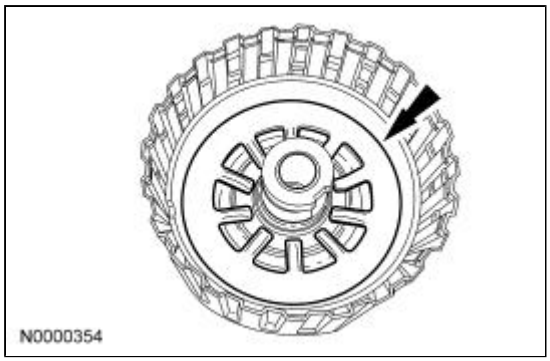


3. Install the overdrive clutch apply piston into the drum with the O-ring seals and the 3 pads facing down toward the drum.



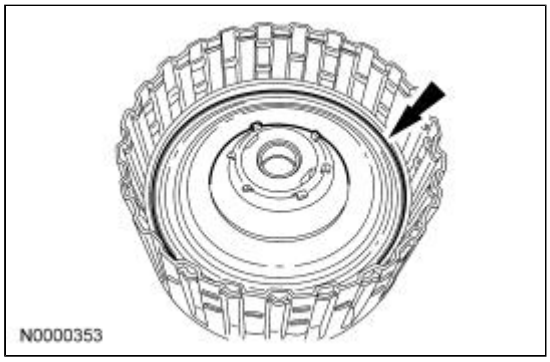
4. **NOTE:** The fingers on the return spring are facing down toward the piston.

Install the overdrive clutch return spring.

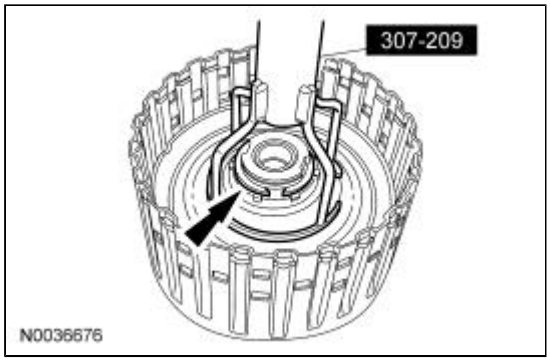


5. **NOTE:** The cone shape of the balance piston must face up when installed correctly.

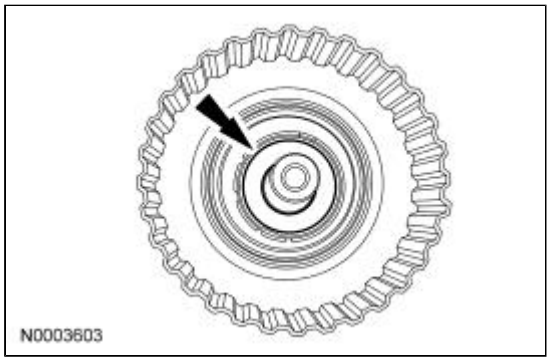
   Install the overdrive clutch balance piston.



6. Using the special tool, install the overdrive clutch balance piston retaining ring.



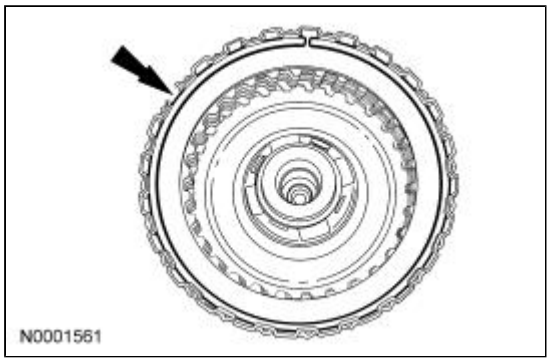
7. If removed, install the overdrive clutch thrust washer.



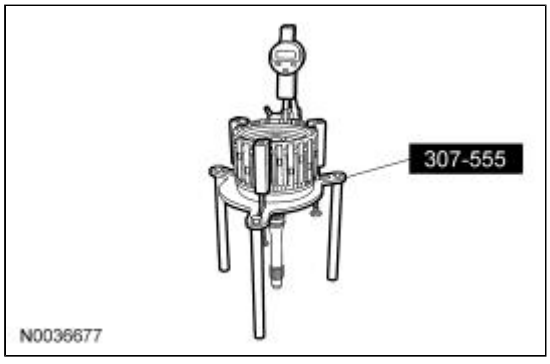
8. **NOTE:** Before assembly, soak the new clutch plates in clean automatic transmission fluid.

   Install the new overdrive clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate on the top.

9. Install the overdrive clutch pack snap ring.



10. Install the overdrive clutch assembly into the special tool.



11. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

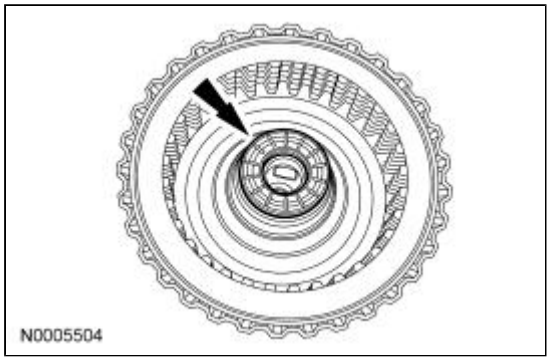
12. Rotate the overdrive clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

13. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine — 0.50-0.90 mm (0.020-0.035 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

14. Install a new roller bearing.


N0005504

Forward/Overdrive Clutch Assembly — Assembly

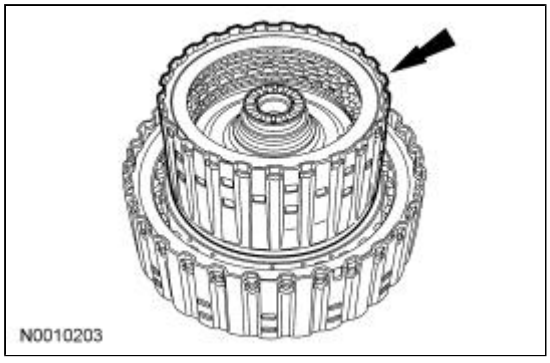
Printable View (228 KB)

Material

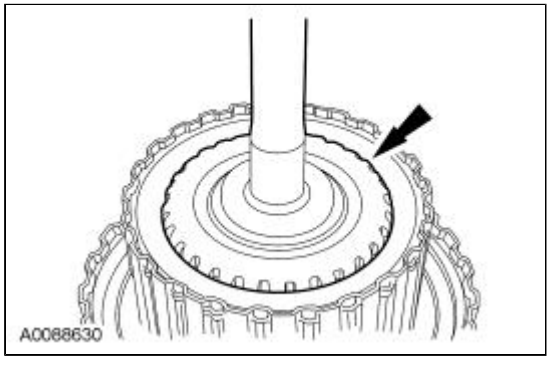
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Assembly

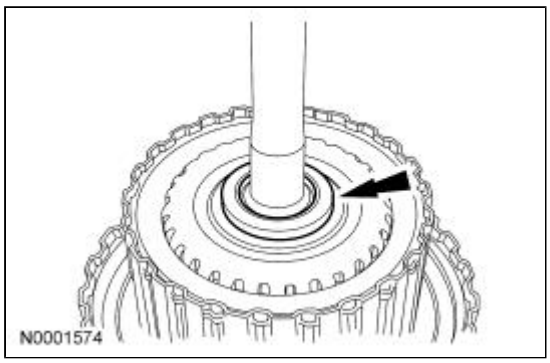
1. Install the overdrive clutch pack onto the forward clutch pack.



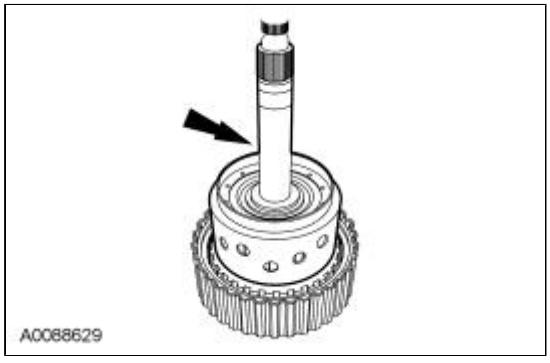
2. Install the intermediate shaft assembly.



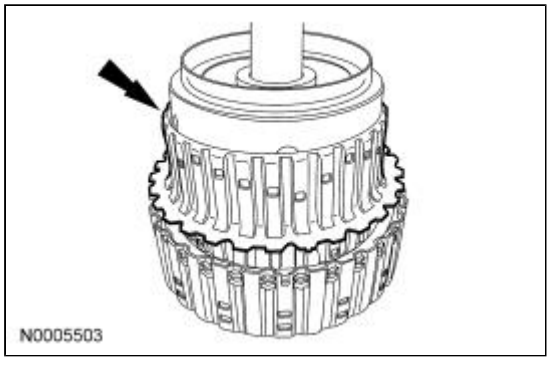
3. Install the intermediate shaft bearing.



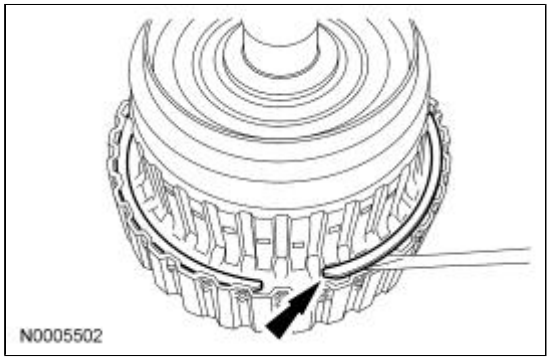
4. Install the overdrive clutch drum.



5. Install the direct clutch outer shell.



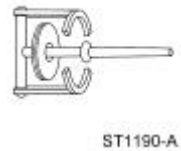
6. Install the direct clutch outer shell retaining ring.



Direct Clutch Assembly

Printable View (713 KB)

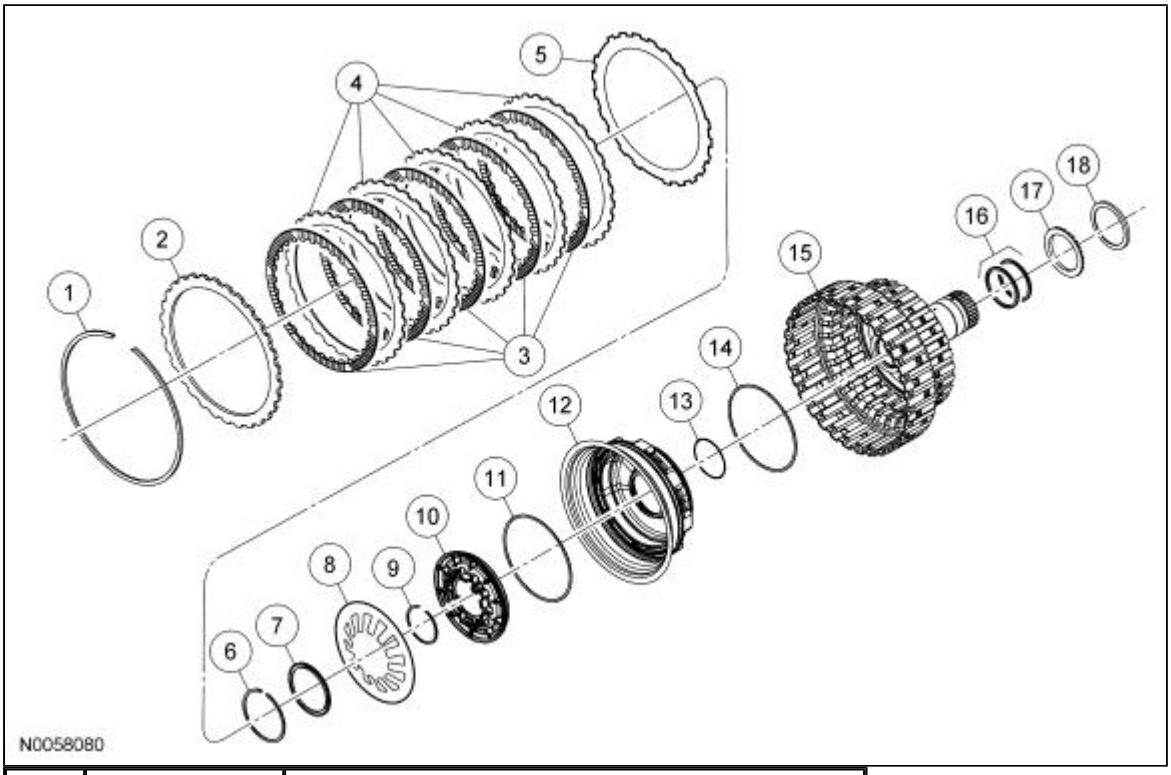
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
ST2892-A	Clutch Pack End Play Gauge 307-555
ST2893-A	Direct Clutch Pack Service Fixture 307-552

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

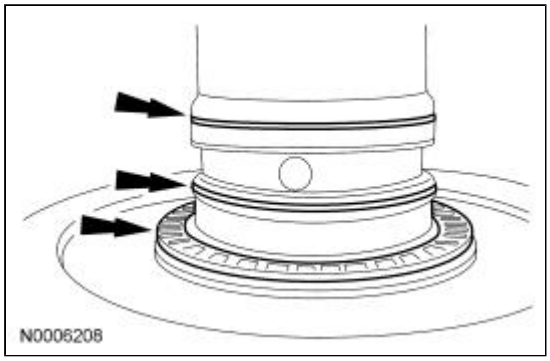
Direct Clutch Assembly



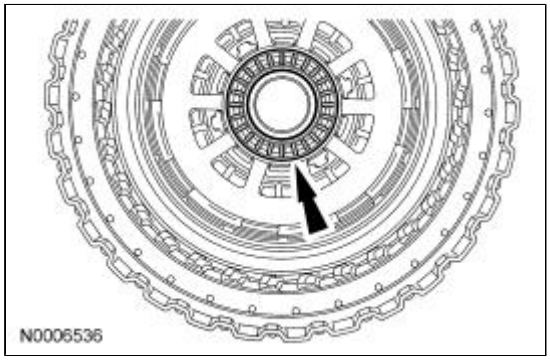
Item	Part Number	Description
1	7B421	Retaining ring
2	7B477	Pressure plate
3	7B164	Direct clutch internal splined friction plates
4	7E314	Direct clutch external splined steel plates
5	7N572	Wave spring
6	7H363	Snap ring
7	7D427	Retaining ring
8	7B448	Return spring
9	7B492	Piston retaining ring
10	7H359	Direct clutch balance piston
11	7C000	Direct clutch balance piston seal
12	7F254	Direct clutch apply piston
13	7F234	Direct clutch apply piston inner seal
14	7C000	Direct clutch apply piston outer seal
15	7F281	Direct clutch cylinder
16	7B399	Seal rings
17	—	Roller bearing
18	—	Seal ring

Disassembly

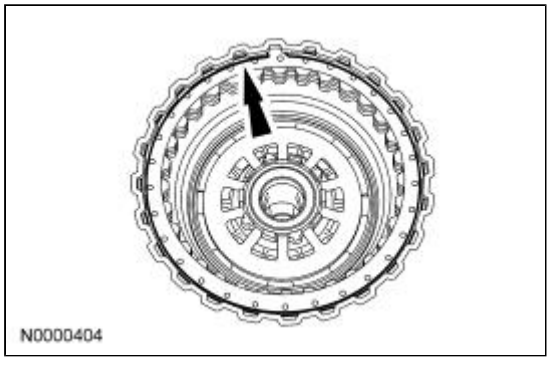
1. Remove and discard the 2 square cut seals and the roller bearing.



2. Remove the upper roller bearing.

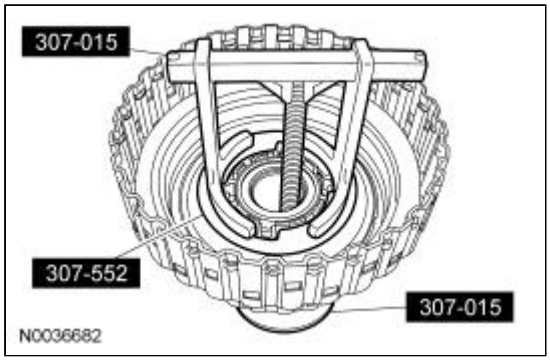


3. Remove the direct clutch snap ring.

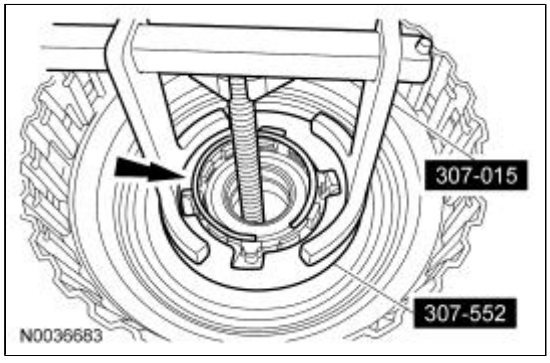


4. Remove the steel and friction direct clutch plates.

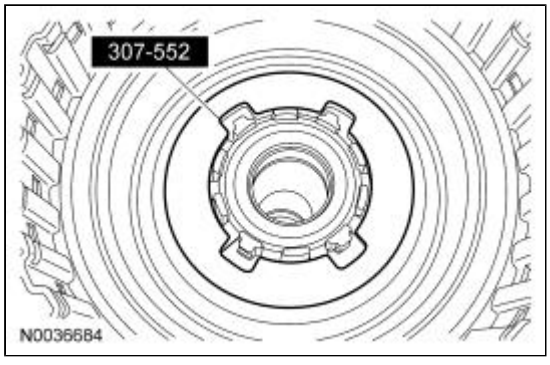
5. Install the special tools onto the direct clutch assembly.



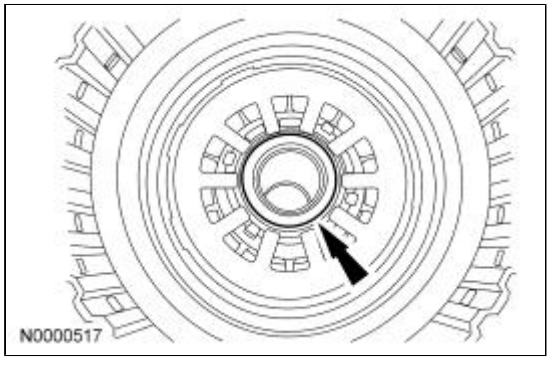
6. Using the special tool, remove the direct clutch return spring retainer.



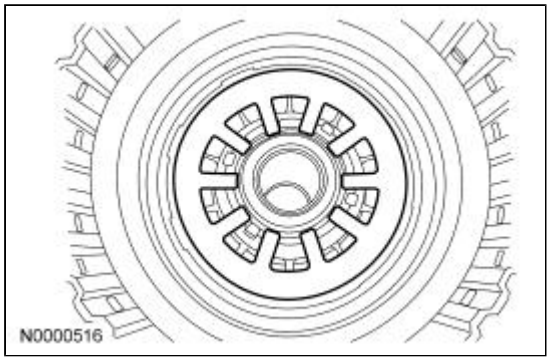
7. Remove the special tool.



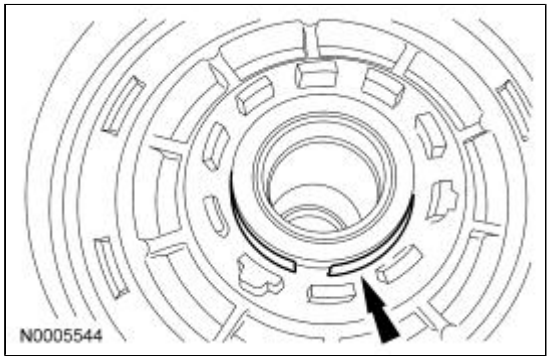
8. Remove the direct clutch return spring washer.



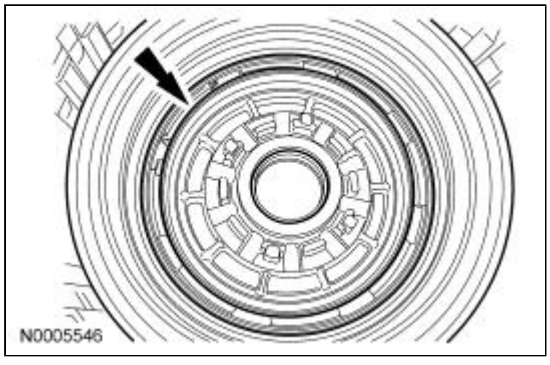
9. Remove the direct clutch return spring.



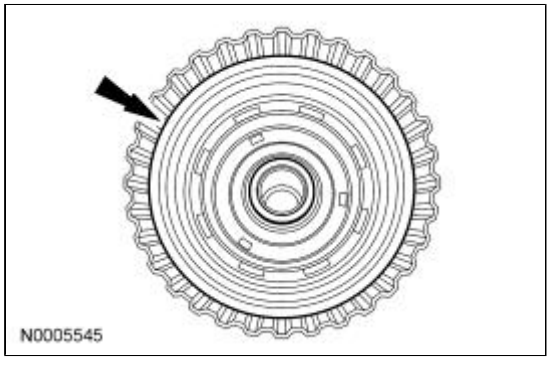
10. Slightly press down on the balance piston and remove the snap ring.



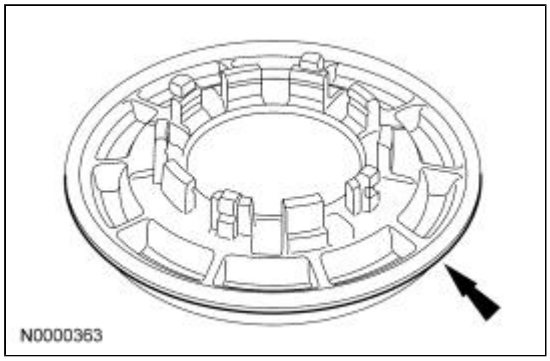
11. Remove the baffle plate from the direct clutch piston.



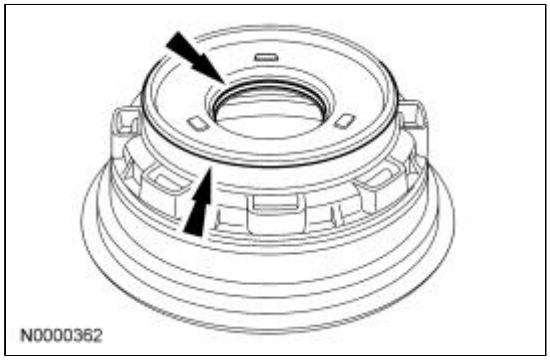
12. Remove the direct clutch piston.



13. Remove and discard the outer O-ring seal from the balance piston.



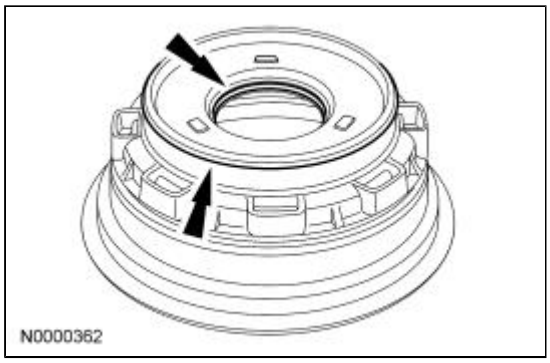
14. Remove and discard the outer and inner O-ring seal from the apply piston.



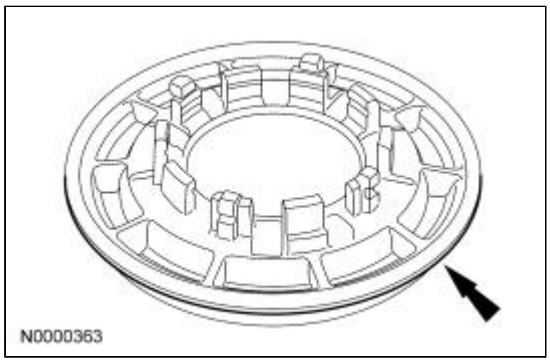
15. Inspect the direct clutch drum for damage. If damage is indicated, install a new direct clutch drum.

Assembly

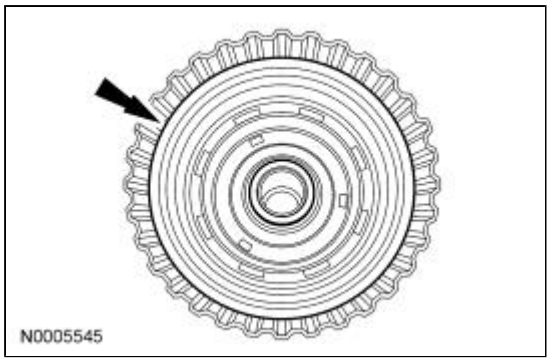
1. Install a new inner and outer O-ring seal on the apply piston.



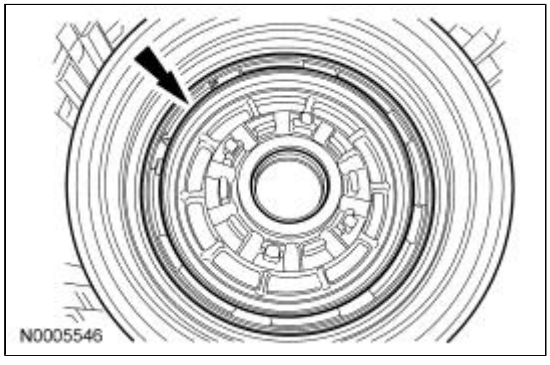
2. Install a new outer O-ring seal on the balance piston.



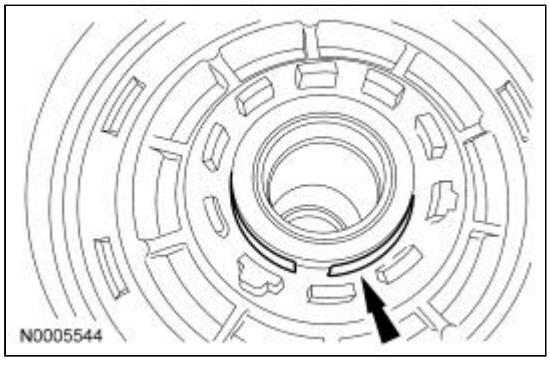
3. Lightly coat the O-ring seals in clean transmission fluid and install the direct clutch piston.



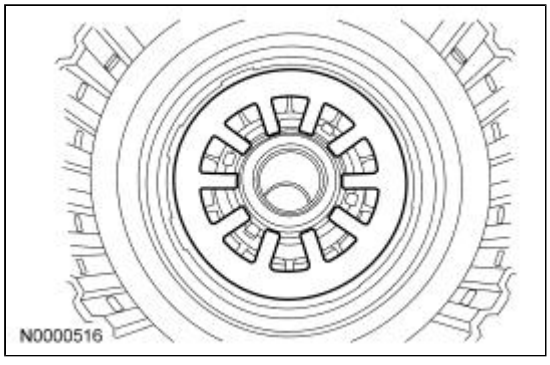
4. Lightly coat the O-ring seals in clean transmission fluid and install the apply piston into the direct clutch balance piston.



5. Slightly press down on the balance piston and install the snap ring.

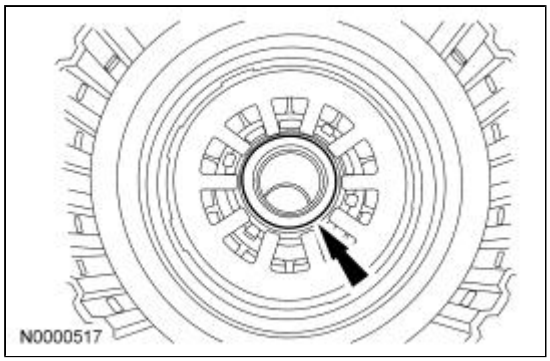


6. Install the direct clutch return spring.

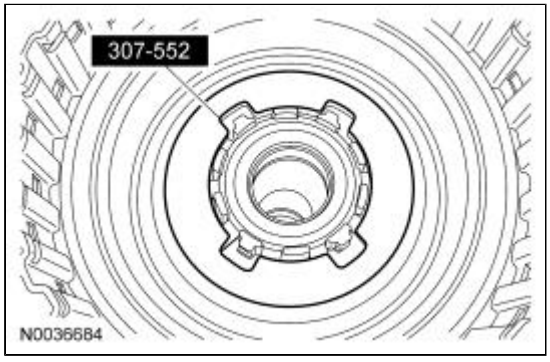


7. **NOTE:** When installing the washer, the stepped edge must face upward.

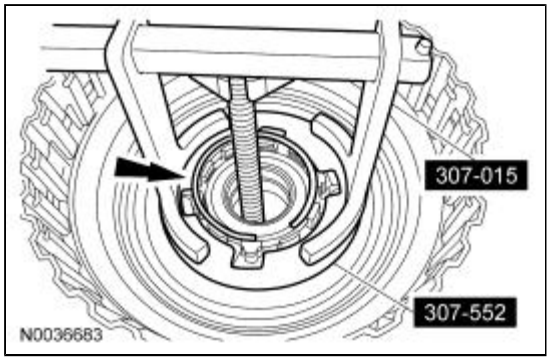
Install the direct clutch return spring washer.



8. Install the special tool.



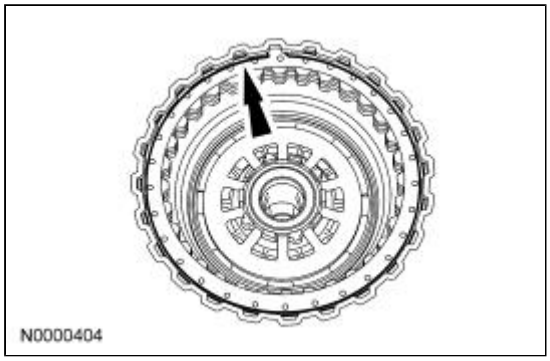
9. Using the special tool, install the direct clutch return spring retainer.



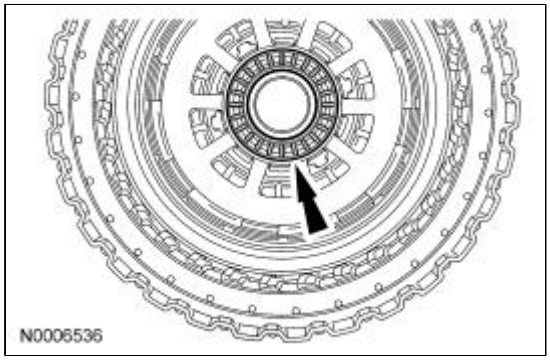
10. **NOTE:** Before assembly, soak the new clutch plates in clean automatic transmission fluid.

    Install the new direct clutch plates, starting with the wave spring then a steel plate and alternating between steel and friction plates, and ending with the pressure plate on the top.

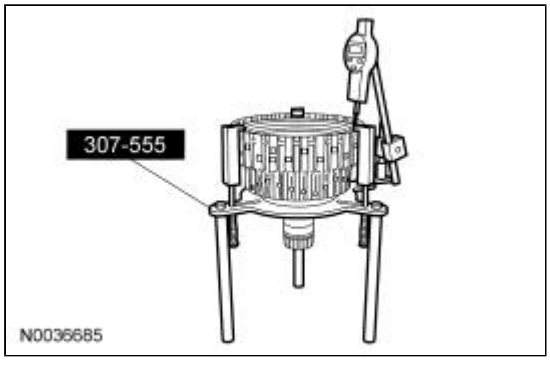
11. Install the direct clutch snap ring.



12. Install a new roller bearing.



13. Install the direct clutch assembly into the special tool.



14. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

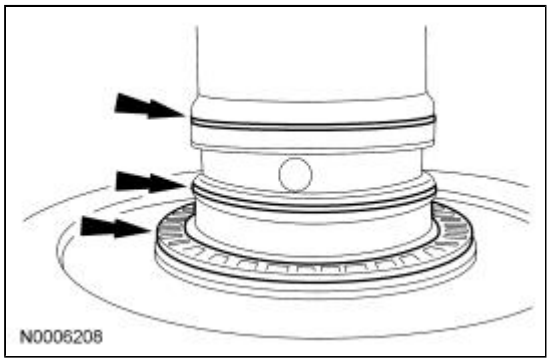
15. Rotate the direct clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

16. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine 0.50-1.30 mm (0.020-0.051 in).

If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

17. Install new square cut seals and roller bearing.



Intermediate Clutch Assembly

Printable View (504 KB)

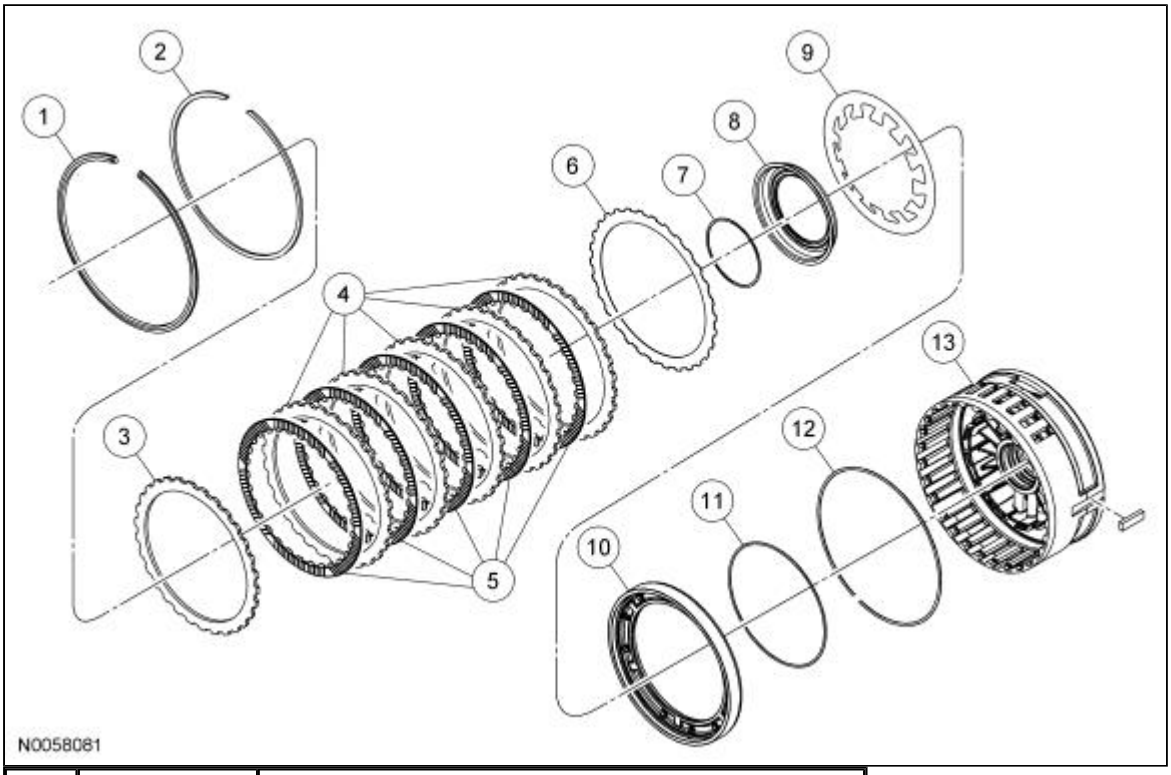
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2881-A	Piston Spring Compressor 307-525
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

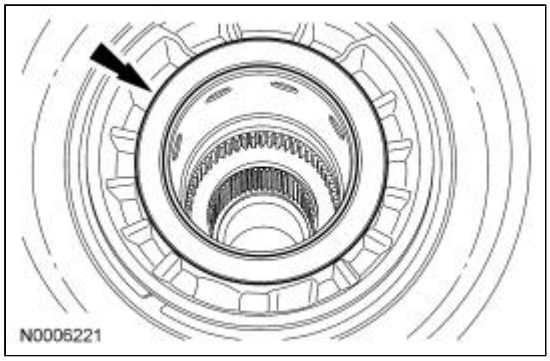
Intermediate Clutch Assembly



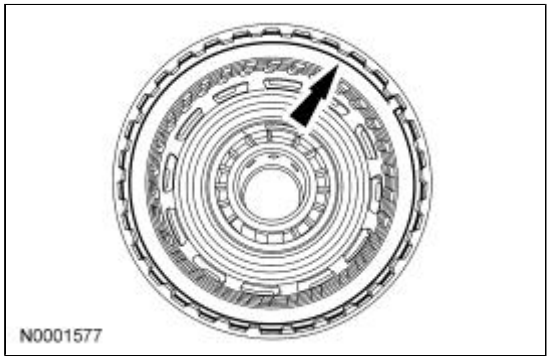
Item	Part Number	Description
1	7L327	Intermediate clutch assembly case retaining ring
2	7B421	Intermediate clutch pack retaining ring
3	7E314	Pressure plate
4	—	Intermediate clutch internal splined friction plates
5	7E314	Intermediate clutch external splined steel plates
6	7H136	Wave spring
7	7N169	Intermediate clutch snap ring
8	7B043	Intermediate clutch return spring retaining ring
9	7C151	Intermediate clutch return spring
10	7J015	Intermediate clutch piston
11	7F225	Intermediate clutch piston inner seal
12	7F224	Intermediate clutch piston outer seal
13	7G033	Intermediate/low/reverse clutch cylinder

Disassembly

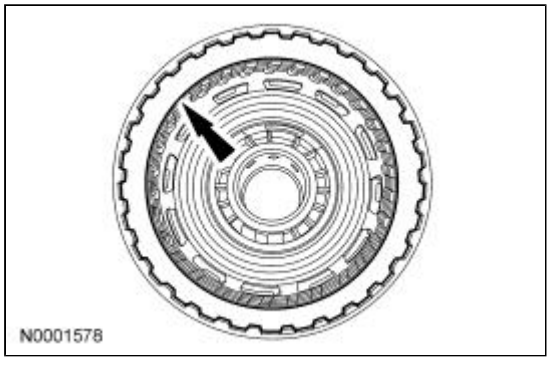
1. Remove the bearing race.



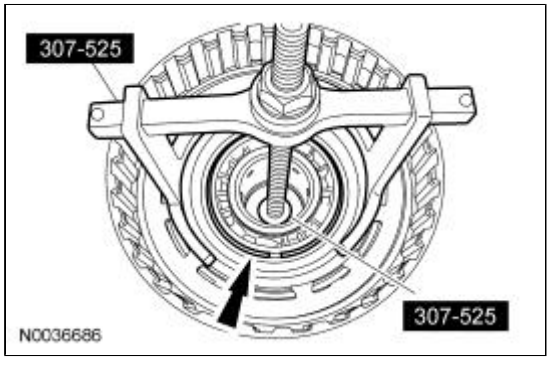
2. Remove the intermediate clutch plate snap ring.



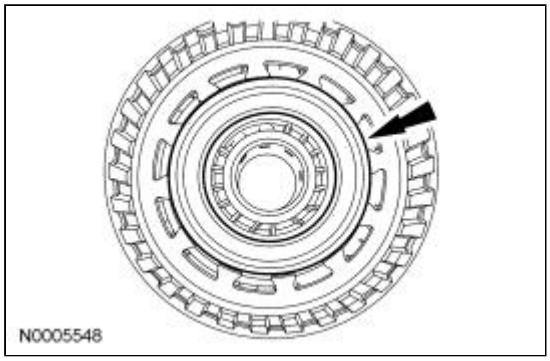
3. Remove the intermediate clutch plates, friction and steel, from the intermediate clutch cylinder.



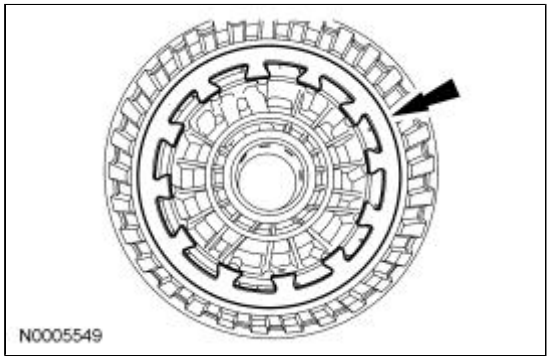
4. Using the special tool, remove the intermediate clutch return spring retainer.



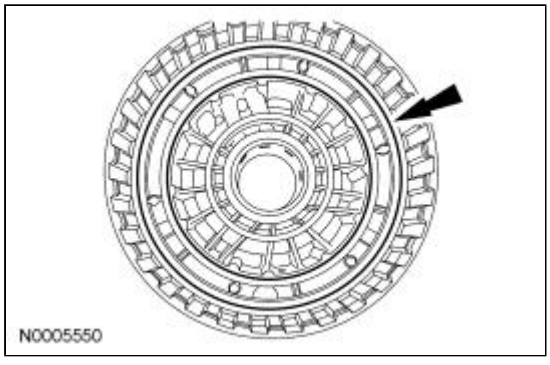
5. Remove the intermediate clutch return spring top plate.



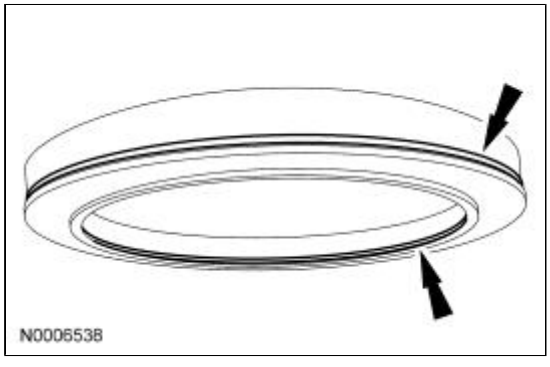
6. Remove the intermediate clutch return spring.



7. Remove the intermediate clutch piston.

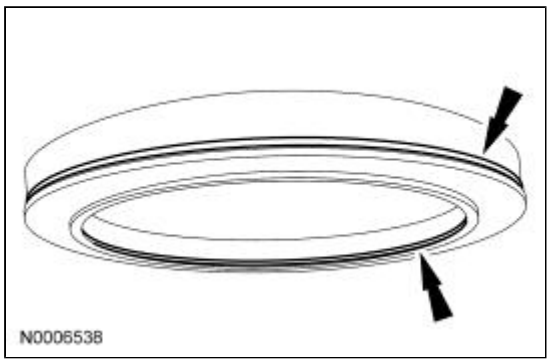


8. Remove and discard the inner and outer intermediate clutch piston O-ring seals.

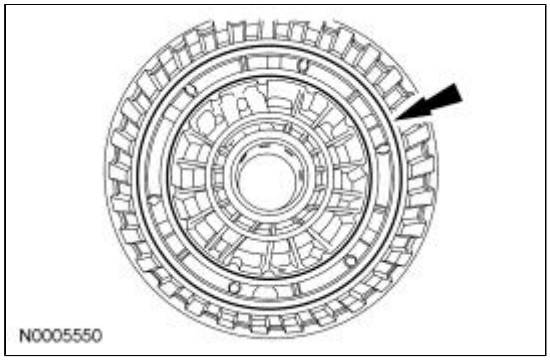


Assembly

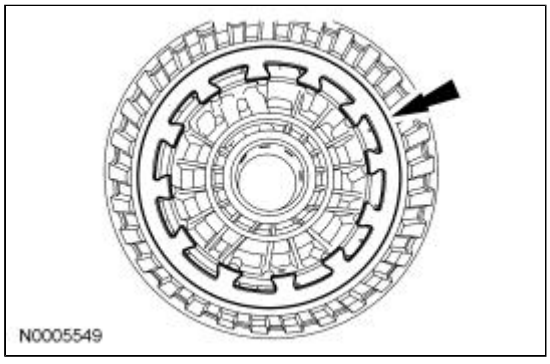
1. Install new inner and outer intermediate clutch piston O-ring seals.



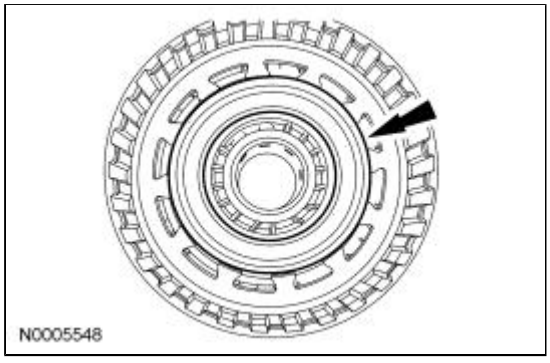
2. Lightly coat the O-ring seals in clean automatic transmission fluid and install the intermediate clutch piston.



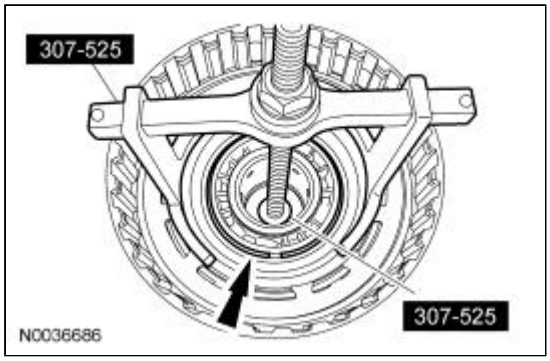
3. Install the intermediate clutch return spring.



4. Install the intermediate clutch return spring top plate.



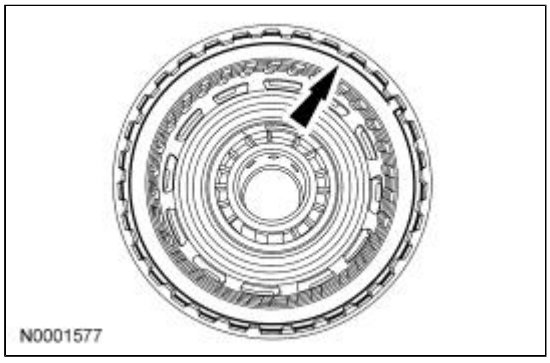
5. Using the special tool, install the intermediate clutch return spring retainer.



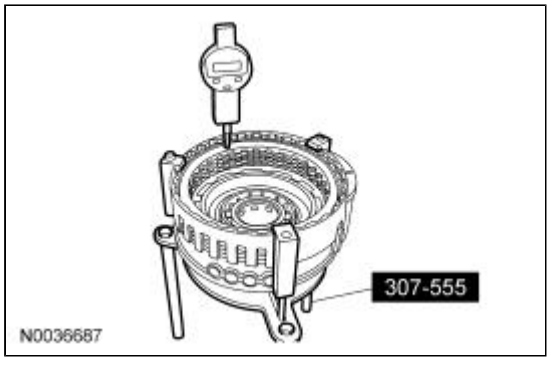
6. **NOTE:** Before assembly, soak the new clutch plates in clean automatic transmission fluid.

   Install the new intermediate clutch plates, starting with the wave spring then a steel plate and alternating between and fiber and steel plates, and ending with the pressure plate.

7. Install the intermediate clutch plate snap ring.



8. Install the intermediate clutch drum into the special tool.



9. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

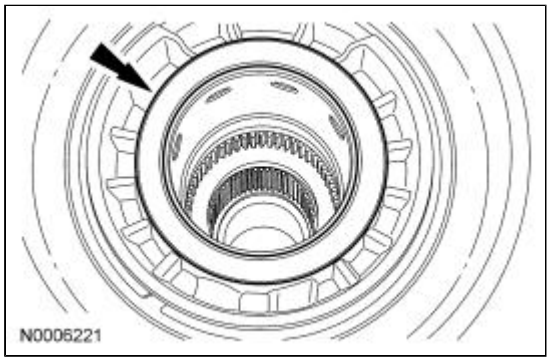
10. Rotate the direct clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

11. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine 0.71-1.10 mm (0.028-0.043 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

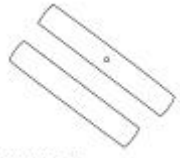
12. Install the bearing race.



Low/Reverse Clutch Assembly

Printable View (632 KB)

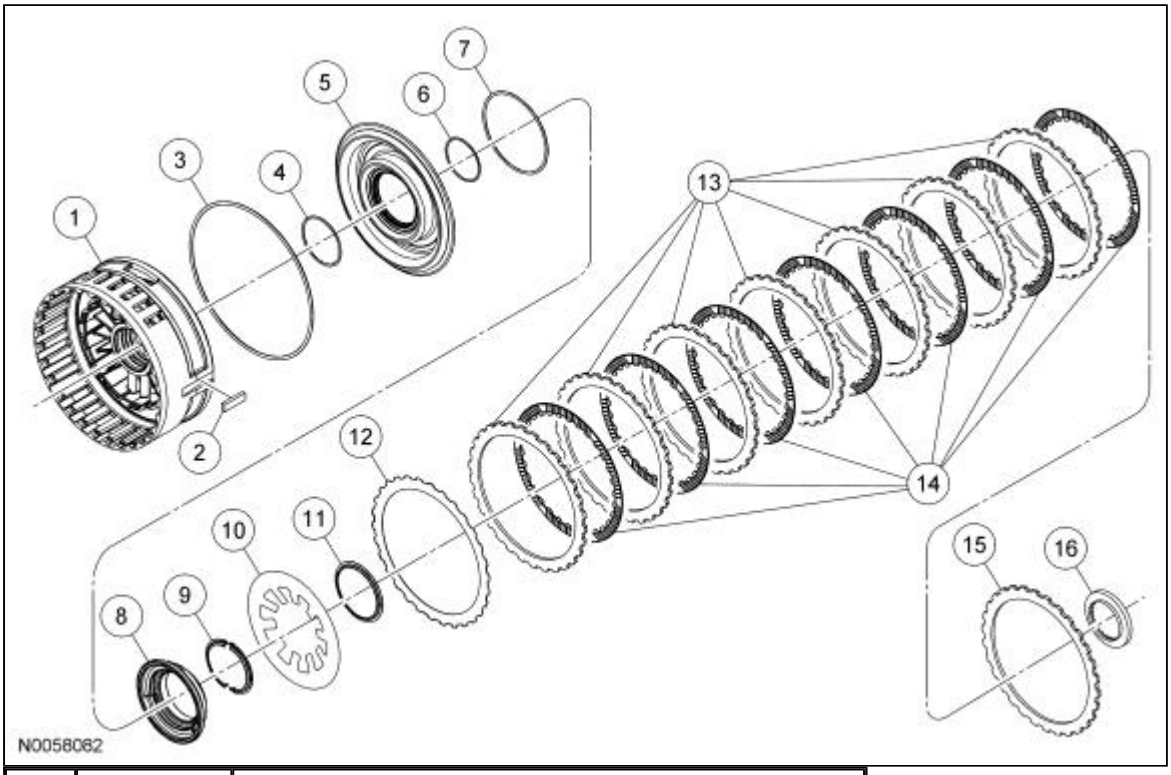
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
	Depth Micrometer 303-D075 (D92P-4201-A) or equivalent
ST2881-A	Piston Spring Compressor 307-525
 ST2896-A	D-Clutch Stack-up Gauge 307-554

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Low/Reverse Clutch Assembly

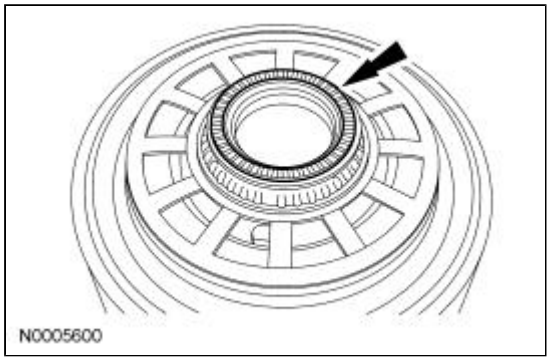


Item	Part Number	Description
1	7G033	Intermediate/low/reverse clutch cylinder
2	7J135	Center support keys (2 required)
3	7G446	Low/reverse clutch cylinder outer seal
4	7G444	Low/reverse clutch cylinder inner seal
5	7D343	Low/reverse clutch piston
6	—	Low/reverse clutch piston inner seal
7	—	Low/reverse clutch baffle plate outer seal
8	—	Low/reverse clutch baffle plate
9	—	Low/reverse clutch baffle plate retaining ring
10	7D404	Return spring
11	7G494	Return spring retainer
12	7N572	Pressure plate (internal to case)
13	7E314	Low/reverse clutch external splined steel plates (internal to case)
14	7B164	Low/reverse clutch internal splined friction plates (internal to case)
15	7E314	Wave spring (internal to case)
16	—	Roller bearing

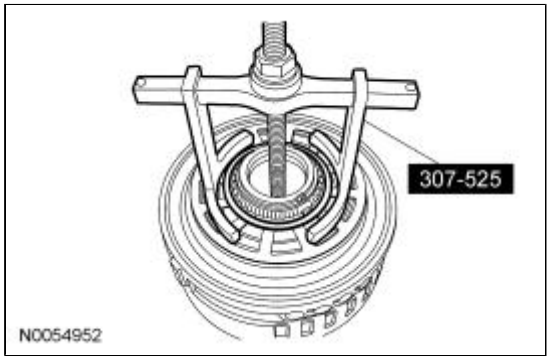
Disassembly

NOTE: The low/reverse clutch plates are installed in the case during the assembly procedure.

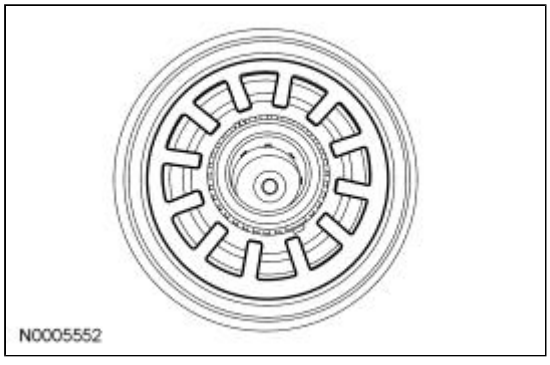
1. Remove the roller bearing on the center support.



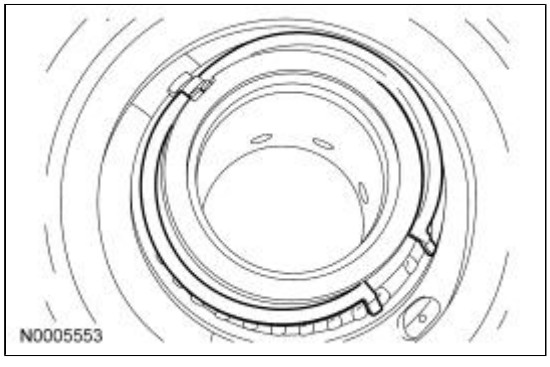
2. Using the special tool, remove the retaining ring.



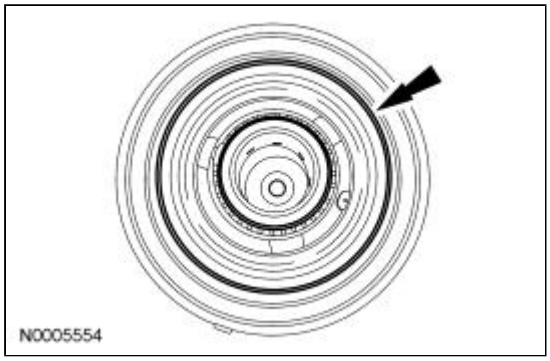
3. Remove the low/reverse clutch return spring.



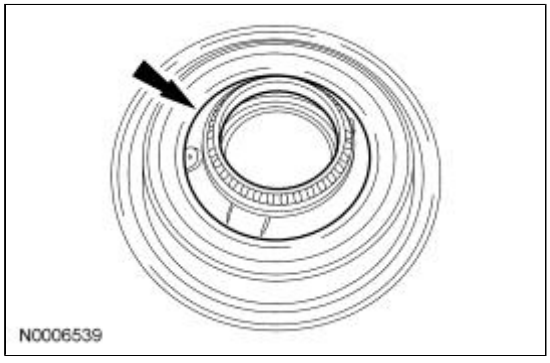
4. Remove the low/reverse clutch baffle plate retainers.



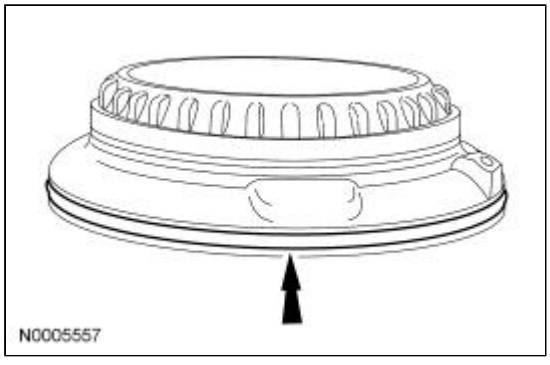
5. Remove the low/reverse clutch baffle plate and piston from the low/reverse clutch drum.



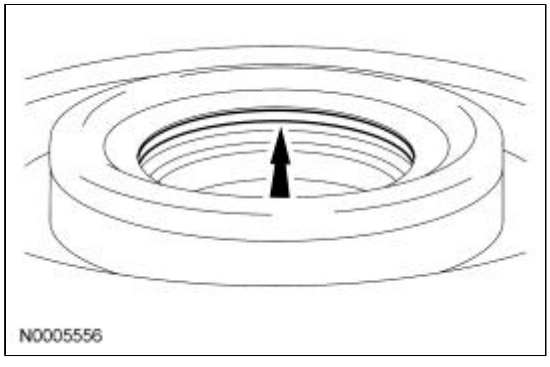
6. Separate the low/reverse clutch baffle plate from the piston.



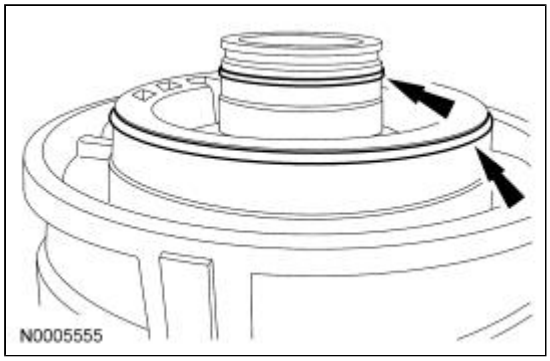
7. Remove and discard the low/reverse clutch baffle plate outer O-ring seal.



8. Remove and discard the low/reverse inner piston O-ring seals.



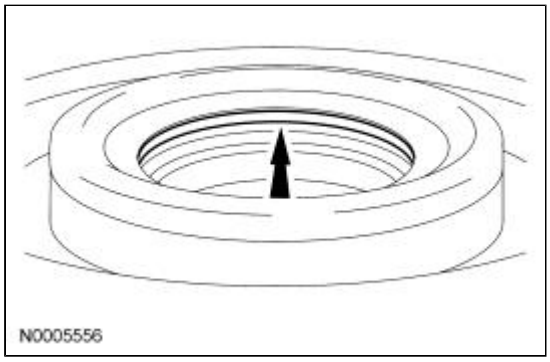
9. Remove and discard the low/reverse drum O-ring seal.



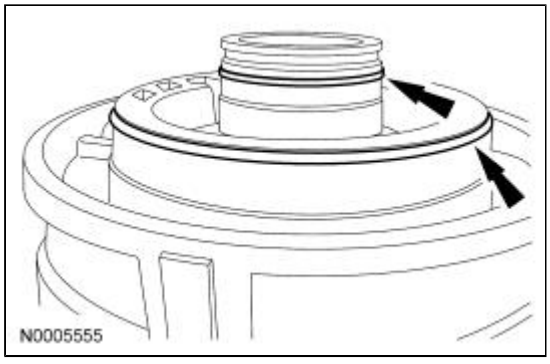
Assembly

Low/reverse piston

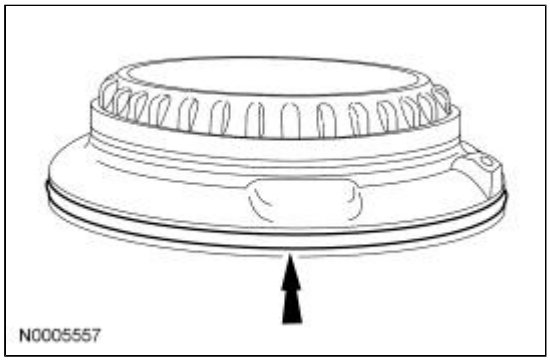
1. Install a new low/reverse inner piston O-ring seals.



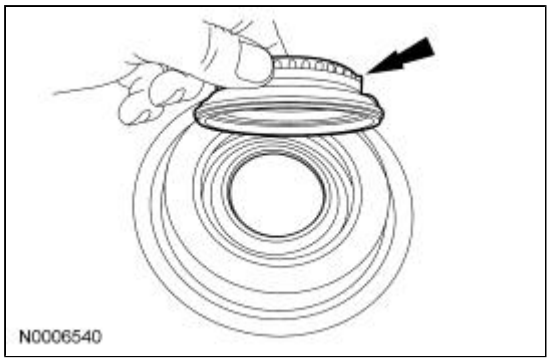
2. Install new low/reverse drum O-ring seal.



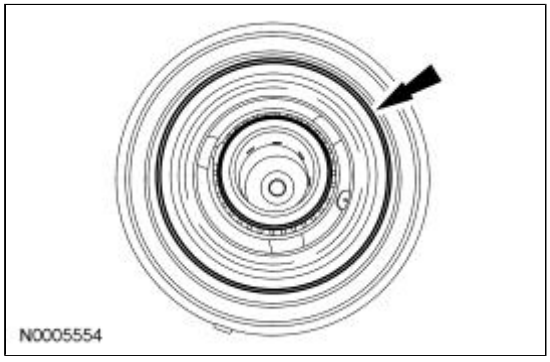
3. Install a new low/reverse clutch baffle plate outer O-ring seal.



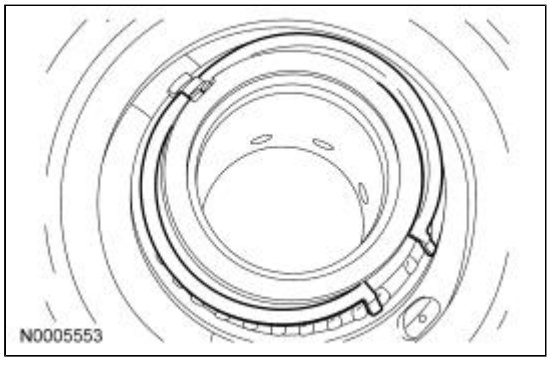
4. Install the low/reverse clutch baffle plate in the low/reverse piston.



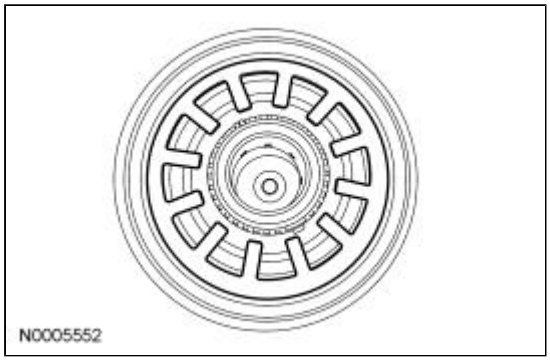
5. Lubricate the O-ring seal with clean automatic transmission fluid, and install the low/reverse piston.



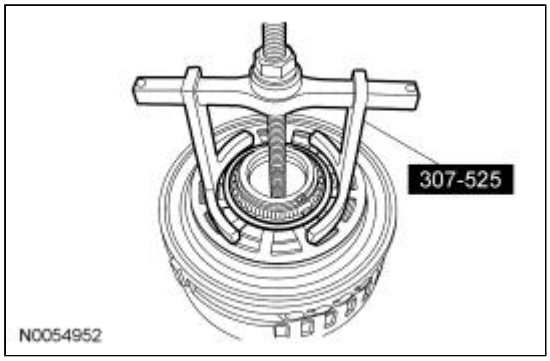
6. Install the low/reverse clutch baffle plate retainers.



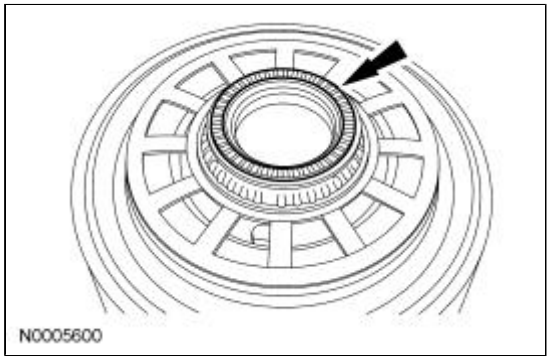
7. Install the low/reverse clutch return spring.



8. Using the special tool, install the retaining ring.



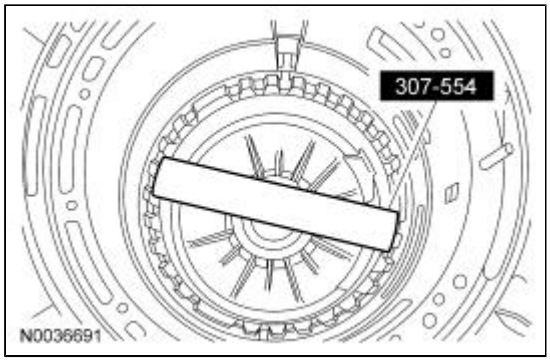
9. Install a new roller bearing on the center support.



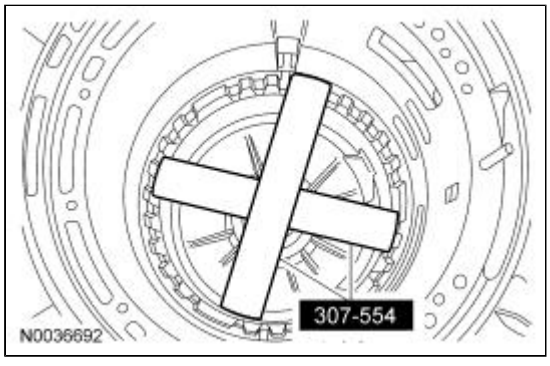
Low/reverse clutch stackup

10. **NOTE:** All intermediate clutch plates friction and steel are of a wave-type design.

    Install the special tool into the case.

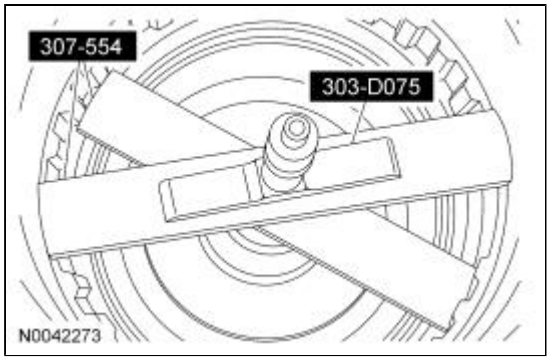


11. Install the special tool into the case as shown.



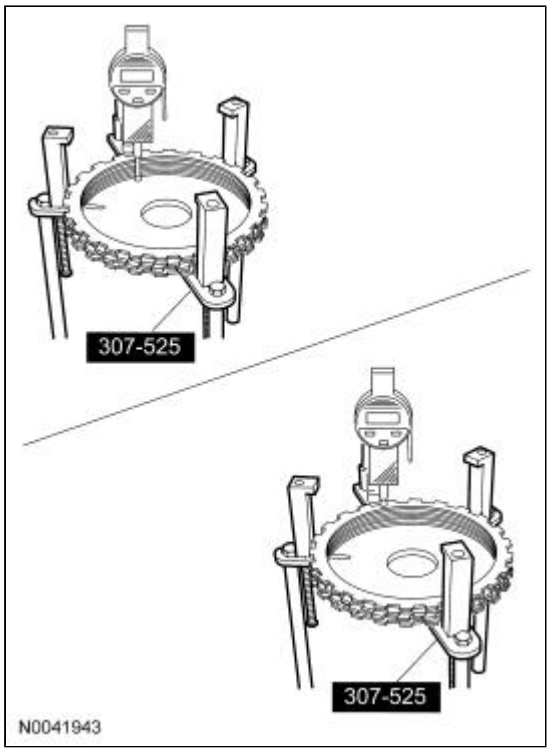
12. Measure case stop depth.

Description	Reading
Measure the distance from the top of the upper gauge bar to the top of the lower gauge bar. Record this reading as the case measurement. Record as reading A	



13. Measure the clutch pack height.

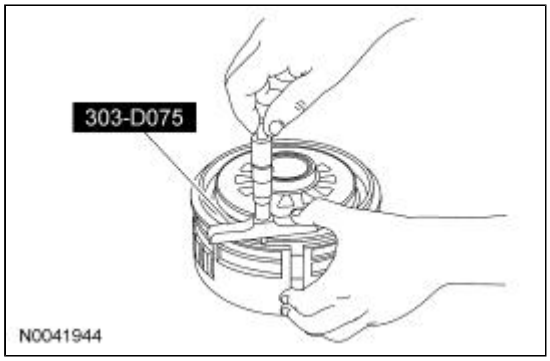
	Description	Reading
A.	Place the clutch pack with the pressure plate on to the special tool with the wave spring down. Slide the clutch off to the side so the probe of the dial indicator is touching the gauge plate of the special. Zero out the dial indicator.	
B.	Carefully lift the probe up enough to slide the clutch pack under the probe to take a reading. Record this reading. Rotate the clutch pack 180 degrees and take a second reading. Add the first and second readings together and divide the total by 2. Record this reading as B.	



14. Measure the piston to center support shoulder height.

Description	Reading

Measure the piston to center support shoulder height. Record this measurement. Rotate the center support 180 degrees and record this measurement. Add the first and the second measurements, then divide by 2. Record this as reading C.	



15. Calculate the end clearance.

Description	Reading
Total C measurement	
Subtract B and C from A to determine end clearance	
Minimum end clearance specification	5.08 mm (0.200 in)
Maximum end clearance specification	5.73 mm (0.226 in)

Compare the end clearance to the specification. If the end clearance is out of specification, select the next thinner or thicker plate as required and repeat Steps 10, 11 and 12.

Pump Assembly

Printable View (280 KB)

Special Tool(s)

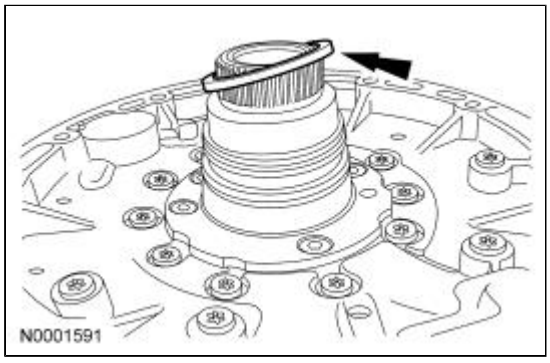
ST2887-A	Installer, Fluid Pump Seal 307-556

Material

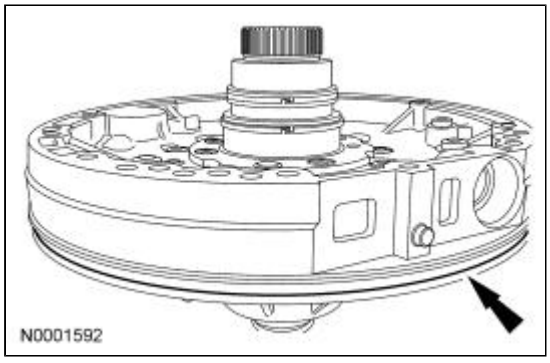
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Disassembly

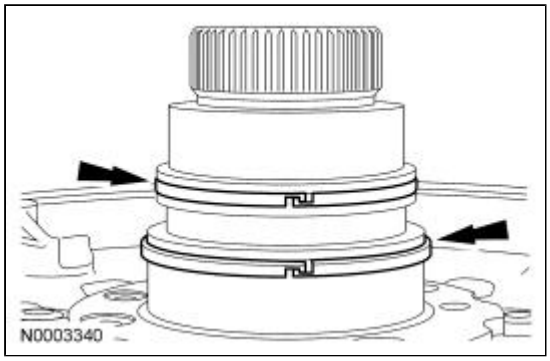
1. Remove the front pump washer.



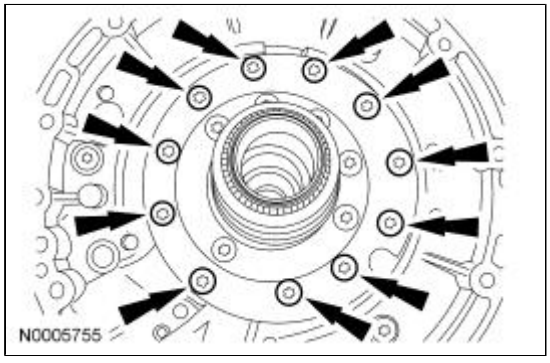
2. Remove and discard the front pump O-ring seal.



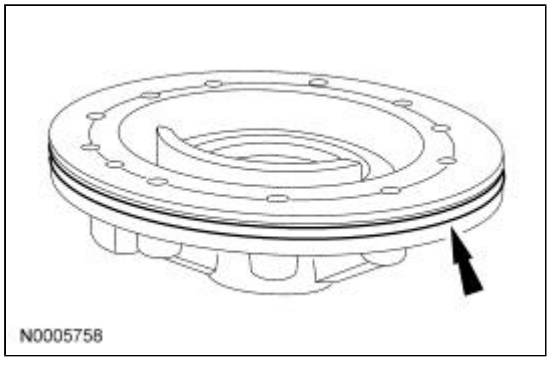
3. Remove and discard the front pump stator support seals.



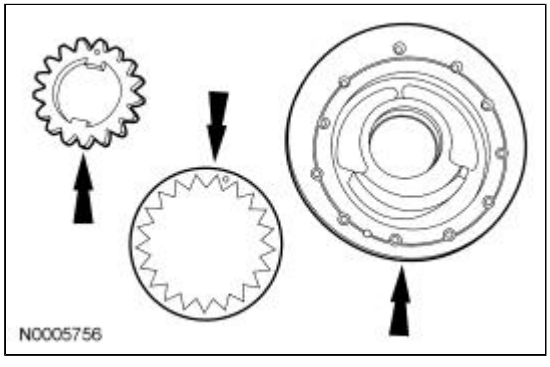
4. Remove the 11 bolts and separate the pump control body from the pump body.



5. Remove and discard the pump body outer seal.



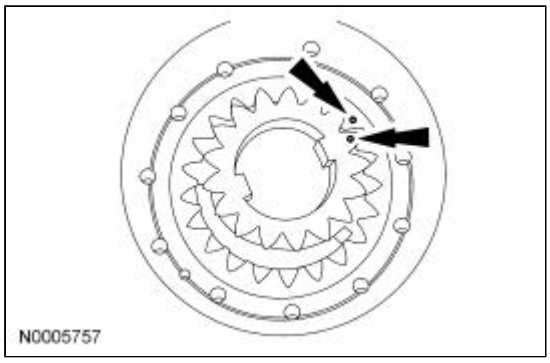
6. Remove and inspect the inner and the outer pump gears.
    - Clean all pump parts in solvent.
    - Dry the parts with compressed air.
    - Inspect the pump gears, faces, gear teeth, pump housing and mating surfaces for damage or scoring.
    - Install a new pump if any of the parts are damaged or worn.



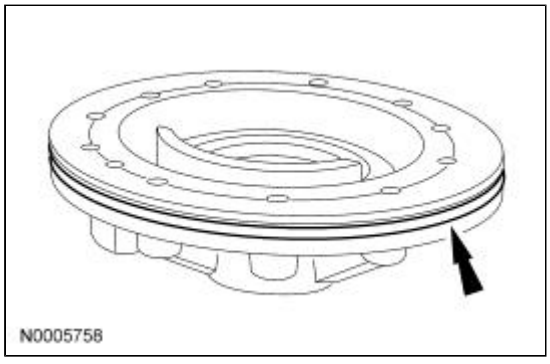
Assembly

1. **NOTE:** Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.

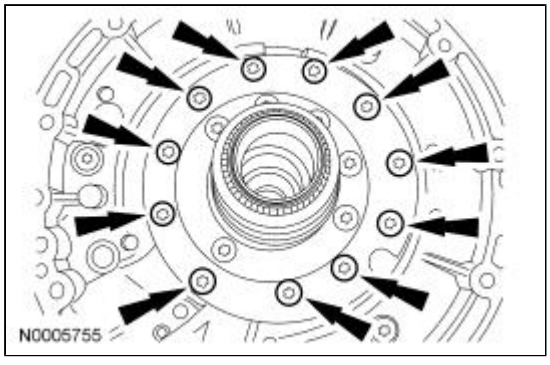
   Install the pump gears, with the dot facing the control body assembly.



2. Install a new pump body outer seal.

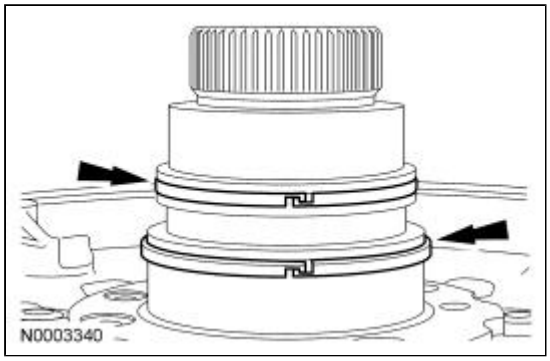


3. Assemble the control body and stator assembly onto the pump body and install the bolts.
   - Tighten to 15 Nm (11 lb-ft).

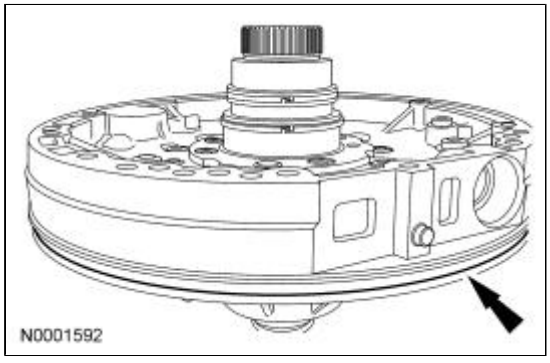


4. **CAUTION: Make sure the seal ends are correctly positioned together and not separated.**

   Install the 2 coast clutch Teflon® seals. Make sure the seals are fully seated in the stator support seal grooves and the seal ends are oriented 180 degrees apart.

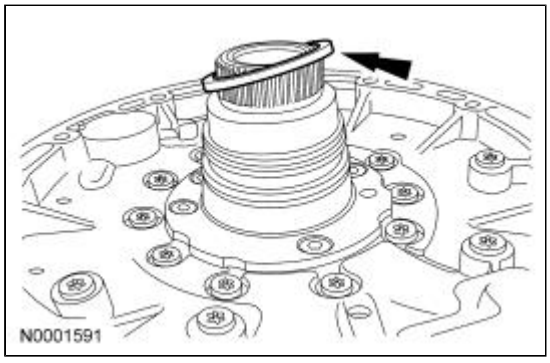


5. Install the pump outer diameter front pump O-ring seal.

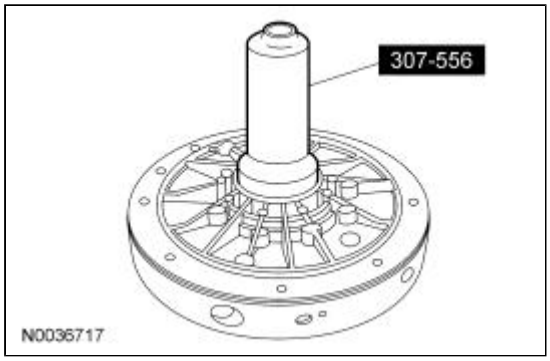


6. **NOTE:** Lightly lubricate the thrust washer and the bearing with petroleum jelly to hold them in place during assembly.

   Install the pump thrust washer.



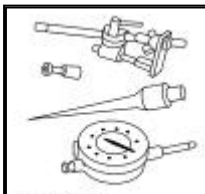
7. Using the special tool, install the front pump seal.



Transmission

Printable View (2659 KB)

Special Tool(s)

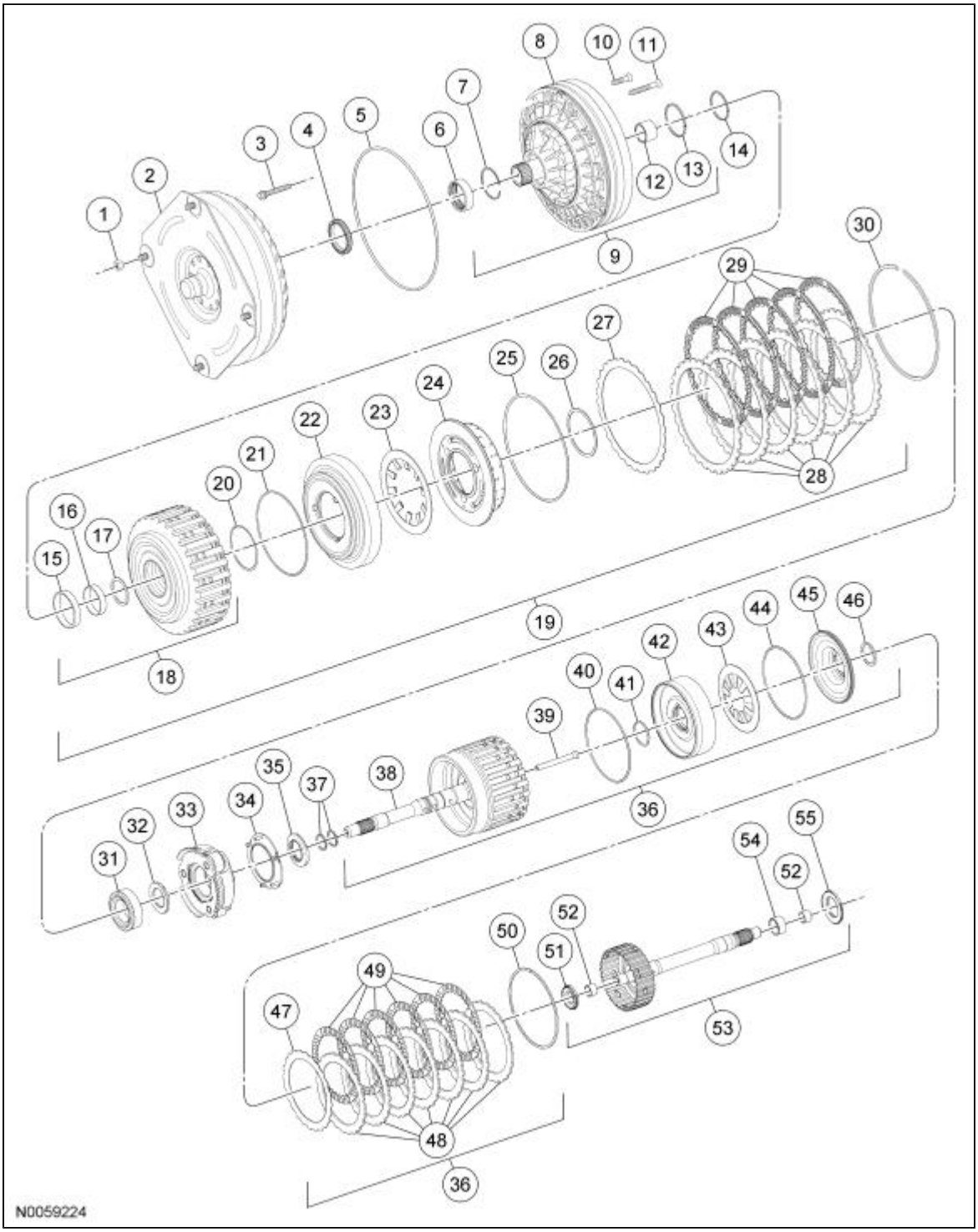
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
ST2890-A	Installer, Shifter Fluid Seal 307-559
ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
ST2888-A	Installer, Transmisison Extension Housing Fluid Seal 307-560
ST2887-A	Installer, Fluid Pump Seal 307-556
ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)
ST1754-A	Aligner, Valve Body 307-334 (T95L-70010-C)
	Installer, Needle Bearing 307-558

ST2894-A	
ST2891-A	Remover, Transmission Fluid Pump 307-553
ST1255-A	Handle, Driver 205-153 (T80T-4000-W)
ST2883-A	End Play Gauge, Transmission 307-534
ST2895-A	Installer, Ball Bearing 307-557
ST2894-A	Installer, Needle Bearing 307-558

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Disassembled Views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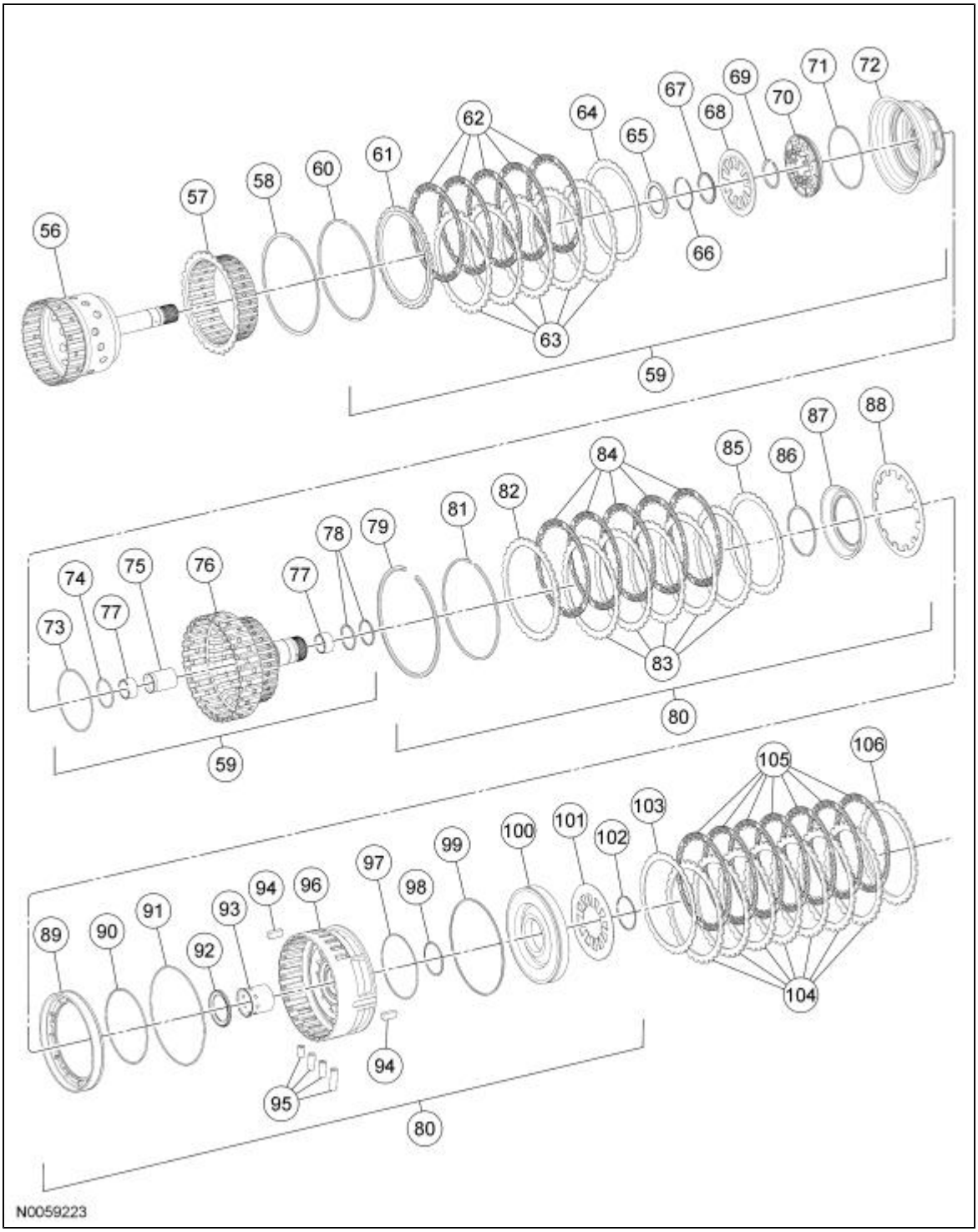
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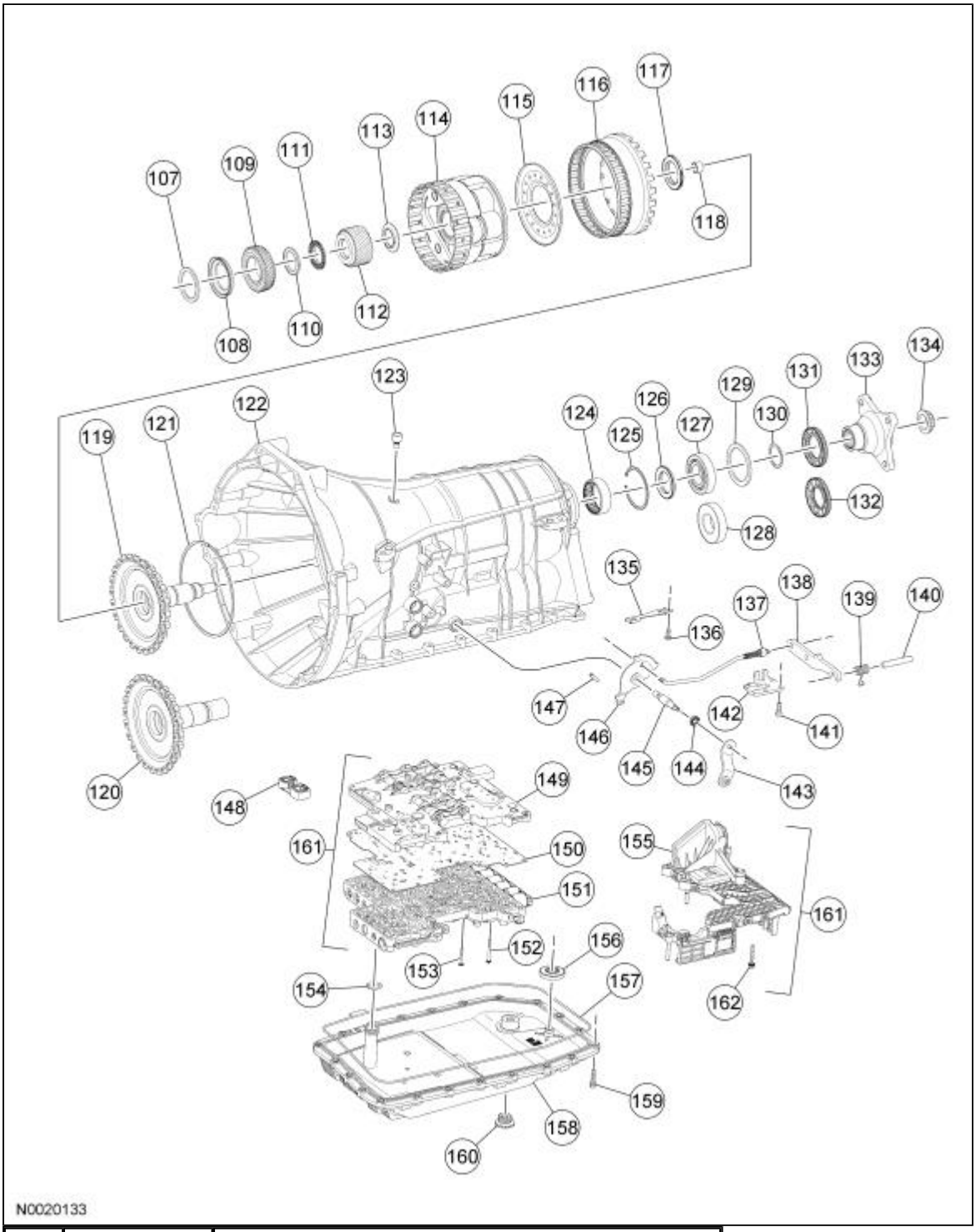


Item	Part Number	Description
1	N800750-S437	Flex plate to torque converter nut (4 required)
2	7902	Torque converter
3	7N134	Oil pump-to-case bolt
4	7A248	Front pump oil seal
5	7B031	Front pump outer oil seal
6	7R166	Front oil pump bearing assembly
7	7N877	Torque converter pump retaining ring
8	7A103	Front pump assembly

9	7A103	Front pump assembly
10	W707870-S300	Bolt — attaches stator support to pump adapter assembly (6 required)
11	W707871-S300	Bolt — attaches pump to pump adapter assembly (11 required)
12	7B261	Converter stator support bushing
13	7Z463	Clutch support oil seal
14	7L323	Front pump support seal
15	7G427	Forward clutch drum front bushing
16	7G428	Forward clutch rear bushing
17	7D014	Front pump support thrust washer
18	7J011	Forward clutch cylinder and hub assembly
19	7A511	Forward clutch assembly (clutch A)
20	7G242	Forward clutch inner piston seal
21	7F227	Forward clutch outer piston seal
22	7L140	Forward clutch piston
23	7F230	Forward clutch piston retaining spring
24	7J032	Forward clutch balance piston assembly
25	7F227	Forward clutch balance piston outer seal
26	7H365	Forward clutch balance piston snap ring
27	7E457	Forward clutch cushion spring
28	7E314	Forward clutch steel plates (externally splined)
29	7B164	Forward clutch friction plates (internally splined)
30	7B421	Pressure plate retaining snap ring
31	7G231	Front planetary sun gear (No. 1)
32	7H375	Bearing (T1)
33	7G219	Front planetary carrier assembly
34	7H587	Transmission fluid cooler plate
35	7L495	Bearing (T2)
36	7L668	Overdrive clutch assembly (clutch E)
37	7G091	Turbine shaft seal (2 required)
38	7J006	Input shaft
39	7C232	Oil distributor sleeve
40	7J008	Overdrive clutch piston outer seal
41	7G007	Overdrive clutch piston inner seal
42	7G418	Overdrive clutch piston
43	7N529	Overdrive clutch piston spring
44	7J009	Balance piston outer seal
45	7J029	Overdrive balance piston
46	7J010	Balance piston snap ring
47	7N572	Clutch cushion plate
48	7B442	Overdrive clutch steel plates (externally splined)

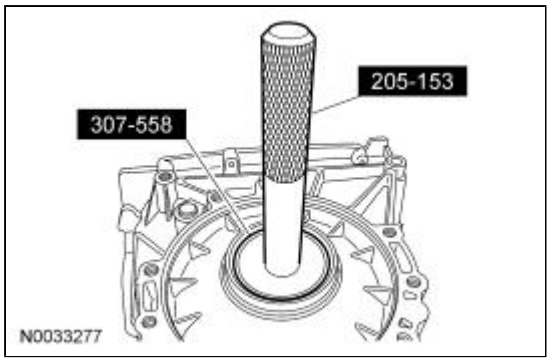
49	7B164	Overdrive clutch friction plates (internally splined)
50	7M157	Overdrive clutch retaining ring
51	7A453	Bearing (T3)
52	7B256	Output shaft bushing (2 required)
53	7F351	Intermediate clutch shaft
54	7D065	Sun gear bushing (part of 7F351)
55	7H375	Bearing (T4)
56	7R193	Sun gear hub and shaft assembly
57	7F236	Direct clutch hub
58	7H076	Direct clutch cylinder retaining ring
59	7C108	Direct clutch assembly (clutch B)
60	7B421	Direct clutch pressure plate retaining ring
61	7B477	Direct clutch pressure plate
62	7B164	Direct clutch friction plates (internally splined)
63	7E314	Direct clutch steel plates (externally splined)
64	7N572	Direct clutch cushion plate
65	7D283	Bearing (T5)
66	7H363	Direct clutch balance piston snap ring
67	7D427	Direct clutch piston spring retainer
68	7B448	Direct clutch piston return spring
69	7B492	Direct clutch piston retaining ring
70	7H359	Direct clutch balance piston
71	7C000	Direct clutch balance seal
72	7F254	Direct clutch piston
73	7C000	Direct clutch piston outer seal
74	7F234	Direct clutch piston inner seal
75	7C486	Gear shaft tube sleeve
76	7F281	Direct clutch cylinder
77	7H240	Direct clutch hub bushing (part of 7F281) (2 required)
78	7B399	Shell cylinder seal (2 required)
79	7L327	Center support retaining ring
80	7F388	Intermediate clutch assembly (clutch C)
81	7B421	Intermediate clutch pressure plate retaining ring
82	7E314	Intermediate clutch pressure plate
83	7E314	Intermediate clutch steel plate (externally splined)
84	—	Intermediate clutch friction plate (internally splined)
85	7H136	Intermediate clutch pressure plate spring
86	7N169	Intermediate clutch retaining ring
87	7B043	Intermediate clutch ring
88	7C151	Intermediate clutch piston spring

89	7J015	Intermediate clutch piston
90	7F225	Intermediate clutch piston inner seal
91	7F224	Intermediate clutch piston outer seal
92	7F373	Bearing (T6)
93	7B314	Center shaft sleeve (part of 7G033)
94	7J114	Center support key (2 required)
95	7J135	Center support seal (4 required)
96	7G033	Support assembly
97	7G446	Low/reverse clutch piston center seal
98	7G444	Low/reverse clutch piston inner seal
99	7F227	Low/reverse clutch piston outer seal
100	7D343	Low/reverse clutch piston
101	7D404	Low/reverse clutch piston return spring
102	7G494	Low/reverse clutch piston retaining ring
103	7N572	Clutch disc cushion plate
104	7E314	Low/reverse clutch steel plates (externally splined)
105	7B164	Low/reverse clutch friction plates (internally splined)
106	7E314	Low/reverse clutch pressure plate (select fit)
107	7H286	Gear thrust shim (select fit)
108	7C041	Bearing (T7)
109	7H580	Sun gear No. 2
110	7D235	Thrust bearing outer race
111	7D234	Bearing (T8)
112	7A348	Sun gear No. 3
113	7D234	Bearing (T9)
114	7G225	Rear planetary carrier assembly
115	7H583	Oil collar rear planetary plate (part of 7G225)
116	7A153	Output shaft ring gear assembly
117	7M152	Bearing (T10)
118	7B256	Output shaft bushing (part of 7096)
119	7096	Output shaft parking gear assembly, rear wheel drive (RWD)
120	7096	Output shaft parking gear assembly, four wheel drive (4WD)
121	7N194	Output shaft retaining ring
122	7006	Transmission case assembly (model dependent)
123	7034	Transmission case vent assembly (model dependent)
124	7A415	Output shaft bearing assembly
125	7030-A	Output shaft retaining ring
126	7E413	Bearing (T11) (4WD only)

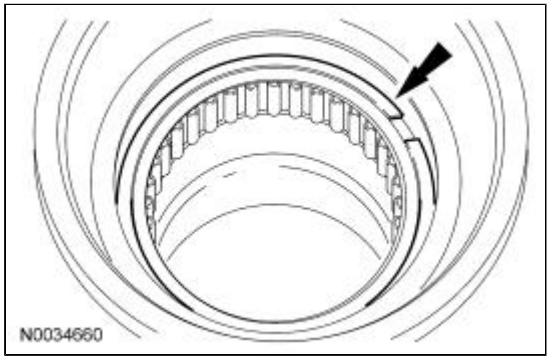
127	7R205	Output shaft bearing (RWD only)
128	7A433	Output shaft spacer (4WD only)
129	7030-B	Output shaft bearing retainer shim
130	7N135	Anti-click washer
131	7052	Extension housing seal (RWD)
132	7052	Extension housing seal (4WD)
133	7A021	Output shaft flange (RWD)
134	7K440	Output shaft flange retaining nut (RWD)
135	7E332	Manual valve detent spring
136	W707913-S300	Manual valve detent spring retaining screw and washer
137	7D410	Parking pawl actuating rod
138	7A441	Parking pawl
139	7D070	Parking pawl return spring
140	7D071	Parking pawl shaft
141	W707914-S300	Parking pawl abutment retaining screw and washer
142	7G010	Parking pawl abutment
143	7A257	Manual control lever
144	7B498	Manual control lever shaft seal
145	7C493	Manual control lever shaft
146	7A115	Manual valve detent lever assembly
147	7G100	Manual valve detent lever retaining pin
148	7F401	Front pump adaptor seal
149	7A091	Main control valve body assembly
150	7ZA490	Main control valve body separator plate
151	7G423	Main control valve body lower
152	W707884	Main control valve body retaining bolts (6 required)
153	W707886	Main control valve body retaining bolts (9 required)
154	—	O-ring seal (part of 7A194)
155	7Z369	Mechatronic control module assembly
156	—	Transmission fluid pan magnet (part of 7A194)
157	7A191	Transmission fluid pan gasket (part of 7A194)
158	7A194	Transmission fluid pan
159	W707883-S437	Transmission fluid pan retaining bolts
160	—	Transmission fluid pan drain plug
161	7A100	Mechatronic assembly
162	7N134	Mechatronic retaining bolts

Four wheel drive (4WD) vehicles

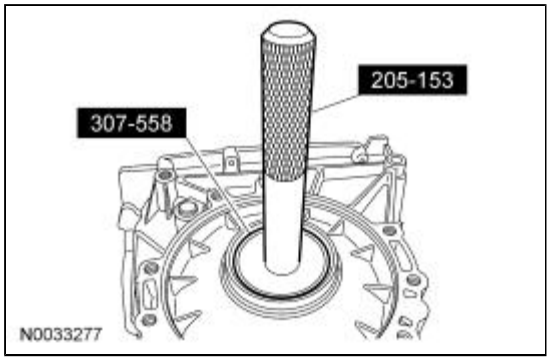
1. Using the special tool, install the rear bearing.



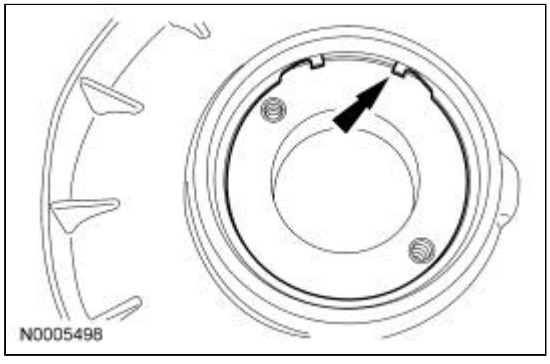
2. Install the snap ring.



3. Using the special tool, install the rear bearing spacer.

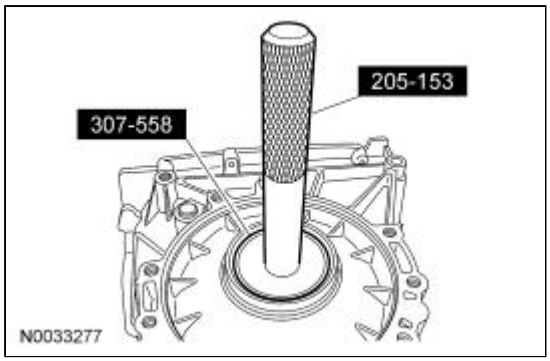


4. Install the rear bearing spacer snap ring.

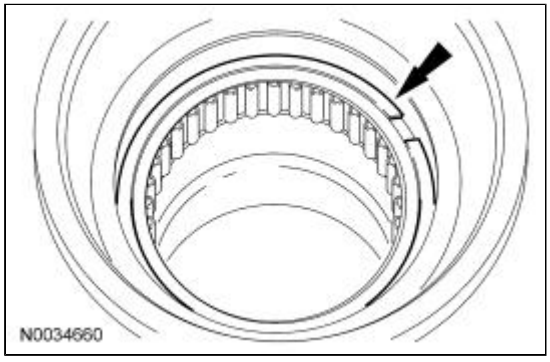


Rear wheel drive (RWD) vehicles

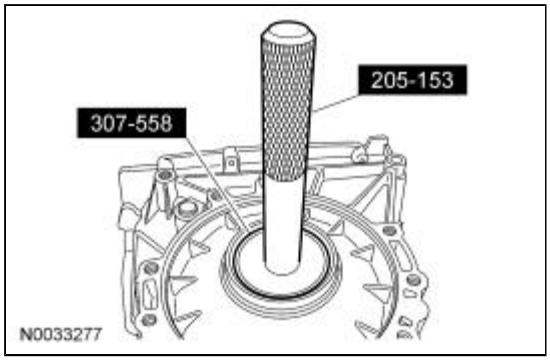
5. Using the special tool, install the rear bearing.



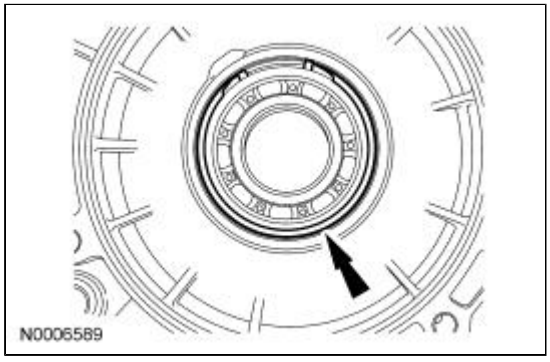
6. Install the snap ring.



7. Using the special tool, install the second rear bearing.



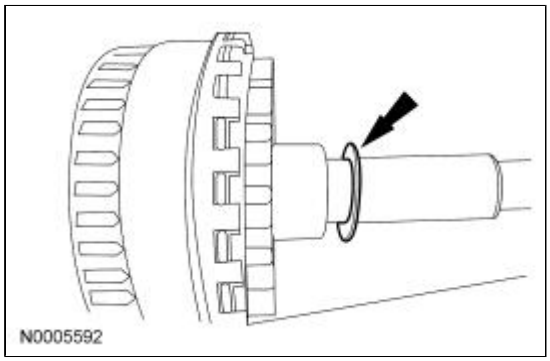
8. Install the rear bearing spacer snap ring.



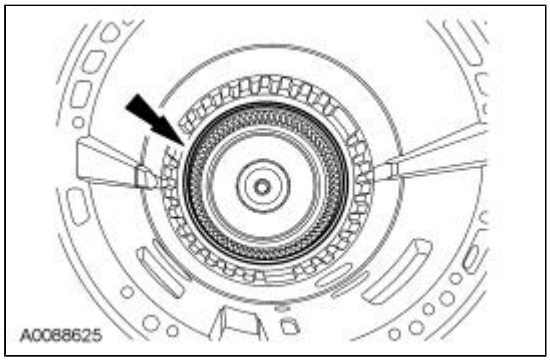
All vehicles

9. Place the transmission in the vertical position.

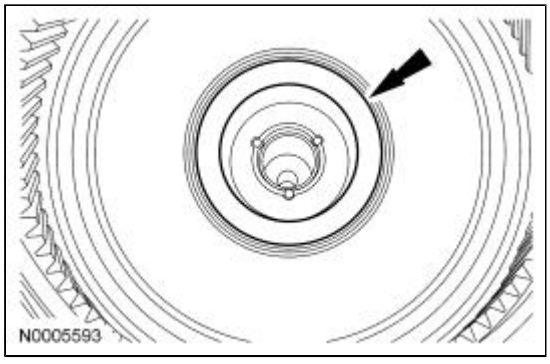
10. Install the shim on the end of the output shaft.



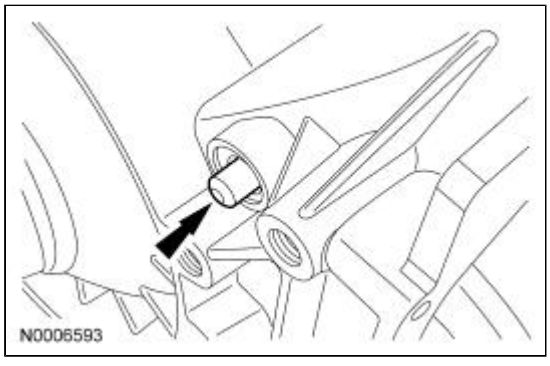
11. Install the planet carrier hub and output shaft assembly.



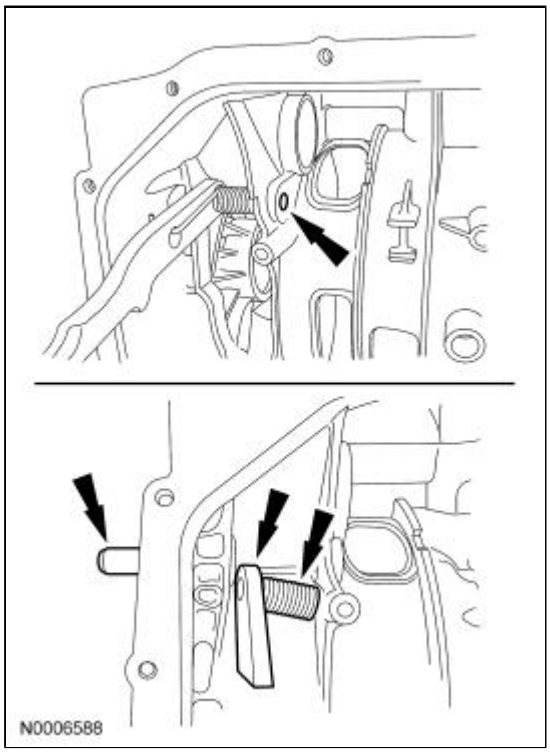
12. Install the silver shim on the planet carrier hub and output shaft assembly.



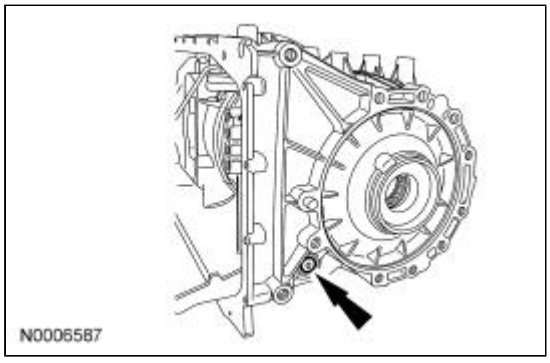
13. Position the park pawl pin into the case.



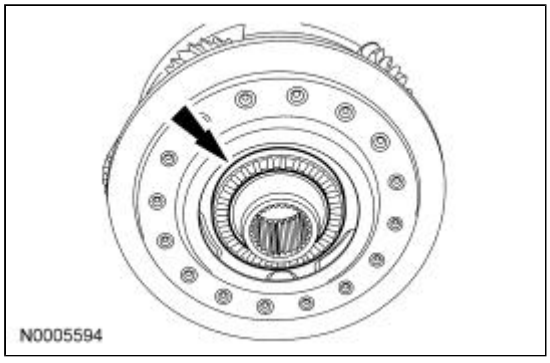
14. Position the park pawl into the case and push the park pawl pin in to hold the park pawl and spring in position.



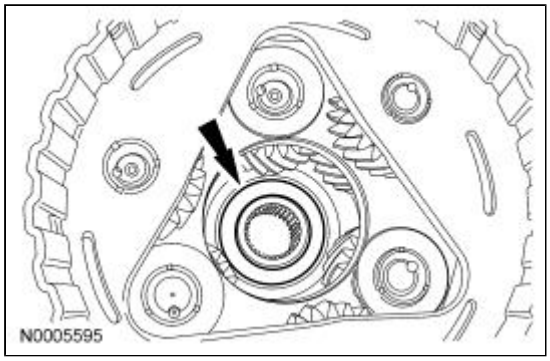
15. Install the park pawl pin bolt.
    - Tighten to 35 Nm (26 lb-ft).



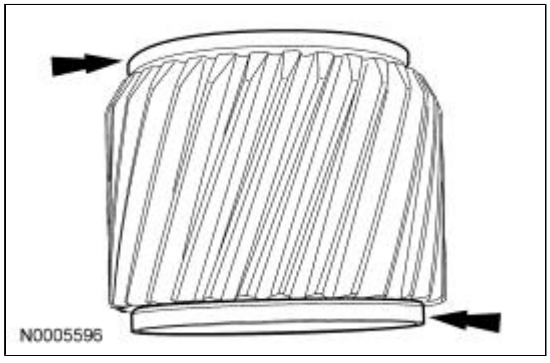
16. Install the roller bearing in the bottom of the carrier.



17. Install the roller bearing race in the bottom of the carrier.

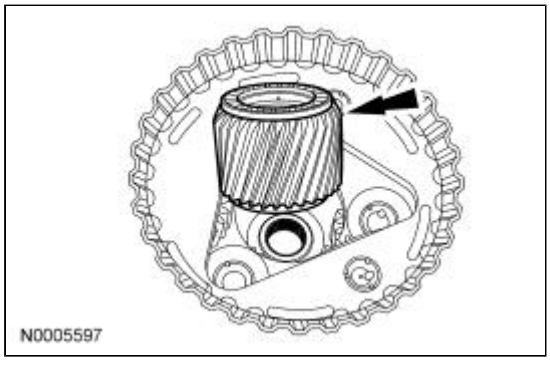


18. Snap the top and the bottom roller bearings onto the sun gear.

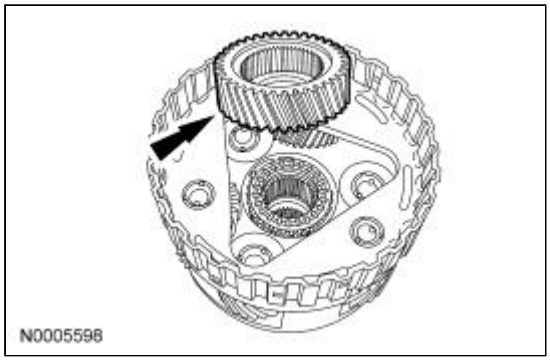


19. **NOTE:** When installing the sun gear, make sure that the taper edge is facing up toward the torque converter housing.

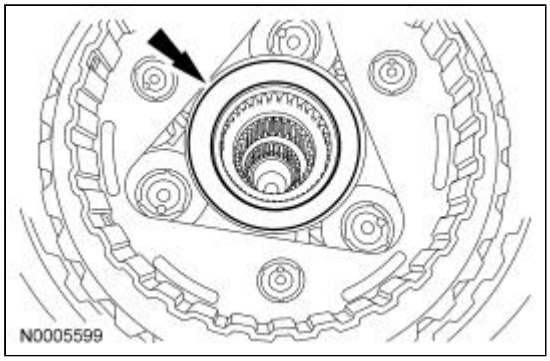
    Install the sun gear into the planet assembly.



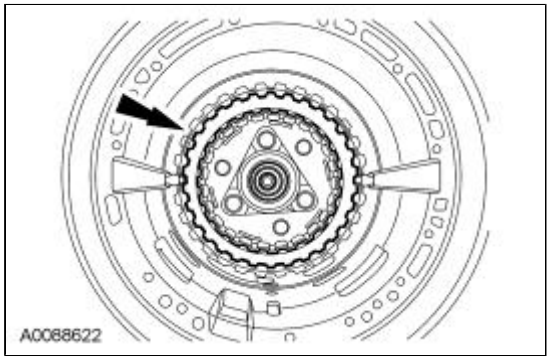
20. Install the low/reverse sun gear.



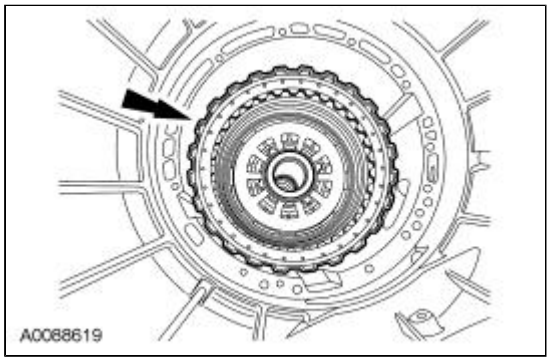
21. Install the low/reverse bearing race.



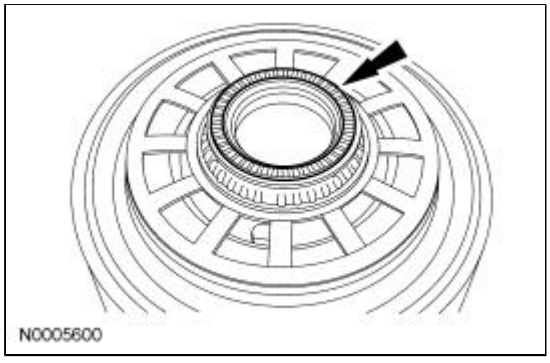
22. Install the planet carrier.



23. Install the low/reverse clutch plates, starting with the pressure plate and alternating between the friction and steel plates, and ending with the wave spring plate on the top.

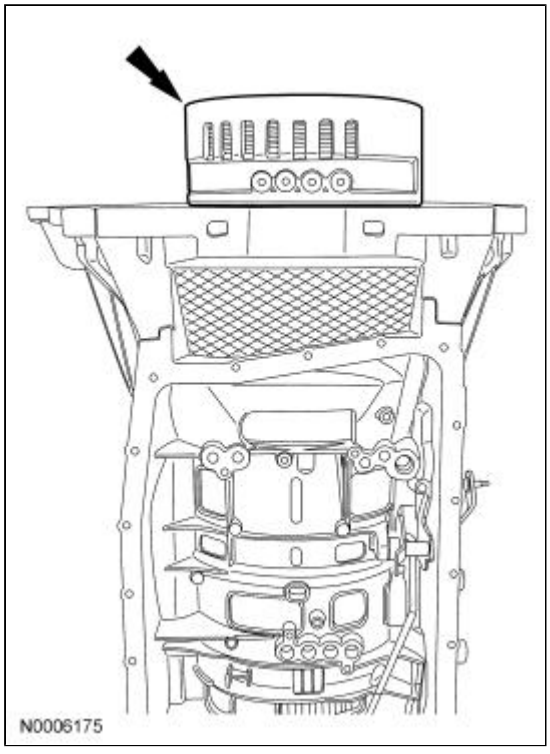


24. If not done previously, install the roller bearing onto the center support.

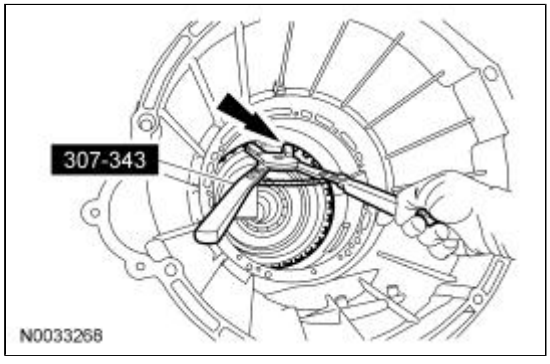


25. **NOTE:** Make sure that when installing the center support the feed holes on the center support are lined up with the feed holes in the case.

    Install the center support into the case.

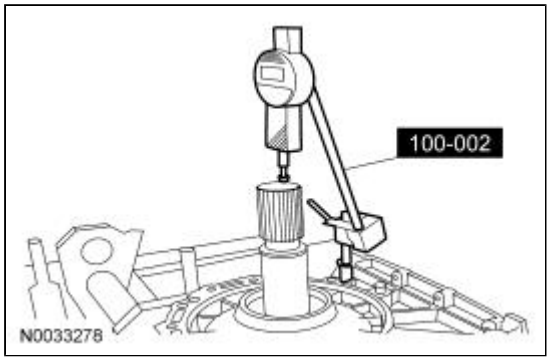


26. Using the special tool, install the center support snap ring. Tap the snap ring into the case to make sure that it is seated into the case.

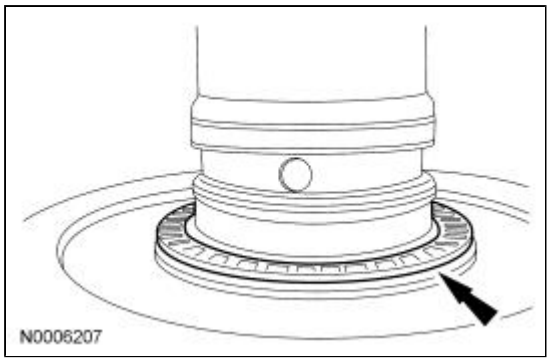


27. **NOTE:** Rotate the case 180 degrees.

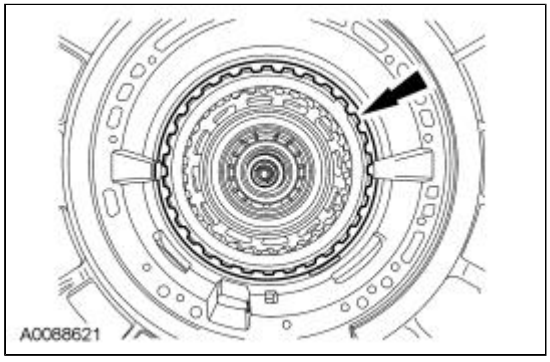
    Using the special tool, lift up on the output shaft and record the reading. The reading should be within the specification.
    - End play specification is 0.15-0.35 mm (0.006-0.013 in).
    - If the end play is not within specification, install a new transmission.



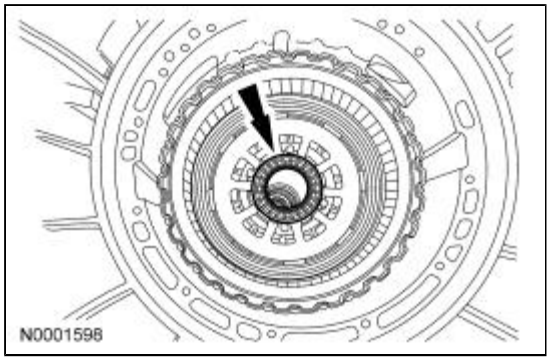
28. Install the roller bearing if not previously installed on the direct clutch drum.



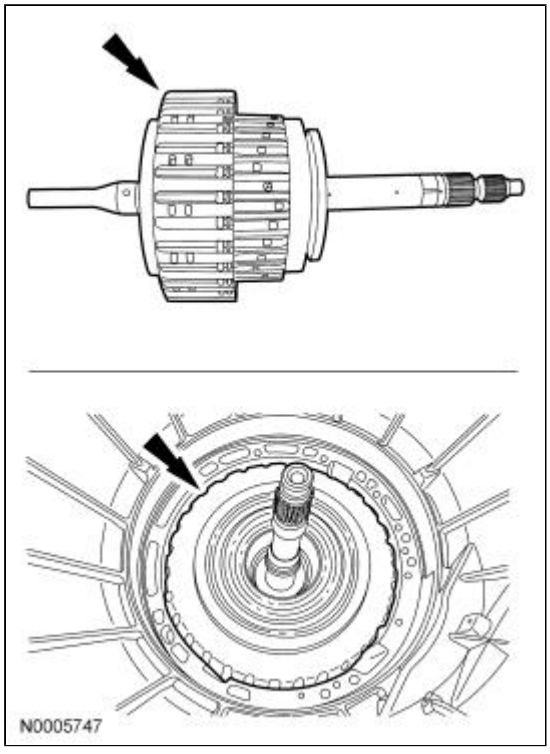
29. Install the direct clutch drum.



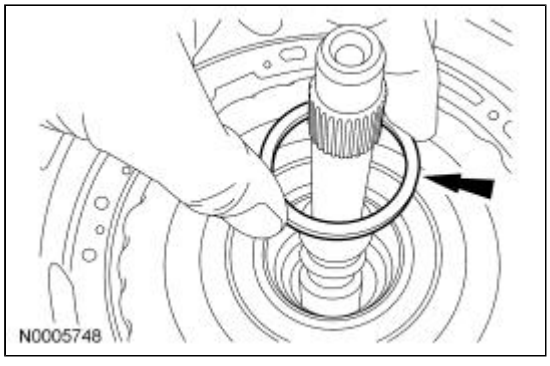
30. Install the roller bearing on the direct clutch assembly.



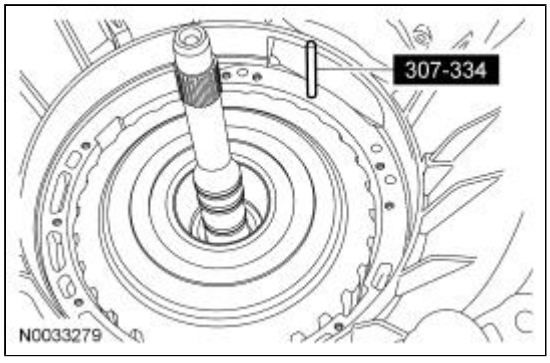
31. Install the forward and overdrive clutch assembly.



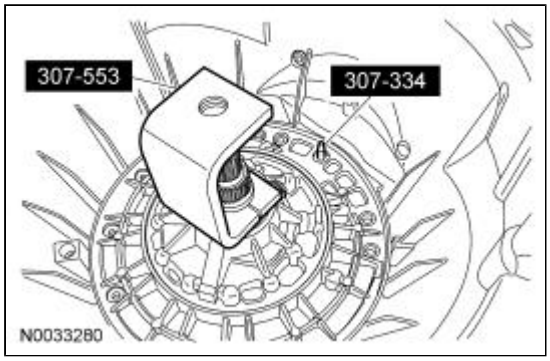
32. Install the pump washer.



33. Install the special tool into the case.

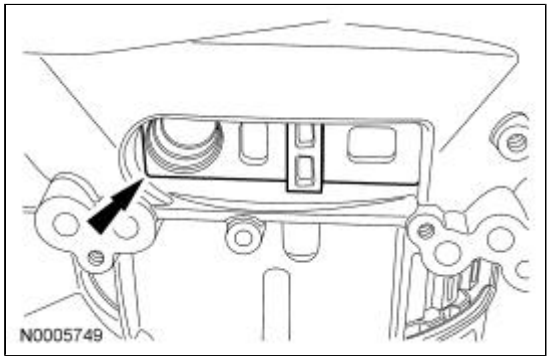


34. Using the special tools, install the front pump.

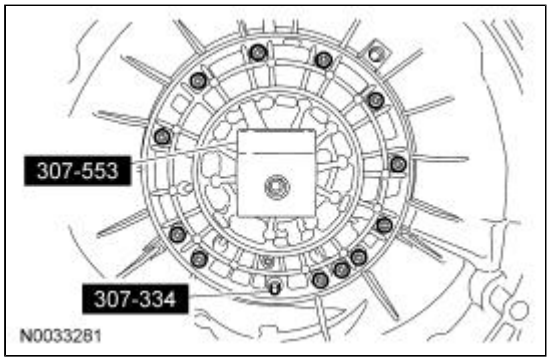


35. **NOTE:** Make sure that the fluid filter seal has been removed. If it has not been removed, use a suitable pick to remove the seal.

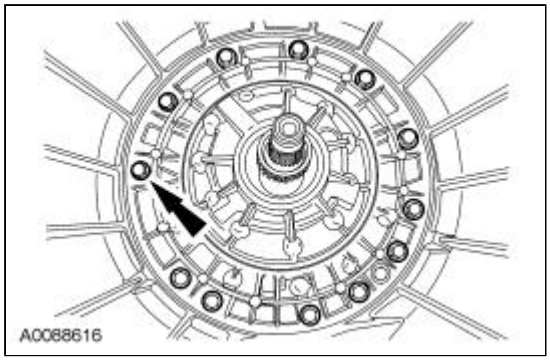
    Make sure that the pump is correctly aligned with the case.



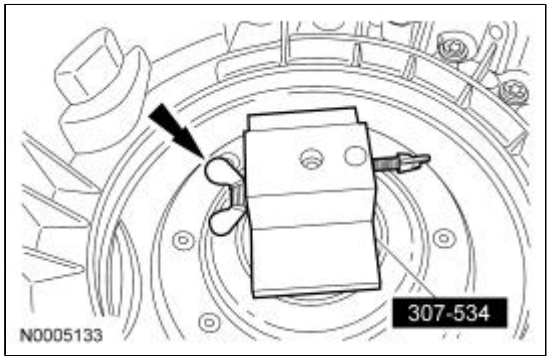
36. Loosely install the new front pump bolts with new washers.



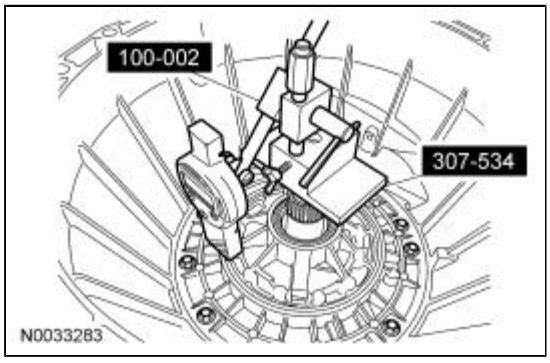
37. Install the remaining front pump bolt. Tighten the bolts in a crisscross pattern.
    - Tighten to 10 Nm (89 lb-in).



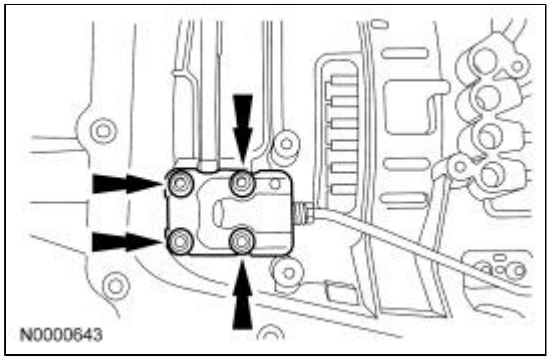
38. Install the special tool onto the input shaft to measure end play.
    - Tighten the wing nut.



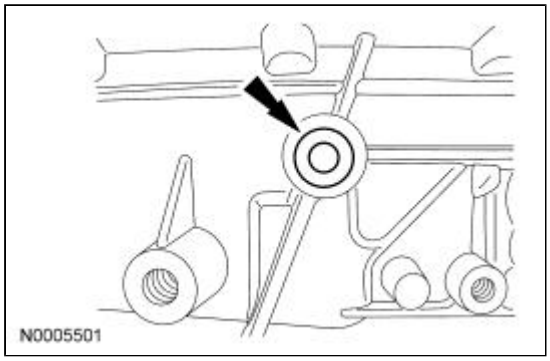
39. Install the remaining special tool.
    - Push down on the special tool and zero out the dial indicator.
    - Lift up on the special tool and record the measurement 0.2-0.4 mm (0.008-0.015 in). If the measurement is not within specification, install a new transmission.



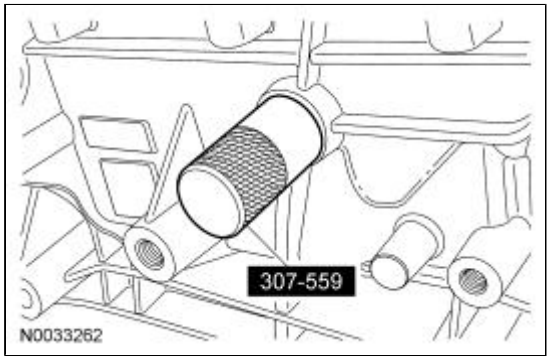
40. Install the park lever actuating plate.
    - Tighten to 10 Nm (89 lb-in).



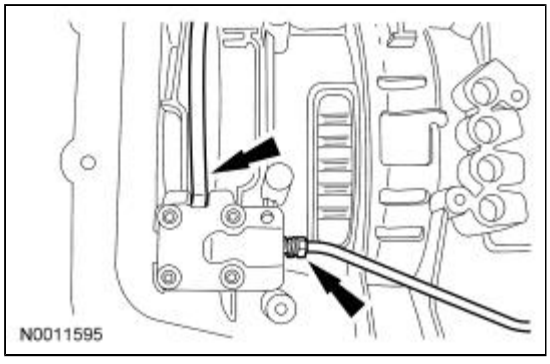
41. Position a new manual control lever seal in place.



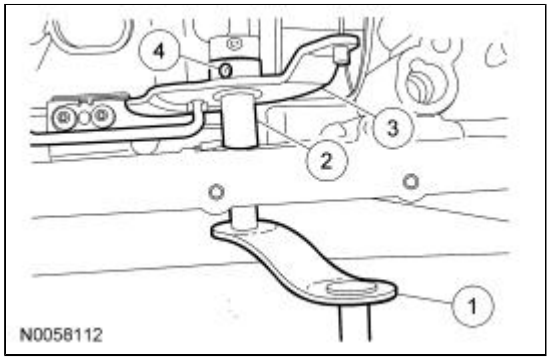
42. Using the special tool, install a new manual control lever shaft seal.



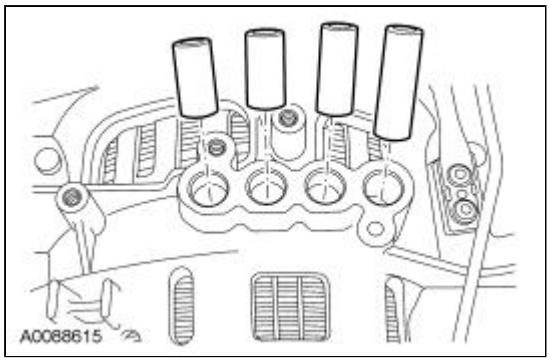
43. Position the manual lever and park rod in place.
    - Push down on the park pawl and slide the park rod in place.



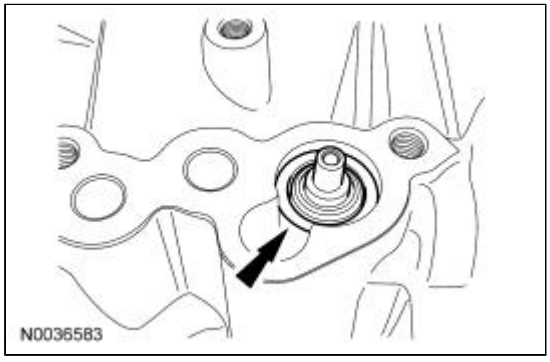
44. Install the manual lever in the case.
    1. Slide the manual lever in the case.
    2. Position the spacer in place while sliding the manual lever into the spacer.
    3. Position the manual valve inner lever while sliding the manual lever and line up the roll pin hole.
    4. Install the roll pin.



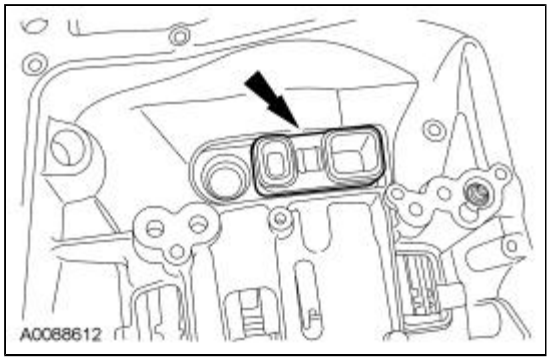
45. Install the 4 rubber feed tubes for the center support.



46. Install the thermal bypass valve into the case.



47. Install the rubber adapter.

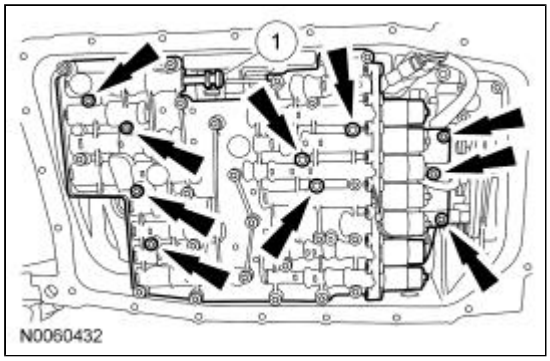


48. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission control module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

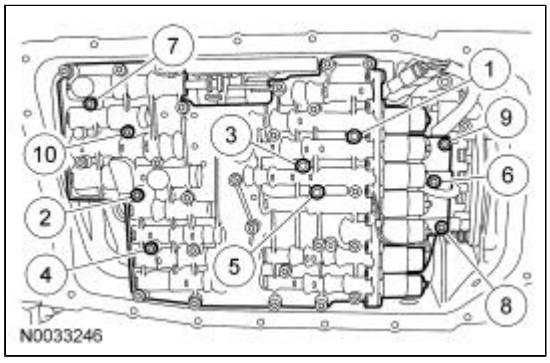
NOTE: The mechatronic assembly will not lay flush on the case, this is normal, the retaining bolts will pull the mechatronic assembly down.

Position the mechatronic assembly in place and loosely install the 10 bolts.

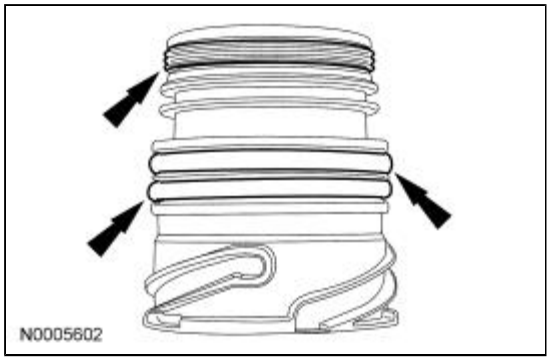
1. Align the manual valve and control lever linkage.



49. Tighten the bolts in the sequence shown.
    - Tighten to 8 Nm (71 lb-in).

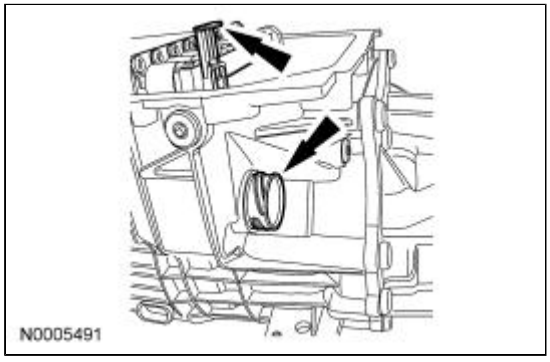


50. Install new O-rings on the outer shell of the bulkhead electrical connector.

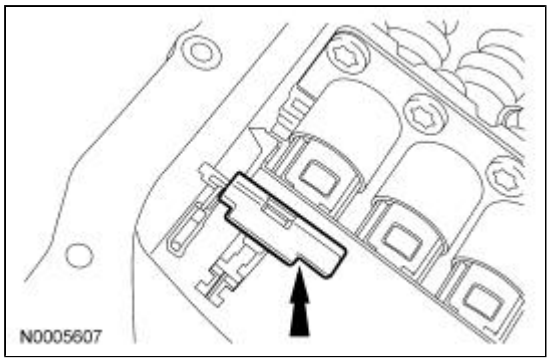


51. **CAUTION: Do not touch the electrical connector pins. Electrostatic charge may occur and will cause damage to the mechatronic unit.**

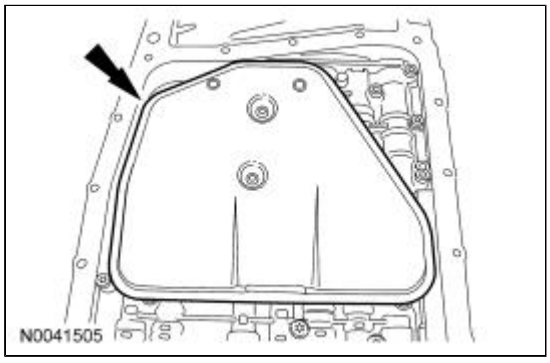
    With the release tab up, push the outer shell of the bulkhead electrical connector into the transmission.



52. Press down on the tab and lock the outer shell of the bulkhead electrical connector in place.

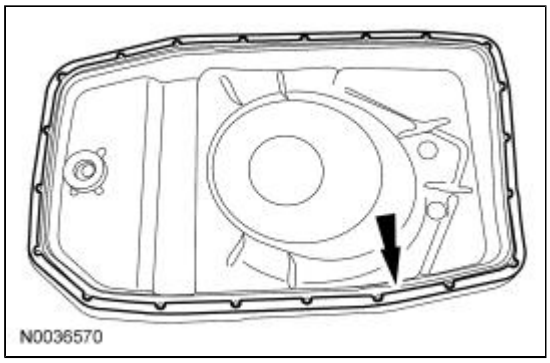


53. Install a new transmission fluid filter.

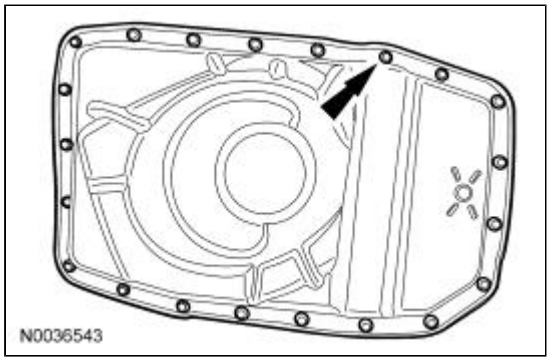


54. **NOTE:** The fluid pan gasket can be reused if not damaged.

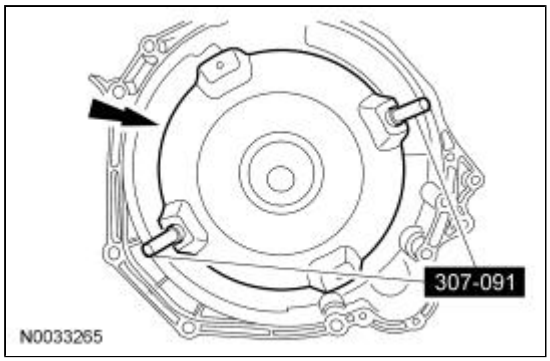
    Install a new transmission fluid pan gasket, if required.



55. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 12 Nm (9 lb-ft).

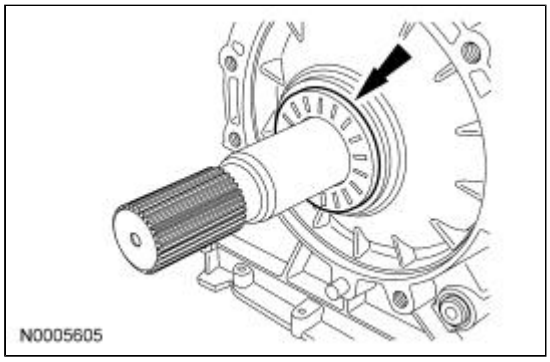


56. Install the torque converter.

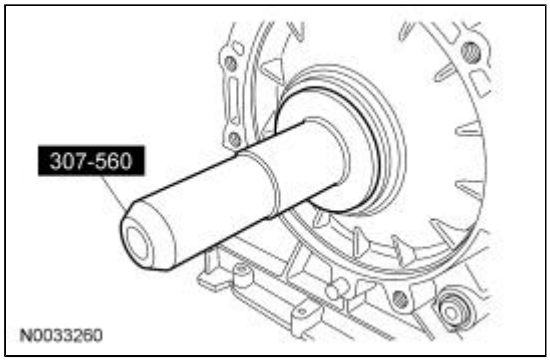


4WD vehicles

57. Position a new output shaft seal in place.

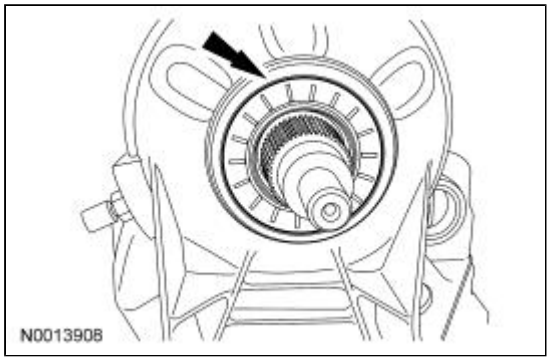


58. Using the special tool, install the output shaft seal.

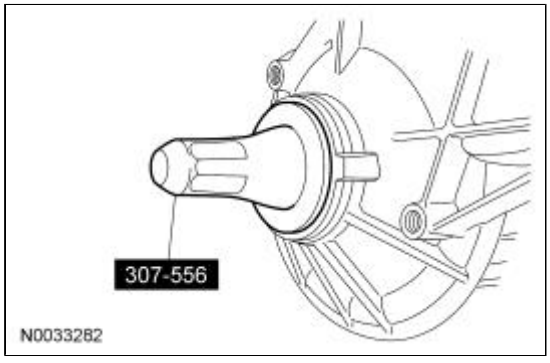


RWD vehicles

59. Position the output shaft seal in place.

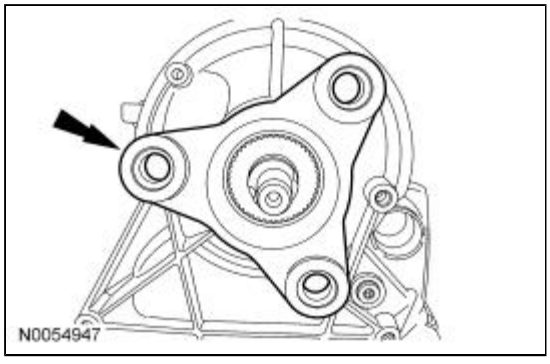


60. Using the special tool, install the output shaft seal.

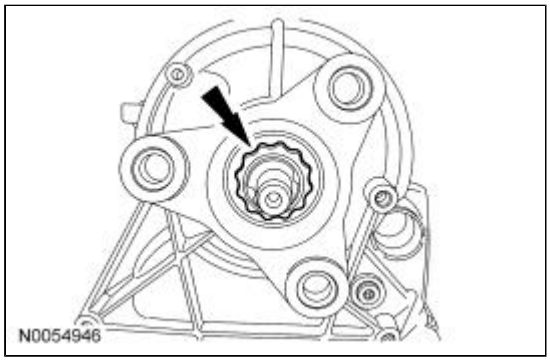


61. Install the anti-click washer over the output shaft.

62. Install the output shaft flange.



63. Install a new output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).



Transmission — Four Wheel Drive (4WD)

Printable View (629 KB)

Special Tool(s)

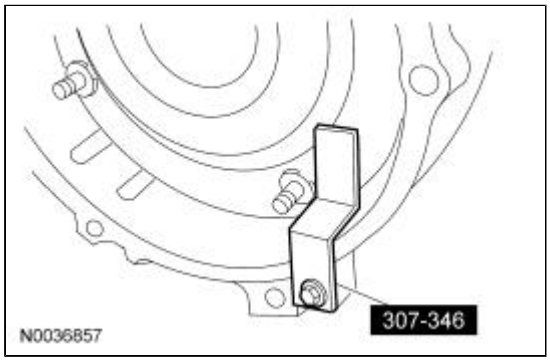
ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Installation

1. Install the special tool.



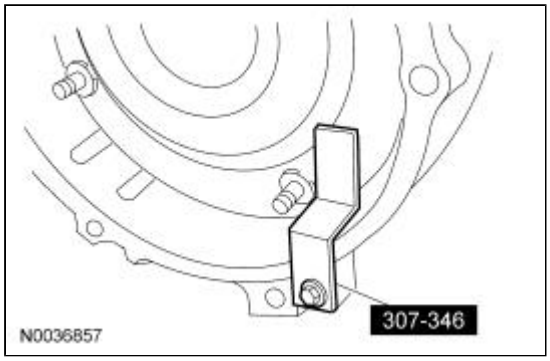
2. **CAUTION: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

   NOTE: Make sure that the transmission is securely fastened to the transmission jack.

   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

3. Remove the special tool.



4. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

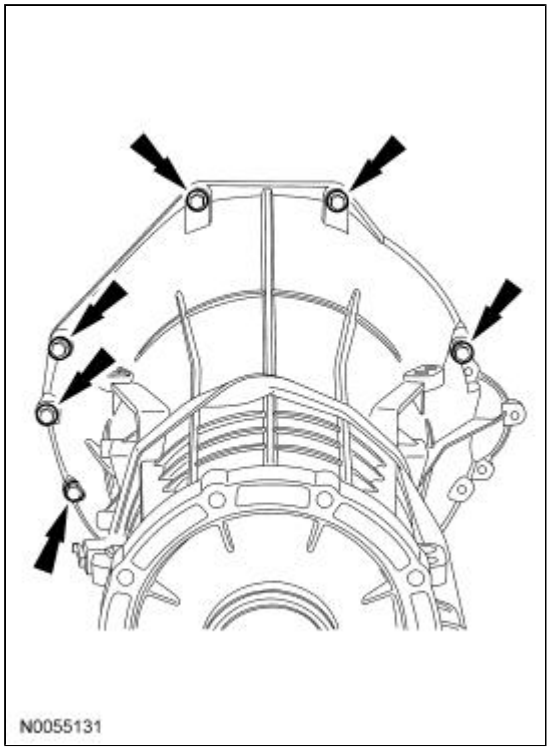
   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

5. **NOTE:** Install the transmission case bolts in their correct locations noted during removal.

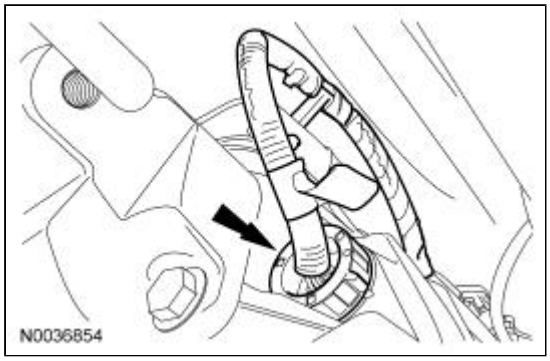
   NOTE: The top 2 transmission case bolts need to be installed prior to installing the rest of the bolts.

   NOTE: The top left bolt is inserted through the fuel line bracket first, then through the transmission case.

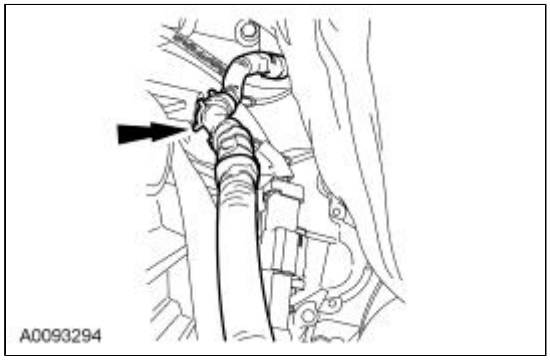
   Install 6 of the 7 transmission case bolts.
   - Tighten to 48 Nm (35 lb-ft).



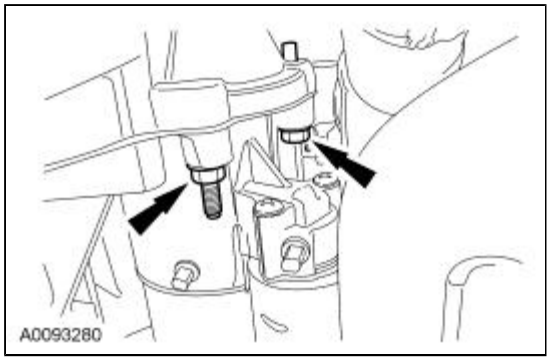
6. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.



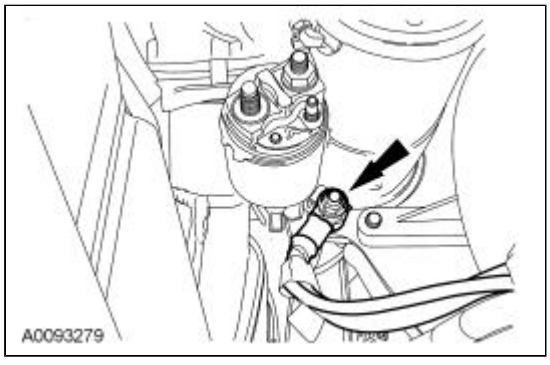
7. Connect the wire harness to the top of the transmission.



8. Install the starter motor and the 3 starter motor bolts.
    - Tighten to 26 Nm (19 lb-ft).

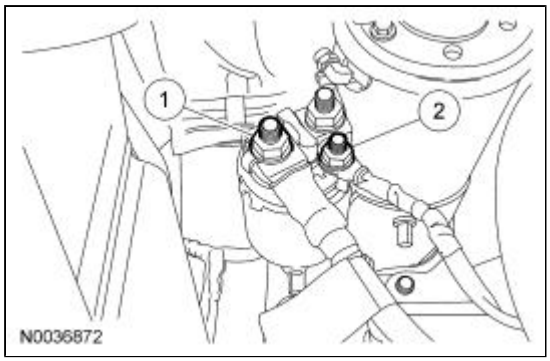


9. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).

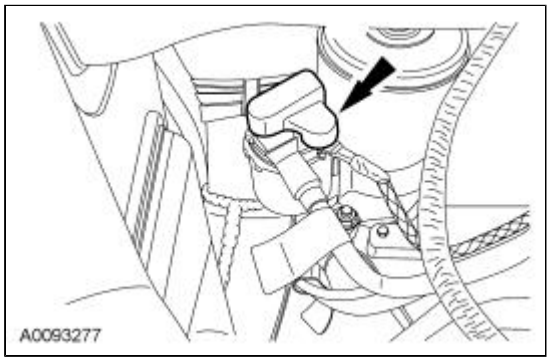


10. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (9 lb-ft).

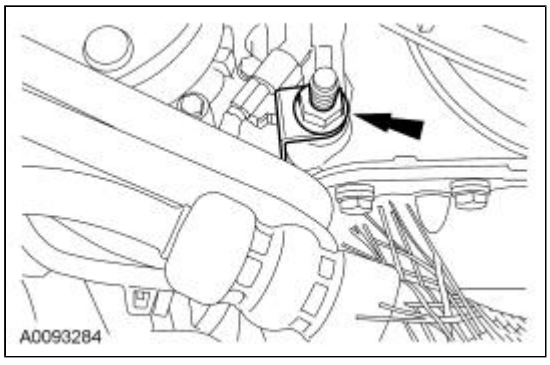
2. Tighten to 6 Nm (53 lb-in).



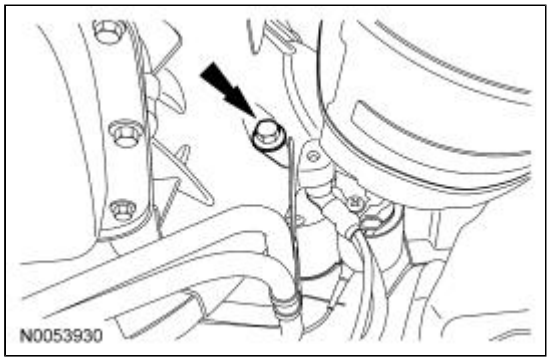
11. Install the plastic starter motor electrical connector cap.



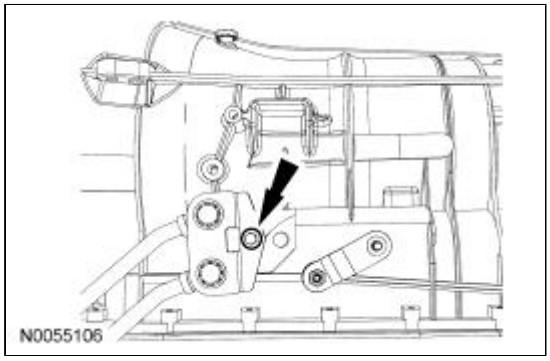
12. Position the transmission cooler tubes in place and install the cooler tube bracket nut.
    - Tighten to 27 Nm (20 lb-ft).



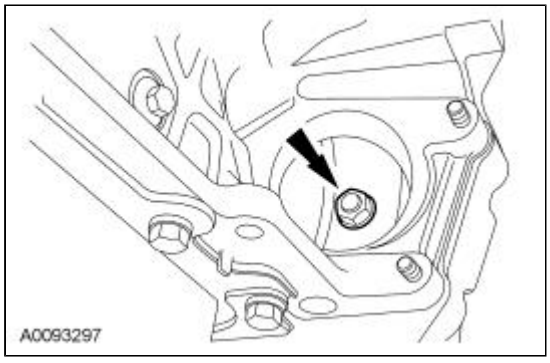
13. Align the bracket and install the remaining transmission case bolt.
    - Tighten to 48 Nm (35 lb-ft).



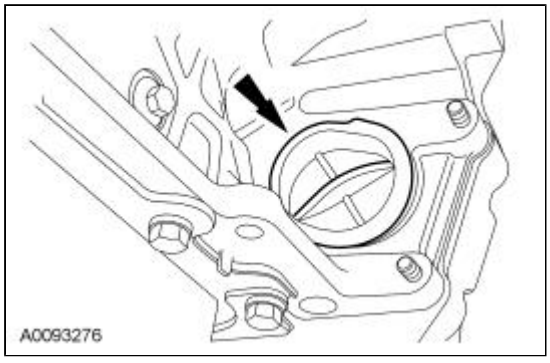
14. Install the transmission cooler tubes and the bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



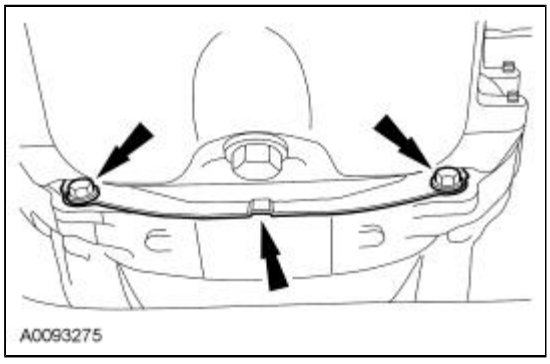
15. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



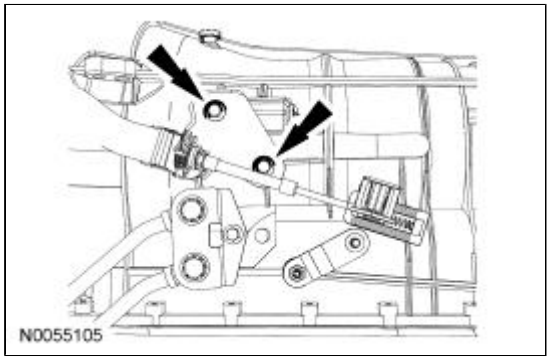
16. Install the rubber access plug.



17. Install the flexplate inspection cover and the inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).

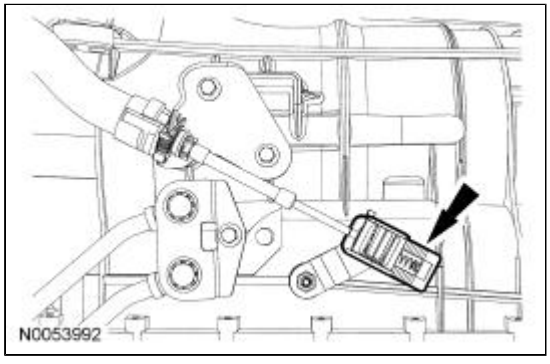


18. Install the selector lever bracket and bolts.
    - Tighten to 48 Nm (35 lb-ft).

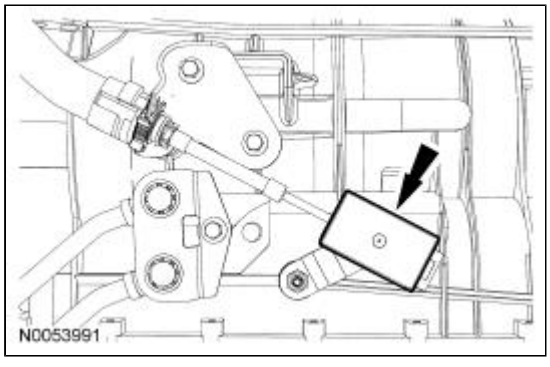


19. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

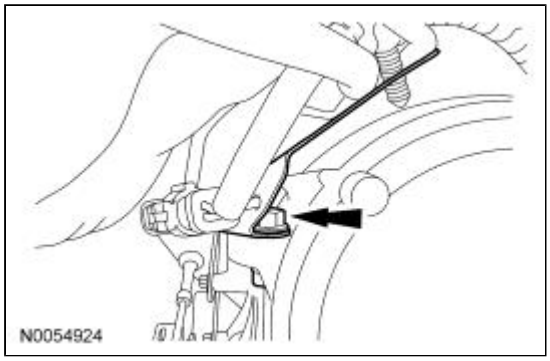
    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever ball stud and move the locking tab up down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure it is correctly installed.



20. If equipped, install the heat shield.



21. Install the rear fuel line bracket and bolt.
    - Tighten to 25 Nm (18 lb-ft).



22. Install the transfer case. For additional information, refer to Section 308-07B .

23. Connect the battery ground cable. For additional information, refer to Section 414-01 .

24. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

25. Reflash the transmission control module (TCM) to the latest level of software.

26. Fill the transmission with clean automatic transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

27. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

Transmission — Rear Wheel Drive (RWD)

Printable View (912 KB)

Special Tool(s)

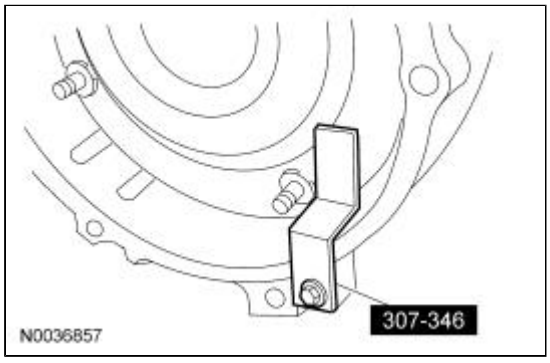
ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Installation

1. Install the special tool.



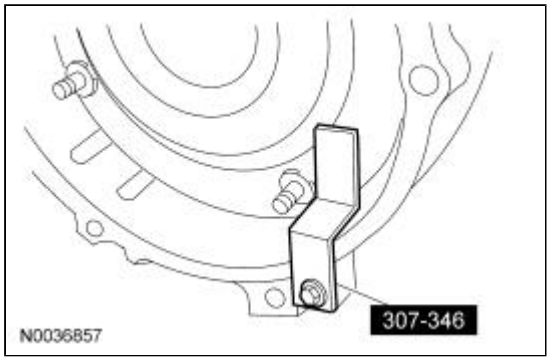
2. **CAUTION: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

   NOTE: Make sure that the transmission is securely fastened to the transmission jack.

   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

3. Remove the special tool.



4. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

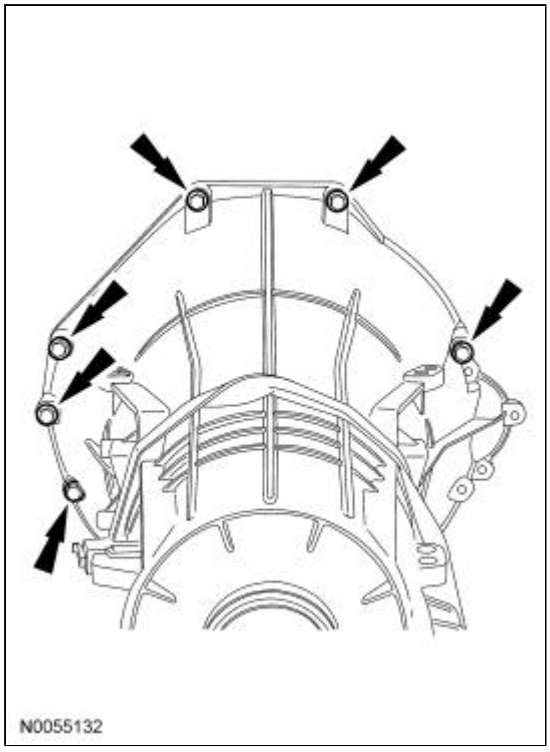
   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

5. **NOTE:** Install the transmission case bolts in their correct locations noted during removal.

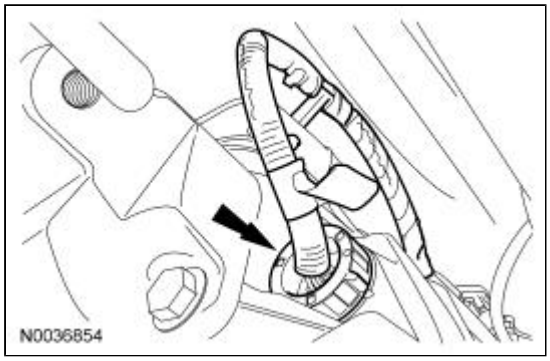
   NOTE: The top 2 transmission case bolts need to be installed prior to installing the rest of the bolts.

   NOTE: The top left bolt is inserted through the fuel line bracket first, then through the transmission case.

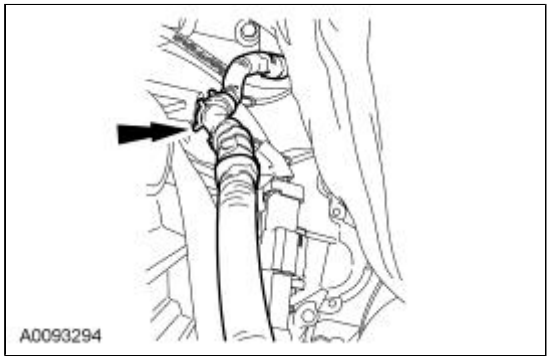
   Install 6 of the 7 transmission case bolts.
   - Tighten to 48 Nm (35 lb-ft).



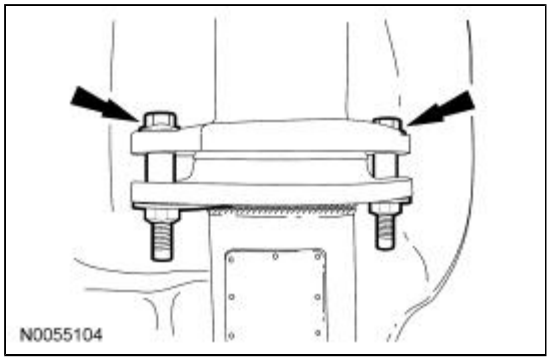
6. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.



7. Connect the wire harness to the top of the transmission.

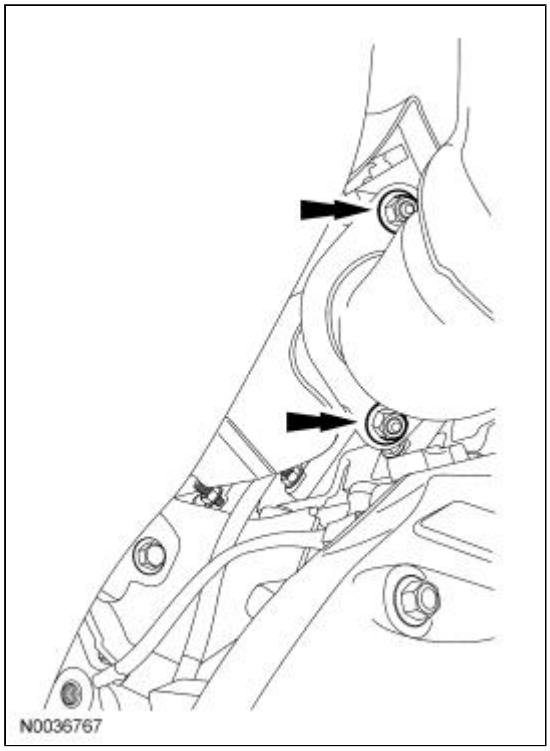


8. Position the dual converter Y-pipe in place and install the 2 dual converter Y-pipe bolts.
    - Tighten to 40 Nm (30 lb-ft).

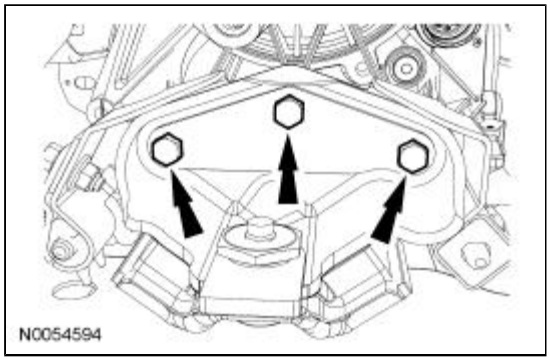


9. **NOTE:** LH shown, RH similar.

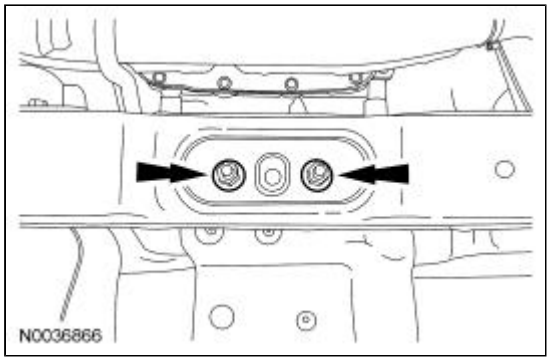
    Install the LH and RH exhaust flange nuts.
    - Tighten to 40 Nm (30 lb-ft).



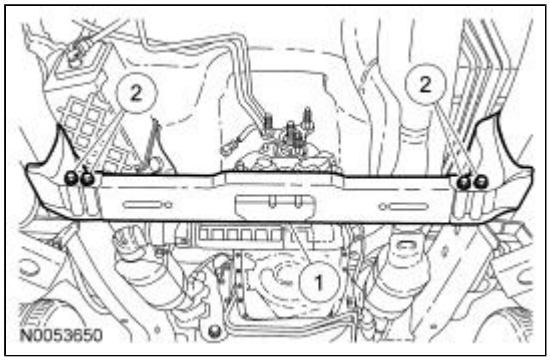
10. Install the transmission insulator and bolts.
    - Tighten to 90 Nm (66 lb-ft).



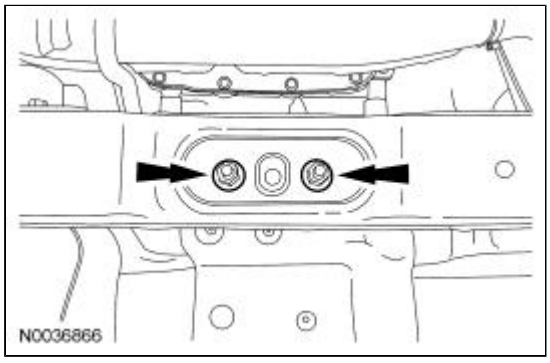
11. Position the rear transmission crossmember in place and loosely install the transmission insulator nuts.



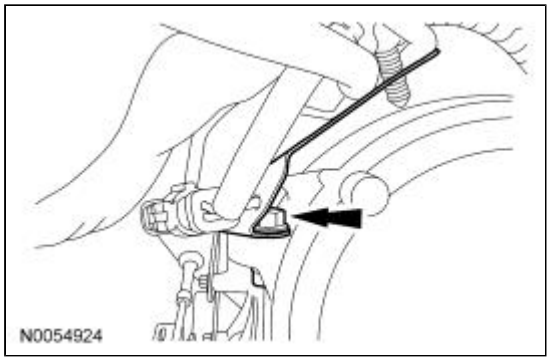
12. Install the rear transmission crossmember.
    1. Install the rear transmission crossmember.
    2. Install the 4 crossmember bolts and nuts.
        - Tighten to 90 Nm (66 lb-ft).



13. Tighten the transmission insulator nuts.
    - Tighten to 103 Nm (76 lb-ft).

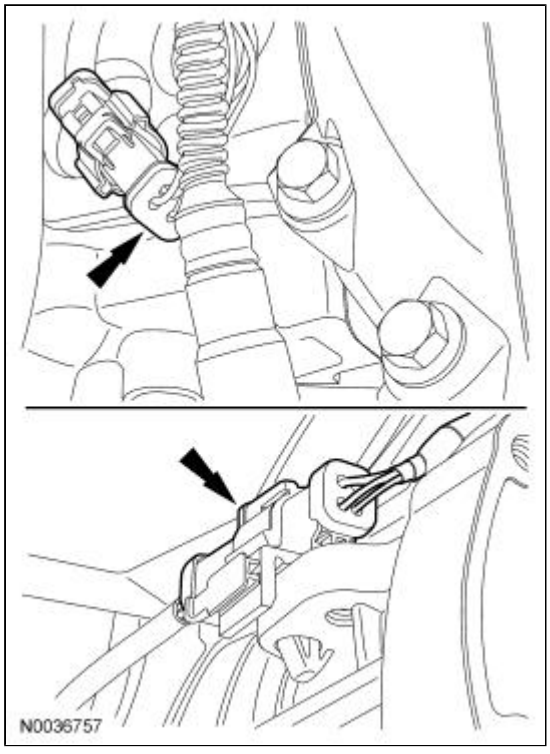


14. Install the rear fuel line bracket and bolt.
    - Tighten to 25 Nm (18 lb-ft).

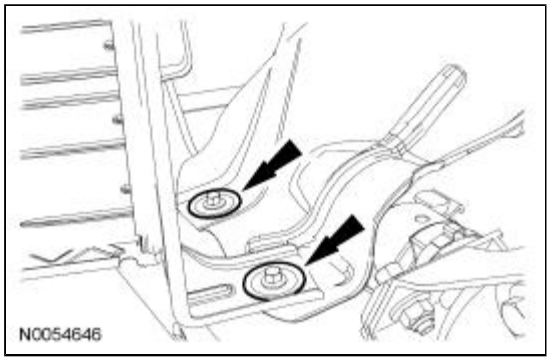


15. **NOTE:** LH shown, RH similar.

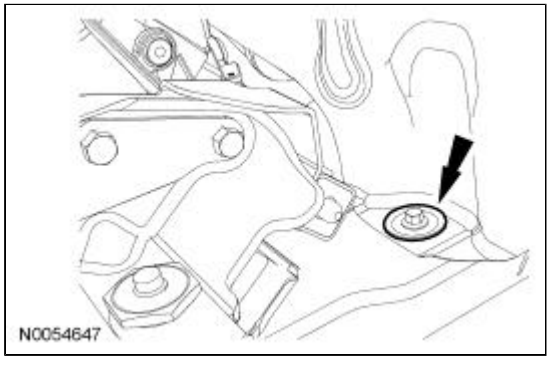
    Connect the RH and LH heated oxygen sensors (HO2S) electrical connectors and the CMS electrical connectors.



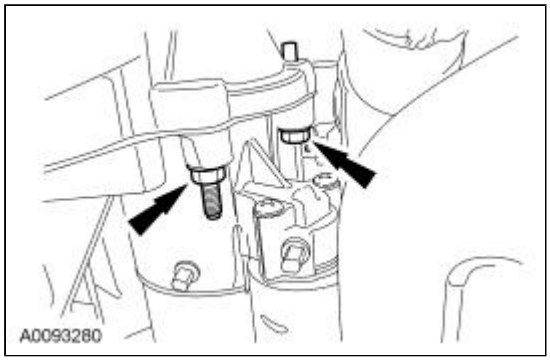
16. Install the LH exhaust heat shield and evaporative emissions canister assembly bolts.
    - Tighten to 15 Nm (11 lb-ft).



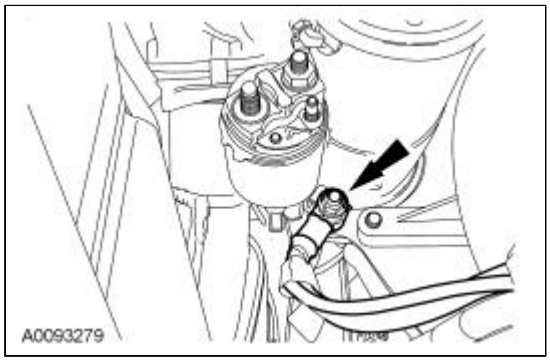
17. Install the RH exhaust heat shield bolt.
    - Tighten to 15 Nm (11 lb-ft).



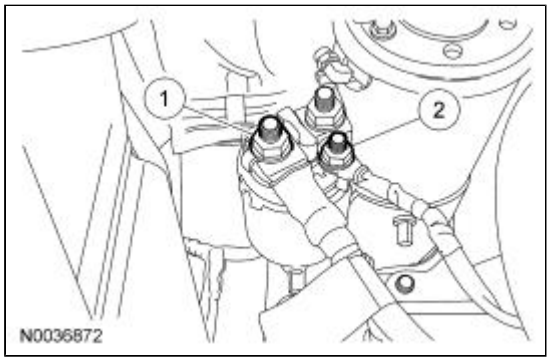
18. Position the starter motor in place and install the 3 starter motor bolts.
    - Tighten to 26 Nm (19 lb-ft).



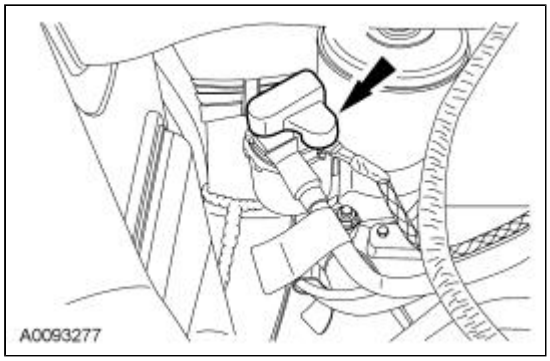
19. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).



20. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (9 lb-ft).
    2. Tighten to 6 Nm (53 lb-in).

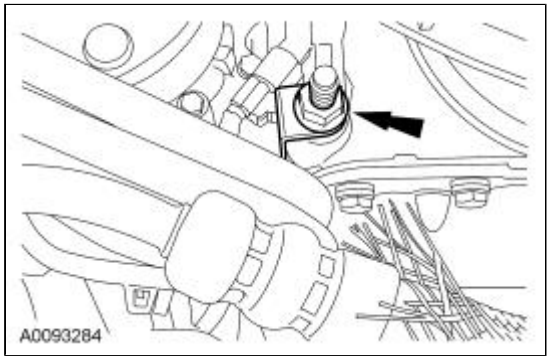


21. Install the plastic starter motor electrical connector cap.

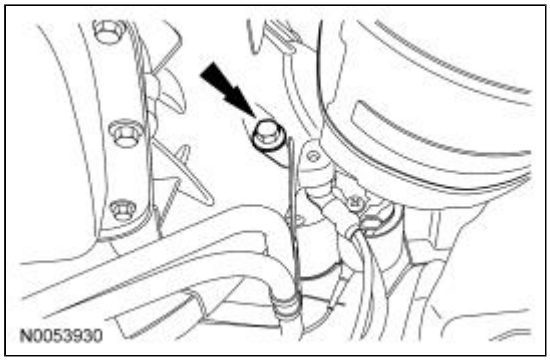


22. Position the transmission fluid cooler tubes in place and install the transmission fluid cooler tube bracket nut.

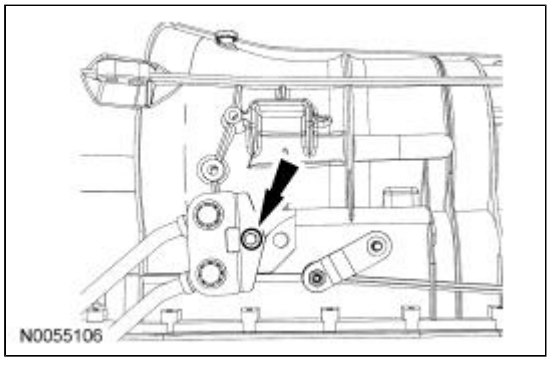
- Tighten to 27 Nm (20 lb-ft).



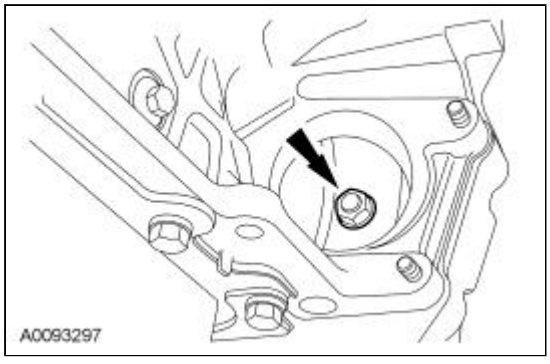
23. Align the transmission fluid cooler tube bracket and install the remaining transmission case bolt.
    - Tighten to 48 Nm (35 lb-ft).



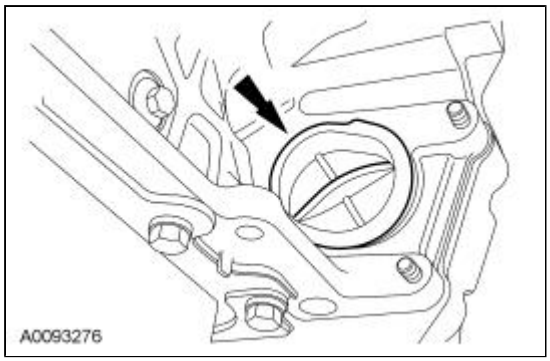
24. Install the transmission fluid cooler tubes and the bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



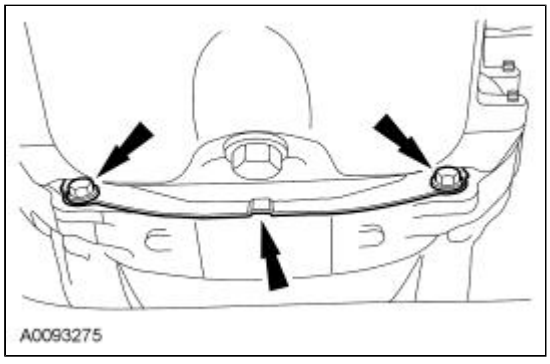
25. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



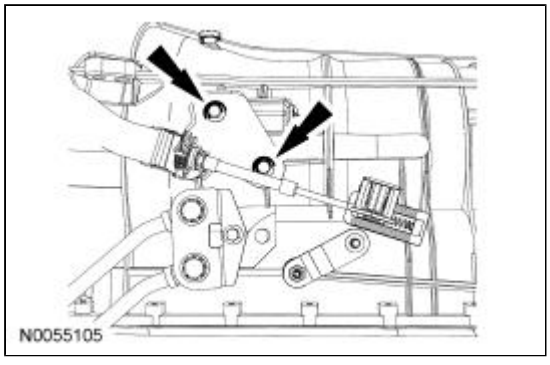
26. Install the rubber access plug.



27. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).

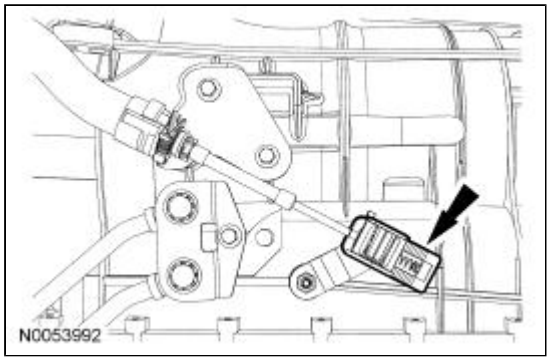


28. Install the selector lever bracket and bolts.
    - Tighten to 48 Nm (35 lb-ft).

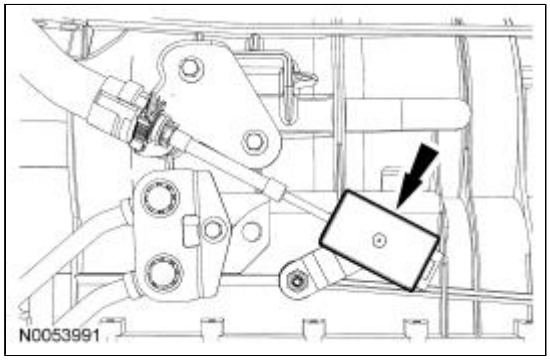


29. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever ball stud and move the locking tab up down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure it is correctly installed.



30. If equipped, install the heat shield.



31. Install the driveshaft. For additional information, refer to Section 205-01 .

32. Connect the battery ground cable. For additional information, refer to Section 414-01 .

33. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

34. Reflash the transmission control module (TCM) to the latest level of software.

35. Fill the transmission with clean automatic transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

36. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

Printable View (91 KB)

General Specifications

Item	Specification
Fluid	
CAUTION: MERCON®, MERCON® V and MERCON® SP are not interchangeable transmission fluids. The use of any other fluid or cleaning agents will cause internal transmission damage.	
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Fluid Capacities	
All (transmission and fluid cooler)	10.5L (11 quarts)
Fluid Filter	
Internal to the transmission	—
Lubricants	
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Automatic Transmission/Power Steering Dye 164-R3701 or equivalent	—

Clutch Application Chart

Gear	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
Park				X	
Reverse		X		X	
Neutral				X	
1st Gear Manual	X			X	
2nd Gear Manual	X		X		
3rd Gear Manual	X	X			
1st Gear D	X			X	
2nd Gear D	X		X		
3rd Gear D	X	X			
4th Gear D	X				X
5th Gear D		X			X
6th Gear D			X		X

Clutch Application Chart

Gear	SS A (VFS1) Proportional	SS B (VFS2) Inversely Proportional	SS C (VFS3) Proportional	SS D (VFS-4) Inversely Proportional	PC A (VFS5) Inversely Proportional	TCC (VFS6) Proportional	SS E (SS1) ON/ OFF
Park				X	a		

Reverse		X		X	a		
Neutral				X	a		
1st Gear Manual	X			X	a	a	
2nd Gear Manual	X		X		a	a	
3rd Gear Manual	X	X			a	a	
1st Gear D	X			X	a	a	
2nd Gear D	X		X		a	a	
3rd Gear D	X	X			a	a	
4th Gear D	X			X	a	a	X
5th Gear D		X		X	a	a	X
6th Gear D			X	X	a	a	X

[a] TCM Controlled

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Stall Speed

Engine	Min	Max
5.4L	2,159	2,531

End Play

NOTE: All friction and steel plates use a wave design plate.

Item	Specifications
Forward Clutch (A)	0.71-1.10 mm (0.028-0.043 in)
Direct Clutch (B)	0.50-1.30 mm (0.019-0.051 in)

Intermediate Clutch (C)	0.71-1.10 mm (0.028-0.043 in)
Low/Reverse Clutch (D)	1.0-1.6 mm (0.039-0.063 in)
Overdrive Clutch (E)	0.50-0.90 mm (0.019-0.035 in)

Clutch Plate Quantity

Component	Number of Frictions	Number of Separator Plates	Separator Plate Thickness	Number of Pressure Plates	Pressure Plate Thickness
Forward Clutch (A)	5	6	3.0 mm (0.11 inch)	1	3.0 mm (0.11 inch)
Direct Clutch (B)	5	5	2.1 mm (0.08 inch)	1	3.9 mm (0.15 inch)
Intermediate Clutch (C)	5	5	3.0 mm (0.11 inch)	1	3.9 mm (0.15 inch)
Low/Reverse (D)	5	5	2.1 mm (0.08 inch)	Select	5.4 mm (0.21 inch)
				Select	5.7 mm (0.22 inch)
			2.1 mm (0.08 inch)	Select	6.0 mm (0.23 inch)
Overdrive Clutch (E)	6	7	6.15 mm (0.24 inch)	1	3.0 mm (0.11 inch)

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet.
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	MPH	Km/H
Light Throttle	1-2	8-13	13-21
TP Voltage	2-3	16-21	26-34
1.25 Volts	3-4	22-27	35-43
	4-5	35-40	56-64
	5-6	44-49	71-79
Closed Throttle	6-5	35-40	56-64
	5-4	25-30	40-48
	4-3	8-13	13-21
	3-2	2-7	3-11
	2-1	1-4	2-6

Wide Open Throttle	1-2	28-33	45-53
(WOT)	2-3	54-59	87-95
	3-4	87-92	140-148

Torque Specifications

Description	Nm	lb-ft	lb-in
Dual converter Y-pipe bolts	40	30	—
Evaporative emissions canister assembly bolt	15	11	—
Exhaust flange nuts	40	30	—
Exhaust heat shield	15	11	—
Flexplate inspection cover	35	26	—
Front pump body bolts	15	11	—
Front pump-to-case bolts	10	—	89
Ground wire nut	23	17	—
Manual control lever nut	18	13	—
Mechatronic bolts [a]	—	—	—
Output shaft flange nut	80	59	—
Park lever guide plate	10	—	89
Park pawl pin bolt	35	26	—
Rear fuel line bracket bolt	25	18	—
Rear transmission crossmember-to-frame nuts and bolts	90	66	—
Selector lever cable bracket bolts	48	35	—
Solenoid bracket bolts	6	—	53
Starter B+ cable	12	9	—
Starter cable (small)	6	—	53
Starter motor bolts	26	19	—
Torque converter nuts	35	26	—
Transmission case bolts	48	35	—
Transmission control module (TCM) bolts [a]	—	—	—
Transmission fluid cooler tubes at the transmission	23	17	—
Transmission fluid cooler tube bracket front stud bolt	27	20	—
Transmission fluid pan bolts	14	10	—
Transmission fluid fill plug	35	26	—
Transmission insulator bolts	90	66	—
Transmission insulator nuts	103	76	—

[a] Specific tightening sequence is required. See the procedure in this section.

Transmission Description

Printable View (105 KB)

This transmission has an internal thermal bypass valve contained within the case. The thermal bypass valve will not allow the use of any type of transmission fluid exchange machine to be used on this transmission.

This transmission uses planetary gears with hydraulic electronic controls. The transmission control module (TCM) and the main control valve body units form a composite element that is installed as a single unit inside the automatic transmission.

This transmission has the following features:

- Six forward speeds
- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear set
- Double planetary gear set
- Two fixed multi-disc clutches
- Three multi-plate clutches

All hydraulic functions are directed by electronic solenoids to control the following:

- Engagement feel
- Shift feel
- Shift scheduling
- Modulated torque converter clutch (TCC) applications

This transmission has a mechatronic unit also referred to as a TCM which contains:

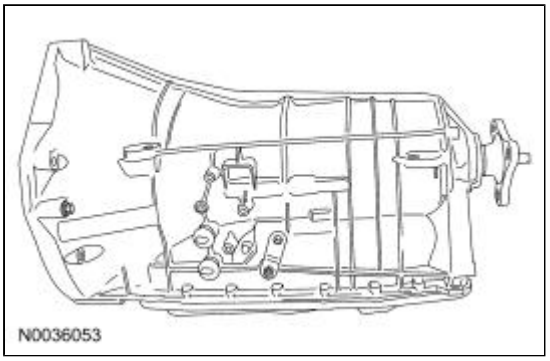
- Turbine shaft speed (TSS) sensor
- Output shaft speed (OSS) sensor
- An internal P, R, N, D selector shaft position sensor
- Transmission fluid temperature (TFT) sensor

Engine power reaches the transmission by a torque converter with an integral converter clutch. The 6 forward gears and one reverse gear are obtained from single planetary sets.

This automatic transmission is a 6-speed electronically controlled transmission comprising the basic elements of a TCM, main control valve body unit, torque converter, one solenoid valve and 6 pressure regulators. Gear selection is achieved by the control of automatic transmission fluid flow to operate various internal clutches. The TCM operates the electrical components and provides for the control of gear selection shift pressure, which increases refinement and torque converter slip.

In the event of a system fault, the TCM also provides for failure mode effect management (FMEM) to maintain maximum functional operation of the transmission with a minimum reduction in driver, passenger or vehicle safety. In the event of a total loss of control or electrical power, the basic transmission functions P, R, N and D are retained. Also 3rd or 5th gear is retained by the hydraulic system. The gear retained is dependent upon the gear selected at the time of the failure.

Automatic Transmission



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Identification Tags

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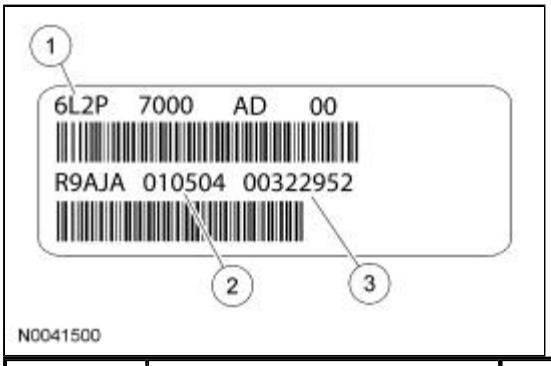
The identification tag is located on the left side of the case just rearward of the manual control lever.



Item	Part Number	Description
1	—	Part number
2	—	Build date
3	—	Serial number

Range Selection

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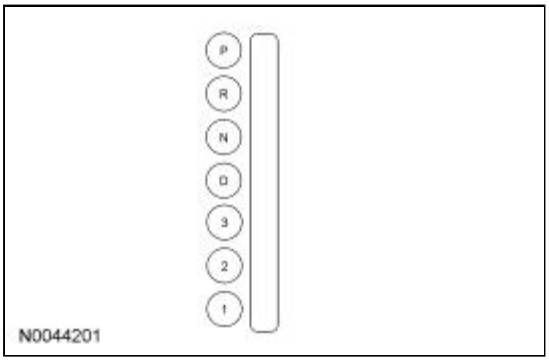
The transmission has 7 range positions: P, R, N, D, 3, 2 and 1.



Park

In the PARK position:

- there is no power flow through the transmission.
- the parking pawl locks the output shaft to the case.
- the engine can be started.
- the ignition key can be removed.

Reverse

In the REVERSE position:

- the vehicle can be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine can be started.

D Position

The D is the normal position for most forward driving.

The D position provides:

- automatic shifts 1-6 and 6-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in all gears.

Position 3 — 3rd Gear

This position provides:

- manual 3rd gear.
- engine braking in 3rd gear.

Position 2 — 2nd Gear

This position provides:

- manual 2nd gear.
- engine braking in 2nd gear.

Position 1 — 1st Gear

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

Shift Patterns

Printable View (64 KB)

Downshifts

Under certain conditions, the transmission will downshift automatically to a lower gear range (without moving the range selector lever). There are 3 categories of automatic downshifts:

- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Torque Converter

Printable View (63 KB)

The torque converter is a 3-element unit containing a 3-plate clutch. The clutch can be controlled and engaged in any gear 2 to 6. Calibration parameters may be set to allow lockup in a higher gear only. The clutch is applied by removing fluid pressure from one side of the plate. The torque converter transmits and multiplies torque. The torque converter includes the following 3 elements:

- Impeller assembly
- Turbine assembly
- Reactor assembly

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

Torque Converter Clutch

The torque converter clutch is a device that reduces slip in the torque converter and, therefore, helps to keep fuel consumption to a minimum.

The torque converter clutch is engaged and released by the control system.

Pressure at the torque converter clutch piston is determined by an electronic pressure control valve.

Geartrain

Printable View (64 KB)

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Clutches are used to hold and drive certain combinations of gearsets. This results in 6 forward ratios and one reverse ratio which are transmitted to the output shaft and differential. The ratios are as follows:

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Single Planetary Gearset

The single planetary gear overdrive carrier is driven by the input shaft. The single planetary gear set consists of the following components:

- One sun gear
- Four planetary gears meshing with the sun gear
- One planetary carrier
- One ring gear

Ravigenaux Planetary Gearset

The ravigenaux planetary gearset is splined to the output shaft and consists of the following components:

- Two sun gears of different sizes
- Three short planetary gear pinions meshing with the sun gears
- Three long planetary gear pinions meshing with the sun gears
- One planetary carrier
- One ring gear

Output Shaft

The output shaft provides torque to the driveshaft and rear axle assembly. It is driven by the ring gear of the planetary gearset.

Apply Components

Printable View (80 KB)

Shift Elements

NOTE: All friction and steel clutch plates use a wave designed plate.

In addition to the torque converter, the other shift elements are:

- three rotating multi-plate clutches: forward, direct and overdrive.
- two fixed multi-disc brakes: intermediate and low/reverse.

All gear shifts from 1st to 6th or from 6th to 1st are power-on overlapping shifts. That is, during the shift, one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The transmission fluid pressure builds up between the cylinder and the piston, pressing the clutches together.

The purpose of these shift elements is to carry out in-load shifts with no interruption to traction.

Multi-plate clutches; forward, direct and overdrive, supply power from the engine to the planetary geartrain. Multi-disc brakes, intermediate and low/reverse, press against the transmission housing in order to achieve a torque reaction effect.

Multi-Plate Clutch

Clutches; overdrive, forward and direct are balanced in terms of dynamic pressure. That is, their pistons are exposed to the transmission fluid flow on both sides, in order to prevent pressure buildup in the clutch as speed increases. This equalization process is achieved by a baffle plate and pressure-free transmission fluid supply by a lubricating passage, through which the space between piston and baffle plate is filled with transmission fluid.

The advantages of this dynamic pressure equalization are:

- reliable clutch engagement and release in all speed ranges.
- improved shift refinement.

Shift Overlap Control

The electro-hydraulic shift action is obtained by means of various valves in the transmission control module (TCM) and main control valve body, actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

Hydraulic Systems

Fluid Pump

The torque converter is supported in the fluid pump by a needle roller bearing. The fluid pump is driven directly from the engine by the torque converter shell and supplies transmission fluid to the transmission and the hydraulic control unit.

The fluid pump draws in transmission fluid through a filter and delivers it at high pressure to the main pressure valve in the main control valve body unit. The valve adjusts the pressure and returns excess

transmission fluid to the fluid pan.

Fluid Filter

All transmission fluid that is picked up from the pan passes through the fluid filter. The filter and its accompanying seal are part of the fluid path from the pan to the fluid pump.

Transmission Electronic Control System

Printable View (74 KB)

Transmission Electronic System

The transmission control module (TCM) and its input/output network control the following operations:

- Shift timing
- Clutch pressure (shift feel)
- Line pressure (shift feel)
- Torque converter clutch

In addition, the TCM receives input signals from certain transmission-related sensors. The TCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the TCM can determine when the time and conditions are right for a shift or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimize shift feel. To accomplish this, the TCM uses 6 pressure control solenoids and one shift solenoid to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Transmission Control Module (TCM) and Main Control Valve Body

The TCM and main control valve body are a combination of hydraulic and electronic control units. Both of these modules are installed in the transmission inside the transmission fluid pan.

Transmission Control Module (TCM)

The TCM for the transmission is mounted on top of the main control valve body. The control module for the transmission has been designed to operate correctly in the environment in which the TCM is located.

The TCM is activated and deactivated by the ignition supply and is connected to the transmission link harness by a 16-pin connector.

The TCM controls the operation of the transmission. The TCM processes information in both analog and digital forms, such as:

- transmission input speed.
- transmission output speed.
- throttle position.
- gear selection.
- engine torque.
- engine speed.
- transmission fluid temperature.
- brake pedal position.
- engine oil temperature.
- engine coolant temperature.
- ABS wheel speed.

The information is then used by the TCM to decide which shift pattern to select and for shift energy management. Electro-hydraulic solenoid valves and pressure regulators control the transmission gear

changes.

Five pressure regulators and one solenoid valve are used to control direct transmission fluid flow to select internal clutches and control the fluid pressure at the clutch. A separate pressure regulator is used exclusively for torque converter clutch control.

The TCM monitors all transmission inputs and outputs to confirm correct system operation. If a fault occurs, the TCM is able to carry out default action. It informs the driver of the problem through the instrument cluster diagnostic MIL light.

The TCM will shut down if the TCM hardware temperature rises above a predetermined temperature. Prior to shutting down, the TCM will log a fault code and enter a mechanical limp-home mode.

Solenoids

The hydraulic module contains one solenoid valve. The solenoid valve is activated by the TCM and is either open or closed. It is used to switch the position valve.

There are 6 electronic pressure control valves which convert an electronic current into a proportional hydraulic pressure. They are energized by the TCM and actuate the valves belonging to the relevant switching elements.

Solenoids VFS1, VFS3 and VFS6 are proportional in operation, meaning that hydraulic pressure increases with an increase in current. Solenoids VFS2, VFS4 and VFS5 are inversely proportional in operation, meaning that hydraulic pressure decreases with an increase in current. Solenoid SS1 is a shift solenoid having a ON/OFF operation.

Controller Area Network (CAN) Interface

For the TCM to carry out shift point and shift quality management, a number of external signals are required. For shift point management alone, the TCM requires output speed sensor, throttle pedal position, brake pedal status, gear selection position, transmission fluid temperature, 4WD position, traction control, engine speed and engine torque. The controller area network (CAN) bus is used to share information between control modules.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the TCM when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects the temperature of the engine coolant and supplies the information to the TCM. The ECT is installed in the heater outlet fitting or cooling passage on the engine. For engine control applications, the ECT signal is used to modify ignition timing, exhaust gas recirculation (EGR) valve flow and air-to-fuel ratio as a function of engine coolant temperature.

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal. The APP sensor detects the position of the accelerator pedal and inputs this information as a voltage to the powertrain control module (PCM). The PCM broadcasts the APP on the CAN bus. The TCM reads APP off the CAN message. The PCM uses the APP sensor information to aid in determining shift scheduling and torque converter control.

Turbine Shaft Speed (TSS) Sensor

The turbine shaft speed (TSS) sensor is a Hall-effect type sensor.

The sensor is mounted internally and is located on the transmission control module.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a Hall-effect type sensor.

The sensor is mounted internally and is located on the transmission control module.

Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature (TFT) sensor is located on the TCM. The TCM uses the sensor input to activate various shift strategies. The sensor is in the form of a temperature-dependent resistor.

The resistance value of the TFT sensor varies with temperature change. The TCM monitors the voltage across the TFT to determine the temperature of the transmission fluid.

The TCM uses this initial signal to determine whether a cold start shift schedule is necessary. The TCM also inhibits torque converter clutch operation at low transmission fluid temperatures.

Transmission Range (TR) Sensor

The TCM uses the position of the transmission range (TR) sensor, housed in the TCM, to determine the selected gear range from the range selector lever.

The sensor completes the start circuit in P and N, and the back-up lamp circuit in R. The sensor also opens/closes a set of switches that are monitored by the TCM to determine the position of the manual lever (P, R, N, D, 3, 2 and 1).

Transmission Operational Strategies

Adaptive Shift Strategy

Adaptive shift strategy is comprised of the following:

- Shift Energy Management — this function involves reducing or increasing engine output torque during shifting.
    - Reduces excessive energy of the friction packs
    - Increases transmission service life
    - Improves shift quality
    - Unique shift schedules are selected based on vehicle operation conditions and environmental conditions
    - Trailer towing mode
- Pressure Modulation — this function monitors the hydraulic pressure in a shift. This pressure must be matched accurately to the transmission input torque to better provide shift comfort.
- Shift Quality Adapts — is used to provide a higher quality and consistent shift feel. Monitoring and adapting shift pressures and shift energy, to overcome hardware variability over time, will achieve this.
- The TCM has the ability to control the engine output torque during the shift, synchronized with the operation of the transmission clutches.
- Trailer towing mode uses a different shift and converter map. This new map reduces the number of gearshifts when towing, climbing steep hills and while driving at higher altitudes.

TCM Monitoring Functions

The TCM monitors all transmission input and output to identify possible transmission failures. If a fault is detected, the TCM takes the appropriate action to make sure that the transmission enters a safe mode of operation.

- Voltage Supply — this function monitors the vehicle battery voltage.
- Watchdog Monitoring — the watchdog monitoring has 2 functions:
    - Checks for faults in the driver circuits by activating each driver.
    - Checks to see if the safety circuit is functioning correctly.
- TCM Temperature — If the TCM temperature rises above a predetermined temperature, the TCM will shut down. Prior to shutting down, the TCM will log a fault code during shutdown. The transmission will enter a mechanical limp-home mode.
- Pressure Regulator/Solenoid — Each pressure regulator and solenoid is monitored for open and short circuits. The TCM also checks that the current being delivered to each solenoid valve or pressure regulator is within limits.
- Torque Converter Control — The TCM checks and verifies that the torque converter has been engaged correctly. If the torque converter has not engaged correctly, the TCM will carry out the fail-safe action of opening the converter clutch.

Diagnostic Strategy

Printable View (80 KB)

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- OASIS Messages
- Technical Service Bulletins (TSBs)
- Wiring Diagram

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check shift linkages for correct adjustment.
- Check TSBs and OASIS messages regarding the concern.

Diagnostics

- Carry out on-board diagnostic procedures Key On/Engine Off (KOEO) and Key On/Engine Running (KOER).
- Record all diagnostic trouble codes (DTCs).
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, go to Diagnosis By Symptom in this section for additional information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Printable View (66 KB)

Prior to carrying out the flow test, the following items should be checked:

- Know and understand the customer concerns.
- Verify the concern by operating the vehicle.
- Check the fluid level and condition.
- Check for non-factory-installed items and verify correct installation.
- Check the shift linkage adjustments.
- Check TSBs and OASIS messages for vehicle concerns.
- Carry out quick test both KOER and KOEO.
- Record all codes.
- Verify that the vehicle transmission control module (TCM) is at the latest calibration release level.

Diagnostic Flow Chart		
1) Did you record any diagnostic trouble codes (DTCs)?	Yes	· REPAIR all hard DTCs. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first, then this workshop manual, then GO to Step 2.
	No	· REFER to Diagnosis By Symptom in this section, then GO to Step 5.
2) Are any continuous test memory codes present?	Yes	· CLEAR codes and CARRY OUT drive cycle test, then GO to Step 3.
	No	· GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	· REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, then this workshop manual, then GO to Step 4.
	No	· GO to Step 4.
4) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	· REFER to Diagnosis By Symptom in this section to diagnose and repair the concern, then GO to Step 5.
5) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	· GET assistance from Technical Hotline.

Preliminary Inspection

Printable View (92 KB)

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer concern or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions, including when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to Verification of Condition.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The torque converter clutch not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperature
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshifting
- Downshifting
- Coasting
- Engagement
- Noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent.

Check Fluid Level and Condition

Fluid Level Check

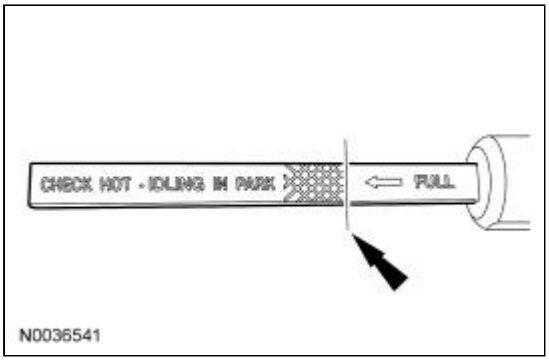
CAUTION: The vehicle should not be driven if the fluid level is low as internal failure could result.

CAUTION: The fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTE: If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the fluid must cool down to obtain an accurate reading.

NOTE: If the transmission starts to slip, shifts slowly or shows signs of fluid leaking, the fluid level should be checked.

This transmission is equipped with an internal thermal bypass located in the case. This internal thermal bypass valve will shut off fluid flowing to the fluid cooler if the fluid temperature falls below normal operating temperature. Refer to Transmission Fluid Level Check in this section.



High Fluid Level

CAUTION: A fluid level that is too high can cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission failure.

If an overfill reading is indicated, remove any excessive fluid. Refer to Transmission Fluid Level Check in this section.

Low Fluid Level

A low fluid level can result in poor transmission engagement, slipping or failure. This may also indicate a leak in one of the transmission seals or gaskets.

Adding Fluid

CAUTION: The use of any other type of transmission fluid than specified can result in transmission failure.

CAUTION: The fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure could result.

NOTE: If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the fluid must cool down to obtain an accurate reading.

Add fluid using the refill procedure. Refer to Transmission Fluid Drain and Refill in this section.

Fluid Condition Check

1. Check the fluid level.

2. Remove the fluid fill plug and fluid level indicator and allow the fluid to drip onto a facial tissue and examine the stain.

3. Observe the color and the odor. The color under normal circumstances should be dark reddish, not black or have a burnt odor.

4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

5. If the stain is a foamy pink color, this may indicate coolant in the transmission. The engine cooling system should also be inspected at this time.

6. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the fluid pan, the transmission must be disassembled and completely cleaned. This includes the torque converter and fluid cooler tubes. A new oil-to-air (OTA) cooler must be installed.

Shift Point Road Test

Printable View (89 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with transmission range selector lever in D position.
3. Apply minimum throttle and observe speeds at which upshift occurs and the torque converter engages. Refer to the Shift Speeds chart in this section.
4. With the transmission in D, move the range selector lever into the manual 3 position. The transmission should downshift to 4th gear. Release the accelerator pedal; engine braking should occur.
5. Press the accelerator pedal to floor, wide open throttle (WOT). Transmission should shift from 4th to 3rd, depending on vehicle speed. The torque converter clutch (TCC) should disengage and then reapply.
6. With the transmission in D position and speed above 80 km/h (50 mph) and less than half throttle, move the transmission range selector lever from D position to manual 2 position and remove pressure from the accelerator pedal. The transmission should downshift into 2nd gear. With the vehicle remaining in manual 2 position, move the transmission range selector lever into manual 1 position and release the accelerator pedal. The transmission should downshift into 1st gear at speeds below approximately 45-56 km/h (28-35 mph).
7. If the transmission fails to upshift/downshift or the TCC does not apply and release, refer to Diagnosis By Symptom in this section.

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet.
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	MPH	Km/H
Light Throttle	1-2	8-13	13-21
TP Voltage	2-3	16-21	26-34

1.25 Volts	3-4	22-27	35-43
	4-5	35-40	56-64
	5-6	44-49	71-79
Closed Throttle	6-5	35-40	56-64
	5-4	25-30	40-48
	4-3	8-13	13-21
	3-2	2-7	3-11
	2-1	1-4	2-6
Wide Open	1-2	28-33	45-53
Throttle (WOT)	2-3	54-59	87-95
	3-4	87-92	140-148

Road Test — Adaptive Drive Cycle

NOTE: Using the scan tool, clear the adaptive table before conducting an adaptive drive cycle test.

NOTE: All adaptive drive cycle tests are carried out with the transmission fluid temperature at normal operating temperature 80°C-82°C (175°F-180°F).

NOTE: All adaptive drive cycle test are carried out with the range selector lever in the D position.

NOTE: Do not clear the powertrain control module (PCM) keep alive memory (KAM).

This test will begin the adaptive learning schedule to provide a better shift quality and shift feel.

1. Verify that the transmission fluid temperature (TFT) PID is above 80°C (175°F).
2. Clear TCM KAM and adaptive tables using the scan tool.
3. Accelerate from rest with light throttle. The 1-2, 2-3 and 3-4 shifts must occur at engine speeds between 1300-1800 RPM.
4. Continue to accelerate gently to 80 Km/h (50 mph) so that the transmission shifts into 5th gear.
5. Brake gently to a complete stop and hold foot on brake for at least 15 seconds.
6. Repeat Steps 3-6 a total of 5 times.

Torque Converter Diagnosis

Printable View (89 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary inspection.
2. Know and understand the customer's concern.
3. Verify the condition — carry out the torque converter operation test.
4. Carry out diagnostic procedures.

- Carry out On-Board Diagnostics. Refer to Diagnostics in this section.
  - Repair all non-transmission related DTCs first.
  - Repair all transmission-related DTCs.
  - Rerun on-board diagnostics to verify repair.
- Carry out Stall Speed Test. Refer to Special Testing Procedures in this section.
- Carry out Diagnostic Routines. Refer to Diagnosis By Symptom in this section.
  - Use the Diagnosis by Symptom to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and repair as required before changing the torque converter.

Torque Converter Operation Test

The Torque Converter Operation Test verifies that the torque converter clutch (TCC) control system and the torque converter are operating correctly.

1. Carry out Quick Test with the scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Check for DTCs.
2. Connect a scan tool to the vehicle.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in D position.
4. After normal operating temperature is reached, maintain a constant speed of about 56 km/h (35 mph) in 5th gear for 10 seconds.

5. Release the accelerator pedal and monitor the scan tool TP voltage to approximately 1.25 volts or 25 percent throttle.

6. Monitor the TCC and engine speed PID. The TCC should release and engine rpms should increase before the 5-4 shift occurs.

NOTE: The following is a list of common vehicle concerns that have been misdiagnosed as TCC shudder. For diagnosis of the following items, refer to the appropriate sections of the workshop manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

- Spark plugs — check for cracks, high resistance or broken insulators
- Plug wires
- Fuel injector — filter may be plugged
- Fuel contamination — engine driveability concerns
- Exhaust gas recirculation (EGR) valve — valve may let in too much exhaust gas and cause engine to run lean
- Vacuum leak — engine will not get correct air/fuel mixture
- Manifold absolute pressure (MAP)/mass air flow (MAF) sensor — incorrect air/fuel mixture
- Heated oxygen sensor (HO2S) — too rich/lean air/fuel mixture
- Fuel pressure — may be too low
- Engine mounts — loose/damaged mounts can cause vibration concerns
- Axle joints — check for vibration

Visual Inspection

Printable View (65 KB)

A visual inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - air conditioning
  - generator (alternator)
  - engine turbo
  - cellular telephone
  - cruise control
  - CB radio
  - linear booster
  - backup alarm signal
  - computer
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module (PCM), transmission control module (TCM) or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.

- Leaks; refer to Leakage Inspection in this section.
- Correct linkage adjustments; refer to Section 307-05 .

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those of the manual lever in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 for shift linkage adjustment.

Check TSBs and OASIS

Refer to all technical service bulletins (TSBs) and OASIS messages that pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using the diagnostic tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostics

Printable View (89 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73 III Automotive Meter 105-R0057 or equivalent

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. One of the most important things to remember is that there is a definite procedure to follow. Do not take shortcuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics With Scan Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool, refer to the scan tool tester manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual. These quick tests should be used to diagnose the powertrain control module (PCM) and should be carried out in order.

- Quick Test 1.0 — Visual Inspection
- Quick Test 2.0 — Set Up
- Quick Test 3.0 — Key On, Engine Off (KOEO)
- Quick Test 4.0 — Continuous Memory
- Quick Test 5.0 — Key On, Engine Running (KOER)
- Special Test Mode
  - Wiggle Test
  - Output Test Mode
- PCM Reset Mode
- Clearing DTCs
- OBD II Drive Cycle

Other Scan Tool Features

For information on other diagnostic testing features using the scan tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Output State Control (OSC) Mode

Printable View (85 KB)

On-Board Diagnostics

Output State Control (OSC) Mode

Output state control (OSC) allows the technician to take control of certain parameters to function the transmission.

For example, OSC allows the technician to shift the transmission only when commanding a gear change. If the technician commands 1st gear in OSC, the transmission will remain in 1st gear until the technician commands the next gear.

Another example of the OSC features is that a technician can command the torque converter to turn ON or OFF to check operation.

This transmission OSC has one mode of operation; DRIVE. This mode has a unique set of operating requirements that the technician must meet before allowed to operate the torque converter or select gears.

NOTE: To operate OSC, the digital transmission range (TR) sensor and the output shaft speed (OSS) sensor must be operational. No diagnostic trouble codes (DTCs) related to the digital TR sensor or the OSS can be present.

- The vehicle requirements MUST BE MET when SENDING the OSC value. Refer to the vehicle requirements for each test.
- If the vehicle requirements are NOT MET when SENDING the OSC value, an ERROR MESSAGE will appear. OSC is aborted and must be restarted.
- If, after the sent value is substituted, the vehicle requirements are no longer met, the powertrain control module (PCM) will cancel the OSC value and resume normal operations. No error message will be sent.
- The OSC value XXX may be sent anytime to cancel OSC.

Output State Control (OSC) Procedures

- Carry out a visual inspection and prepare the vehicle as necessary.
- Select the "Vehicle and Engine Selection" menu.
- Select the appropriate vehicle and engine.
- Select "Diagnostic Data Link."
- Select "Powertrain Control Module."
- Select "Diagnostic Test Mode."
- Select "KOEO On-Demand Self Test and KOER On-Demand Self Test."
- Carry out the tests and record the DTCs.
- Repair all non-transmission DTCs.
- Repair all VSS and digital TR sensor DTCs.
- Make sure that the OSS and digital TR sensors are functional.
- Select "Active Command Mode."
- Select "Output State Control."
- Select "Trans-Drive Mode."

OSC — Transmission in Drive Mode

The OSC provides the following DRIVE Mode functions:

- GEAR — Allows upshifts and downshifts.
- TCC — Engages or disengages the torque converter clutch (TCC).

GEAR in Drive Mode

The DRIVE Mode allows the technician to choose the following options:

- 1 - TCM selects 1st gear.
- 2 - TCM selects 2nd gear.
- 3 - TCM selects 3rd gear.
- 4 - TCM selects 4th gear.
- 5 - TCM selects 5th gear.
- 6 - TCM selects 6th gear.

The DRIVE Mode for GEAR operates ONLY when:

- The OSS and digital TR sensor are operational.
- No OSS and digital TR sensor DTCs are set.
- The Key is ON, engine running.
- The transmission shifter is in the D position.
- Vehicle speed is above 3 km/h (2 mph).

OSC Command Values:

- 1 - TCM selects 1st gear.
- 2 - TCM selects 2nd gear.
- 3 - TCM selects 3rd gear.
- 4 - TCM selects 4th gear.
- 5 - TCM selects 5th gear.
- 6 - TCM selects 6th gear.
- XXX - Cancels a value sent to the TCM.
- SEND - Sends a value to the TCM.

Drive Mode Procedure for GEAR

Follow operating instructions from scan tool menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during tests.
- Select "Parameters - GEAR."
- Select value "1-6."
- Press "SEND" to send the command.
- Select "XXX" to cancel at any time.
- Press "SEND."

TCC in Drive Mode

The DRIVE Mode allows the technician to choose the following options:

- TCC - Activates TCC OFF and ON.

- ON - Turns TCC solenoid ON.
- OFF - Turns TCC solenoid OFF.

DRIVE Mode for "TCC OFF" operates only when:

- The OSS and digital TR sensor are set.
- NO OSS and digital TR sensor DTCs are set.
- The key is ON, engine running.
- The transmission shifter is in the D position.
- Vehicle speed is above 16 km/h (10 mph).

DRIVE Mode for "TCC ON" operates only when:

- The OSS and digital TR sensor are operational.
- No OSS and digital TR sensor DTCs are set.
- The key is ON, engine running.
- The transmission shifter is in the D position.
- Vehicle speed is above 16 km/h (10 mph).
- TFT is above 38°C (100°F).
- The brake is not applied below 32 km/h (20 mph).
- Steady vehicle speed is maintained.

OSC Command Values:

- OFF - Turns TCC OFF.
- ON - Turns TCC ON.
- XXX - Cancels OSC value sent to the TCM.
- SEND - Sends the values to the TCM.

Drive Mode Procedures for TCC

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during tests.
- Select "Parameters - TCC."
- Select "ON" to turn the TCC solenoid ON.
- Press "SEND" to send the ON command.
- Select "OFF" to turn the TCC solenoid OFF.
- Press "SEND" to send the OFF command.
- Select "XXX" to cancel at any time.
- Press "SEND."

Diagnostic Parameters Identification (PID) Chart

Printable View (73 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnostic PID Chart

PID No.	PID Name	Units
ECT	Engine coolant temperature	Degrees
VSS	Vehicle speed sensor— low resolution	MPH
TP	Absolute throttle position sensor	Percent full throttle
VBAT	VPWR: Control module voltage	Volts
APP_A	APP_D: Accelerator pedal position D	Percent
SSA_AMP	Commanded current for shift solenoid A	Amperes
SSB_AMP	Commanded current for shift solenoid B	Amperes
SSC_AMP	Commanded current for shift solenoid C	Amperes
SSD_AMP	Commanded current for shift solenoid D	Amperes
PCA_AMP	Commanded current for pressure control A	Amperes
TCC_AMP	Commanded current for torque converter clutch pressure control	Amperes
SSE_DC	Shift solenoid E duty cycle	Percent
RPM	Engine speed	RPM
VBAT	Battery voltage	Volts
GEAR	Gear commanded (1, 2, 3, 4, 5 and 6)	1, 2, 3, 4, 5 and 6
TCCMACT	Absolute value of slip across torque converter	RPM
RAT_CMD	Current transmission gear ratio commanded	1, 2, 3, 4, 5 and 6
RAT_MES	Current transmission gear ratio measured (input speed/output speed)	1, 2, 3, 4, 5 and 6
TFT	Transmission fluid temperature	Degrees
DSS_SRC	Output shaft speed (OSS) — raw signal	RPM
TSS	Turbine shaft speed (TSS) — raw signal	RPM
TR	PRNDL position	—
BPP	Brake pedal position (BPP) switch	ON or OFF
PCA	Commanded pressure for pressure control solenoid A (VFS5)	PSI
PM	Engine speed (revolutions per minute)	RPM
SLIPABS	Torque converter speed ratio (engine speed compared with turbine	

	shaft speed)	
OSS	Output shaft speed (OSS) sensor	MPH

Transmission Drive Cycle Test

Printable View (82 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur 4 times consecutively for shift error diagnostic trouble code (DTC) code to be set, and 5 times consecutively for continuous torque converter clutch (TCC) code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, refer to the Solenoid Application Chart for correct solenoid operation.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in DRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into 6th gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in 6th gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stop lamps. Then, hold speed and throttle steady for a minimum of 5 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat Steps 4 through 6 at least 5 times.
8. Carry out the Quick Test and record continuous DTCs.
    - If the DTCs are still present, refer to the Diagnostic Trouble Code Chart. Repair all non-transmission DTCs first as they can directly affect the operation of the transmission. Repeat the Quick Test and the Road Test to verify the correction. Erase the DTCs, carry out the Drive Cycle Test and repeat the Quick Test after completing the repair on the DTC.
    - If the continuous test passes and a concern is still present, refer to Diagnosis By Symptom in this section, OASIS messages and TSBs for concerns.

After On-Board Diagnostic

NOTE: The vehicle wiring harness, powertrain control module (PCM) and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission-related DTCs. Use the diagnostic trouble code chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Diagnostic Trouble Code (DTC) Charts

Printable View (140 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Using a scan tool to retrieve diagnostic trouble codes (DTCs), begin with and correct all non-transmission related DTCs. Start with the U-DTC codes (communication link codes) then repair any transmission-related DTCs.

Limp-home mode is a default condition to protect the engine and transmission when a fault occurs. Limp-home mode depends on the actual gear the vehicle was in when the fault has occurred.

- For gears 1-3, the limp-home default will be 3rd gear.
- For gears 4-6, the limp-home default will be 5th gear.

The limp-home gear will be held until the vehicle is placed in R, P or the vehicle has been restarted. After these action(s) the vehicle will default to the limp-home mode of 3rd gear.

Diagnostic Trouble Code Chart

Five Digit DTC	Component	Description	Condition	Symptom	Action
P0218	TFT	Transmission fluid over temperature condition.	TCM has detected a TFT that has exceeded a set temperature.	• Aggressive lockup schedule	CARRY OUT normal diagnostic for an overheating condition. REFER to Diagnosis By Symptom in this section.
P0562	Battery	System voltage low.	TCM has detected a voltage level below minimum voltage to operate solenoids. Maintains current solenoid state.	• No adaptive strategy • No self learning strategy • May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Battery voltage below 9 volts • Will turn on TCIL	MONITOR the appropriate Parameter Identification (PID) to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P0563	Battery	System voltage high.	TCM has detected a voltage level above maximum voltage.	• No adaptive strategy • No self learning strategy • May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Battery voltage above 16 volts • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0605	TCM	The TCM ROM has been corrupted.	TCM has detected an internal software concern with ROM.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	REFLASH the original mechatronic to the latest level calibration. CLEAR all DTCs. TEST the system for normal operation. If DTCs return, INSTALL a new mechatronic assembly. After installing the new mechatronic assembly, it must be reflashed to the latest level calibration. CARRY OUT the Road Test — Adaptive Drive Cycle. REFER to Shift Point Road Test in this section.
P0613	TCM	TCM processor.	TCM has detected an internal software issue.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	INSTALL a new mechatronic assembly. After installing the new mechatronic assembly, it must be reflashed to the latest level calibration.
P0634	TCM	TCM module temperature.	Internal temperature within TCM too high. Possible restriction in cooling circuit.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear	MONITOR the TFT PID to validate that an error is present. INSPECT the transmission cooler lines for possible restrictions (kinked or bent cooler lines). VERIFY correct operation/orientation of the thermal bypass valve. INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest

					level calibration.
P0641	TCM	TCM module sensor voltage failed.	Sensor reference voltage A circuit open, voltage too high or too low.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL • Low battery voltage under 9 volts. May also cause P0562	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0657	TCM	Actuator supply voltage A circuit open.	Power supply actuators open circuit.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0658	TCM	Actuator supply voltage A circuit low.	Power supply actuators short circuit to ground.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0659	TCM	Actuator supply voltage A circuit high.	Actuator power supply short circuit to power before key ON.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0667	TCM-TFT	PCM, ECM, TCM internal temperature sensor range operation.	Substrate temperature sensor.	—	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.

P0701	Transmission control system	Transmission control system. Range operation.	TCM has detected a concern with the operational strategy.	• Dual DTC code causing transmission default to a hydraulic limp-home mode • May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	Multiple DTC failure with conflicting failure mode actions. If other DTCs are present, REPAIR them first. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. REFLASH the TCM first. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0705	TR sensor	TR sensor circuit error.	TCM has detected a TR signal (P, R, N, D, 3, 2 or 1) is out of normal range.	• May turn on MIL • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0711	TFT sensor	No change in TFT during operation.	PCM has detected no TFT change during operation. TFT stuck at some normal reading.	—	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0712	TFT sensor	TFT sensor circuit grounded.	TCM has detected a voltage drop across TFT sensor exceeds scale set for temperature (grounded circuit).	—	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.

P0713	TFT sensor	TFT sensor circuit short to power.	TCM has detected a voltage drop across TFT sensor; exceeds scale set for temperature.	—	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0714	TFT sensor	TFT intermittent error.	TCM has detected no TFT intermittent operation.	—	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0715	TSS sensor	TSS sensor circuit error.	TSS has detected a short circuit to power.	• No TCC engagements • May turn on MIL • Max line pressure • No adaptive learning strategy • Hold in 3rd gear • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0716	TSS sensor	TSS range or operation insufficient input from TSS.	TCM has detected a loss or noisy TSS signal during operation.	• No TCC engagements • May turn on MIL • Max line pressure • No adaptive learning strategy • Hold in 3rd gear • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0717	TSS sensor	No TSS signal.	TCM has not detected a TSS signal. No TSS signal when OSS signal is present.	• No TCC engagements • May turn on MIL • Max line pressure • No adaptive learning strategy • Hold in 3rd gear • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit.

					After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0720	OSS sensor	No OSS signal.	TCM has detected an OSS short circuit to power.	May turn on MIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0721	OSS sensor	OSS range or operation insufficient input from OSS.	TCM has detected a loss or noisy OSS signal during operation.	May turn on MIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0722	OSS sensor	No OSS signal.	TCM has not detected a OSS signal. No OSS signal when OSS signal is present.	May turn on MIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0723	OSS sensor	No OSS signal intermittent.	TCM has detected an intermittent signal.	• No TCC engagements • Hold in gear currently selected • Max line pressure • No adaptive learning strategy • Will turn on	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If

				TCIL	the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0729	Transmission	Sixth gear ratio error.	No 6th gear ratio detected by the TCM.	• No 6th gear • No TCC engagements • May turn on MIL • No adaptive learning strategy • Max line pressure • Held in 5th gear • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 272. REFER to Diagnosis By Symptom in this section.
P0731	Transmission	First gear ratio error.	No 1st gear ratio detected by the TCM.	• No 1st gear • No TCC engagements • May turn on MIL • No adaptive learning strategy • Held in 3rd gear • Max line pressure • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 215. REFER to Diagnosis By Symptom in this section.
P0781	Transmission	1-2 or 2-1 shift error.	Incorrect ratio calculated during shift 1-2 or 2-1.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material)	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 220 or 225. REFER to

				• No TCC engagements • No adaptive learning strategy • Hold in 3rd, 2nd or 4th gear • Will turn on TCIL	Diagnosis By Symptom in this section.
P0782	Transmission	2-3 or 3-2 shift error.	Incorrect ratio calculated during shift 2-3.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 4th, 3rd or 2nd gear • May turn on MIL • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 221 or 224. REFER to Diagnosis By Symptom in this section.
P0783	Transmission	3-4 or 4-3 shift error.	Incorrect ratio calculated during shift 3-4 or 4-3.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 4th or 3rd gear • May turn on MIL • Will turn on	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 222 or 223. REFER to Diagnosis By Symptom in this section.

				TCIL	
P0784	Transmission	4-5 or 5-4 shift error.	Incorrect ratio calculated during shift 4-5 or 5-4.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • No TCC engagements • No adaptive learning strategy • Hold in 5th or 4th gear • May turn on MIL • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 270 or 271. REFER to Diagnosis By Symptom in this section.
P0732	Transmission	Second gear ratio error.	No 2nd gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 3rd gear • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 220, 224 and 217. REFER to Diagnosis By Symptom in this section.
P0733	Transmission	Third gear ratio error.	No 3rd gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 4th gear • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 221

					or 223. REFER to Diagnosis By Symptom in this section.
P0734	Transmission	Fourth gear ratio error.	No 4th gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 3rd gear • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 222 or 271. REFER to Diagnosis By Symptom in this section.
P0735	Transmission	Fifth gear ratio error.	No 5th gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 3rd gear • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 270 or 273. REFER to Diagnosis By Symptom in this section.
P0736	Transmission	Reverse gear ratio error.	No reverse gear ratio detected by the TCM.	• No TCC engagements • No adaptive learning strategy • Max line pressure • May turn on MIL • Hold in 4th gear	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 202 or 205. REFER to Diagnosis By Symptom in this section.

P0829	Transmission	5-6 or 6-5 shift error.	Incorrect ratio calculated during shift 5-6 or 6-5.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). • No TCC engagements • Held in 3rd or 2nd gear • May turn on MIL • Will turn on TCIL	FOLLOW preliminary diagnostics. MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic routine 272 or 273. REFER to Diagnosis By Symptom in this section.
P0960	PC A	PC A circuit or solenoid failure or open circuit.	PC A circuit or solenoid (VFS-5) failed during operation.	• No adaptive strategy • Max line pressure • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0962	PC A	PC A solenoid signal or ground circuits either short or open solenoid circuit failure.	Voltage through PC A solenoid (VFS-5) is checked. An error will be noted if tolerance is exceeded.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0963	PC A	PC A solenoid short to power circuit failure.	Voltage through PC A solenoid (VFS-5) is checked. An error will be noted if tolerance is exceeded.	• Max line pressure • No adaptive strategies • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0972	SS A	SS A circuit or solenoid failure.	SS A (VFS-1) circuit or solenoid failure.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new

					mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0973	SS A	SS A solenoid or circuit shorted to ground or open.	Voltage through SS A solenoid (VFS-1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0974	SS A	SS A solenoid or circuit shorted to power or open.	Voltage through SS A solenoid (VFS-1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0975	SS B	SS B circuit shorted to ground or open.	SS B (VFS-2) circuit or solenoid failure.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0976	SS B	SS B solenoid or circuit shorted to ground or open.	Voltage through SS B solenoid (VFS-2) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0977	SS B	SS B solenoid or circuit shorted to power or open.	Voltage through SS B solenoid (VFS-2) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0978	SS C	SS C circuit	SS C (VFS-3)	• Mechanical	INSTALL a new

		shorted to ground or open.	circuit or solenoid failure.	limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0979	SS C	SS C solenoid or circuit shorted to ground or open.	Voltage through SS C solenoid (VFS-3) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0980	SS C	SS C solenoid or circuit shorted to power or open.	Voltage through SS C solenoid (VFS-3) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0981	SS D	SS D circuit shorted to ground or open.	SS D (VFS-4) circuit or solenoid failure.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0982	SS D	SS D solenoid or circuit shorted to ground or open.	Voltage through SS D solenoid (VFS-4) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0983	SS D	SS D solenoid or circuit shorted to power or open.	Voltage through SS D solenoid (VFS-4) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.

P0770	SS E	SS E circuit or solenoid failure.	SS E (SS1) circuit or solenoid failure.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new SS E (SS1) solenoid.
P0985	SS E	SS E solenoid signal circuit shorted to ground or open.	Voltage through SS E solenoid (SS1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new SS E (SS1) solenoid.
P0986	SS E	SS E solenoid or circuit shorted to power or open.	Voltage through SS E solenoid (SS1) is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	• Mechanical limp-home mode — default to 3rd or 5th gear • May turn on MIL • Will turn on TCIL	INSTALL a new SS E (SS1) solenoid.
P1707	Transmission	P/N switch circuit failure.	Circuit or sensor failure high. Circuit or sensor failure low.	• Engine will not crank in P or N or engine will crank in all gears • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. CHECK the shift linkage. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P1910	Reverse lamp circuit	Reverse solenoid circuit failure.	Circuit or sensor failure.	• Park lock or interlock switched OFF • Reverse lamps may be on at all times • Reverse may not come on	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all the DTCs. TEST system for

					normal operation. If DTC returns, REFER to Section 417-01 .
P1911	Reverse lamps	Reverse solenoid signal circuit shorted to ground. Circuit low.	Circuit or sensor failure.	—	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all the DTCs. TEST system for normal operation. If DTC returns, REFER to Section 417-01 .
P1912	Reverse lamps	Reverse solenoid circuit shorted to power. Circuit high.	Circuit or sensor failure.	Park lock or interlock switched OFF.	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all the DTCs. TEST system for normal operation. If DTC returns, REFER to Section 417-01 .
P0740	TCC solenoid	TCC solenoid circuit failure.	TCC solenoid (VFS-6) circuit fails. Circuit open.	• May turn on MIL • No adaptive learning strategy • Mechanical limp-home mode — default to 3rd or 5th gear • TCC engagements • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P2763	TCC	TCC solenoid signal circuit shorted to power. Circuit high (ON).	TCC solenoid (VFS-6) circuit fails to provide voltage drop across solenoid. Circuit shorted to power.	• No TCC engagements • May turn on MIL • No adaptive learning strategy • Mechanical limp-home mode — default to 3rd or 5th gear • Will turn on TCIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P2764	TCC	TCC solenoid circuit shorted to ground. Circuit low.	TCC solenoid (VFS-6) circuit fails to provide voltage drop	• No TCC engagements • May turn on MIL	INSTALL a new mechatronics unit. After installing the new mechatronic unit,

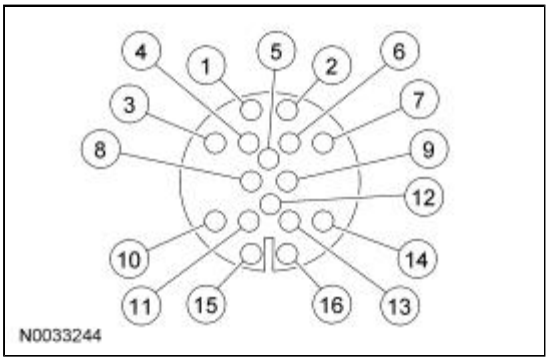
			across solenoid.	• No adaptive learning strategy • Will turn on TCIL	it must be reflashed to the latest level calibration.
U0073	CAN	CAN communication link error.	CAN communication bus off, short circuit CAN high to CAN low.	• No adaptive learning strategy • Hold in 3rd gear • Max line pressure • Will turn on TCIL • No TCC engagements	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a] .
U0155	CAN	TCM communication link error.	CAN link error detected by TCM and IP.	• No communication with instrument panel cluster (IPC)	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a] .
U0100	CAN	TCM communication link error.	CAN link error detected by TCM, between TCM and ECM.	• No adaptive learning strategy • Hold in 3rd gear • Max line pressure • Will turn on TCIL • No TCC engagements	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a] .
U0121	CAN	TCM communication link error.	PCM/TCM have detected an error in the CAN wheel RPM information from the ABS system.	—	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual [a] .
P062F	TCM	Transmission control module EEPROM error.	TCM has detected an internal software concern with KAM.	• May turn on MIL • No adaptive strategy • Will turn on TCIL	MONITOR the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR all DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronics unit. After installing the new mechatronic unit, it must be reflashed to the latest level calibration.
P0741	TCC	TCC solenoid	TCC solenoid	• No TCC	CARRY OUT normal

		circuit stuck open.	(VFS-6), clutch or circuit open.	engagements • May turn on MIL • Will turn on TCIL	diagnostics for TCC. FOLLOW diagnostic routines 240, 241 and 242. REFER to Diagnosis By Symptom in this section.

Transmission Connector Layouts

Printable View (97 KB)

Transmission Vehicle Harness Connector



Pin Number	Circuit	Circuit Function
1	—	NOT USED
2	—	CAN low
3	—	NOT USED
4	—	NOT USED
5	—	NOT USED
6	—	CAN high
7	—	NOT USED
8	—	NOT USED
9	—	Term 15 (Ignition)
10	—	Park/Neutral signal (to PCM TRSW-PN T-19)
11	—	NOT USED
12	—	NOT USED
13	—	Term 31 (Ground)
14	—	Term 30 (Battery voltage)
15	—	NOT USED
16	—	Terminal 31 (Ground)

Special Testing Procedures

Printable View (135 KB)

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

Stall Speed Test

WARNING: Apply the service and parking brakes firmly while carrying out each stall test.

CAUTION: Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur.

NOTE: The stall test should only be carried out with the engine and transmission at normal operating temperatures.

The stall test checks the operation of the following items:

- Torque converter one-way clutch
- Forward clutch
- Reverse clutch
- Direct clutch
- Engine driveability concerns

1. Connect a tachometer to the engine.
2. After testing each of the following ranges, D, 3, 2, 1 and R, move the transmission range selector lever to N (NEUTRAL) and run the engine for about 15 seconds to allow the torque converter to cool before testing the next range.
3. **CAUTION: If the engine rpm recorded by the tachometer exceeds the maximum specified rpm, release the accelerator pedal immediately. Clutch slippage is indicated.**

   CAUTION: Do not maintain wide-open throttle (WOT) in any gear range for more than 5 seconds or damage to the transmission may occur.

   Press the accelerator pedal to the floor (WOT) in each range. Record the rpm reached in each range. Stall speeds should be in the appropriate range.

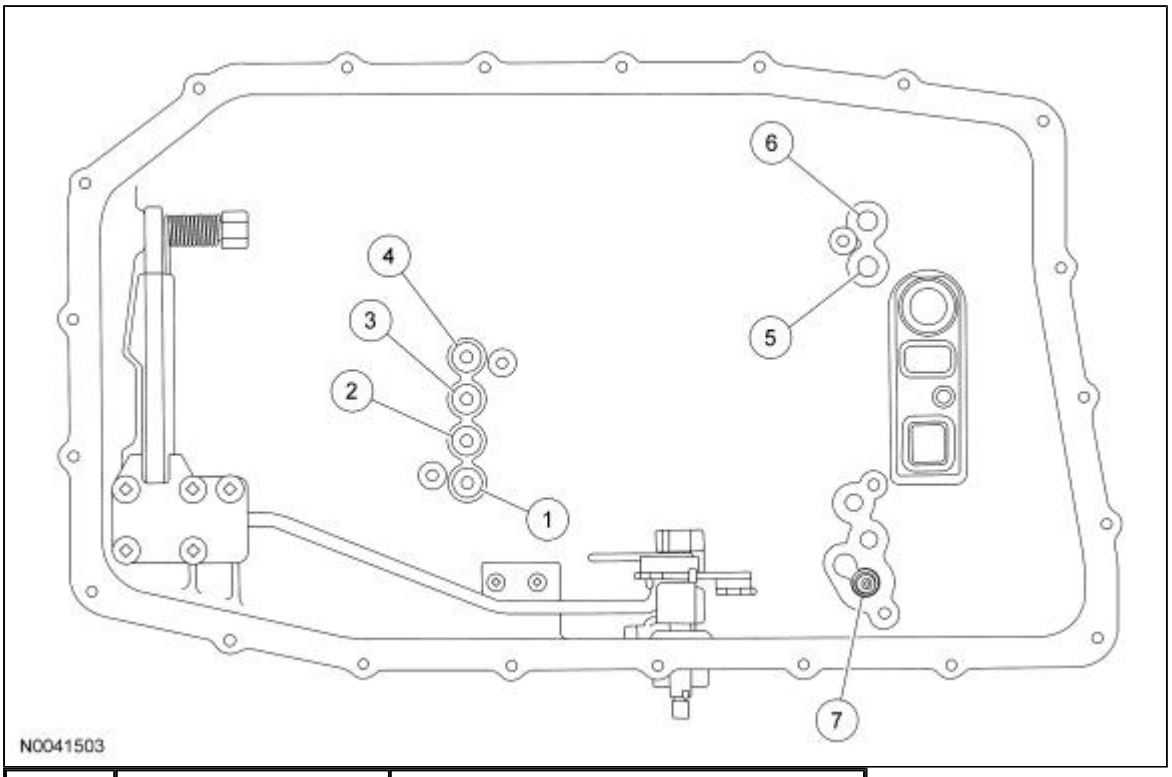
Stall Speed

Engine	Min	Max

5.4L	2,159	2,531

If the stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If the stall speeds were too low, check engine tune-up. If the engine is OK, remove the torque converter and check the torque converter reactor one-way clutch for slippage.

Air Pressure Test



Item	Part Number	Description
1	—	Clutch (C) port
2	—	Clutch (D1) port
3	—	Clutch (D2) port
4	—	Direct clutch (B) port
5	—	Overdrive clutch (E) port
6	—	Forward clutch (A) port
7	—	Cooler bypass valve

A no-drive condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. Refer to the Clutch Application Chart to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

Example: When the transmission range selector lever is in a forward gear range (D, 3, 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.

2. Remove the filter and seal assembly and the mechatronics unit.

3. The inoperative clutches can be located by applying air pressure into the appropriate clutch port.

4. Apply air pressure to the appropriate clutch port. A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing may be heard.

5. If the clutches fail to operate during the air check:
    - the piston seals are not seated, damaged or not installed correctly.
    - plugged feed holes for clutch apply in the case and/or clutch cylinder.
    - damaged piston and/or clutch cylinder.

6. Service as required and recheck.

Leakage Inspection

Printable View (110 KB)

Special Tool(s)

ST1300-A	100W/12 Volt DC UV Lamp 164-R0751 or equivalent

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Automatic Transmission/Power Steering Dye 164-R3701 or equivalent	—

The transmission has the following parts to prevent external fluid leakage:

- Gaskets
- Lip-type seals
- O-ring seals
- Seal rings
- Seal grommets
- Seal washers
- Thread sealant

Leakage at the transmission pan-to-case gasket often can be stopped by tightening the bolts to specification. Refer to Torque Specifications in this section.

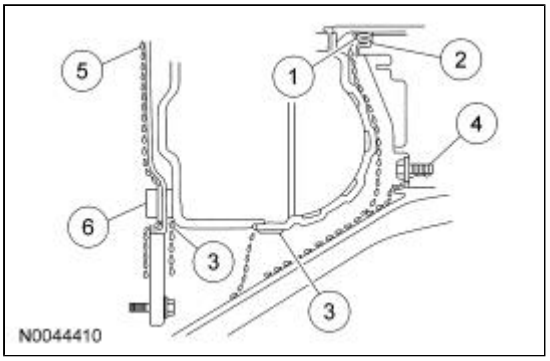
When fluid is found to be leaking between the case and the cooler tube fitting, tighten the fitting to maximum specification.

If leakage is found at the manual control lever shaft, install a new seal.

Check for fluid leaking from the end of the extension housing. Leakage can result from a damaged seal, missing garter spring or worn extension bushing. Install a new seal assembly, bushing or both, as necessary.

Fluid Leakage in Torque Converter Area

Leakage at the front of the transmission, as evidenced by fluid around the torque converter housing part of the case, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of the leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 6 numbers in the illustration correspond with the 6 flow path steps.



Leak Path	Symptom	Possible Source
1, 2 and 4	Leak at front of transmission	Pump lip seal
1, 2 and 4	Leak at front of transmission	Vent
1, 2 and 4	Leak at front of transmission	Converter hub weld
1, 2 and 4	Leak at front of transmission	External pump seal (large)
1, 2 and 4	Leak at front of transmission	Pump to case fasteners
1, 2 and 4	Leak at front of transmission	Pump gasket
3	Leak at front of transmission	Torque converter seal weld
5	Leak at front of transmission	Engine oil leak; rear main seal
5	Leak at front of transmission	Engine valve cover
5	Leak at front of transmission	Oil galley
5	Leak at front of transmission	Pump lip seal
5	Leak at front of transmission	Engine oil pressure sensor
6	Leak at front of transmission	Torque converter rivet

Leak Check Test with A Black Light

NOTE: Automatic Transmission/Power Steering Dye (164-R3701 or equivalent specifically formulated for ATF) is used to detect a transmission fluid leak.

Add Automatic Transmission/Power Steering Dye to the transmission fluid. Use one 30.0 mL (1 oz) of dye solution for every 3.8L (4 qt) of transmission fluid. Add any additional transmission fluid to bring it to the correct level. Such dyes can be used to determine whether an engine fluid or transmission fluid leak is present, or if the fluid in the transmission fluid cooler hose leaks into the engine coolant system. An ultraviolet light must be used to detect the fluorescent dye solution.

1. Remove the fluid level fill plug and note the color of the fluid that drips out. Original factory fill fluid is clear and red if the fluid has been exchanged.

2. Clean off any fluid from the top and bottom of the torque converter housing, front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable non-flammable solvent and blow-dry with compressed air.

3. Wash out the torque converter housing and the front of the flexplate. The torque converter housing may be washed out using clean solvent and a squirt-type oil can. Blow-dry all washed areas with compressed air.

4. Start and run the engine until the transmission reaches its normal operating temperature. Shift the transmission through all the gear ranges to make sure that the dye has circulated through the

transmission. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Observe the front of the flexplate, back of the cylinder block (in as far as possible) and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined. Repair as required.

External Fluid Leaks

Leak Path	Possible Source
Leaks at the fluid pan to case	• Pan bolts not tightened to specification • Pan gasket damaged • Case pan rail damaged
Fluid cooler tubes or O-rings leaking	• Cooler tube(s), cooler tube O-rings damaged • Cooler tube hold-down plate damaged
Leaks at the fluid cooler	• Fluid cooler damaged • Cooler tube O-rings damaged
Leaks at the manual control lever	• Manual control lever seal missing or damaged
Mechatronic harness connector	• O-ring on connector missing or damaged

Transmission Fluid Cooler Tube Replacement

For installation of new transmission fluid cooler tube, refer to Section 307-02.

Transmission Fluid Cooler

Printable View (79 KB)

CAUTION: Whenever a transmission has been disassembled to install new parts, the transmission fluid cooler and transmission fluid cooler tubes must be cleaned and backflushed. Use a torque converter/oil cooler cleaner.

NOTE: Cleaning and backflushing the transmission fluid cooling system, along with following all the normal cleaning and inspection procedures during disassembly and reassembly, will keep contaminants from entering the transmission, causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back into use.

Diagnosis By Symptom

Printable View (163 KB)

The Diagnosis By Symptom gives the technician diagnostic information and direction, and suggests possible components using a symptom as a starting point. All routines start out with any potential electrical components that can cause or contribute to the symptom described. The routines then list all possible hydraulic or mechanical components that can cause or contribute the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom, select the condition that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the fluid levels.
    4. carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

   NOTE: When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The transmission control module (TCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the TCM.

   Begin with the ROUTINES, if indicated. Follow the reference or action required statements. Always carry out the on-board diagnostic tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.

5. The list contains only possible hydraulic or mechanical components that may cause or contribute to the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure that repairs are complete.

Diagnosis by Symptom Index

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Diagnostic Routines

Engagement Concerns: No Forward in D

Possible Component	Reference/Action
201 — ROUTINE	
Fluid	
・Incorrect fluid level	・Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Shift Linkage	

· Shift linkage — damage or incorrectly adjusted	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector lever cable as necessary.
Mechatronics	
· Defective manual valve	· Inspect connection to shift linkage.
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Engagement Concerns: No Reverse

Possible Component	Reference/Action
202 — ROUTINE	
Fluid Level	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Shift Linkage	
· Shift linkage — damage or incorrectly adjusted	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector lever cable as necessary.
Mechatronics	
· Defective direct clutch (B) or low/reverse clutch (D) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Engagement Concerns: Harsh Reverse

Possible Component	Reference/Action
203 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Driveline	
· Engine driveline looseness in the driveshaft, U-joints or the engine mounts	· Repair as required.

Engagement Concerns: Harsh Forward Only

Possible Component	Reference/Action
204 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Mechatronics	
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Driveline	
· Engine driveline looseness in the driveshaft, U-joints or the engine mounts	· Repair as required.

Engagement Concerns: Delayed/Soft Reverse Only

Possible Component	Reference/Action
205 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Engagement Concerns: Delayed/Soft Forward Only

Possible Component	Reference/Action
206 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Engagement Concerns: No Forward and No Reverse

Possible Component	Reference/Action
207 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.

Mechatronics	
· Defective manual valve	· Inspect connection to shift linkage.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Engagement Concerns: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses, solenoids, transmission range (TR) sensor, SSA solenoid, PCA solenoid	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Multiple shift missing (more than one gear)	· If some shifts are missing, determine which shifts do not occur. Refer to clutch and solenoid application charts in this section. Monitor appropriate PIDs as listed in diagnostics. Refer to routine 210.
Mechatronics	
· Gears 4-6 default to 5th gear and gears 1-3 default to 3rd gear	· Retrieve DTC codes.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Engagement Concerns: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage Damaged or Incorrectly Adjusted	
· External shift cable	· Inspect and repair as required. Verify transmission selector lever cable adjustment. Refer to Section 307-05 . Adjust transmission selector lever cable as necessary.
Forward Clutch (A) Assembly (No Shifts)	
· Seals, piston — damaged	· Inspect for damage. Repair as required.
· Friction elements — damaged or worn	· Inspect for damage. Repair as required.
· Return springs — damaged	· Inspect for damage. Repair as required.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses, solenoids, transmission range (TR) sensor, SSA solenoid, PCA solenoid	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Multiple shift missing (more than one gear)	· If some shifts are missing, determine which shifts do not occur. Refer to clutch and solenoid application charts in this section. Monitor appropriate PIDs as listed in diagnostics.

Shift Concerns: Timing — Early/Late

Possible Component	Reference/Action
211 — ROUTINE	
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· Engine driveability concerns	· Refer to Section 303-00 .
Mechatronics	
· Bolts not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Incorrect Pressures	
· Application pressures are incorrect	· Incorrect application pressures may be due to non-transmission components, mechatronic assembly or internal transmission damage. Repair all non-transmission components then continue with this routine.
Other	

· Tire size change, axle ratio change	· Verify that the vehicle has the original equipment. Refer to the certification label. Changes in tire size and axle ratio will affect shift timing.

Shift Concerns: Timing — Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 — ROUTINE	
Fluid	
· Incorrect level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Condition	· Carry out the fluid level check in Transmission Fluid Level Check in this section.
· Fluid over temperature condition	· Refer to transmission overheating.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Torque Converter Concerns	
· Torque converter clutch	· Refer to torque converter clutch operation concern: cycling shutter chatter.

Shift Concerns: Feel — Soft or Slipping (Some or All)

Possible Component	Reference/Action
213 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Transmission Fluid Temperature (TFT) Sensor Damaged	
· Mechatronic assembly	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Bolts not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stick or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Shift Concerns: Feel — Harsh (Some/All)

Possible Component	Reference/Action
214 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Re-flash mechatronic assembly to the latest level calibration. Carry out road test — adaptive drive cycle, refer to Shift Point Road Test in this section. Road test and carry out on-board diagnostic test again.
Mechatronics	
· Bolts not tightened to specification	· Tighten bolts to specification.
· Mechatronic assembly contaminated, solenoid(s) damaged, solenoids stuck or bore damaged.	· Inspect for damage. If damaged install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Manual valve damaged, stuck or bore damaged.	· Inspect for damage. If damaged install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

Shift Concerns: No 1st Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ROUTINE	
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Incorrect Gear	
· Mechatronic failure	· Determine which gear the transmission is in. Refer to the Clutch and Solenoid Application Charts in this section.

Shift Concerns: No 1st Gear Manual

Possible Component	Reference/Action
216 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage	
· External selector lever cable system — damaged, misaligned	· Inspect and repair as necessary.

Mechatronics	
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in this section.

Shift Concerns: No 2nd Gear Manual

Possible Component	Reference/Action
217 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Shift Linkage	
· External selector lever cable system — damaged, misaligned	· Inspect and repair as necessary.
Mechatronics	
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control System	
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	
· Pump gear — failure	· Install a new pump assembly. Refer to Pump Assembly in

	this section.

Shift Concerns: No 3rd Gear Manual

Possible Component	Reference/Action
218 — ROUTINE	
Shift Linkage	· Inspect and repair as necessary.
· External selector lever cable system — damaged, misaligned	
Mechatronics	
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control System	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs. Road test and carry out on-board diagnostic test again.
· PCM electrical inputs/outputs, TCM, external vehicle wiring harnesses	
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure.	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.
Pump	· Install a new pump assembly. Refer to Pump Assembly in this section.
· Pump gear — failure	

Shift Concerns: No 1-2 Shift

Possible Component	Reference/Action
220 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.

· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the intermediate clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the low/reverse clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.

Shift Concerns: No 2-3 Shift

Possible Component	Reference/Action
221 — ROUTINE	
Fluid	
· Incorrect fluid level	· Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid filter and seal assembly — plugged, damaged	· Install a new filter assembly.
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the intermediate clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 3-4 Shift

Possible Component	Reference/Action

222 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (E) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective solenoid multiplex valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSE (SS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Overdrive clutch (E) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Overdrive Clutch Assembly in this section.

Shift Concerns: No 4-5 Shift

Possible Component	Reference/Action
270 — ROUTINE	
Mechatronics	
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective forward clutch (A) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSA (VFS-1) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.

· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.

Shift Concerns: No 5-6 Shift

Possible Component	Reference/Action
272 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 6-5 Shift

Possible Component	Reference/Action
273 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	

· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 5-4 Shift

Possible Component	Reference/Action
271 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective forward clutch (A) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Forward clutch (A) friction and steel plate — failure	· Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.

Shift Concerns: No 4-3 Shift

Possible Component	Reference/Action
223 — ROUTINE	
Mechatronics	
· Defective overdrive clutch (E) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective overdrive clutch (E) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Solenoid multiplex valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Drive enable valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSD (VFS-4) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Overdrive clutch (E) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Overdrive Clutch Assembly in this section.

Shift Concerns: No 3-2 Shift

Possible Component	Reference/Action
224 — ROUTINE	
Mechatronics	
· Defective direct clutch (B) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective direct clutch (B) latch valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSB (VFS-2) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (B) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Intermediate clutch (C) friction and steel plate — failure	· Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Intermediate Clutch Assembly in this section.

Shift Concerns: No 2-1 Shift

Possible Component	Reference/Action
225 — ROUTINE	
Mechatronics	
· Defective intermediate clutch (C) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective low/reverse clutch (D) regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective SSC (VFS-3) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.

· TCM mechatronic unit — failed	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Electronic component — failure	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
· Direct clutch (C) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.
· Low/reverse clutch (D) friction and steel plate — failure	· Inspect the direct clutch assembly for damage. Repair as required. Refer to Low/Reverse Clutch Assembly in this section.

Torque Converter Clutch Operation Concerns : Does Not Apply

Possible Component	Reference/Action
240 — ROUTINE	
Torque Converter	
· Torque converter components	· Remove the transmission. Inspect for damage. Install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.
Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective torque converter apply regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective torque converter release regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Mechatronic assembly bolts — not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.

Torque Converter Clutch Operation Concerns : Cycling/Chatter

Possible Component	Reference/Action
241 — ROUTINE	

Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective torque converter apply regulator valve	· Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Mechatronic assembly bolts — not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Torque Converter	
· Torque converter components	· Remove the transmission. Inspect for damage. Install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Clutch Operation Concerns : Always Applied/Stalls Vehicle

Possible Component	Reference/Action
242 — ROUTINE	
Fluid	
· Fluid condition	· Carry out the fluid level check in Preliminary Inspection in this section.
Mechatronics	
· Defective TCC (VFS-6) shift solenoid	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· Mechatronic assembly bolts — not tightened to specification	· Tighten to specification.
· Mechatronic unit contaminated, solenoid (s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	· Inspect for damage. If damaged, install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Powertrain Control Module	
· Powertrain control system electrical inputs/outputs, TCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out on-board diagnostic tests. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
Torque Converter	

· Torque converter components	· Remove the transmission. Inspect for damage. install a new or remanufactured torque converter. Refer to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ROUTINE	
Fluid	
· Incorrect level	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
· Transmission case vent — damaged, case porosity	· Inspect for damage. If damaged, repair as necessary.
· Leakage at gaskets, seals, bulkhead connector	· Refer to Leakage Inspection , Fluid Leakage in the Torque Converter Area and Transmission Leak Check Test Procedures in this section for potential leak locations. Remove all traces of lubricant on exposed surface of the transmission. Repair as necessary.
Fluid Cooler Tubes	
· Cooler tube fittings	· Locate leak source. Repair as required. Refer to Section 307-02 .
· Cooler tube O-rings, cooler tubes	· Locate leak source. Repair as required. Refer to Section 307-02 .
Torque Converter	
· Torque converter studs	· Install a new torque converter.
· Torque converter hub seal	· Install a new torque converter hub seal.
· Torque converter weld	· Install a new torque converter.
Transmission Case	
· Case — leaking	· Install a new transmission case. Refer to Transmission in this section.
· Transmission electrical bulkhead connector	· Install a new transmission electrical bulkhead connector O-ring.
· Fluid fill plug	· Install a new fill plug.
· Output shaft seal	· Install a new seal. Refer to Output Shaft Seal in this section.
· Manual control lever seal	· Install a new seal.
· Transmission fluid pan seal (gasket)	· Install a new seal.
Fluid Pump	
· Fluid pump O-ring	· Install a new O-ring. Refer to Pump Assembly in this section.
· Fluid pump seal ring	· Install a new seal ring. Refer to Pump Assembly in this section.

Noise/Vibration — Forward or Reverse

Possible Component	Reference/Action
254 — ROUTINE	
Fluid	
· Fluid level (low) pump cavitation	· Check the fluid level. Adjust fluid to correct level. Refer to Preliminary Inspection in this section.
Fluid Cooler Tubes	
· Cooler line grounding out	· Adjust or reposition cooler tubes.
Torque Converter	
· Check the torque converter components/balance weight	· Locate source of disturbance. Repair as required.
Engine Driveline	
· Engine drive accessories	· Refer to Section 303-00 .

Engine Will Not Crank

Possible Component	Reference/Action
255 — ROUTINE	
External Selector Lever Cable System	
· Cable system — damaged, misaligned	· Inspect and repair as necessary. Refer to Section 307-05 .
Powertrain Control System	
· Electrical inputs/outputs, TCM, vehicle wiring harnesses, engine starting system, TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. Check PIDs for TR park and neutral positions. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again
Torque Converter	
· Flexplate — damaged	· Inspect for damage. Repair as necessary.
Vehicle Starter	
· Starter system concerns	· Inspect and repair as necessary. Refer to Section 303-06 .
TR Sensor Assembly	
· TR assembly — damaged	· Inspect and repair as necessary.
Fluid Pump Assembly	
· Internal parts seized	· Inspect for damage. Repair as necessary.

No Park Range

Possible Component	Reference/Action
256 — ROUTINE	
Selector Lever Cable	
· Cable system — damaged, misaligned	· Inspect and repair as necessary.

· Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged, park pawl pin loose or damaged, park rod actuating plate loose, damaged or missing	· Inspect for damage. If damaged, repair as necessary.
· Transmission case assembly	· Inspect for damage. If damaged, repair as necessary.
· Park gear, parking pawl, parking pawl return spring, part or guide, parking actuating rod, parking pawl shaft, manual lever	· Inspect for damage. If damaged, repair as necessary.
· External linkages/brackets — damaged	· Inspect for damage. If damaged, repair as necessary.
TR Assembly Damaged	
· Manual Lever Detent Spring	· Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
· TR assembly	

Transmission Overheating

Possible Component	Reference/Action
257 — ROUTINE	
Fluid	
· Incorrect level	· Check fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
· Fluid condition	· Carry out the fluid level check. Refer to Preliminary Inspection in this section.
Powertrain Control System	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. Check PIDs for TR park and neutral positions. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
· Electrical inputs/outputs, TCM, vehicle wiring harnesses, TCC solenoid	
Torque Converter Not Engaging	· Install a new torque converter.
· Torque converter	
Case Vent Damaged	· Inspect for damage. If damaged, repair as necessary.
· Transmission case assembly	
Other	
· Restriction in transmission cooling system	· Check transmission cooling system efficiency. Refer to Section 307-02 for automatic transmission cooling system diagnostic procedures.
· Excessive trailer tow load	· Refer to the Owner Guide for specifications on trailer towing.
· Vehicle heat shield — missing or damaged	· Inspect for damage. If damaged, repair as necessary.
· Vehicle airflow is restricted	· Inspect for damage. If damaged, repair as necessary.

Fluid Venting/Foaming

Possible Component	Reference/Action
261 — ROUTINE	
Incorrect Level	
・Fluid	・Check the fluid level. Adjust fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Case Vent Damaged	
・Transmission case assembly	・Inspect for damage. If damaged, repair as necessary.

Transmission Fluid Cooler — Backflushing and Cleaning

Printable View (80 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

CAUTION: When internal damage occurs in the transmission, metal particles and clutch plate material can travel into the torque converter and the transmission fluid cooler. These contaminates are a major cause of recurring transmission concerns. To prevent further concerns, remove these contaminates from the cooler lines and install a new cooler before placing the transmission in use.

1. Install a new transmission fluid cooler if any fluid leaks are indicated or a major metallic failure is indicated.

2. Using a suitable torque converter/fluid cooler cleaner, flush the fluid cooler and lines.

3. **NOTE:** Rubber hoses must be attached to the ends of the fluid cooler tubes, to aid in connecting them to the cleaner.

   Connect the cleaner pressure and return lines appropriately.
   1. Connect the pressure line to the fluid cooler inlet tube.
   2. Connect the return line to the fluid cooler outlet tube.
   3. Place the outlet end of the return line in the fluid tank reservoir.

4. **NOTE:** Cycling the fluid pump ON and OFF will help dislodge contaminants in the cooler system.

   Switch the fluid pumps ON. Allow the fluid to circulate a minimum of 5 minutes.

5. Switch the fluid pump OFF.

6. Disconnect the cleaner pressure line at the fluid cooler tube.

7. Using compressed air, blow through the fluid cooler inlet tube until all fluid is removed.

8. Remove the rubber hoses from the fluid cooler tubes.

Transmission Fluid Drain and Refill

Printable View (304 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2933-A	Transmission Fluid Fill Tube 307-570
ST2715-A	Transporter Fluid Evacuator/Injector 307-D465 or equivalent
ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)

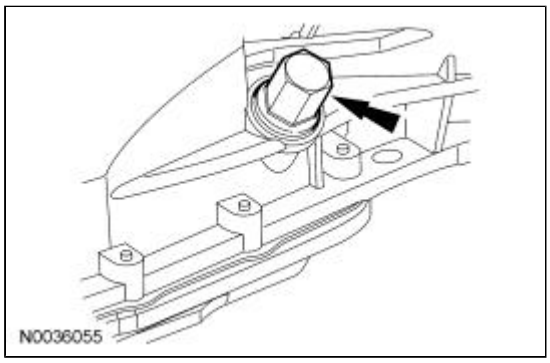
Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

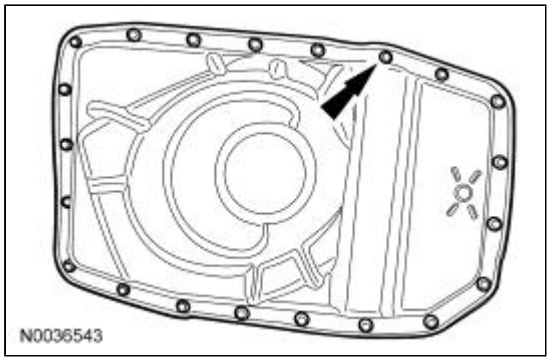
Drain

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. **NOTE:** Some fluid leakage may occur when removing the fluid fill plug.

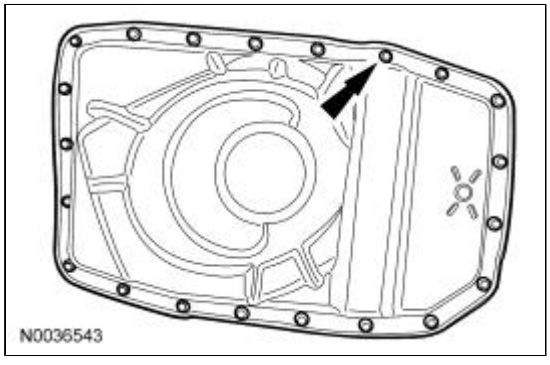
Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.



3. Remove the transmission fluid pan and allow the fluid to drain.



4. Install the transmission fluid pan.
    - Tighten to 14 Nm (10 lb-ft).



Transmission Fluid Refill

CAUTION: This procedure contains the air purge steps required to purge air from the cooling system. This procedure is NOT intended for use with the Transmission Fluid Level Check.

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure could result.

CAUTION: The fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

CAUTION: The use of any other transmission fluid than specified, can result in the transmission failing to operate in a normal manner or transmission failure.

NOTE: If the transmission starts to slip, shifts slowly or shows signs of fluid leaking, the fluid level should be checked.

NOTE: Here is an overview of the Transmission Fluid Drain and Refill procedure.

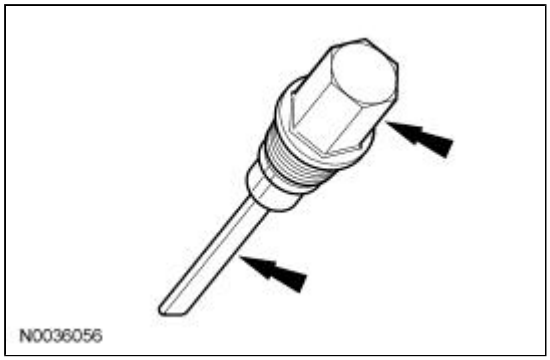
- Adding 3.3L (3.5 qt) of clean automatic transmission fluid to the transmission is an initial fill enabling you to start the engine.
- The cold level range shown in the procedure allows the vehicle to be driven.
- The vehicle should be driven to allow the transmission fluid temperature to reach 85ºC-88ºC (185ºF-190ºF) in order to purge the air from the transmission cooling system.
- Fill the transmission fluid to the fill range on the fluid level indicator at the normal operating range 80ºC-85ºC (175ºF-185ºF).

1. **NOTE:** The transmission will need 3.3L (3.5 qt) of clean automatic transmission fluid added to the transmission as an initial fill if:
   - the transmission has been overhauled.
   - a new mechatronic assembly has been installed.
   - the transmission fluid pan or fluid filter have been removed.

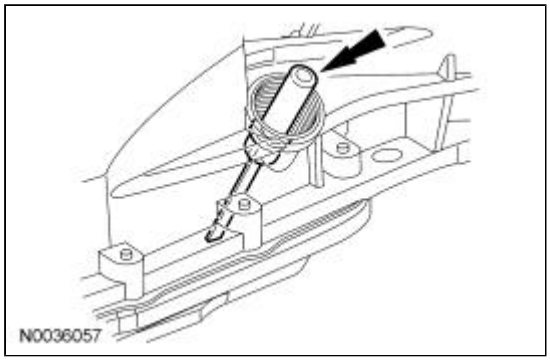
   Using the special tool, add 3.3L (3.5 qt) of clean automatic transmission fluid to the transmission through the fluid fill hole. For additional information, refer to Adding Additional Transmission Fluid in this procedure.

2. Check the transmission fluid level cold.
   1. The vehicle is safe to drive if the transmission fluid is in the cold level range 32°C-43°C (90°F-110°F).
   - Using the scan tool and the engine running, place the transmission selector lever in each gear position and hold approximately 5 seconds. Place the transmission selector lever in PARK, with the engine at idle (600-750 rpm).

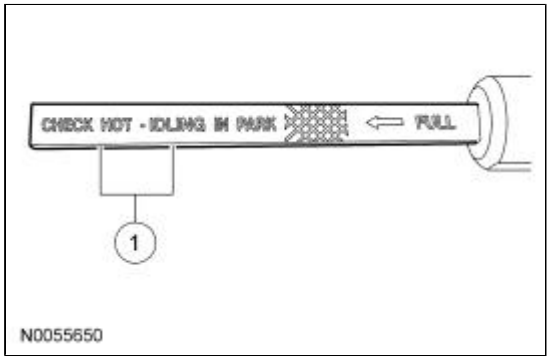
3. Separate the fluid level indicator from the fill plug.



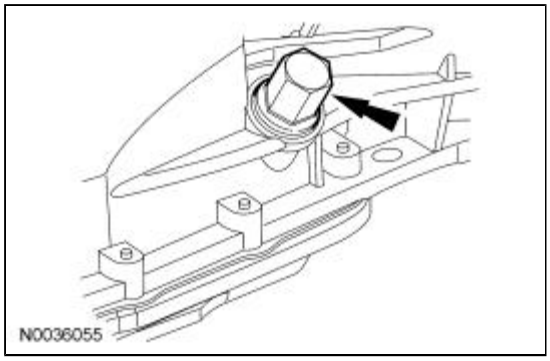
4. Wipe the fluid level indicator clean. Reinstall the fluid level indicator only back into the fill plug hole to check the fluid level. Repeat this until a consistent reading is established.



5. Add clean transmission fluid to the cold level location as shown in the illustration.

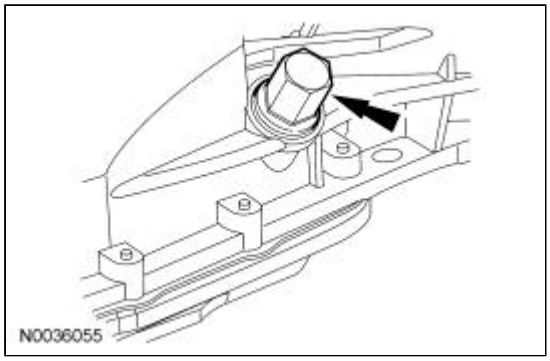


6. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).

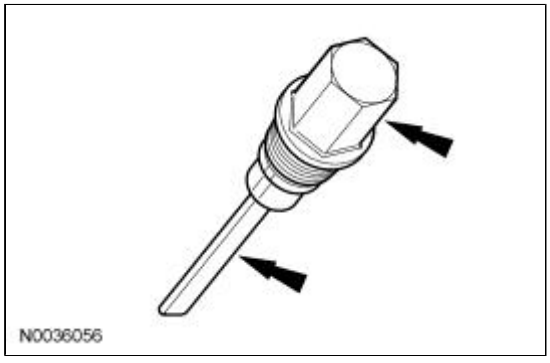


7. While driving the vehicle, use the scan tool to verify that the transmission fluid temperature has reached a temperature of 88°C (190°F). This will circulate the transmission fluid through the torque converter and the cooling system, eliminating any trapped air in the cooling system.
    - With the engine idling (600-750 rpm) in PARK, verify that the transmission fluid temperature is between 80ºC-85ºC (175ºF-185ºF).

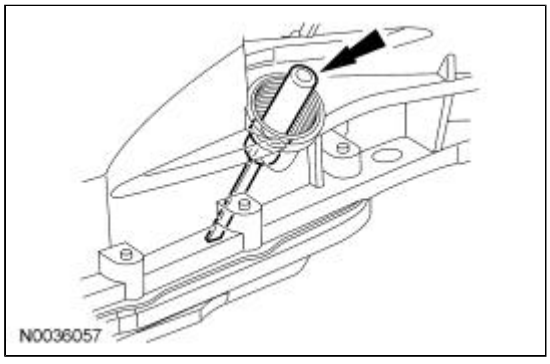
8. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case.



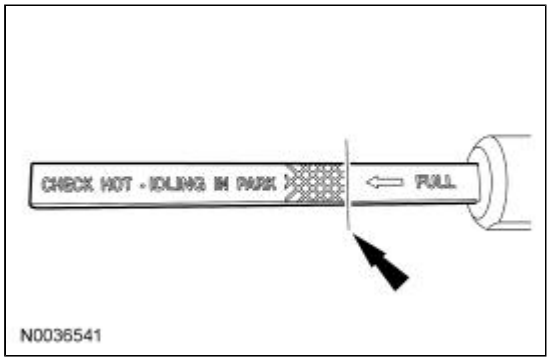
9. Separate the fluid level indicator from the fill plug.



10. Wipe the fluid level indicator clean. Reinstall the fluid level indicator only back into the fill plug hole to check the fluid level. Repeat this until a consistent reading is established.



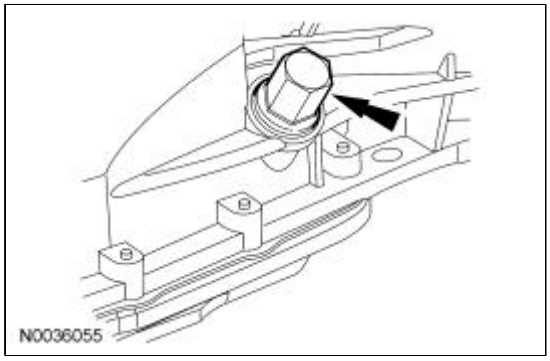
11. Using the scan tool verify that the transmission fluid temperature is between 80ºC-85ºC (175ºF-185ºF). The fluid level must be at the upper level of the crosshatch mark.



12. **NOTE:** If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid in this procedure.

Install the fluid fill plug.

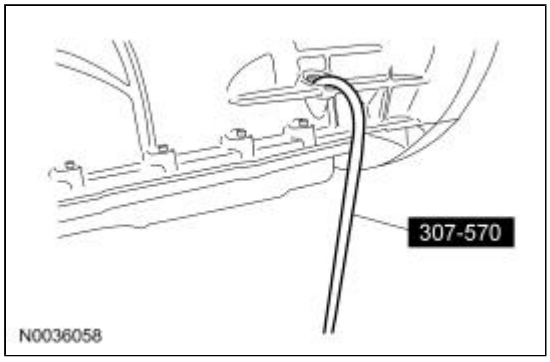
- Tighten to 35 Nm (26 lb-ft).



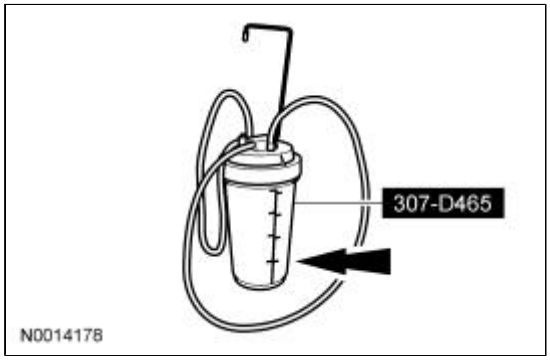
Adding Additional Transmission Fluid

NOTE: To get an accurate fluid level reading the engine should be idling (600-750 rpm) in PARK.

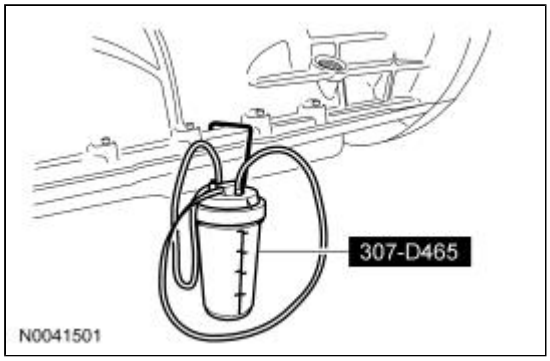
1. Install the special tool into the fluid fill hole.



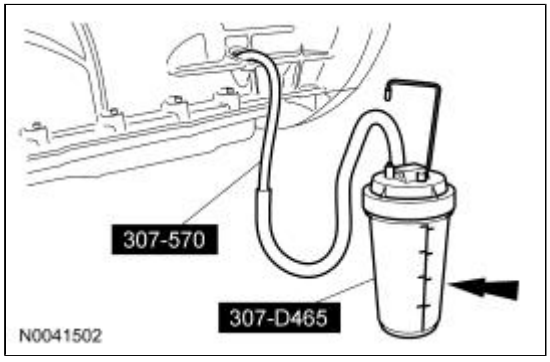
2. Fill the special tool with approximately 0.47L (1 pt) of clean automatic transmission fluid.



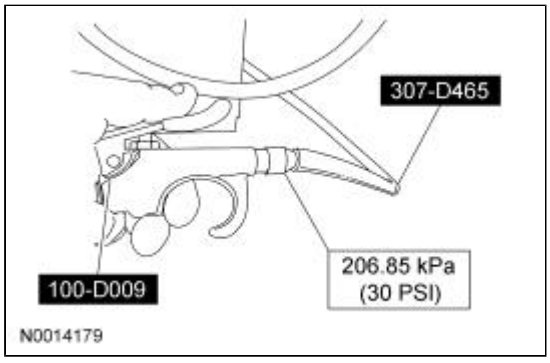
3. Hang the special tool under the vehicle, upright and close to the transmission.



4. Connect the special tools.
    - Connect the open end of the fluid hose from the special tool onto the special tool from the transmission case.

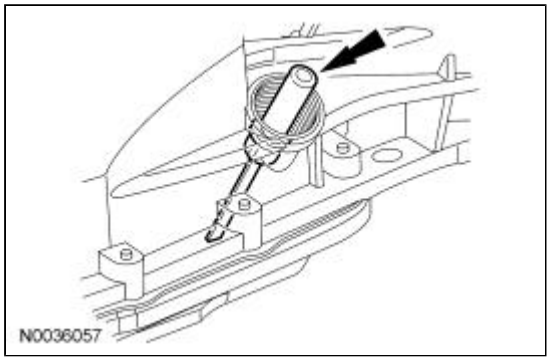


5. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission.

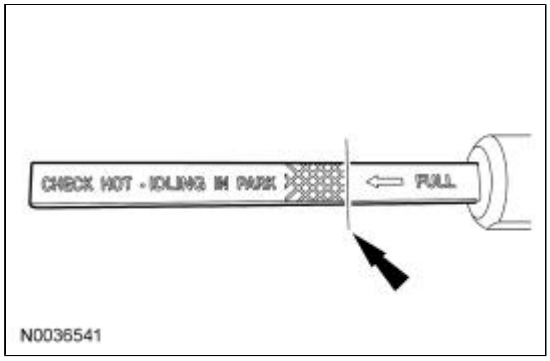


6. **NOTE:** Do not overfill the transmission. The fluid level must be at the upper level of the crosshatch mark.

    Reinstall the fluid level indicator only back into the fill plug hole to check the fluid level. Repeat this until a consistent reading is established.

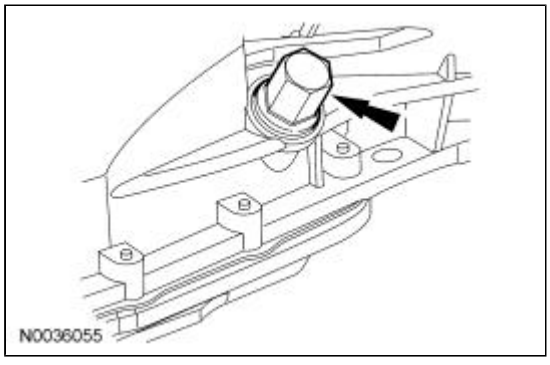


7. Using the scan tool verify that the transmission fluid temperature is between 80ºC-85ºC (175ºF-185ºF). The fluid level must be at the upper level of the crosshatch mark.



8. **NOTE:** If the transmission fluid is over full, follow the steps for Removing Transmission Fluid in this procedure.

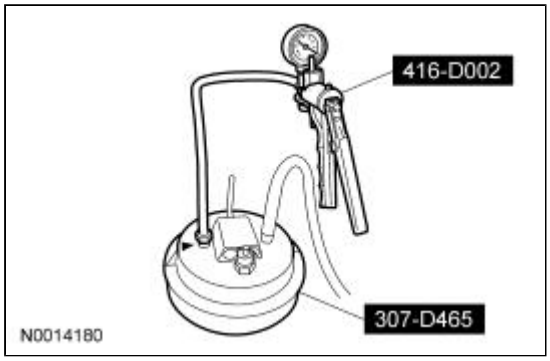
   Install the fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).



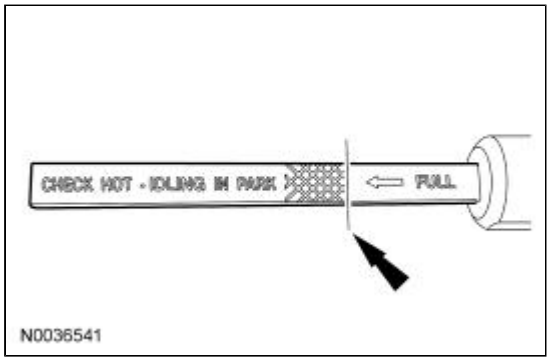
Removing Transmission Fluid

NOTE: To get an accurate fluid level reading the engine should be idling (600-750 rpm) in PARK.

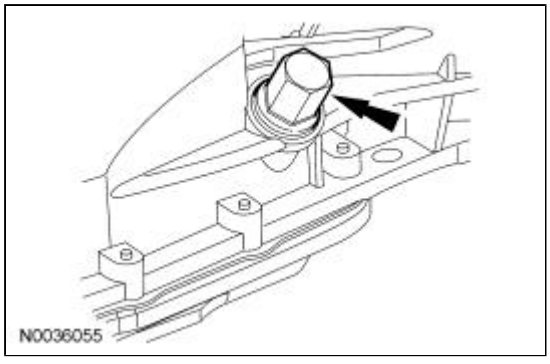
1. If the transmission is overfilled, fluid must be removed to the correct level. Use the special tools to extract any excessive fluid.



2. Using the scan tool, verify that the transmission fluid temperature is between 80ºC-85ºC (175ºF-185ºF). The fluid level must be at the upper level of the crosshatch mark. Reinstall the fluid level indicator only back into the fill plug hole to check the fluid level. Repeat this until a consistent reading is established.



3. Install the fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



Transmission Fluid Level Check

Printable View (145 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

CAUTION: The vehicle should not be driven if the fluid level is low as internal failure could result.

CAUTION: The fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTE: If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the fluid must cool down to obtain an accurate reading.

NOTE: If the transmission starts to slip, shifts slowly or shows signs of fluid leaking, the fluid level should be checked.

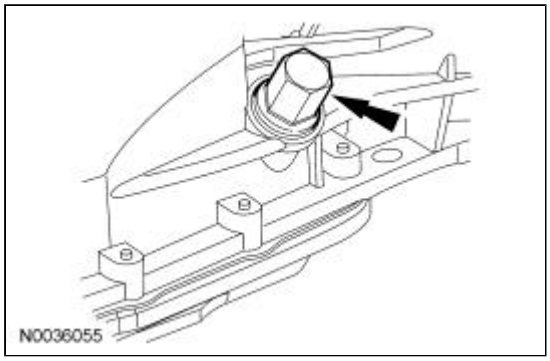
NOTE: Do not overfill the transmission. The fluid level must be at the upper level of the crosshatch mark.

NOTE: If the installation of a new transmission fluid cooler, cooler lines have been carried out the vehicle must be driven to get the transmission fluid to a temperature of 88ºC (190ºF) in order to purge the air from the cooling system.

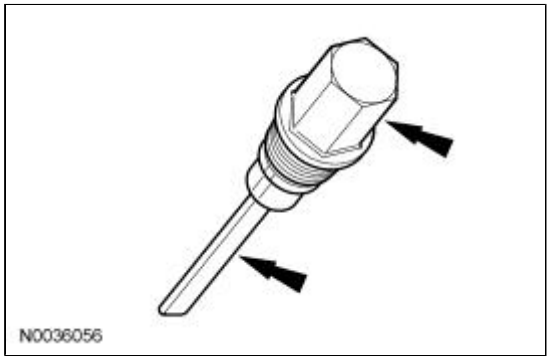
1. With the engine running, place the transmission selector lever in each gear position and hold approximately 5 seconds. Place the transmission selector lever in PARK.

2. With the engine idling (600-750 rpm) in PARK, position it on a hoist. For additional information, refer to Section 100-02 .

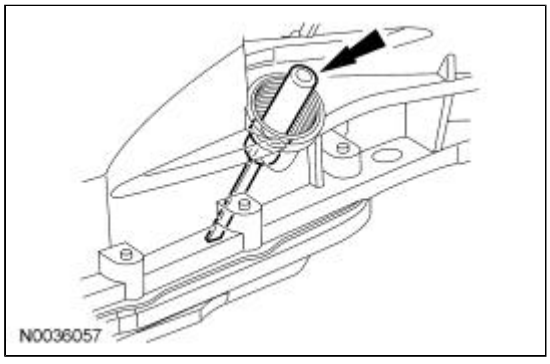
3. Remove the fluid fill plug fluid level indicator assembly, located on the passenger side front portion of the transmission case.



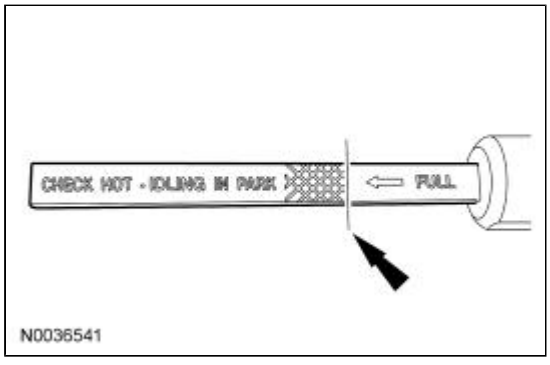
4. Separate the fluid level indicator from the fill plug.



5. Wipe the fluid level indicator clean. Reinstall the fluid level indicator only back into the fill plug hole to check the fluid level.



6. Using the scan tool, verify that the transmission fluid temperature is between 80ºC-85ºC (175ºF-185ºF). Do not overfill the transmission. The fluid level must be at the upper level of the crosshatch mark.

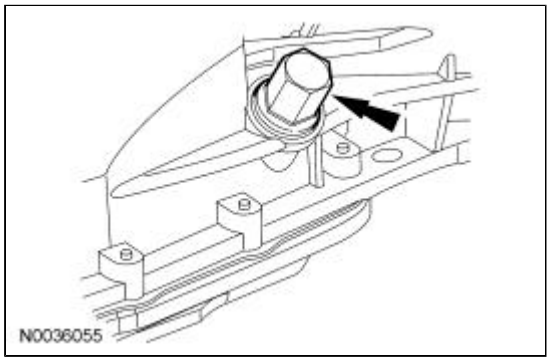


7. **NOTE:** If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to

Transmission Fluid Drain and Refill in this section.

Install the fluid fill plug.

- Tighten to 35 Nm (26 lb-ft).



Torque Converter

Printable View (63 KB)

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - Converter rivets, impeller hub or bushing are damaged.
    - Discoloration (due to overheating).
    - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
        - Major metallic failure.
        - Multiple clutches or clutch plate failures.
        - Sufficient component wear which results in metallic contamination.
        - Internal torque converter contamination present. For additional information, refer to Torque Converter Contamination Inspection in this section.

Torque Converter Contamination Inspection

Printable View (80 KB)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

CAUTION: Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission, damage will occur. Use only clean automatic transmission fluid designated for the transmission and converter being serviced.

1. If a new or remanufactured torque converter is not being installed, the following steps must be completed.
2. With the torque converter on a bench, pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter and examine the fluid.
3. Observe the color and odor of the fluid. The fluid should be red, not brown or black. Odor may indicate an overheating condition such as clutch disc or band failure.
4. Examine the stain on the tissue for evidence of particles (specks of any kind). Examine the fluid level indicator for signs of antifreeze (gum or varnish). If particles are present in the fluid, a new torque converter must be installed.
5. If there are no particles or contamination present, drain the remainder of the transmission fluid from the torque converter.
6. Add 1.9L (2 qt) of clean automatic transmission fluid into the converter and agitate by hand.
7. Thoroughly drain the fluid.

Fluid Pan, Gasket and Filter

Printable View (251 KB)

Material

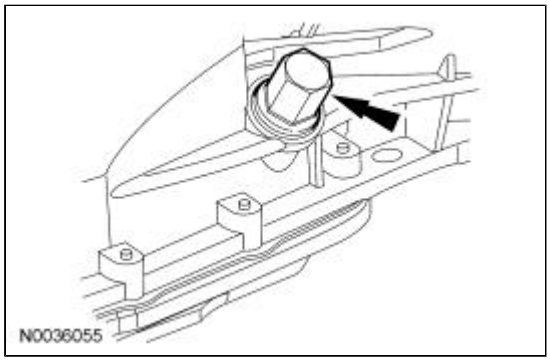
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Removal

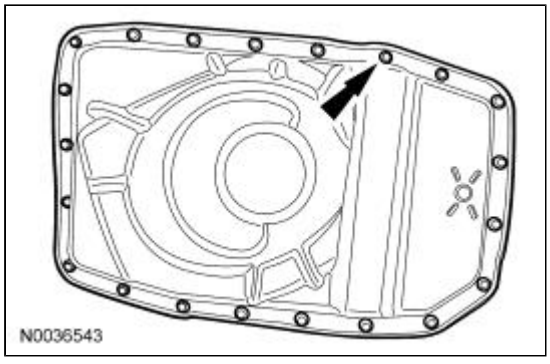
CAUTION: The use of any other transmission fluid than specified, can result in the transmission failing to operate in a normal manner or transmission failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

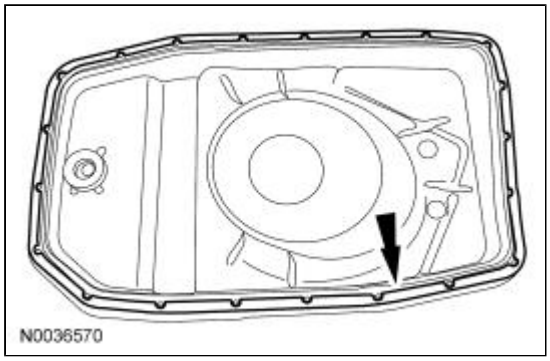
2. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.



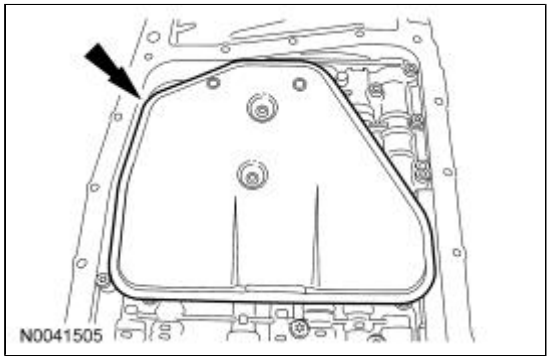
3. Remove the transmission fluid pan and allow the fluid to drain.



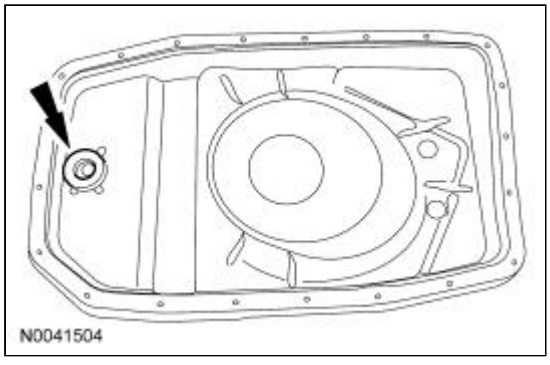
4. Remove the fluid pan gasket.



5. Remove and discard the transmission fluid filter.



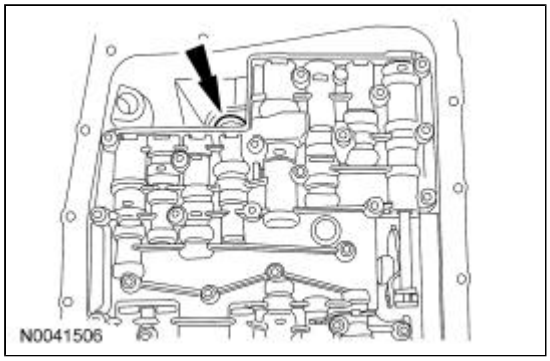
6. Clean and inspect the transmission fluid pan and magnet.



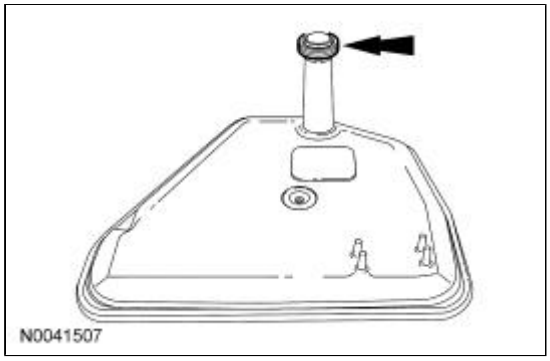
Installation

NOTE: If the transmission is being repaired for a contamination-related failure, install a new transmission fluid filter and seal assembly. The fluid filter may be reused if no excessive contamination is indicated.

1. Inspect the transmission case for the transmission fluid filter seal. If the seal is in the case, carefully remove the seal without scratching the case.

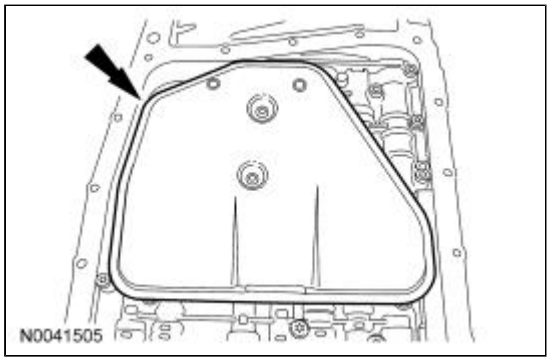


2. Make sure that the seal is on the transmission fluid filter and lubricate the seal with clean automatic transmission fluid.

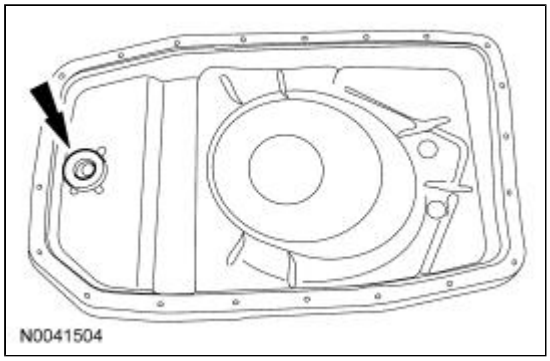


3. **NOTE:** The fluid filter may be reused if no excessive contamination is indicated.

   Install a new transmission fluid filter.

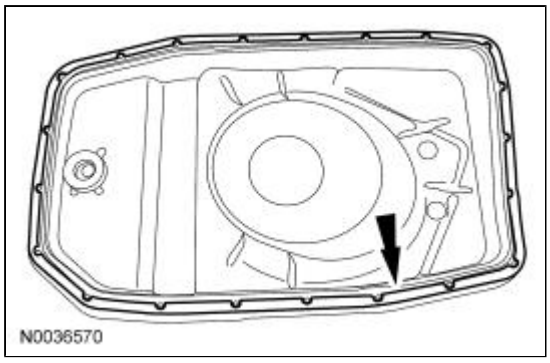


4. Position the magnet in the transmission fluid pan.

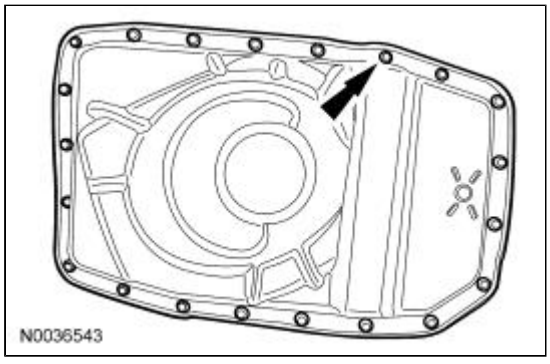


5. **NOTE:** The fluid pan gasket can be reused if not damaged.

Install a new transmission fluid pan gasket if required.



6. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 14 Nm (10 lb-ft).



7. Using the refill procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Mechatronic Assembly

Printable View (586 KB)

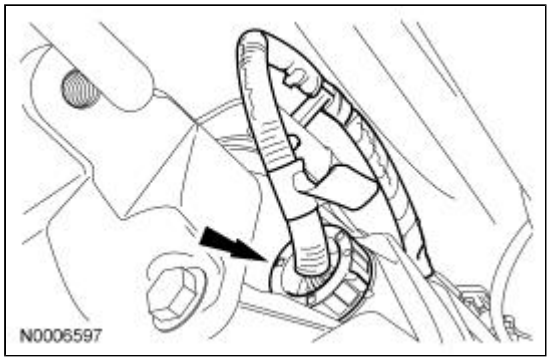
Removal

NOTE: If a new or the existing mechatronic assembly is installed, the transmission control module (TCM) will need to be reflashed to the latest level calibration available.

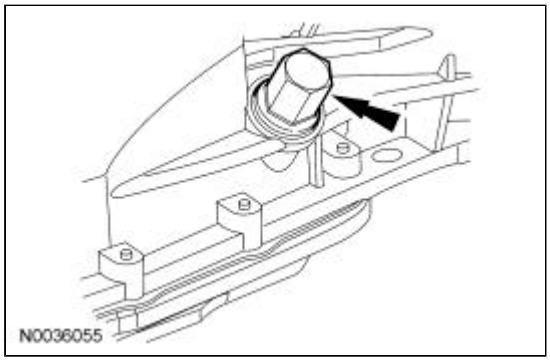
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

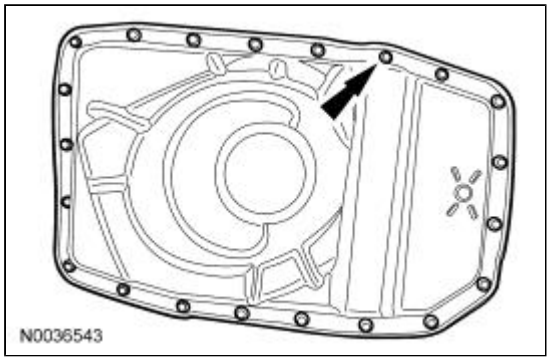
   Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.



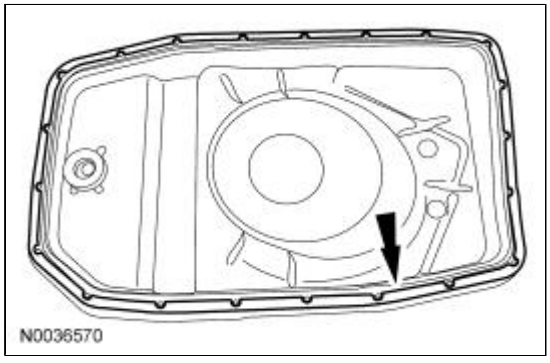
3. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.



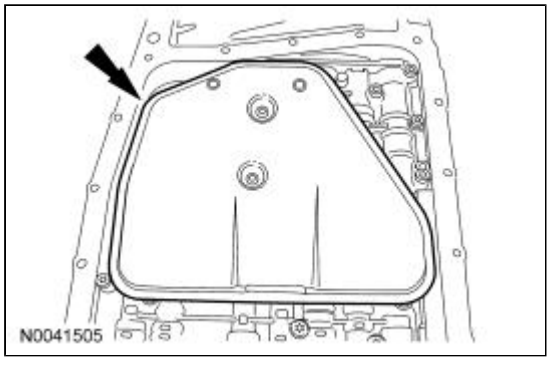
4. Remove the transmission fluid pan and allow the fluid to drain.



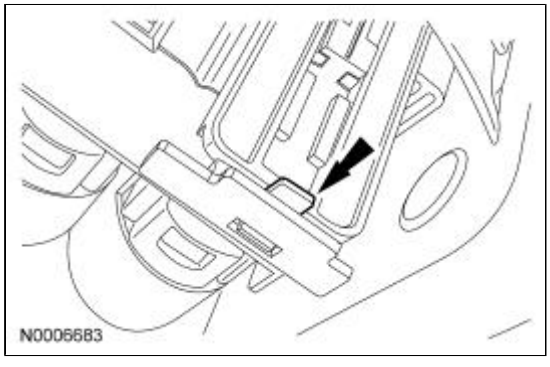
5. Remove the fluid pan gasket.



6. Remove and discard the transmission fluid filter.

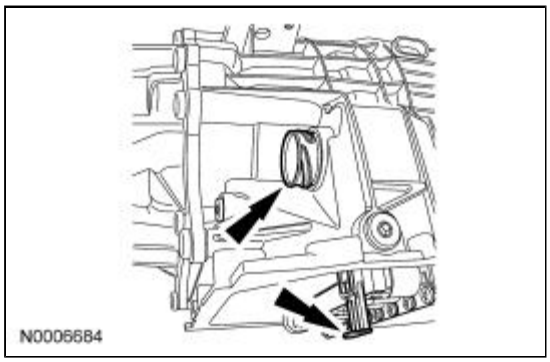


7. Pull the release tab and pull down on the bulkhead connector retainer.



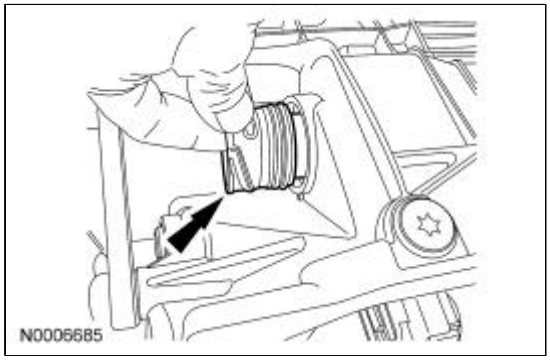
8. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

With the release tab down, pull the outer shell of the bulkhead electrical connector out of the TCM.

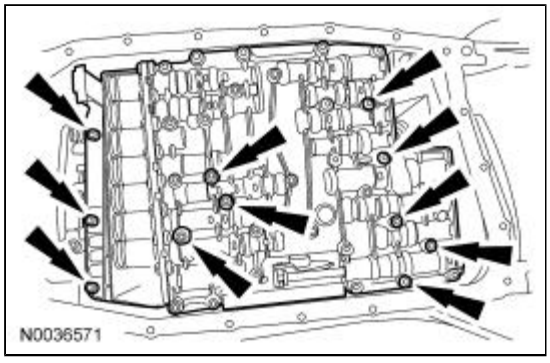


9. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

   Pull the bulkhead electrical connector out of the transmission.



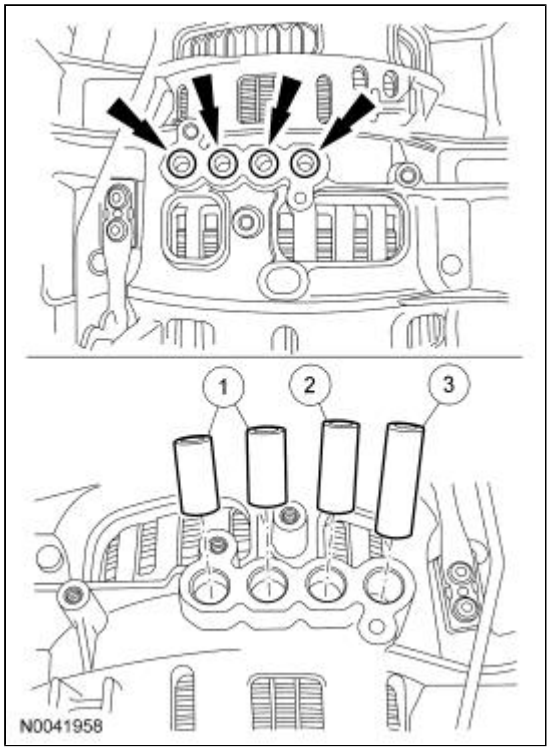
10. Remove the 11 bolts from the mechatronic assembly and remove the mechatronic assembly.



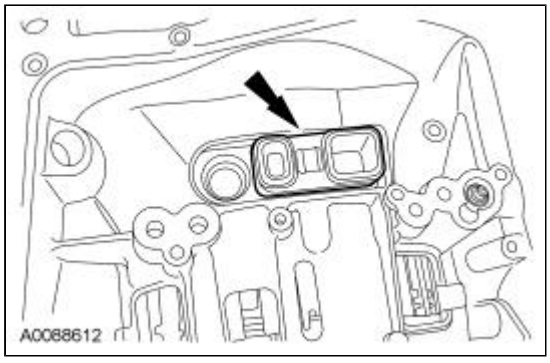
Installation

1. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

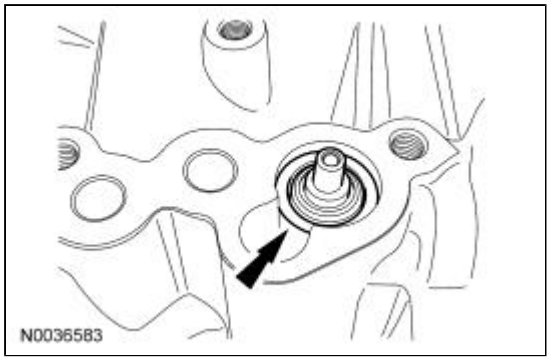
   Verify the 4 rubber feed tubes for the center support are in place.
   1. Black feed tube.
   2. Green feed tube.
   3. Blue feed tube.



2. Verify the rubber adapter is in place.



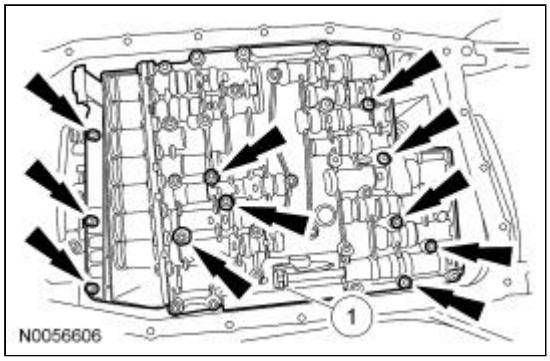
3. Verify the thermal bypass valve is in the case.



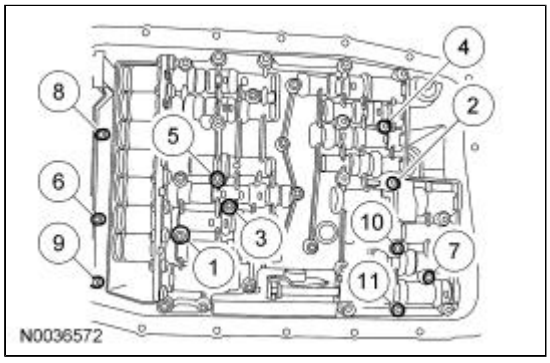
4. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

Position the mechatronic assembly in place and loosely install the 11 bolts.

1. Align the manual valve and control lever linkage.

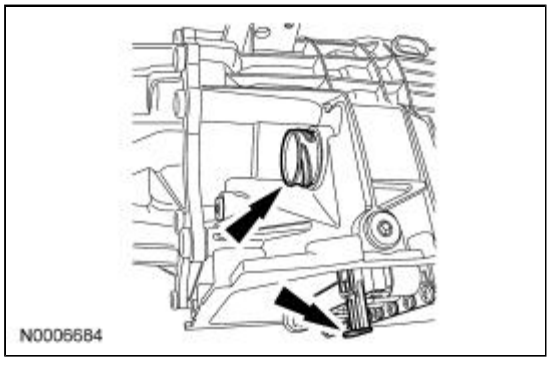


5. Tighten the mechatronic bolts in the sequence shown.
    - Tighten to 6 Nm (53 lb-in).

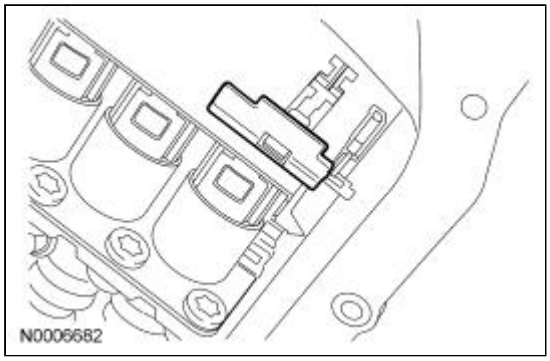


6. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

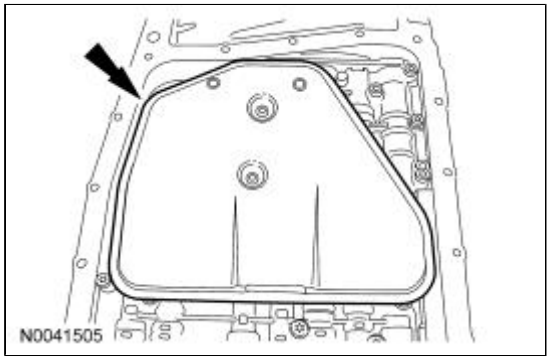
    With the release tab down and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure that the bulkhead connector is fully seated into the TCM.



7. Press up on the tab and lock the outer shell of the bulkhead electrical connector in place. Make sure that the locking tab is securely locked.

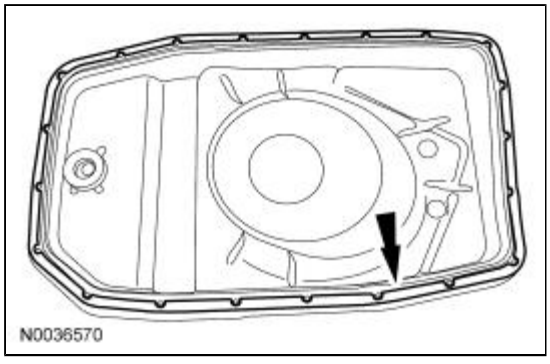


8. Install a new transmission fluid filter.

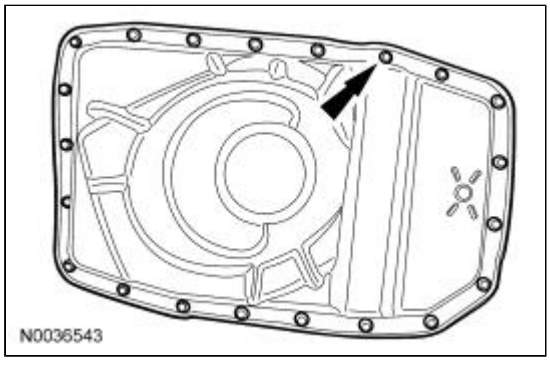


9. **NOTE:** The fluid pan gasket can be reused if not damaged.

   Install the transmission fluid pan gasket if required.

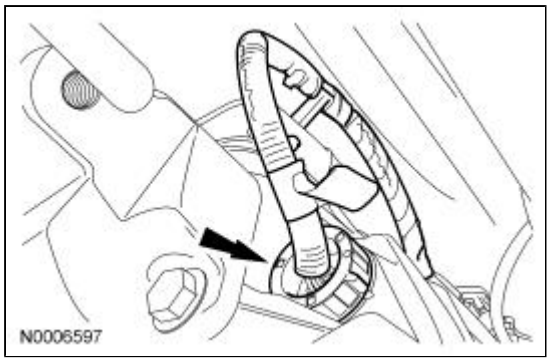


10. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 14 Nm (10 lb-ft).



11. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to

lock it in place.



12. Using the refill procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

13. If a new or the existing mechatronic assembly is installed, the TCM will need to be reflashed to the latest level calibration available.

Output Shaft Seal

Printable View (448 KB)

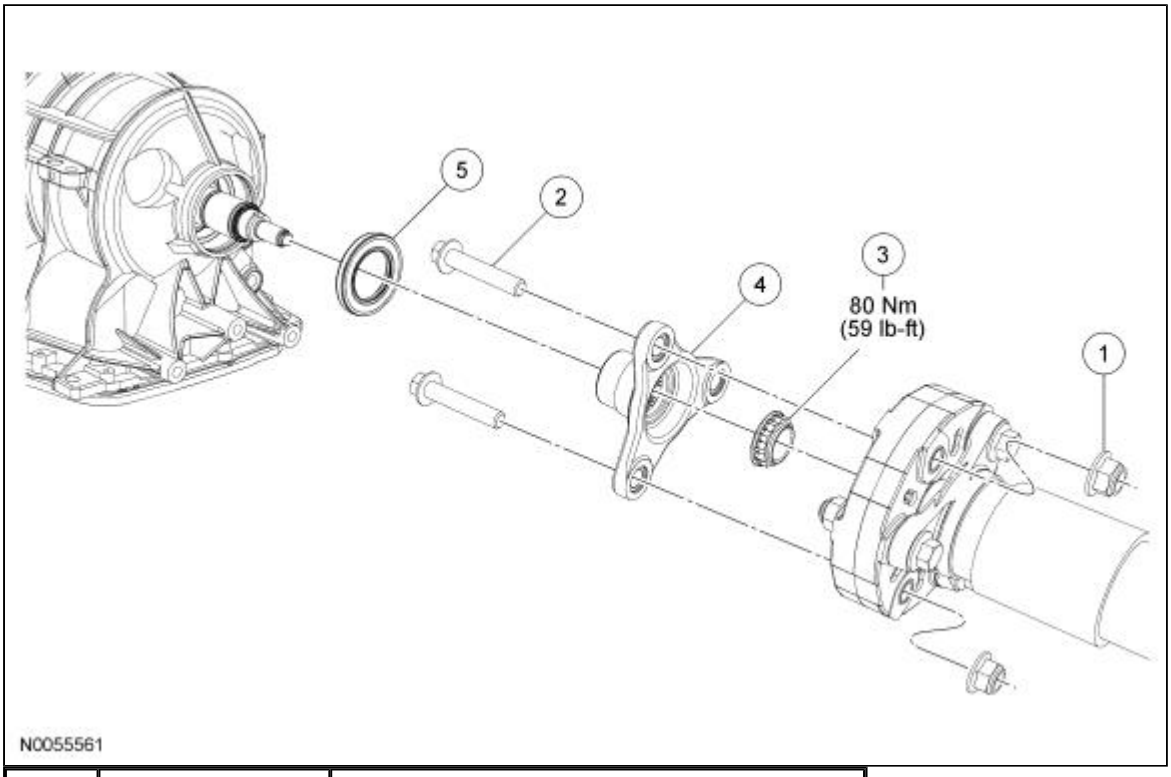
Special Tool(s)

ST2888-A	Installer, Transmission Extension Housing Fluid Seal 307-560
ST2887-A	Installer, Fluid Pump Seal 307-556
ST2381-A	Remover, Input Shaft Oil Seal 308-375
ST1187-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	—	Rear driveshaft nuts (3 required)
2	—	Rear driveshaft bolts (3 required)
3	7K440	Output shaft flange nut
4	7A021	Output shaft flange
5	7052	Output shaft seal

Removal

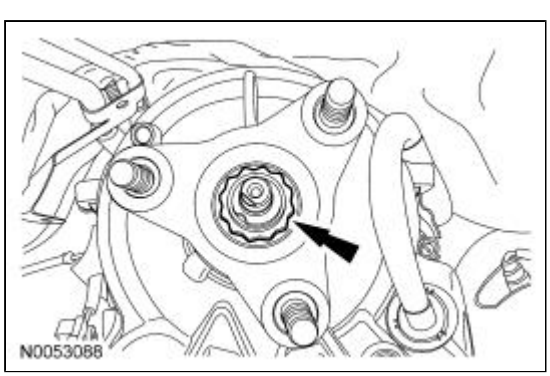
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

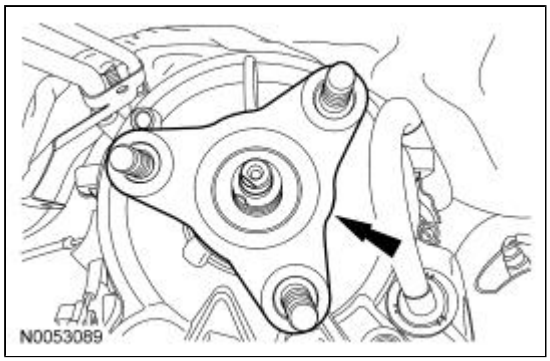
Rear wheel drive (RWD) vehicles

2. Remove the rear driveshaft. For additional information, refer to Section 205-01 .

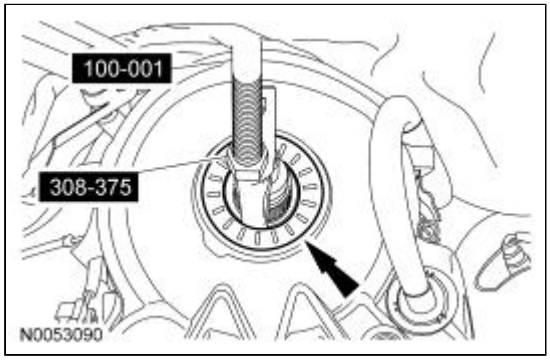
3. Remove and discard the output shaft flange nut.



4. Remove the output shaft flange.



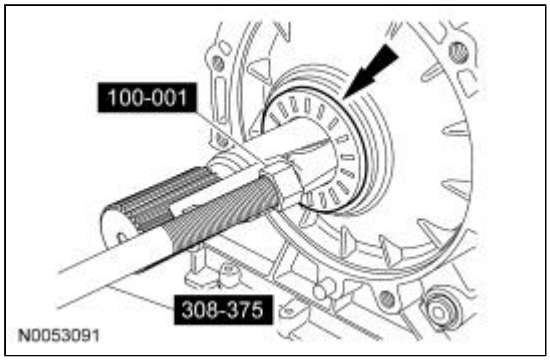
5. Using the special tools, remove the output shaft seal.



Four wheel drive (4WD) vehicles

6. Remove the transfer case. For additional information, refer to Section 308-07B .

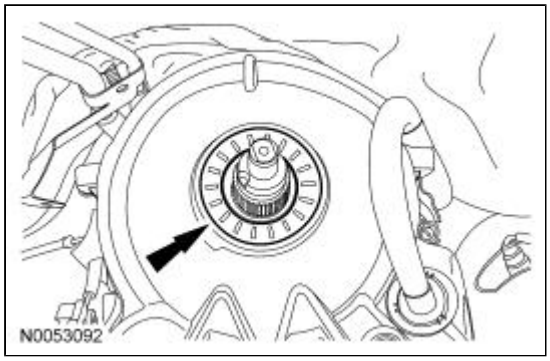
7. Using the special tools, remove the output shaft seal.



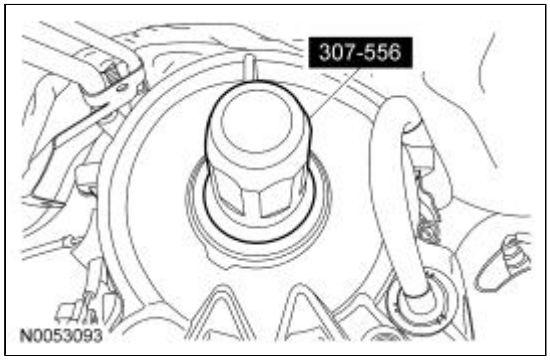
Installation

RWD vehicles

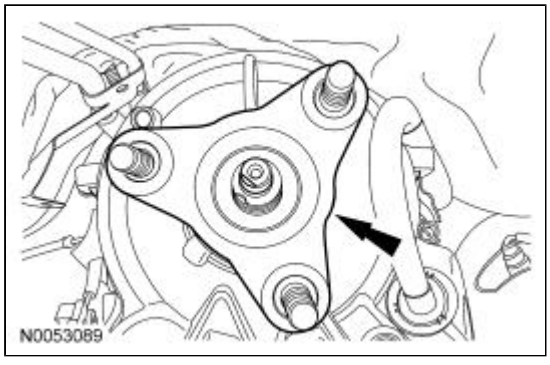
1. Position a new output shaft seal.



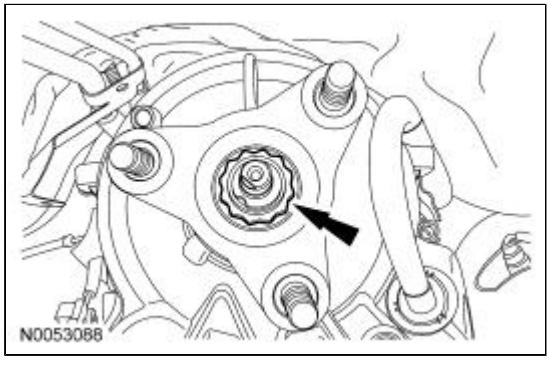
2. Using the special tool, install the output shaft seal.



3. Install the output shaft flange.



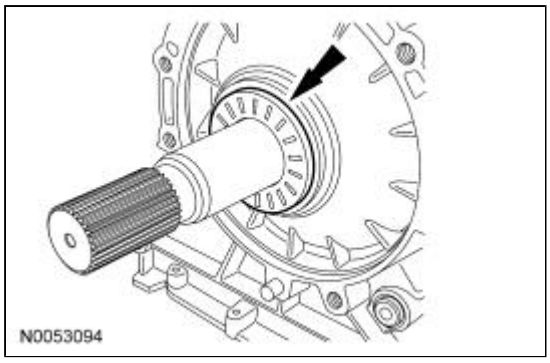
4. Install a new output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).



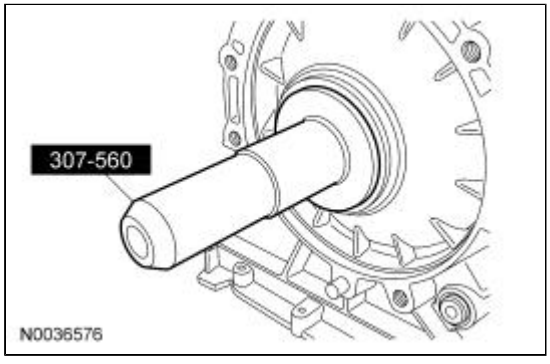
5. Install the rear driveshaft. For additional information, refer to Section 205-01 .

4WD vehicles

6. Position the output shaft seal.



7. Using the special tool, install a new output shaft seal.



8. Install the transfer case. For additional information, refer to Section 308-07B .

All vehicles

9. Fill and check the transmission fluid. For additional information, refer to Transmission Fluid Level Check in this section.

Manual Control Lever Shaft and Seal

Printable View (785 KB)

Special Tool(s)

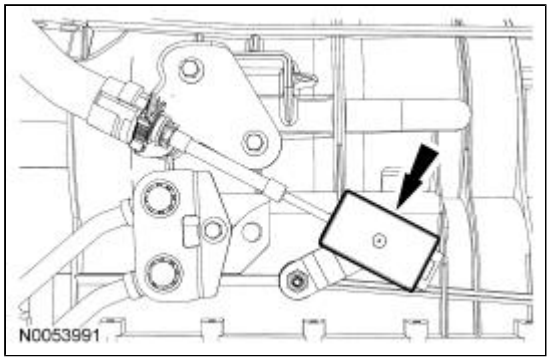
ST2890-A	Installer, Shift Shaft Fluid Seal 307-559

Material

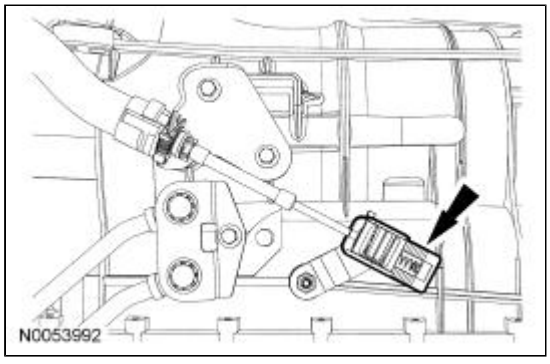
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Removal

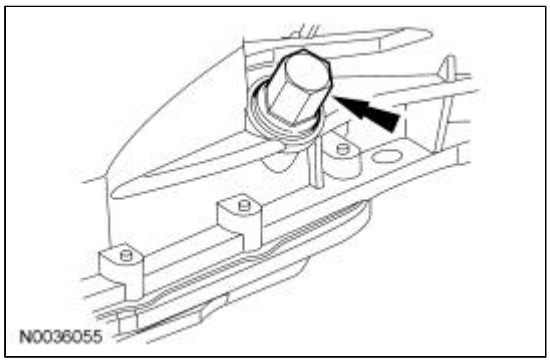
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If equipped, remove the heat shield.



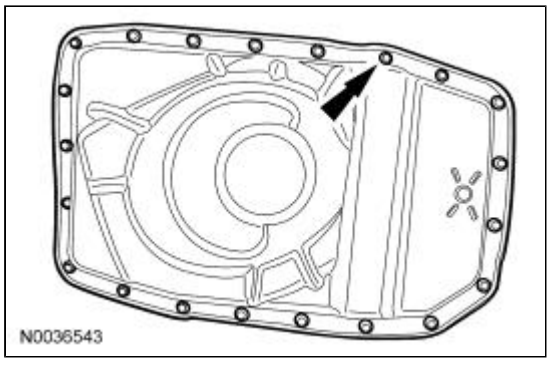
3. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.



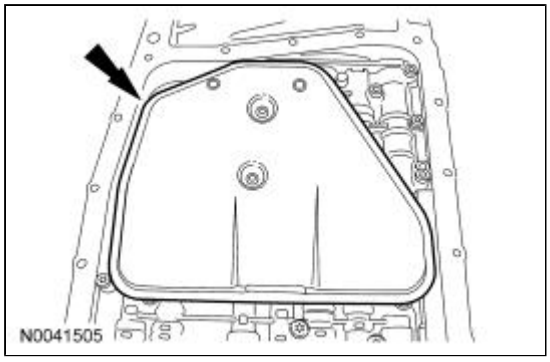
4. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.



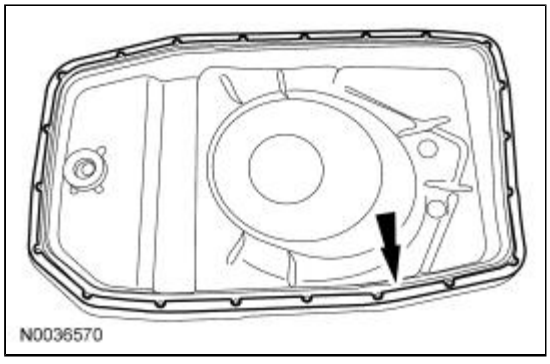
5. Remove the transmission fluid pan and allow the fluid to drain.



6. Remove and discard the transmission fluid filter.

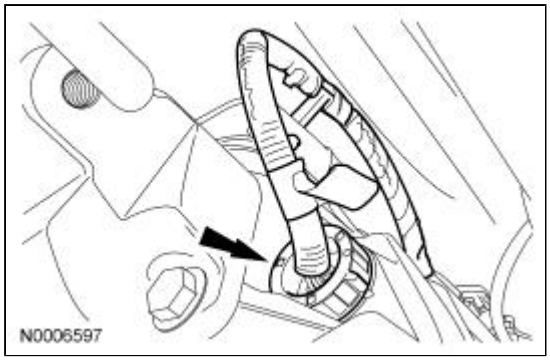


7. Remove the fluid pan gasket.

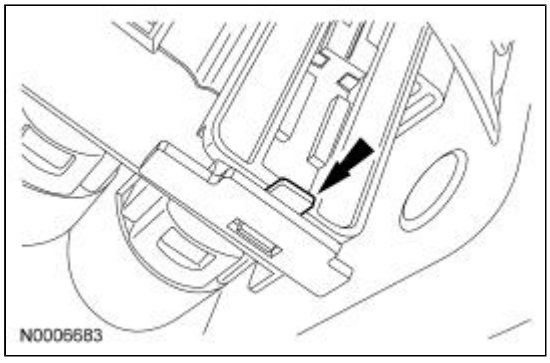


8. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

   Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.

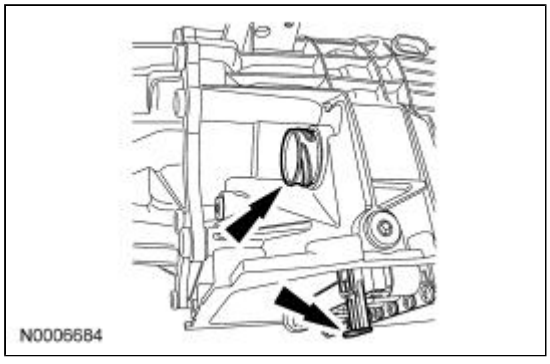


9. Pull the release tab and pull down on the bulkhead connector retainer.



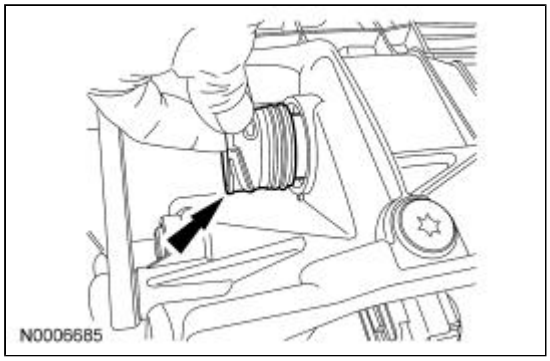
10. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

    With the release tab down, pull the outer shell of the bulkhead electrical connector out of the transmission control module (TCM).

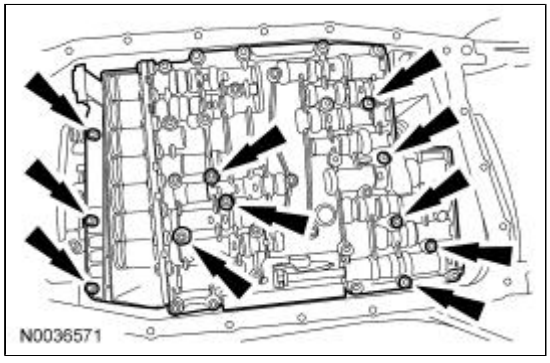


11. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

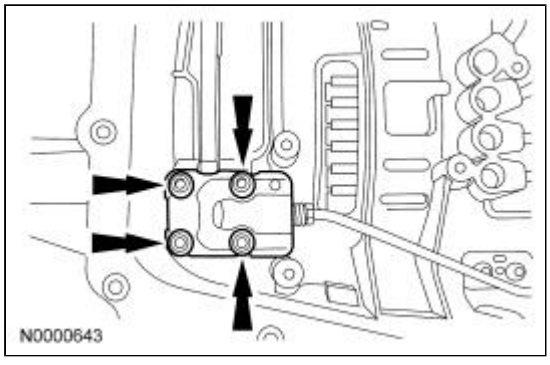
    Pull the bulkhead electrical connector out of the transmission.



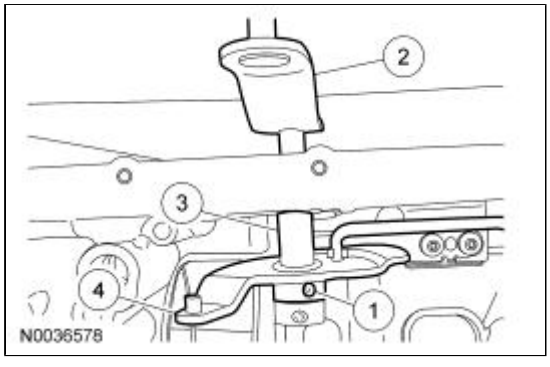
12. Remove the 11 bolts from the mechatronic assembly and remove the mechatronic assembly.



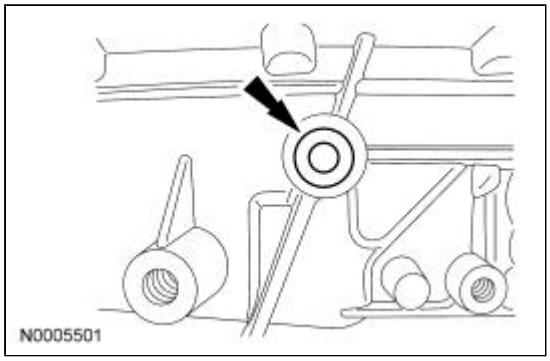
13. Remove the park rod actuating plate.



14. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the spacer to keep it from falling out of the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.

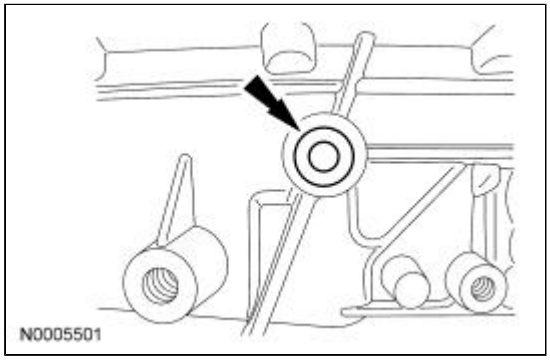


15. Remove and discard the manual control lever seal.

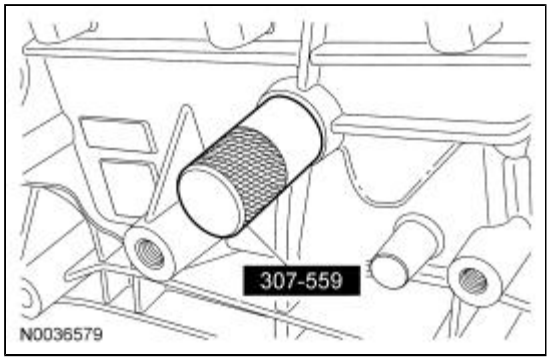


Installation

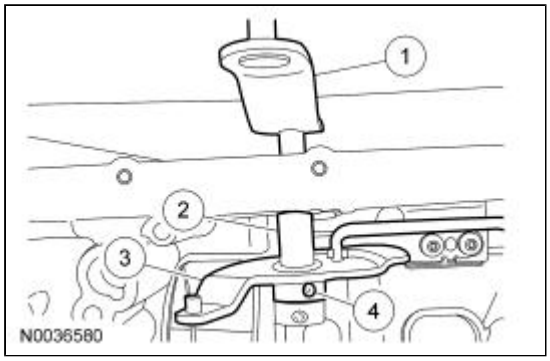
1. Position a new manual control lever seal in place.



2. Using the special tool, install a new manual control lever shaft seal.

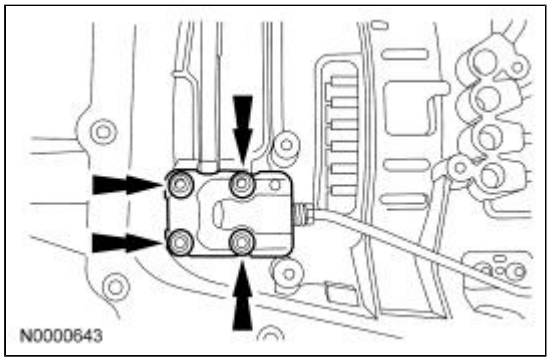


3. Install the manual lever in the case.
    1. Slide the manual lever in the case.
    2. Position the spacer in place while sliding the manual lever into the spacer.
    3. Position the manual valve inner lever while sliding the manual lever and lining up the roll pin hole.
    4. Install the roll pin.



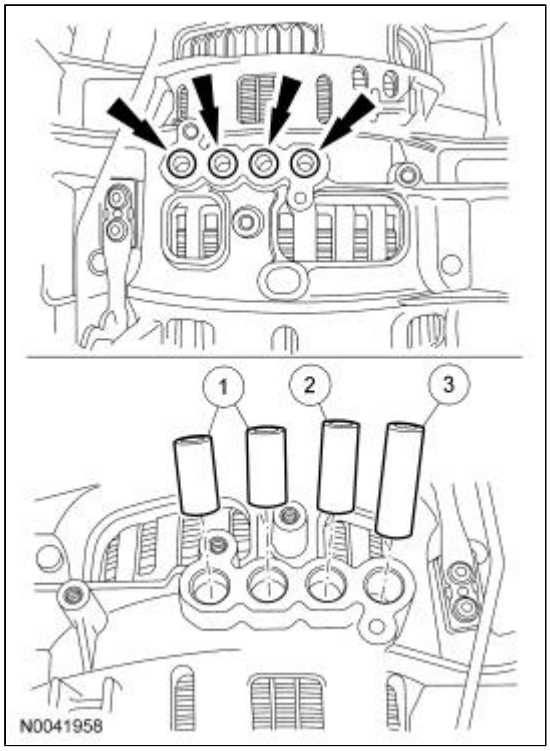
4. Position the park rod in place. Push down on the park pawl and position the park rod in place.

5. While holding the park rod down, install the park rod actuating plate.
   - Tighten to 10 Nm (89 lb-in).

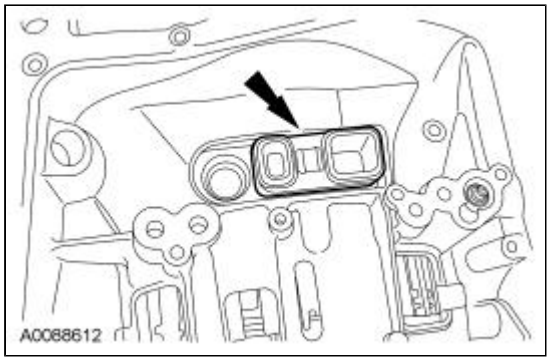


6. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

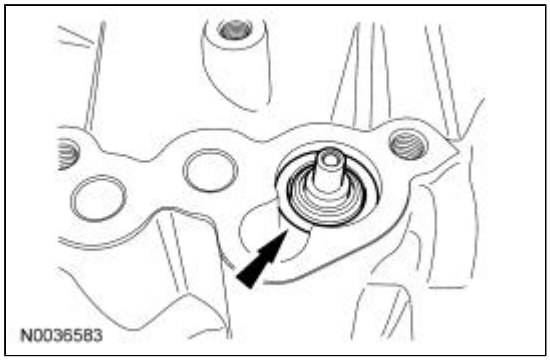
   Verify the 4 rubber feed tubes for the center support are in place.
   1. Black feed tube.
   2. Green feed tube.
   3. Blue feed tube.



7. Verify the rubber adapter is in place.



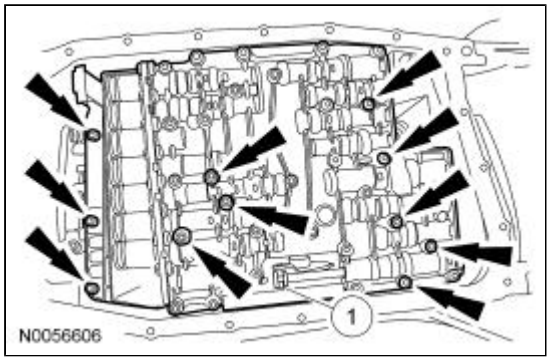
8. Verify the thermal bypass valve is in the case.



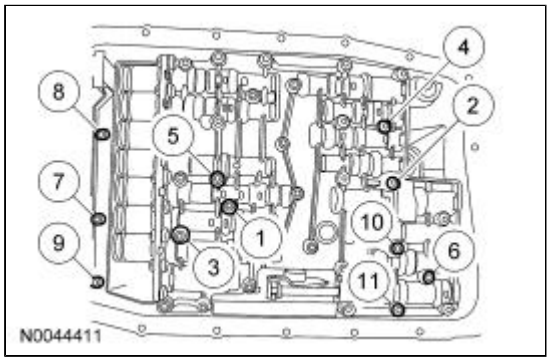
9. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

Position the mechatronic assembly in place and loosely install the 11 bolts.

1. Align the manual valve and control lever linkage.

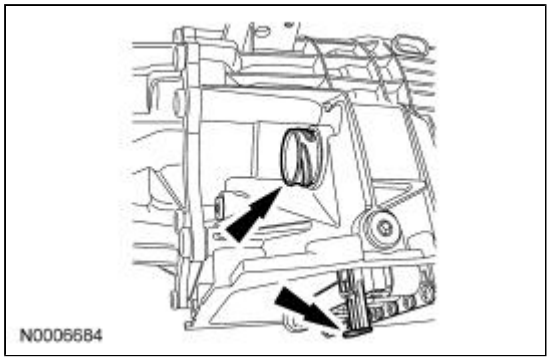


10. Tighten the mechatronic bolts in the sequence shown.
    - Tighten to 6 Nm (53 lb-in).

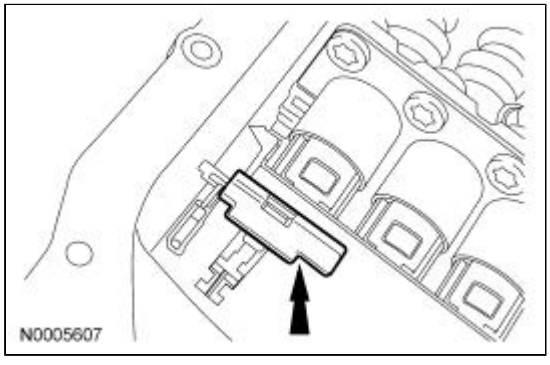


11. **CAUTION: Do not touch the electrical connector pins. Electrostatic discharge may occur and will cause damage to the mechatronic unit.**

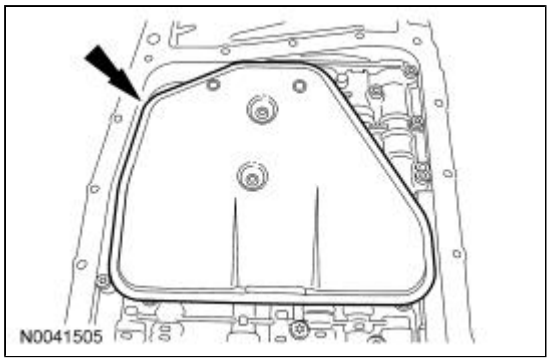
    With the release tab down and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure that the bulkhead connector is fully seated into the TCM.



12. Press up on the tab and lock the outer shell of the bulkhead electrical connector in place.

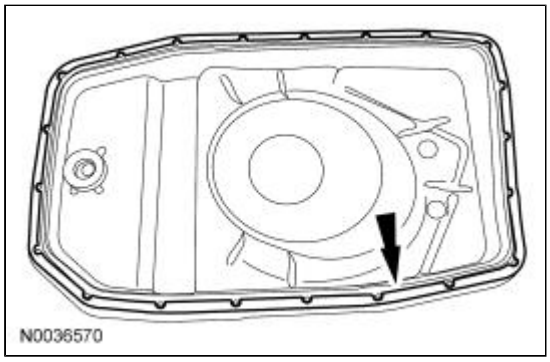


13. Install a new transmission fluid filter.

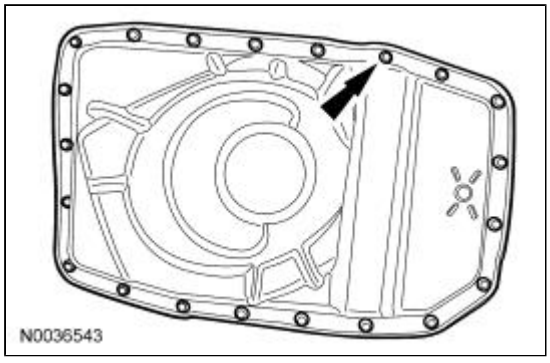


14. **NOTE:** The fluid pan gasket can be reused if not damaged.

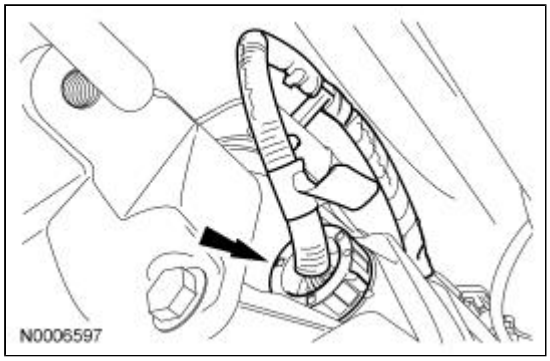
    Install the transmission fluid pan gasket if necessary.



15. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 14 Nm (10 lb-ft).

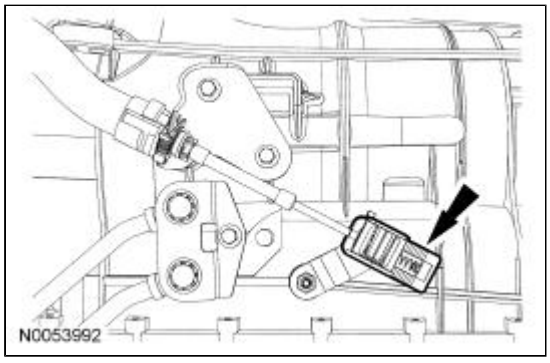


16. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.

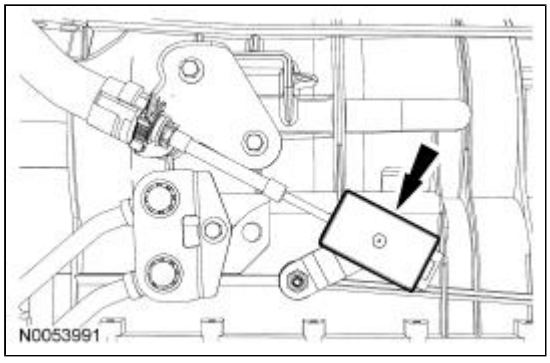


17. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

    Connect the selector lever cable onto the ball stud and move the locking tab down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.



18. If equipped, install the heat shield.



19. Using the refill procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission — Four Wheel Drive (4WD)

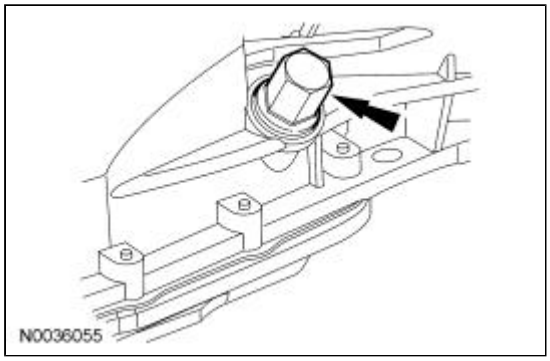
Printable View (678 KB)

Special Tool(s)

ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

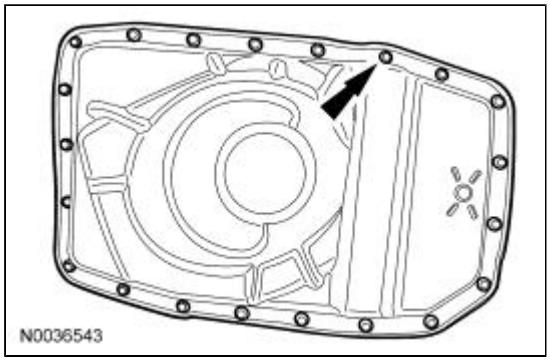
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.

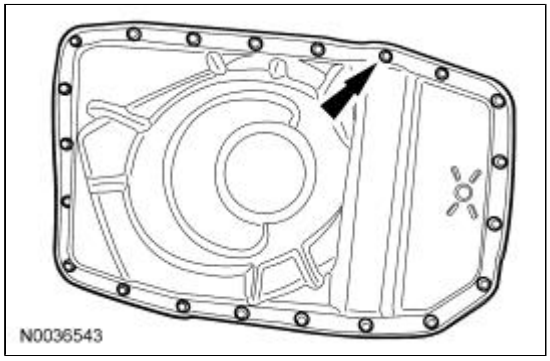


4. **NOTE:** If transmission disassembly or installation of a new transmission is necessary, the transmission fluid will need to be drained.

   Remove the transmission fluid pan and allow the fluid to drain.

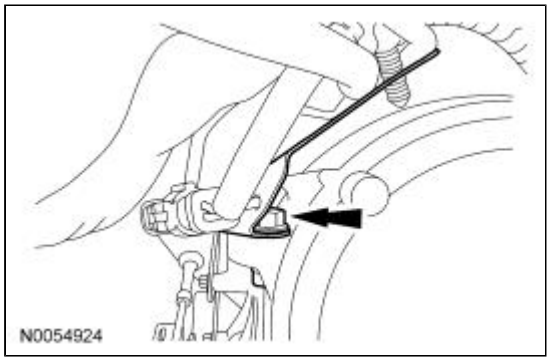


5. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 14 Nm (10 lb-ft).

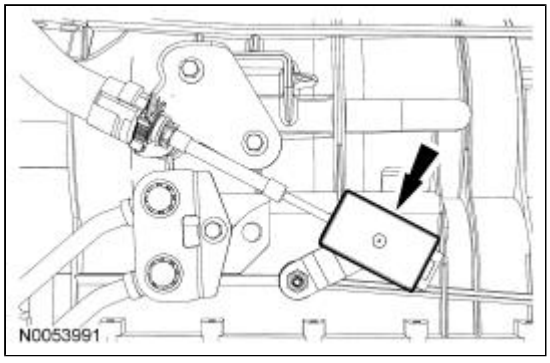


6. Remove the transfer case. For additional information, refer to Section 308-07B .

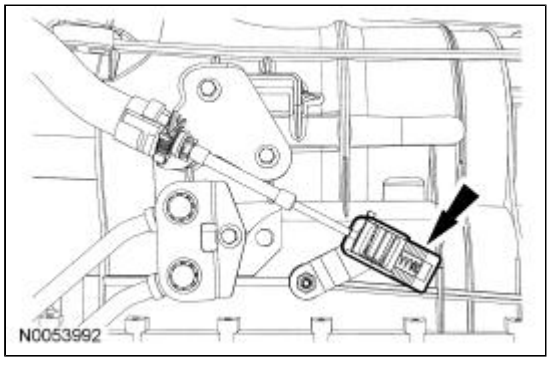
7. Remove the fuel line bracket bolt and position the bracket and lines aside.



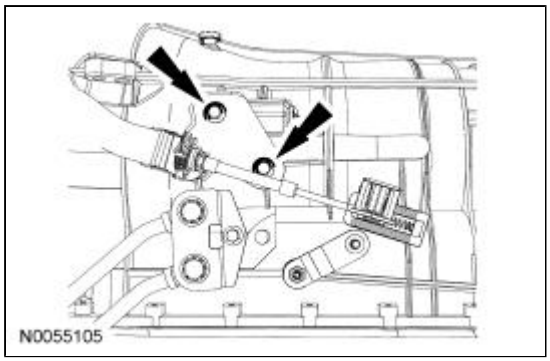
8. If equipped, remove the heat shield.



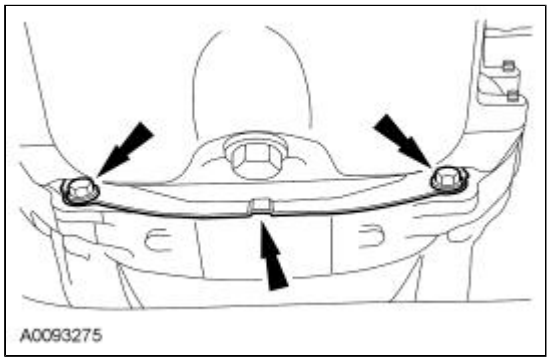
9. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.



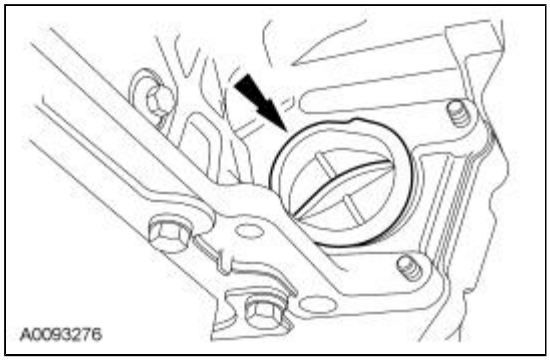
10. Remove the selector lever bracket bolts and remove the bracket.



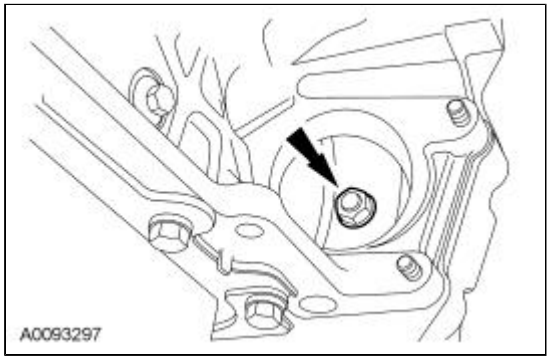
11. Remove the flexplate inspection cover bolts and the inspection cover.



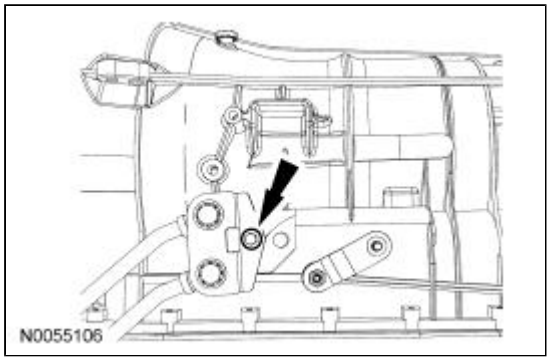
12. Remove the rubber torque converter nut access plug.



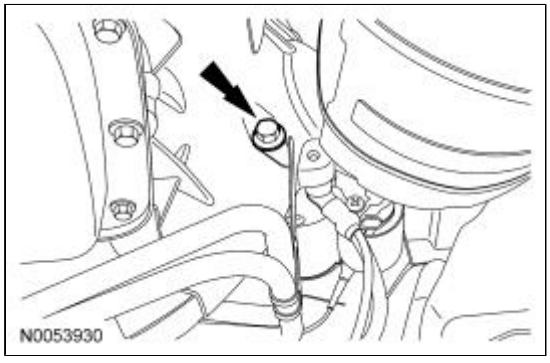
13. Remove and discard the 4 flexplate-to-torque converter nuts.



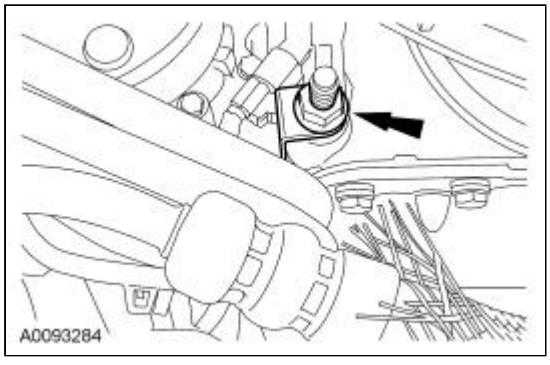
14. Remove the transmission cooler tube bracket bolt.



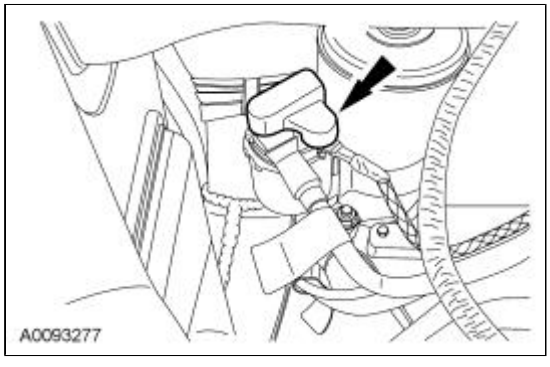
15. Remove the transmission case bolt.



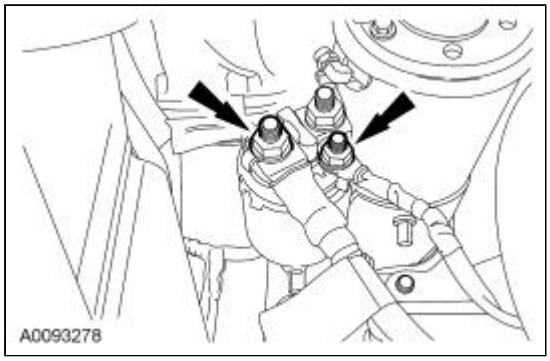
16. Remove the transmission fluid cooler tube bracket nut and position the bracket and tubes aside.



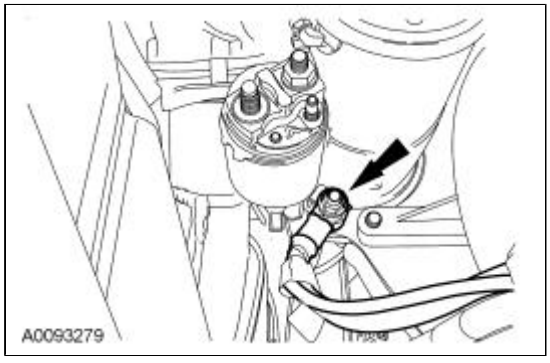
17. Remove the plastic starter motor electrical connector cap.



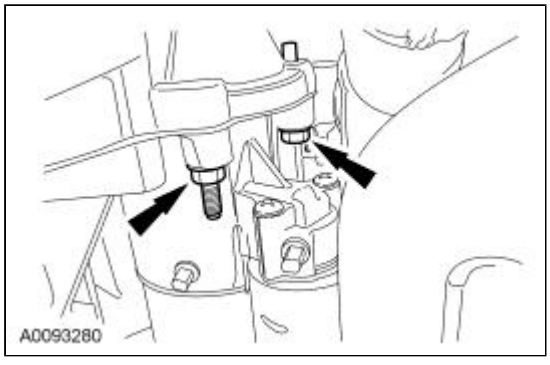
18. Remove the starter motor electrical connectors.



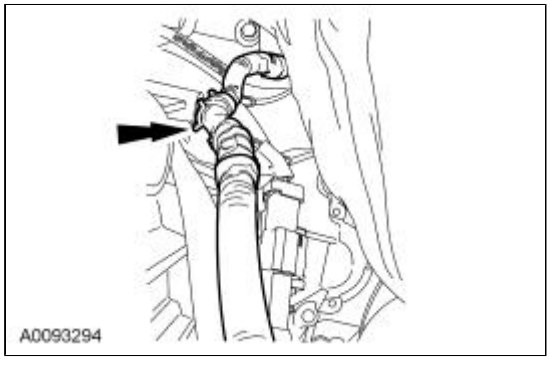
19. Remove the ground wire from the stud.



20. Remove the 3 starter motor bolts and the starter motor.



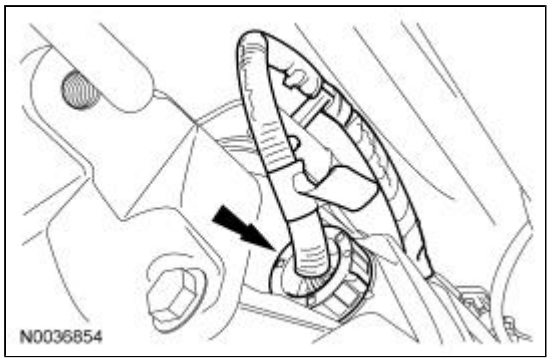
21. Disconnect the wiring harness from the top of the transmission.



22. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

    Disconnect the main transmission electrical harness by twisting the outer shell and pulling back

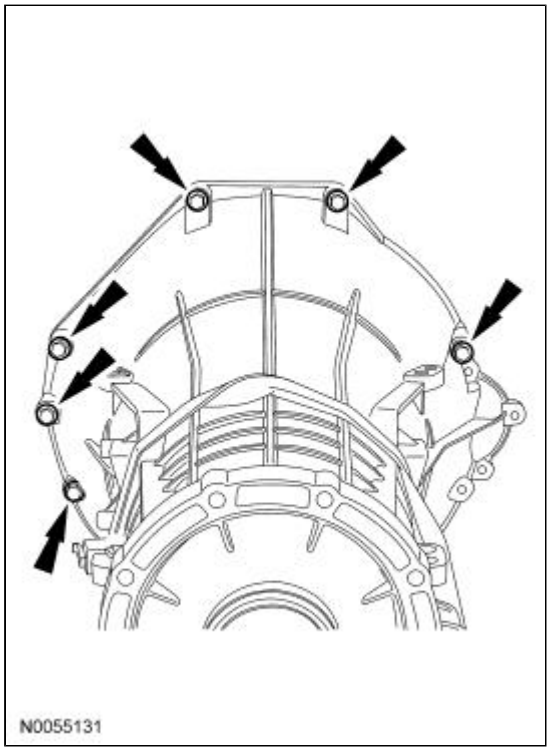
on the connector.



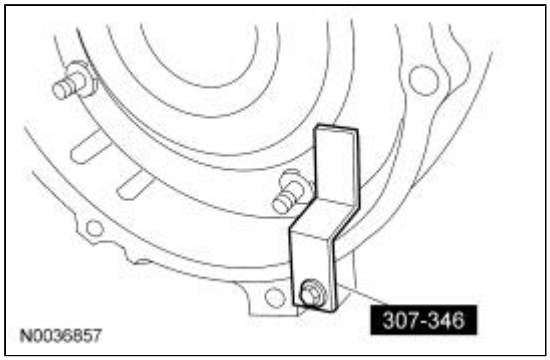
23. **NOTE:** The top 2 transmission case bolts need to be removed prior to removing the rest of the bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission case bolts.



24. Slide the transmission back enough to install the special tool.



25. Remove the transmission from the vehicle.

26. If the transmission is to be overhauled or if installing a new transmission, carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Transmission — Rear Wheel Drive (RWD)

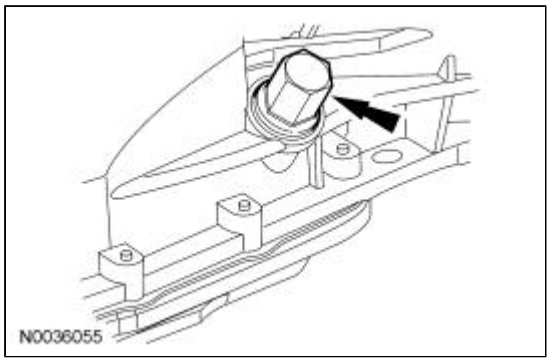
Printable View (959 KB)

Special Tool(s)

ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

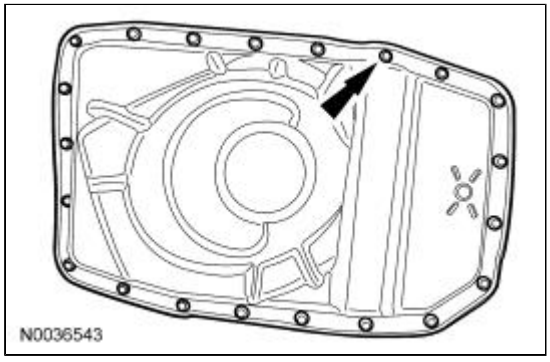
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the driveshaft. For additional information, refer to Section 205-01 .
3. Remove the fluid fill plug fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the fluid pan to be easily removed when the bolts are removed.



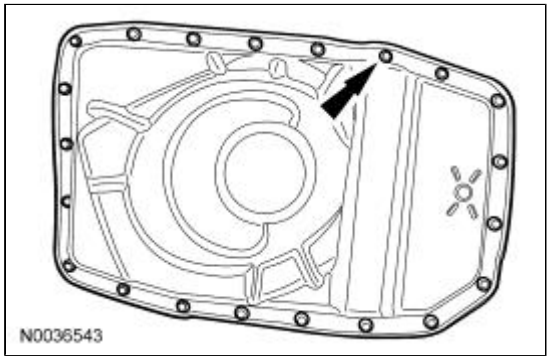
4. **NOTE:** If transmission disassembly or installation of a new transmission is necessary, the transmission fluid will need to be drained.

   Remove the transmission fluid pan and allow the fluid to drain.

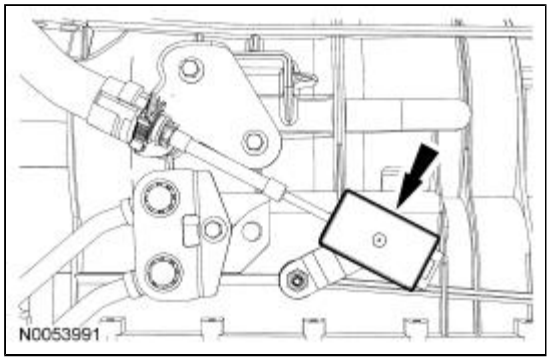


5. Install the fluid pan and tighten the bolts in a crisscross pattern.

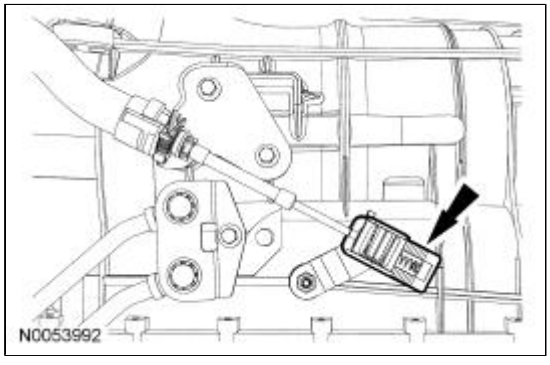
- Tighten to 14 Nm (10 lb-ft).



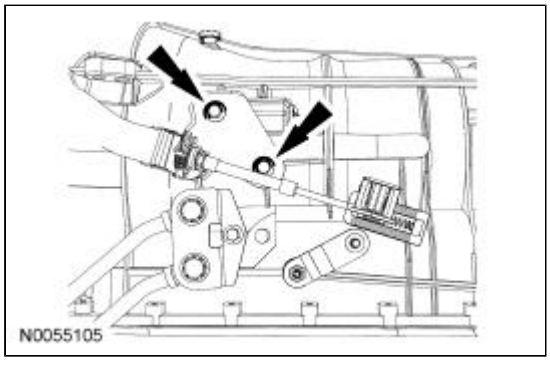
6. If equipped, remove the heat shield.



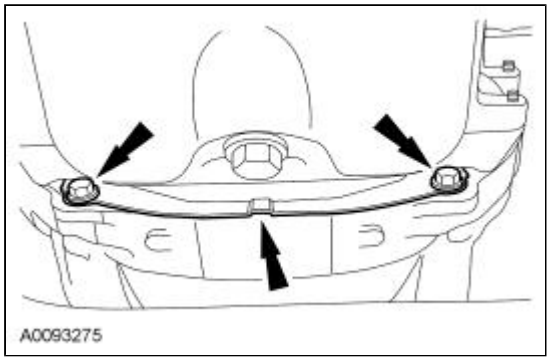
7. Move the locking tab up and disconnect the selector lever cable from the manual lever ball stud.



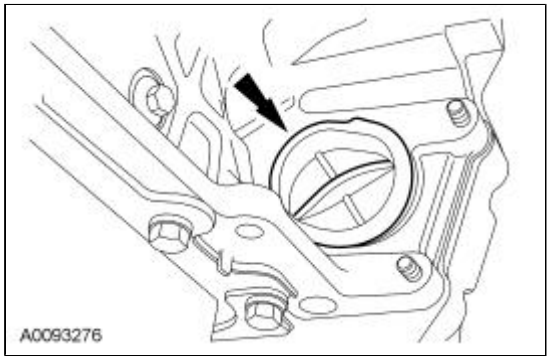
8. Remove the selector lever bracket bolts and remove the bracket.



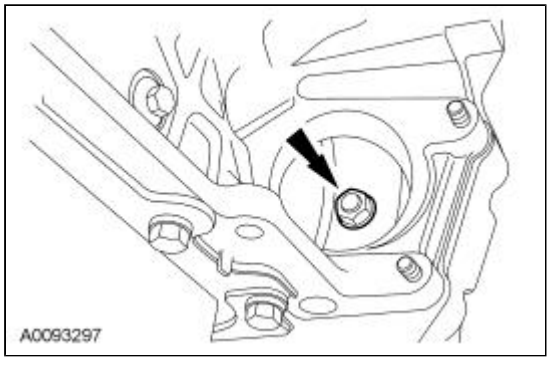
9. Remove the flexplate inspection cover bolts and the inspection cover.



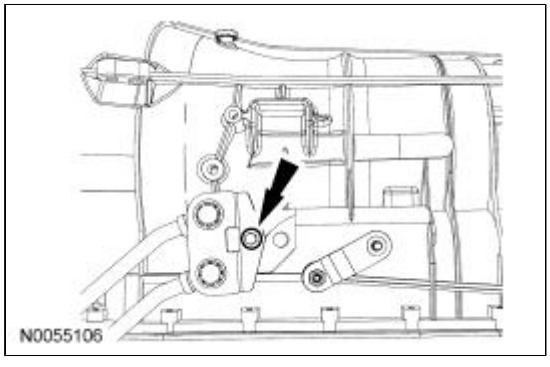
10. Remove the rubber torque converter nut access plug.



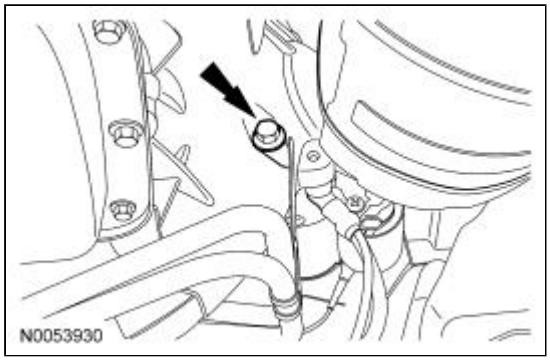
11. Remove and discard the 4 flexplate-to-torque converter nuts.



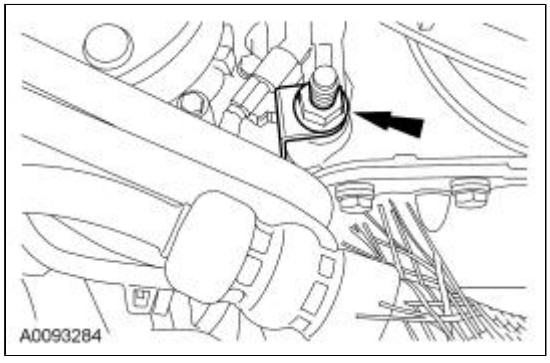
12. Remove the transmission cooler tube bracket bolt.



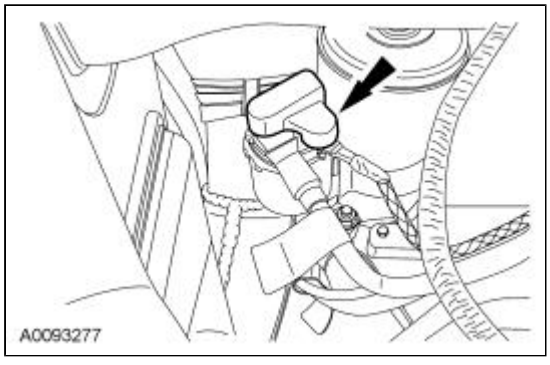
13. Remove the transmission case bolt.



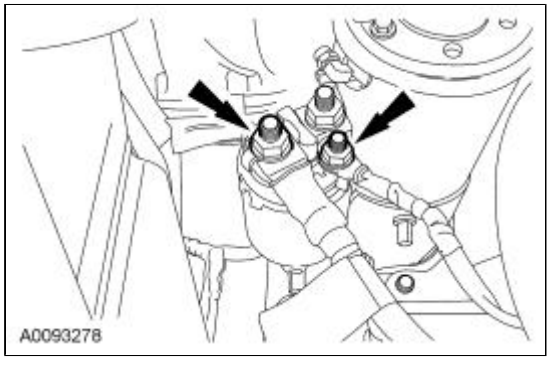
14. Remove the transmission fluid cooler tube bracket nut and position the bracket and tubes aside.



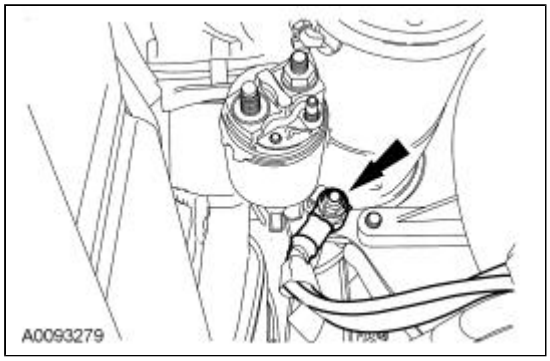
15. Remove the plastic starter motor electrical connector cap.



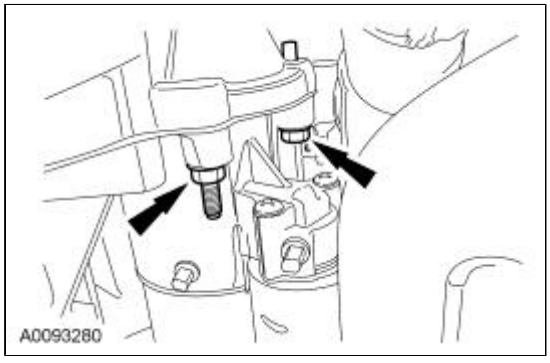
16. Remove the starter motor electrical connectors.



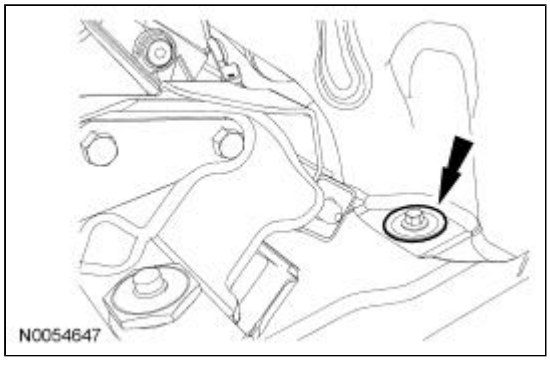
17. Remove the ground wire from the stud.



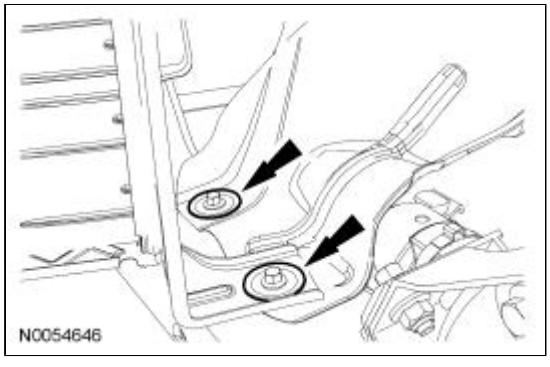
18. Remove the starter motor bolts and the starter motor.



19. Remove the RH exhaust heat shield bolt.

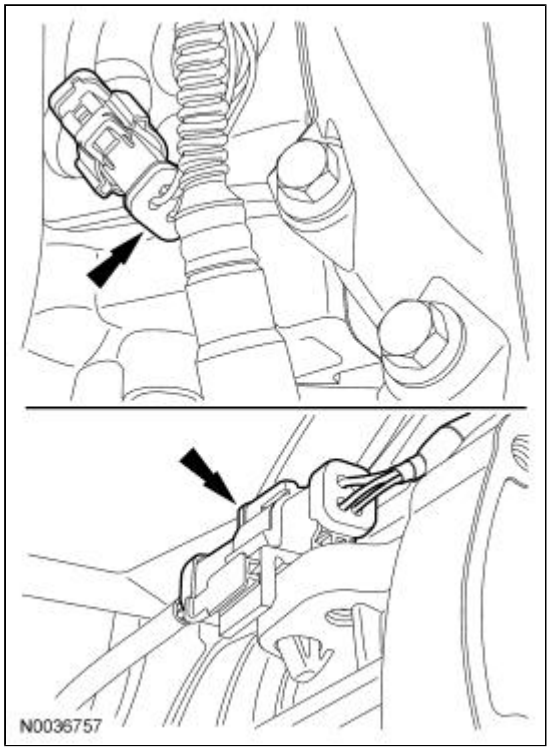


20. Remove the LH exhaust heat shield and evaporative emissions canister assembly bolts.

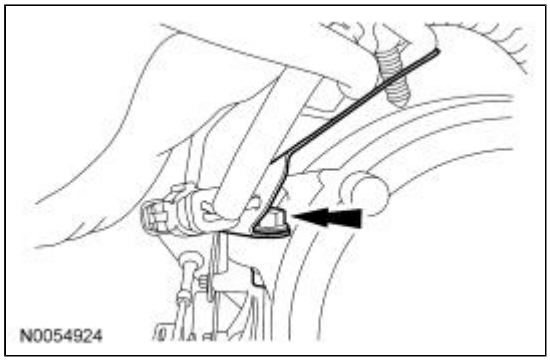


21. **NOTE:** LH shown, RH similar.

    Disconnect the RH and LH heated oxygen sensors (HO2S) and the catalyst monitor sensor (CMS) electrical connectors.



22. Remove the fuel line bracket bolt and position the bracket and lines aside.

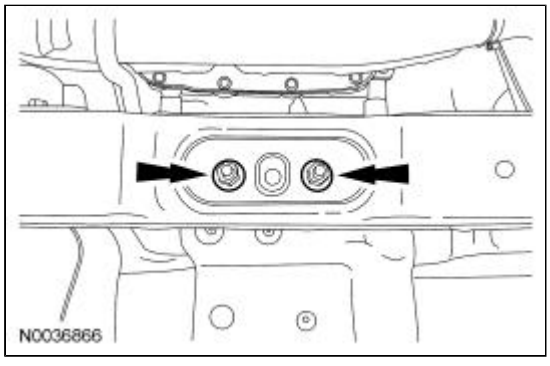


23. **NOTE:** Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

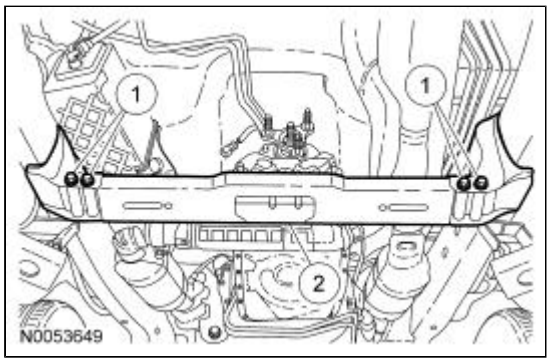
    NOTE: Make sure that the transmission is securely fastened to the transmission jack.

    Position a suitable high-lift transmission jack under the transmission.

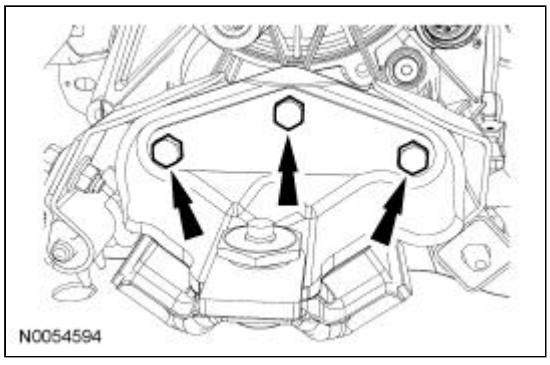
24. Remove the 2 rear crossmember nuts.



25. Remove the rear crossmember.
    1. Remove the 4 crossmember bolts and nuts.
    2. Remove the crossmember.

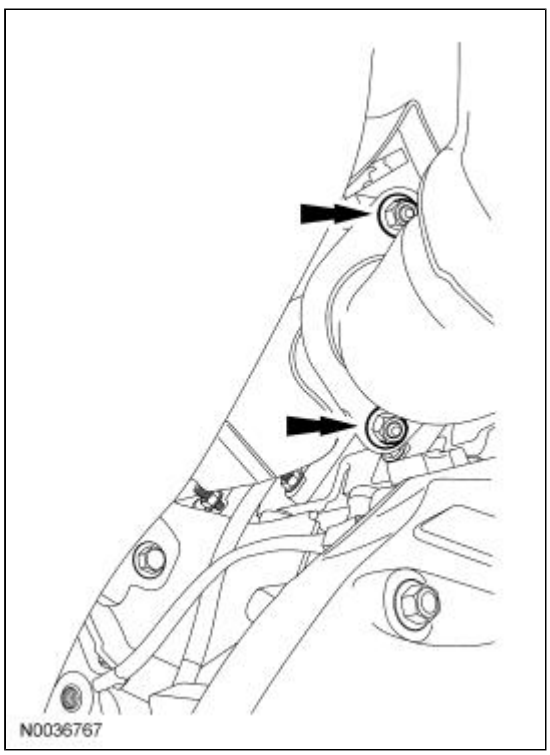


26. Remove the 3 bolts and remove the insulator.

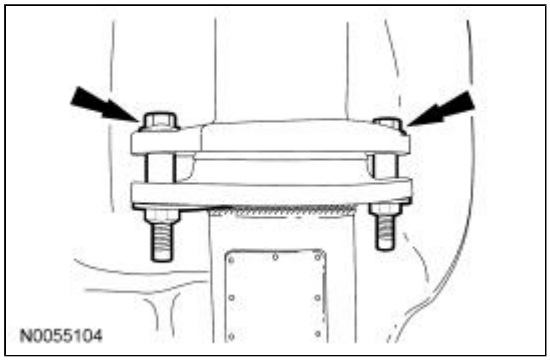


27. **NOTE:** LH shown, RH similar.

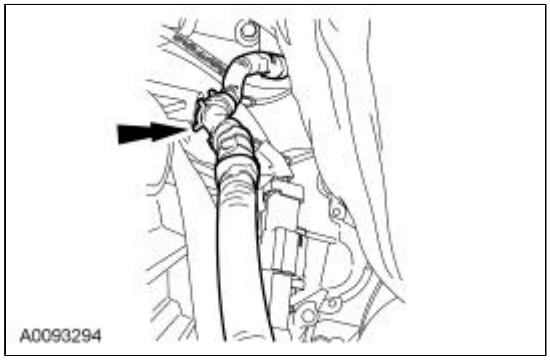
    Remove the RH and LH exhaust flange nuts.



28. Remove the 2 dual converter Y-pipe bolts and the dual converter Y-pipe.

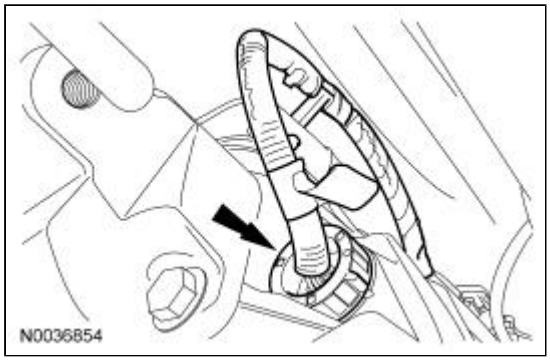


29. Disconnect the wire harness from the top of the transmission.



30. **CAUTION: Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

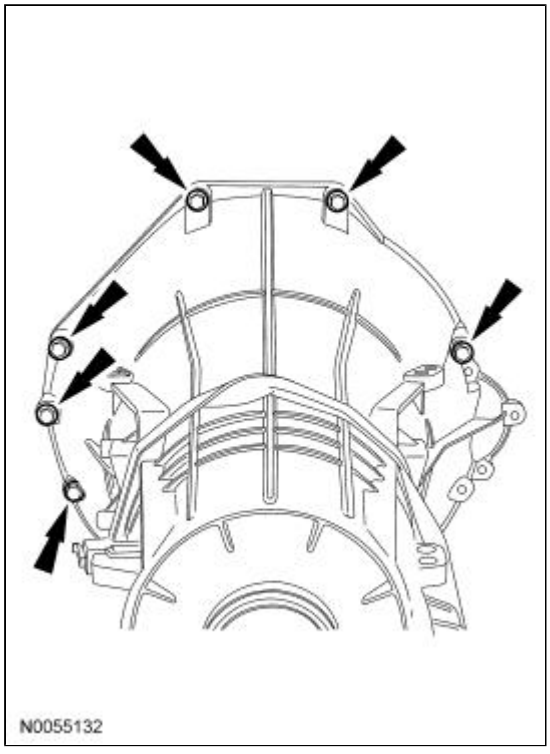
    Disconnect the main transmission electrical harness by twisting the outer shell and pulling back on the connector.



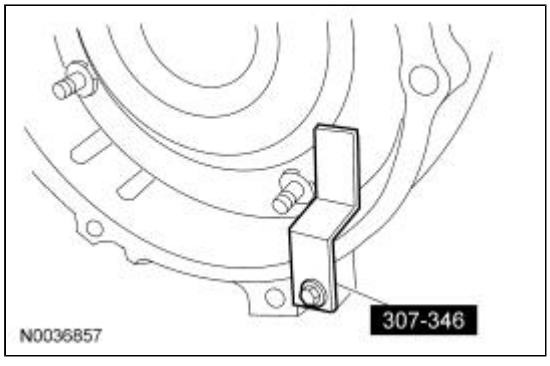
31. **NOTE:** The top 2 transmission-to-engine bolts need to be removed prior to removing the rest of the bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission case bolts.



32. Slide the transmission back far enough to install the special tool.



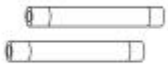
33. Remove the transmission from the vehicle.

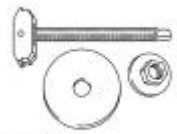
34. If the transmission is to be overhauled or if installing a new transmission, carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Transmission

Printable View (1635 KB)

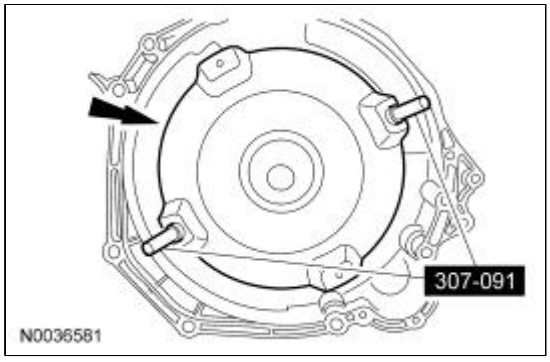
Special Tool(s)

ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
ST2381-A	Remover, Input Shaft Oil Seal 308-375
ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)
ST1608-A	Collet, 1 1/4 to 1 1/24 Inch 303-D022 (D80L-100T) or equivalent
ST1606-A	Actuator Pin 303-D012 (D80L-100-H) or equivalent
ST2891-A	Remover, Front Pump 307-553
	Remover, Needle Bearing 307-562 (includes 307-562/1

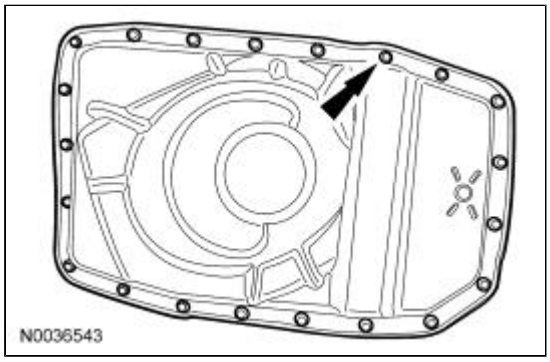
 ST2932-A	and 307-562/2)

All vehicles

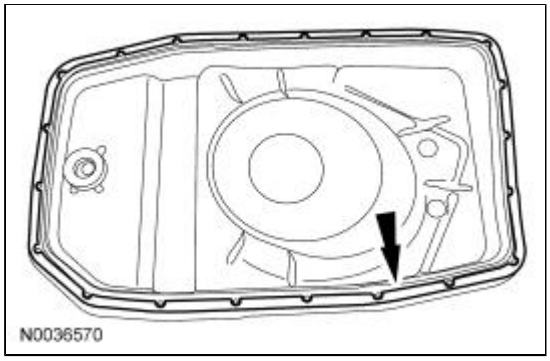
1. Using the special tools, remove the torque converter.



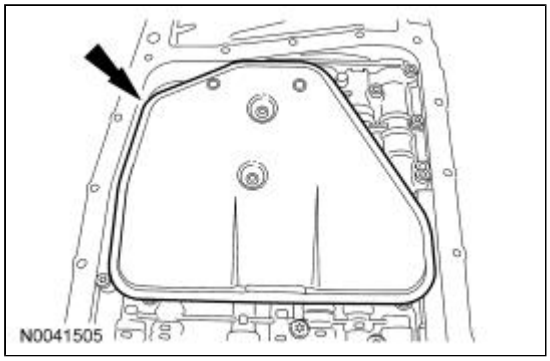
2. Remove the transmission fluid pan.



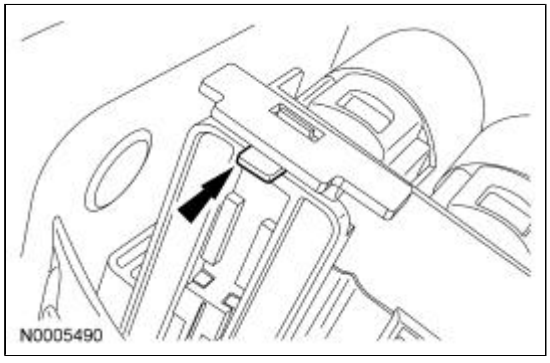
3. Remove the fluid pan gasket.



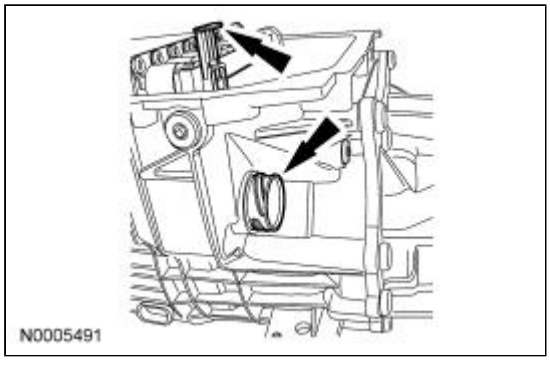
4. Remove and discard the transmission fluid filter.



5. Press the release tab and lift up on the bulkhead connector retainer.

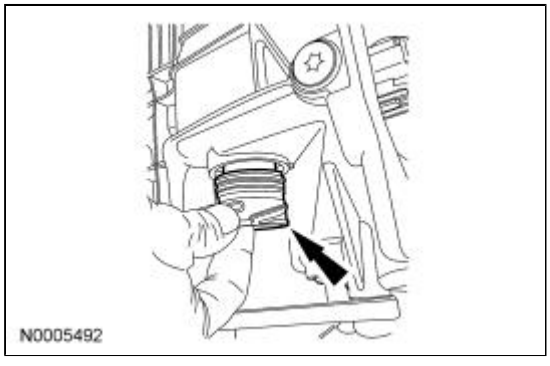


6. With the release tab up, pull the outer shell of the bulkhead electrical connector.

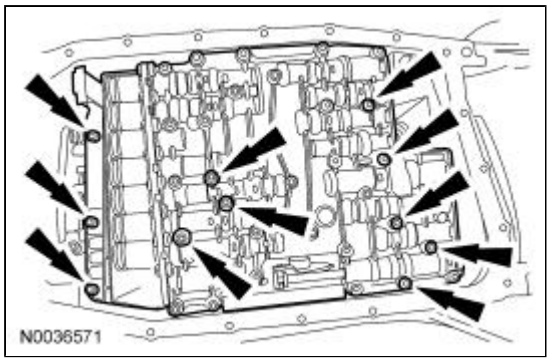


7. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

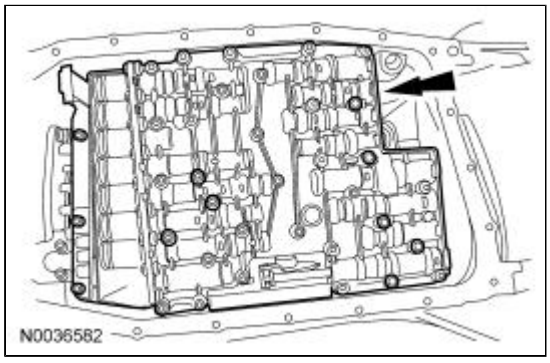
   Pull the outer shell of the bulkhead electrical connector out of the transmission.



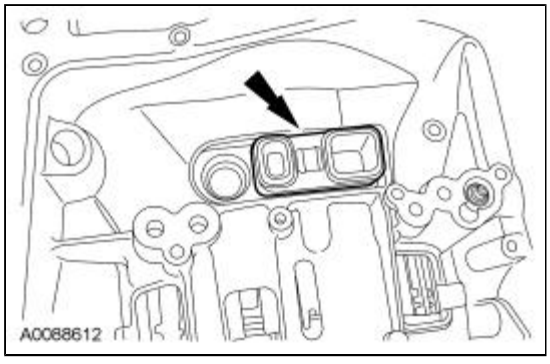
8. Remove the 11 bolts from the mechatronic assembly.



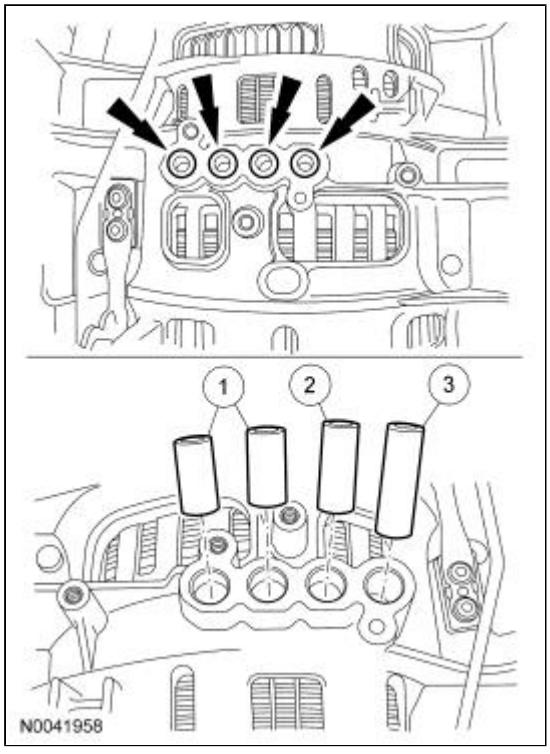
9. Remove the mechatronic assembly.



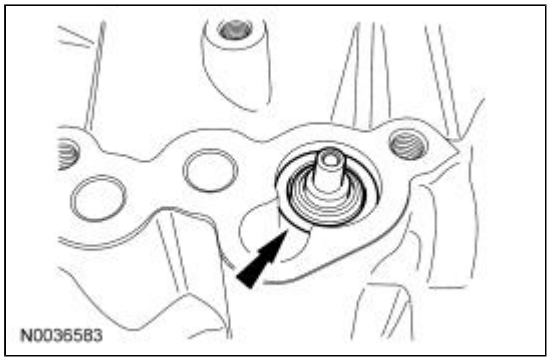
10. Remove the rubber adapter and the fluid filter seal.



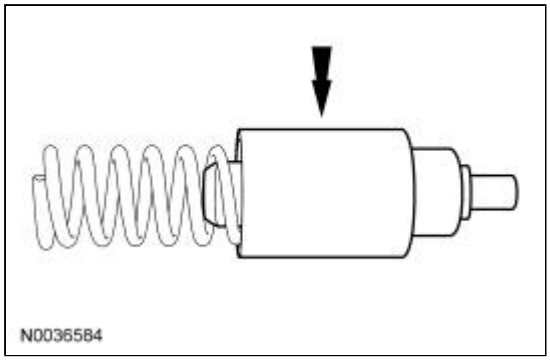
11. Remove and discard the 4 rubber feed tubes for the center support. Note the size and location while removing for correct installation.
    1. Black feed tubes.
    2. Green feed tube.
    3. Blue feed tube.



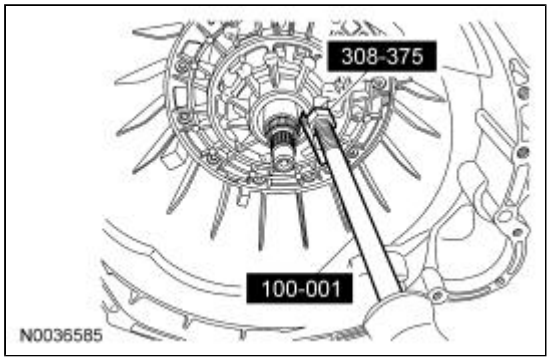
12. Remove the thermal bypass valve from the case.



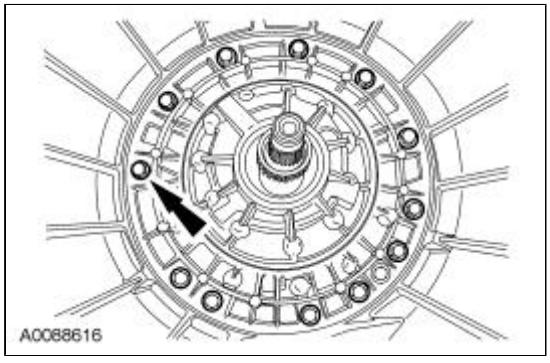
13. Inspect the thermal bypass valve for damage, install a new valve if damage is indicated.



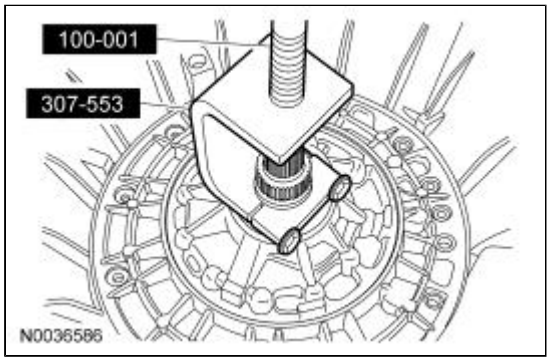
14. Using the special tools, remove and discard the front pump seal.



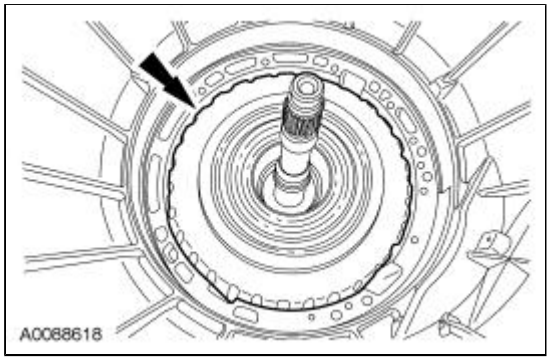
15. Remove and discard the front pump bolts.



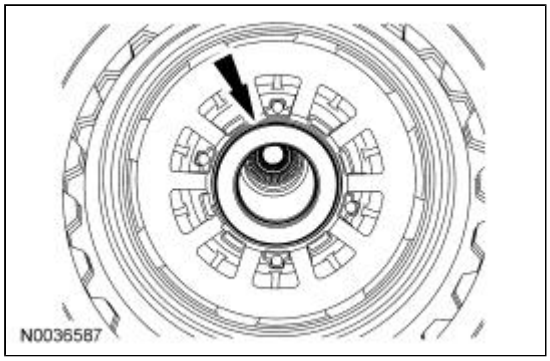
16. Using the special tools, remove the front pump support. Make sure that the selective shim is on the back side of the pump.



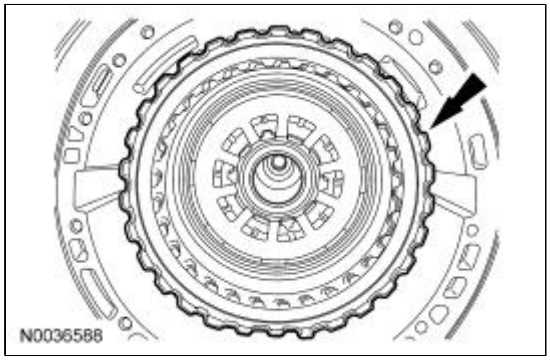
17. Remove the forward (clutch A)/overdrive (clutch E) clutch assembly.



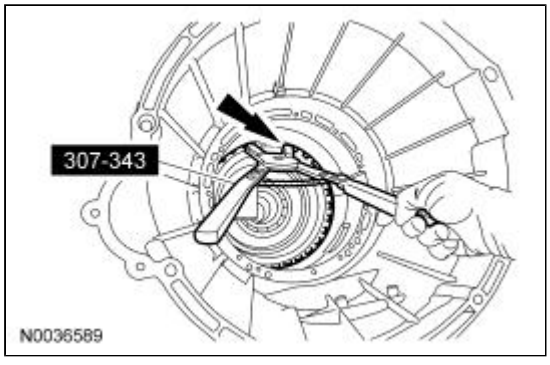
18. Remove the caged roller bearing.



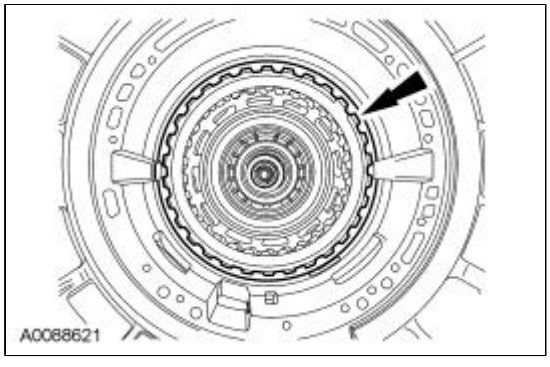
19. Remove the direct clutch assembly.



20. Using the special tool, remove the center support snap ring.

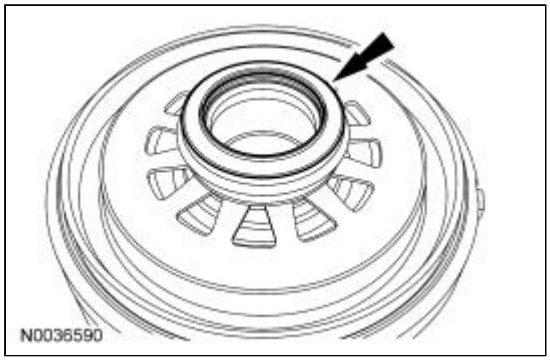


21. Remove the center support.



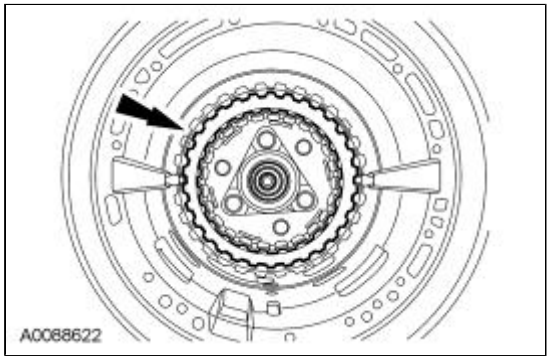
22. **NOTE:** During the removal the bearing may be on the back of the center support.

    Remove the bearing from the back of the center support if it is there.

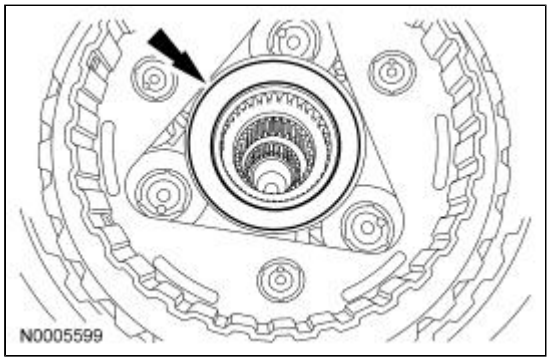


23. **NOTE:** When removing the planet carrier and the low/reverse clutch pack some of the clutch plates may stay in the case. Try to keep all the clutches together.

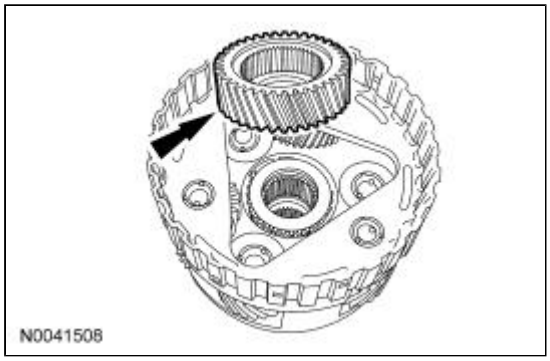
    Remove the planet carrier and the low/reverse clutch pack as an assembly.



24. Remove the low/reverse bearing race.

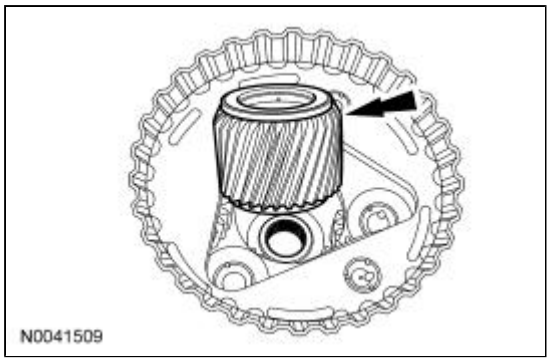


25. Remove the low/reverse sun gear.

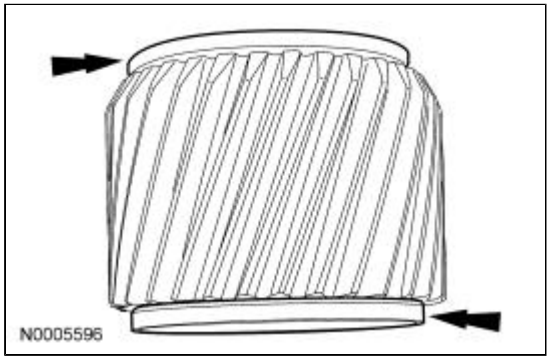


26. **NOTE:** When removing the sun gear, take note that the taper edge is facing up toward the torque converter housing.

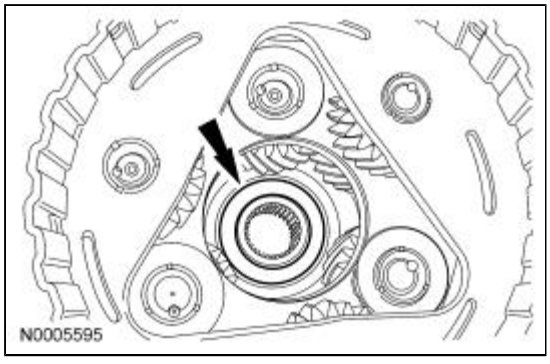
Remove the sun gear into the planet assembly.



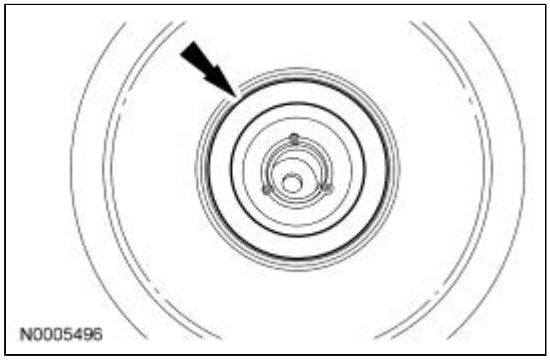
27. Remove the top and the bottom roller bearings from the sun gear.



28. Remove the roller bearing race in the bottom of the carrier.

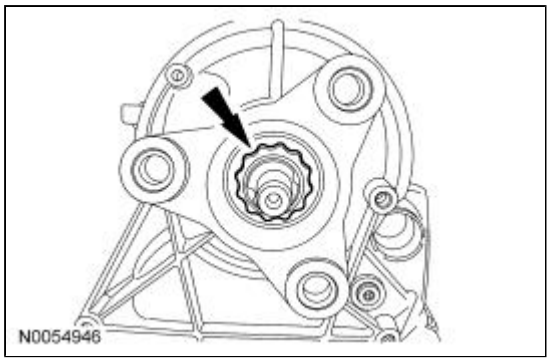


29. Remove the washer.

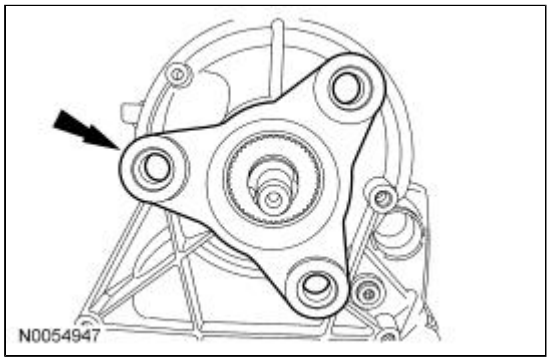


Rear wheel drive (RWD) vehicles

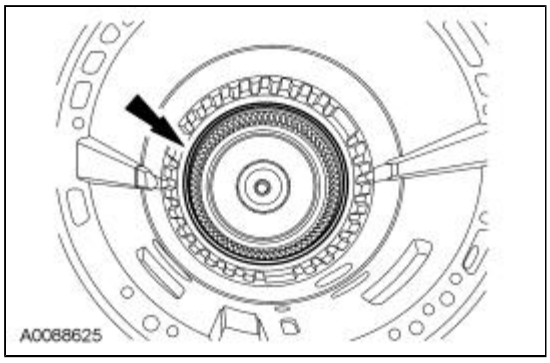
30. Remove and discard the output shaft flange nut.



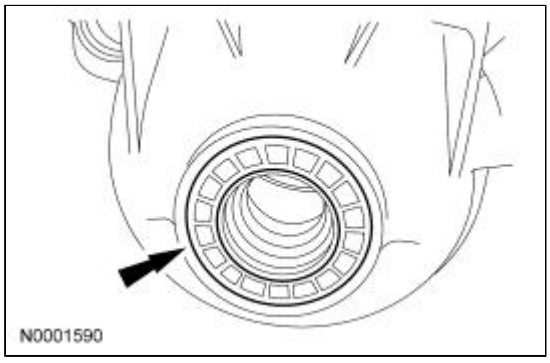
31. Remove the output shaft flange.



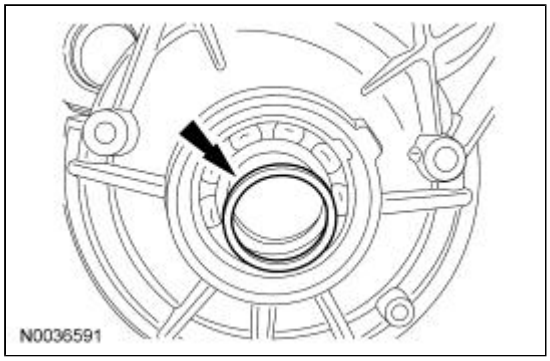
32. Remove the planet carrier hub and output shaft assembly.



33. Remove the output shaft seal.

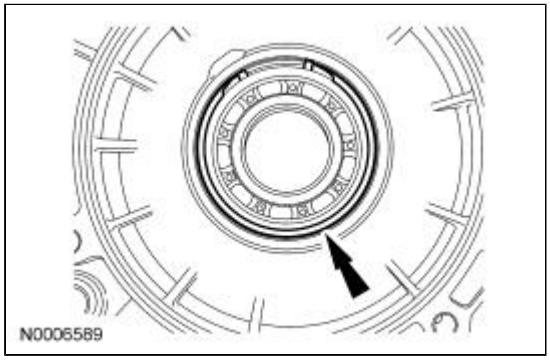


34. Remove the anti-click washer.



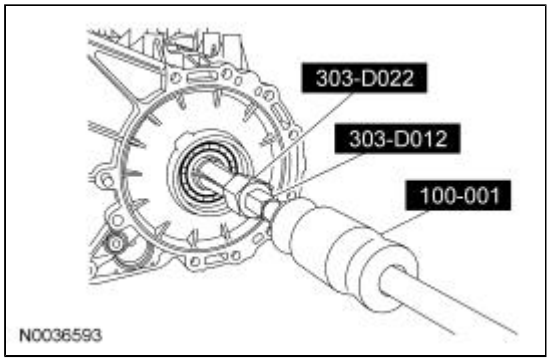
35. **NOTE:** Four wheel drive (4WD) case shown, RWD case similar.

    Remove the snap ring from the case.

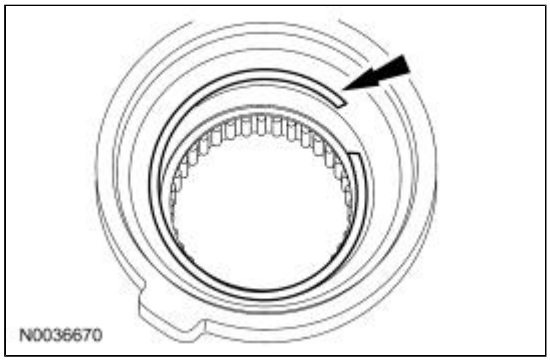


36. **NOTE:** 4WD case shown, RWD case similar.

    Using the special tools, remove the roller bearing.

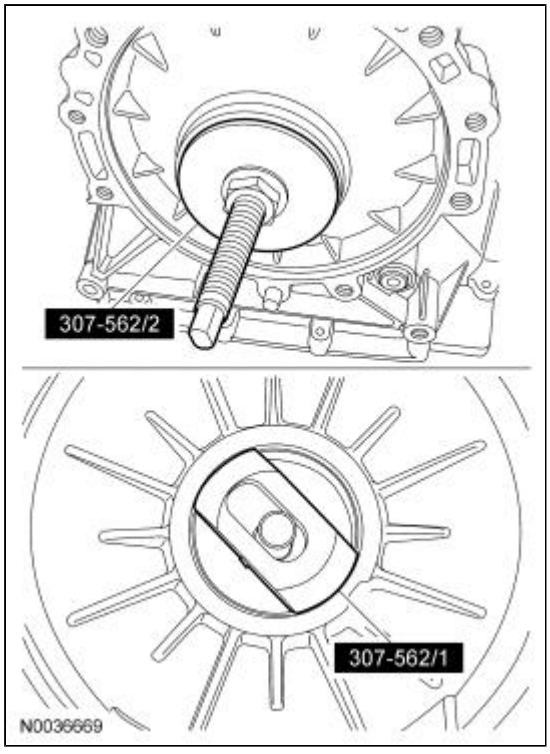


37. Using a suitable tool, remove the inner bearing snap ring.



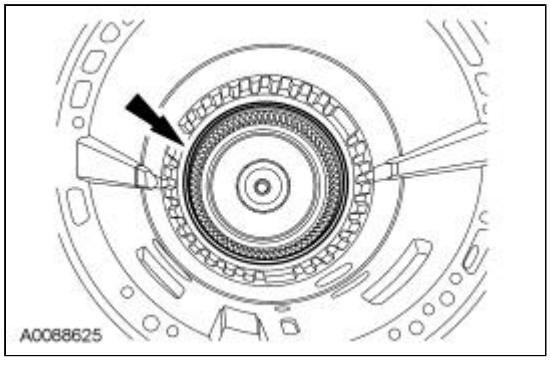
38. **CAUTION: Use care when installing the special tool. Look inside the transmission case to make sure that the tool contacts the bearing only and not the lip of the case, or damage to the case will occur.**

    Using the special tool, remove the bearing assembly.

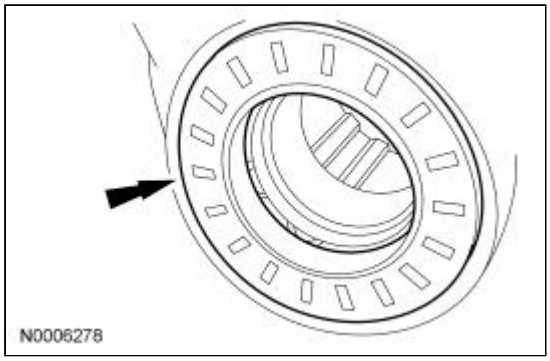


4WD vehicles

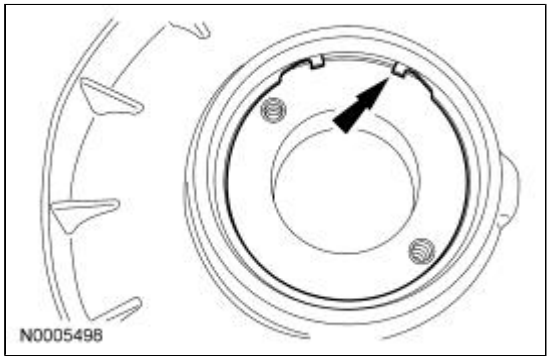
39. Remove the planet carrier hub and output shaft assembly.



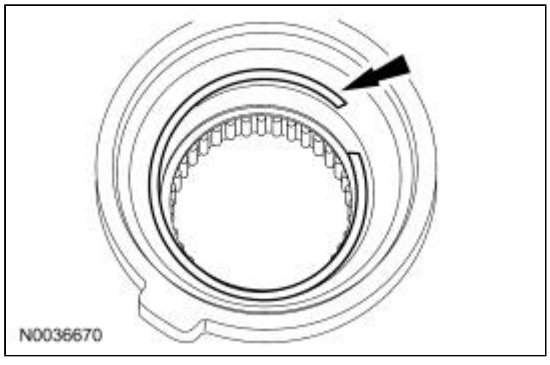
40. Remove and discard the output shaft seal.



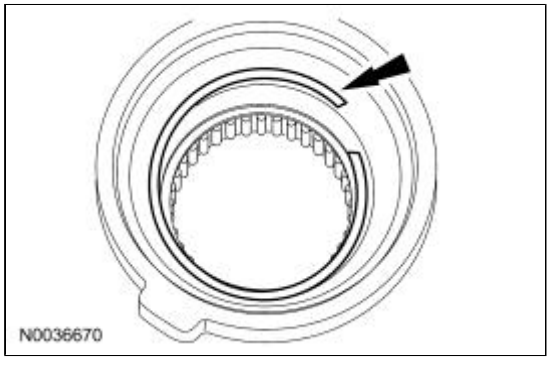
41. Remove the snap ring from the case.



42. Using the special tools, remove the bearing spacer.

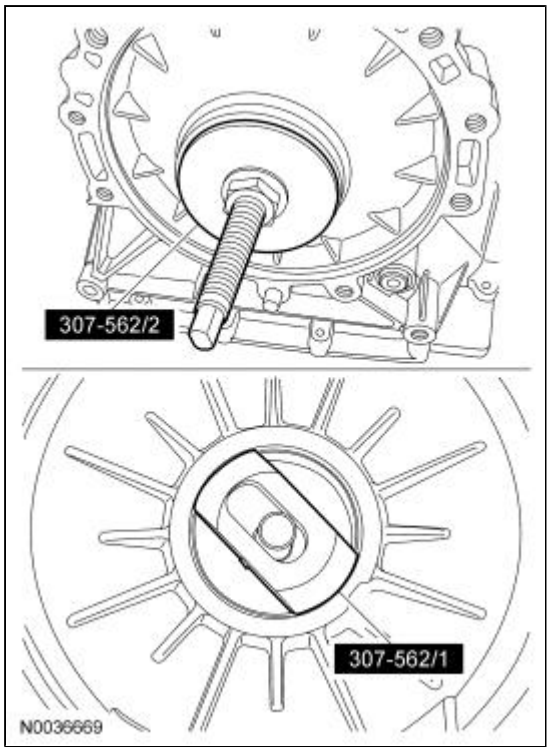


43. Using a suitable tool, remove the inner bearing snap ring.



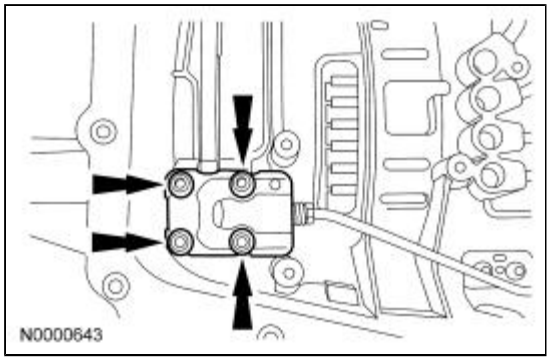
44. **CAUTION: Use care when installing the special tool. Look inside the transmission case to make sure that the tool contacts the bearing only and not the lip of the case, or damage to the case will occur.**

Using the special tool, remove the bearing assembly.

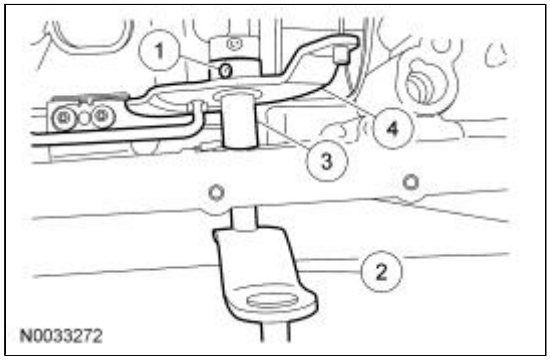


All vehicles

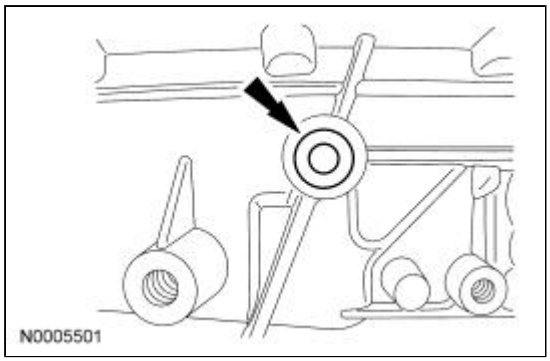
45. Remove the park rod actuating plate.



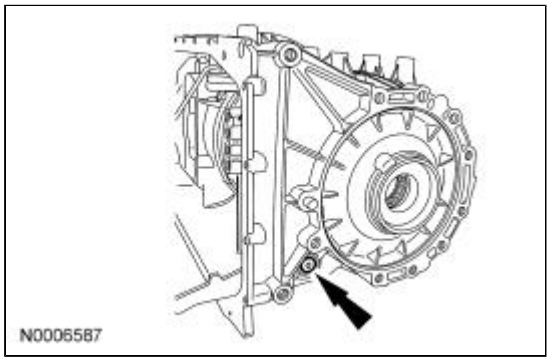
46. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the spacer to keep from falling into the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.



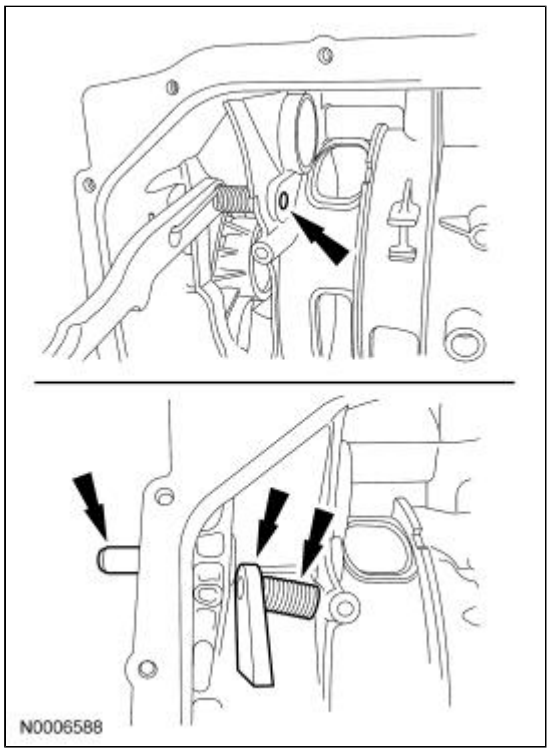
47. Remove and discard the manual control lever seal.



48. Remove the bolt from the back of the case to gain access to the park pawl pin.



49. From the inside of the case, push the park pawl pin out toward the back side of the case while holding the spring and the park pawl. Remove the park pawl pin then remove the park pawl and spring.



Forward/Overdrive Clutch Assembly — Disassembly

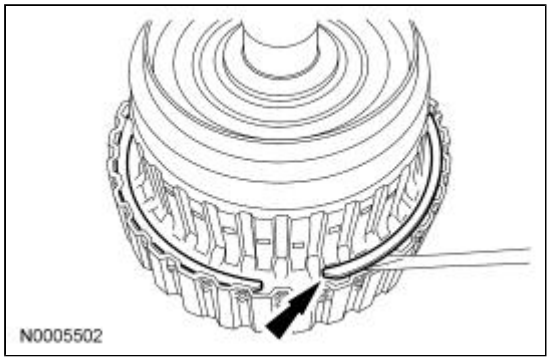
Printable View (243 KB)

Material

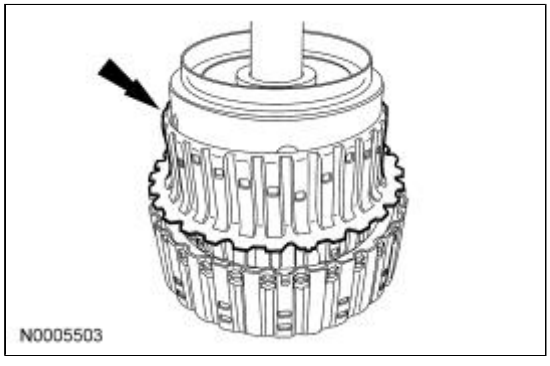
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Disassembly

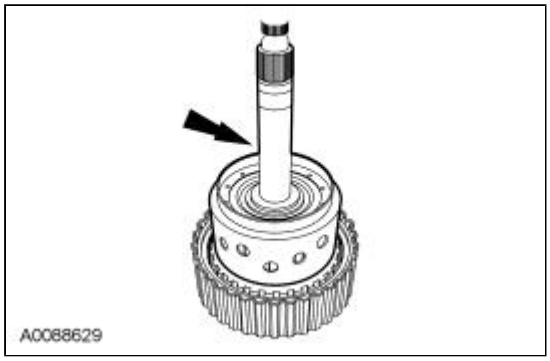
1. Remove the direct clutch outer shell retaining ring.



2. Remove the direct clutch hub.

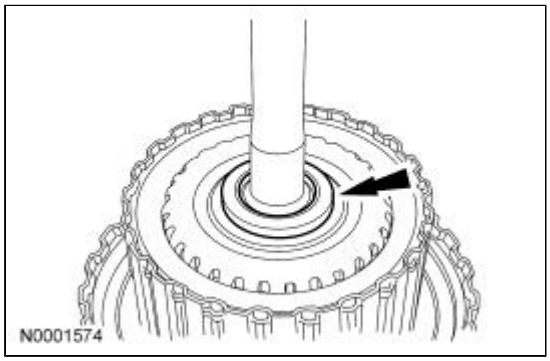


3. Remove the forward clutch and sun shaft assembly.

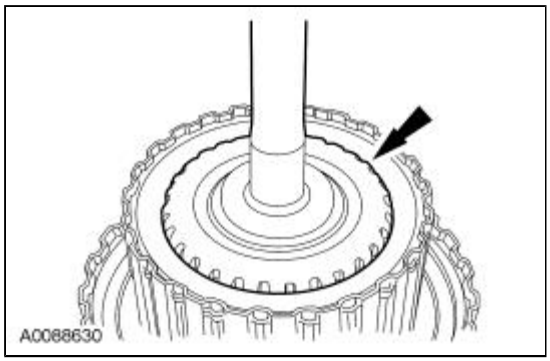


4. **NOTE:** The bearing may stick in the forward clutch drum.

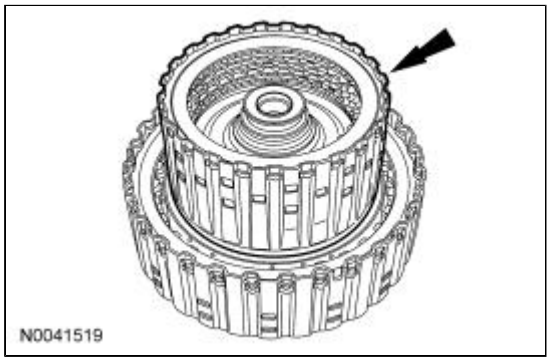
   Remove the intermediate shaft bearing.



5. Remove the intermediate shaft assembly.



6. Remove the overdrive clutch pack from the forward clutch pack.



Forward Clutch Assembly

Printable View (748 KB)

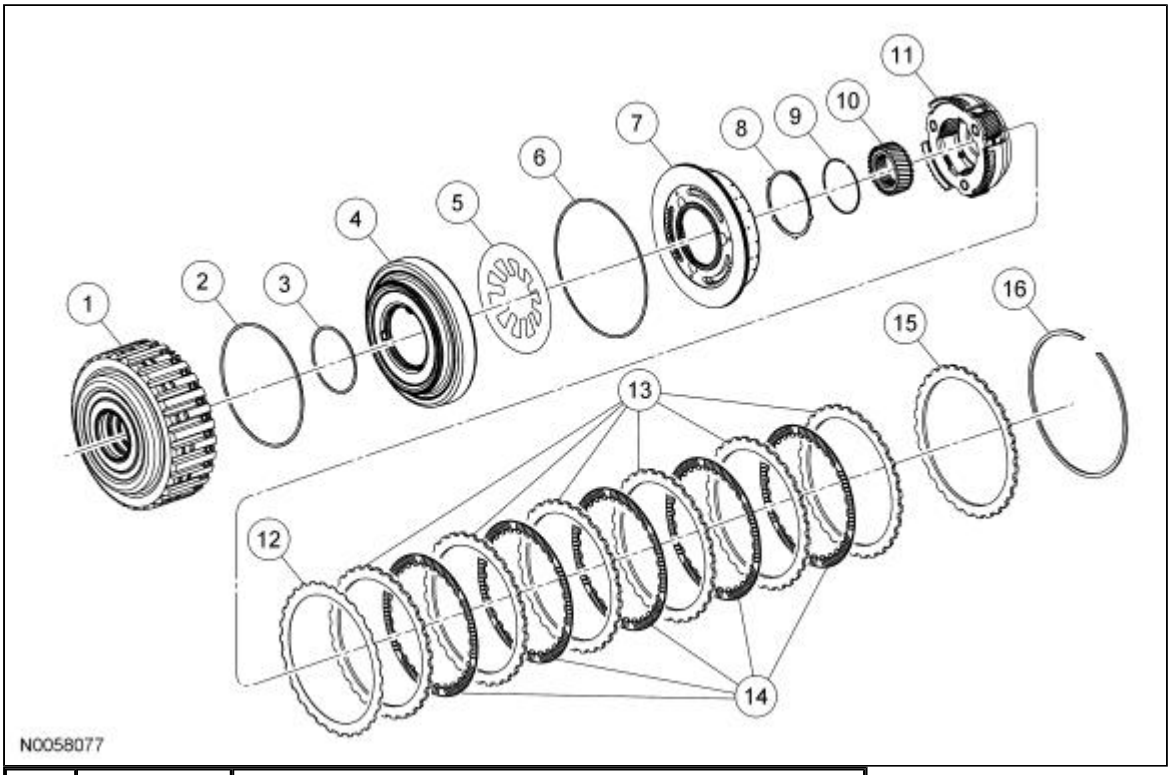
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2881-A	Piston Spring Compressor 307-525
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

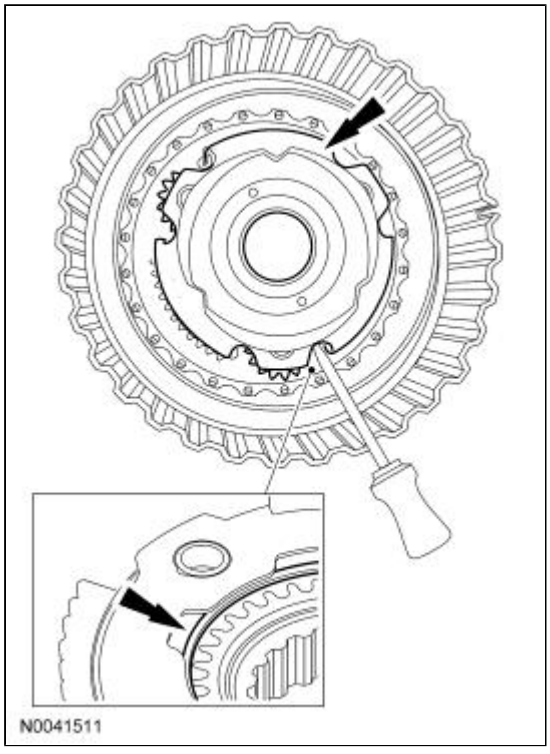
Forward Clutch Assembly (A Clutch)



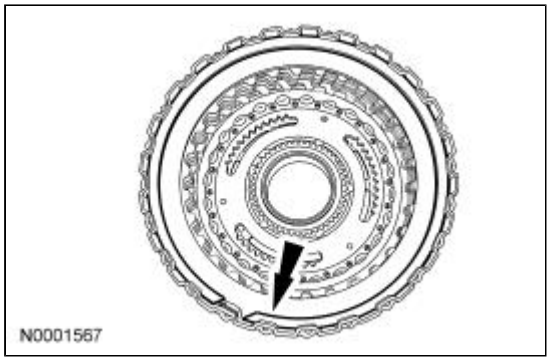
Item	Part Number	Description
1	—	Forward clutch drum
2	—	Forward clutch piston outer O-ring seal
3	—	Forward clutch piston inner O-ring seal
4	—	Forward clutch piston
5	—	Forward clutch piston return spring
6	—	Forward clutch balance dam O-ring seal
7	—	Forward clutch balance dam
8	—	Forward clutch balance dam retaining ring
9	—	Sun gear retaining ring
10	—	Sun gear
11	—	Planetary gear
12	—	Forward clutch wave spring
13	—	Forward clutch external splined steel plates (quantity model dependent)
14	—	Forward clutch internal splined friction plates (quantity model dependent)
15	—	Forward clutch pressure plate
16	—	Forward clutch plate retaining ring.

Disassembly

1. Remove the sun gear from the forward clutch assembly.
    - With a small screwdriver or a suitable pick inserted into the sun gear push on the retaining ring in 3 places while lifting up on the sun gear to remove.

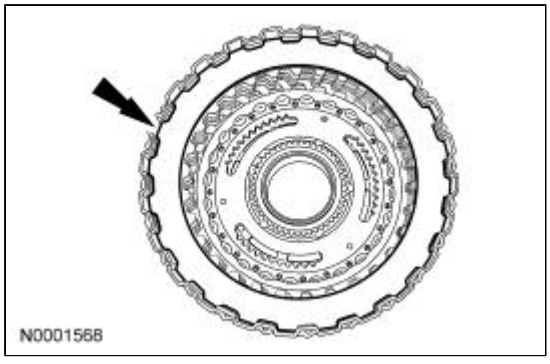


2. Remove the forward clutch pack snap ring.



3. **NOTE:** Inspect the forward clutch drum and the friction and steel plates for damage. Install new components as necessary.

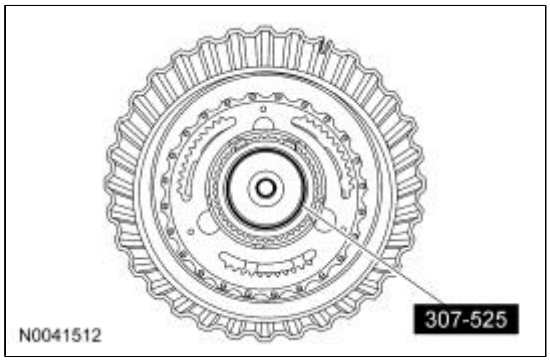
   Remove and inspect the forward clutch steel and friction plates.
   - If the plates are damaged install a new forward clutch assembly.
   - If no damage is indicated the forward clutch can be reassembled



4. **NOTE:** The bottom of the special tool will need to be installed from the back side of the forward

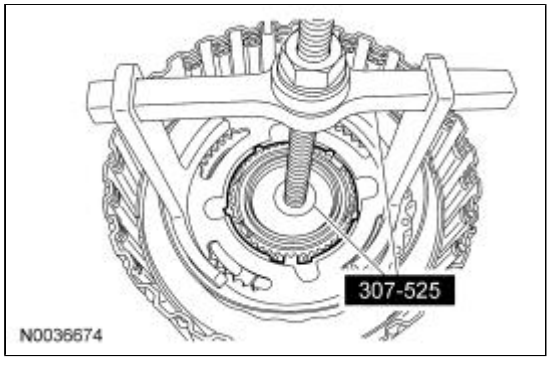
clutch assembly.

Install the special tool under the forward clutch drum.

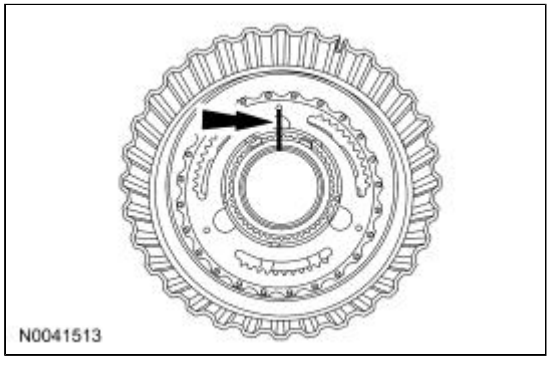


5. **NOTE:** The bottom of the special tool will need to be installed from the back side of the forward clutch assembly.

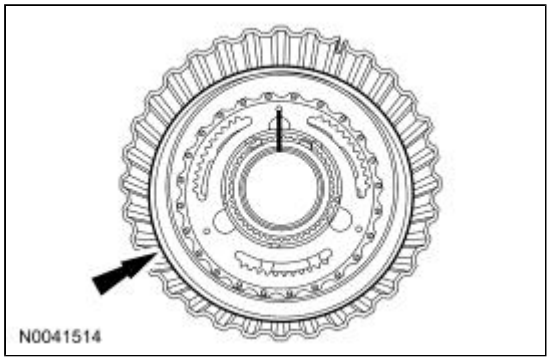
   Using the special tool, slightly collapse the balance dam to gain access to the retaining ring. Remove the retaining ring.



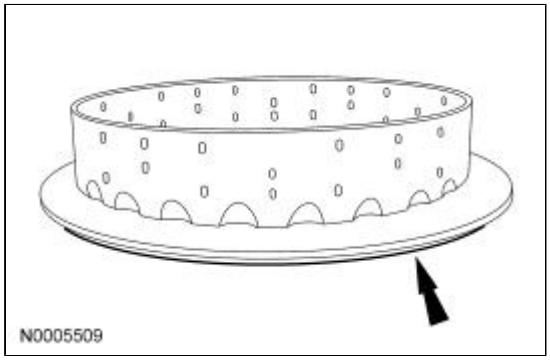
6. Prior to removing the balance dam, make an identifying mark on the balance dam and the center part of the housing. This is for correct alignment during the assembly.



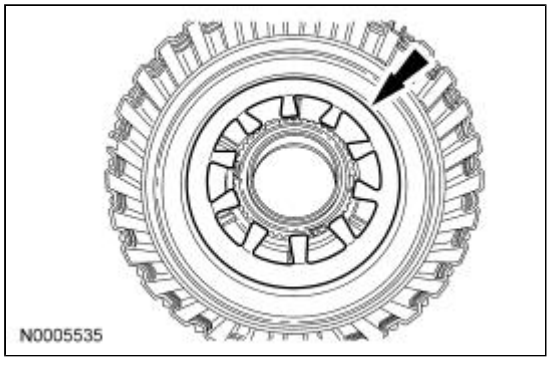
7. Remove the balance dam.



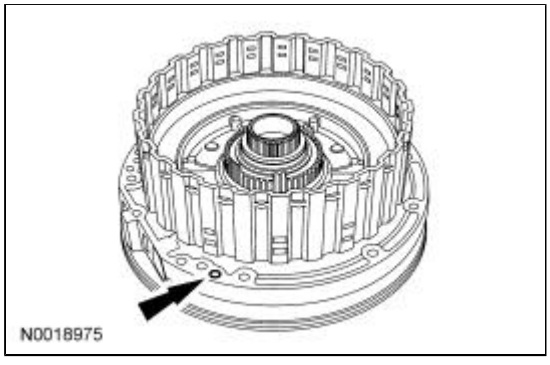
8. Remove and discard the O-ring seal from the balance dam.



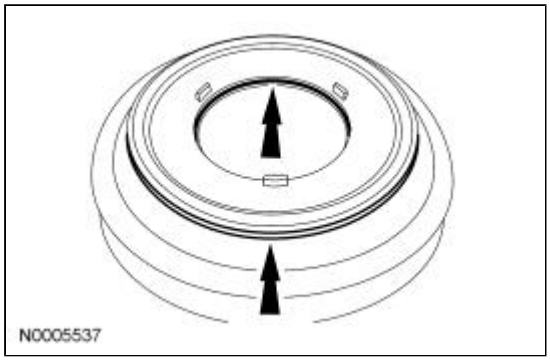
9. Remove the forward clutch return spring.



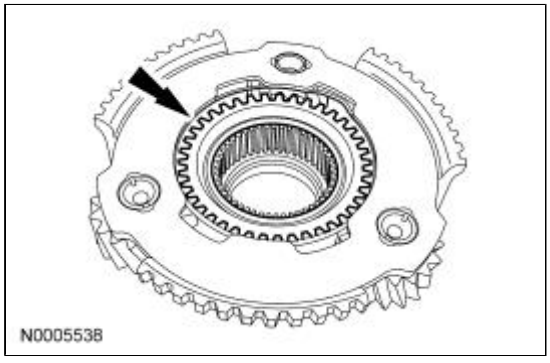
10. Install the forward clutch into the front pump to remove the forward clutch piston. Apply a small amount of shop air to remove the piston.



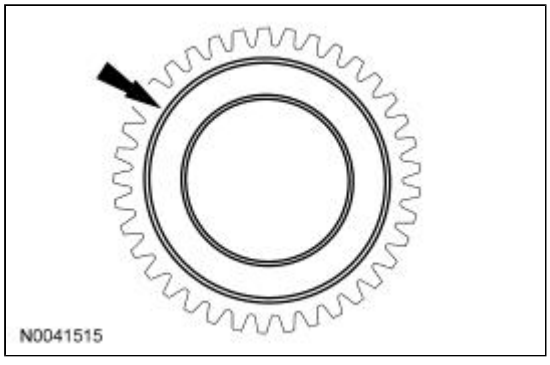
11. Remove and discard the inner and outer piston O-ring seals.



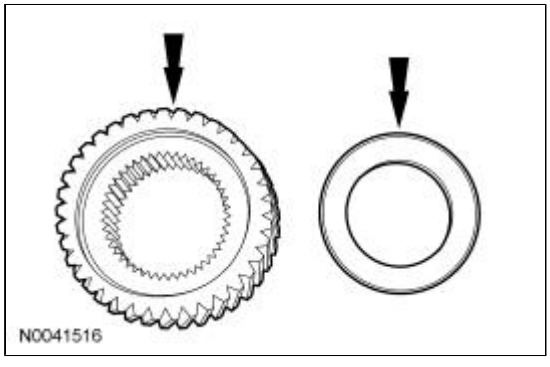
12. Remove the sun gear from the planet assembly.



13. Remove the bearing from the sun gear.

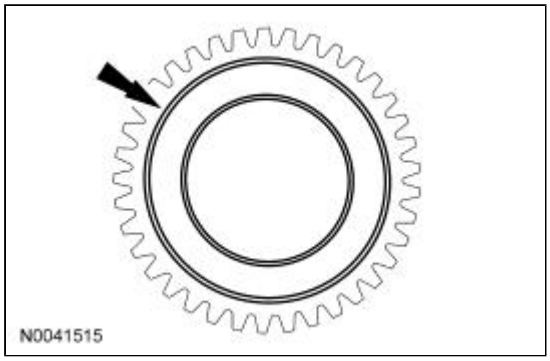


14. Inspect the sun gear and bearing for damage. Install new components as necessary.

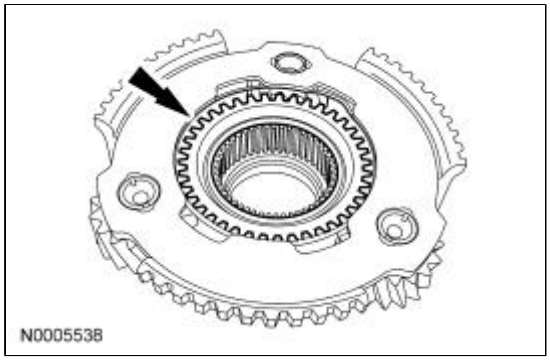


Assembly

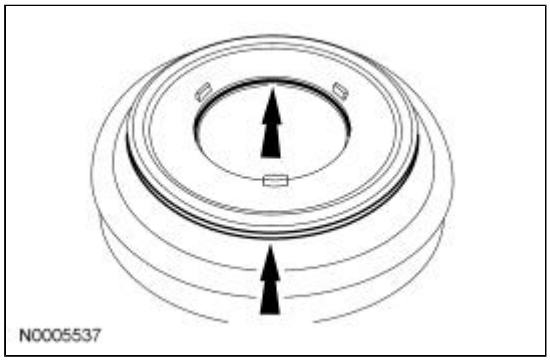
1. Install the bearing onto the sun gear.



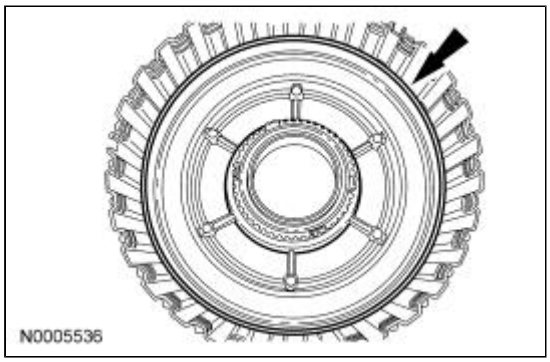
2. Install the sun gear into the planet assembly with the bearing facing down and the recess part of the gear up.



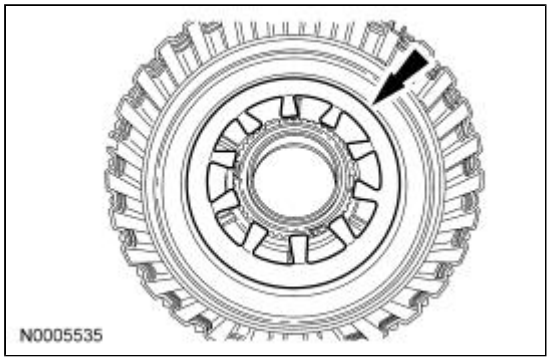
3. Install new O-ring seals onto the forward clutch piston.



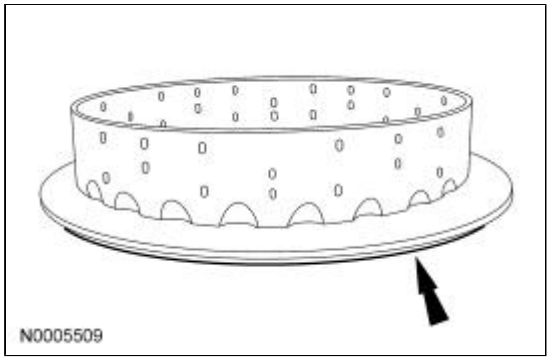
4. Lightly coat the O-ring seals with clean transmission fluid and install the forward clutch piston into the forward clutch drum.



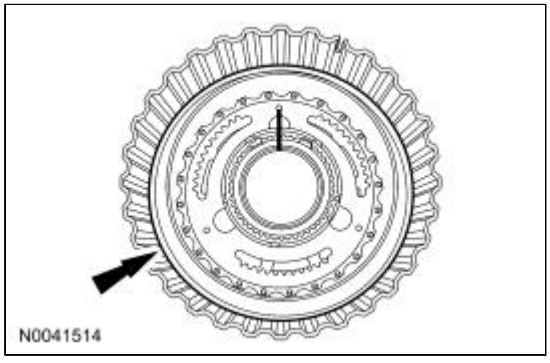
5. Install the forward clutch return spring.



6. Install a new O-ring seal onto the forward clutch balance dam. Lightly coat the O-ring seal with clean transmission fluid.

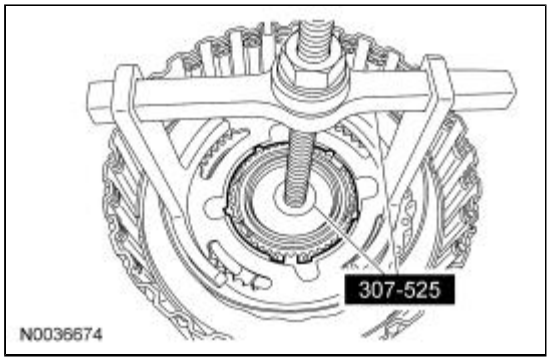


7. Align the marks made during disassembly and install the balance dam into the forward clutch drum.

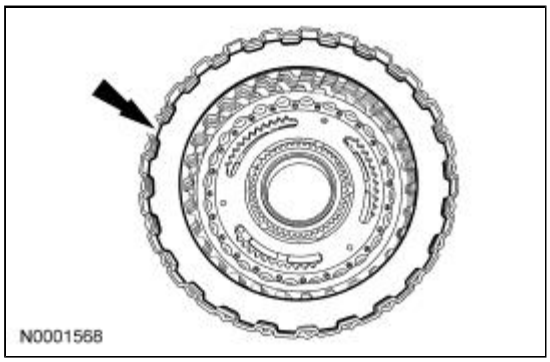


8. **NOTE:** Prior to releasing the special tool, make sure that the snap ring is fully seated.

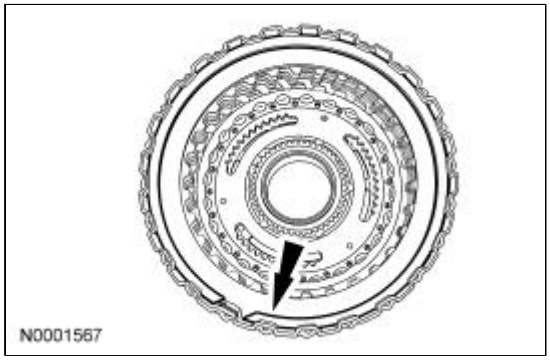
   Using the special tool, slightly collapse the balance dam to install the retaining ring. Install the retaining ring.



9. Install the new forward clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending up with the pressure plate.

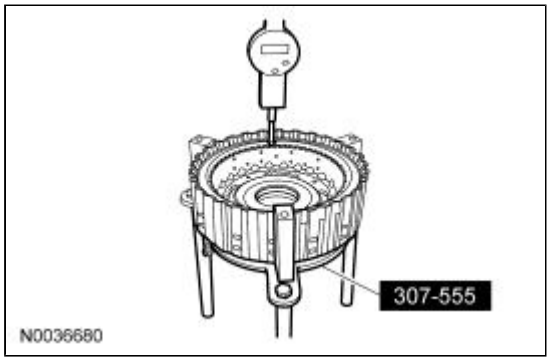


10. Install the forward clutch plate snap ring.



11. **NOTE:** All forward clutch plates, friction and steel are of a wave-type design.

    Install the forward clutch assembly into the special tool so the dial indicator fits into the opening of the snap ring.



12. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

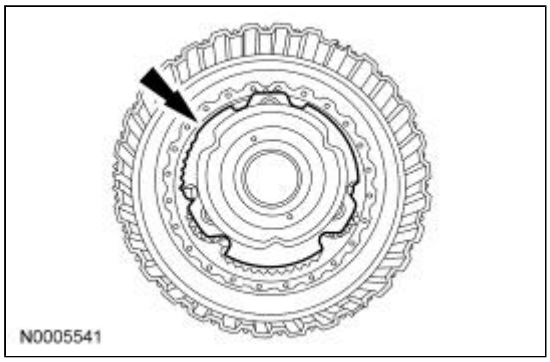
13. Rotate the forward clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

14. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine — 0.71-1.10 mm (0.028-0.043 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

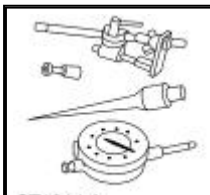
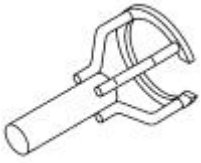
15. Install the sun gear and planetary gearset into the forward clutch drum. Make sure it snaps and locks in place.



Overdrive Clutch Assembly

Printable View (489 KB)

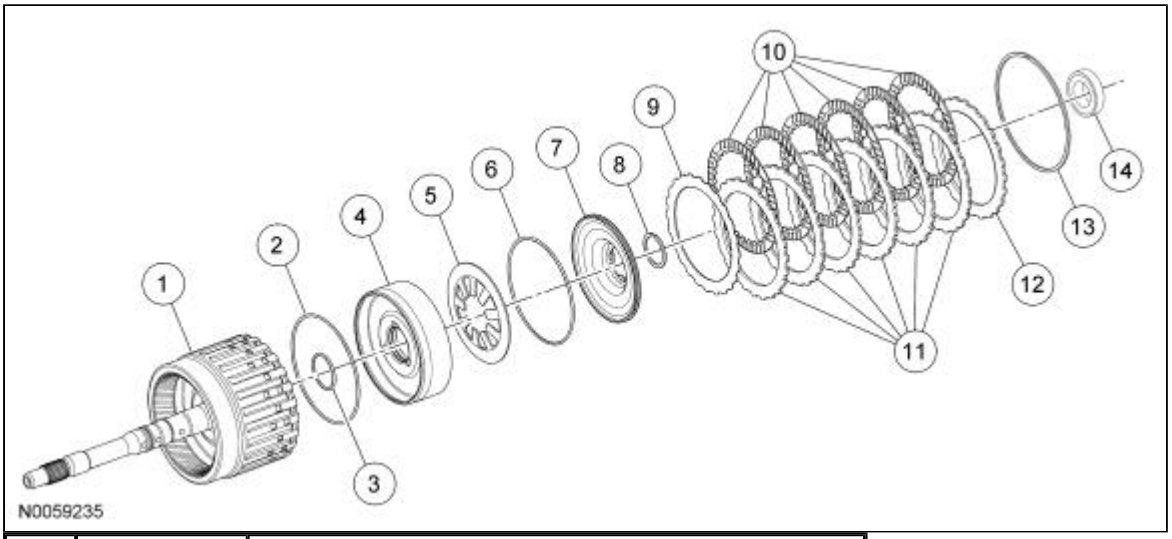
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2497-A	Compressor, Spring Washer 307-209
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Overdrive Clutch Assembly

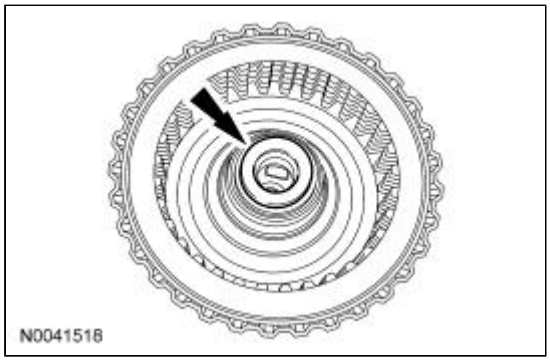


	Part	

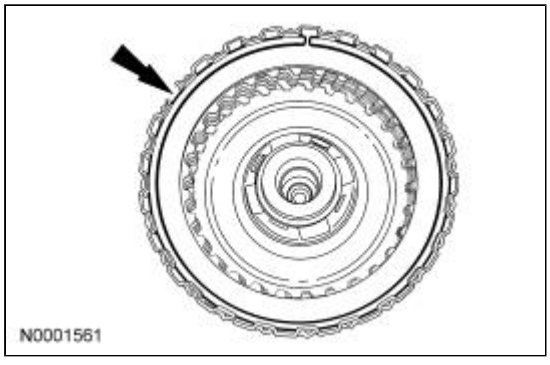
Item	Number	Description
1	7J006	Input shaft
2	7J008	Overdrive clutch piston outer seal
3	7G007	Overdrive clutch piston inner seal
4	7G418	Overdrive clutch piston
5	7N529	Overdrive clutch piston spring
6	7J009	Overdrive balance piston outer seal
7	7J029	Overdrive balance piston
8	7J010	Overdrive balance piston snap ring
9	7N572	Overdrive clutch cushion plate
10	7B164	Overdrive clutch internal splined clutch plates (friction)
11	7B442	Overdrive clutch external splined clutch plates (steel)
12	7C576	Overdrive pressure plate
13	7M157	Overdrive clutch retaining ring
14	7A453	Bearing T3

Disassembly

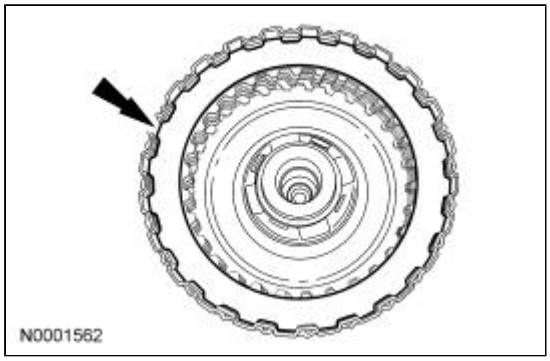
1. Remove the thrust bearing (T3).



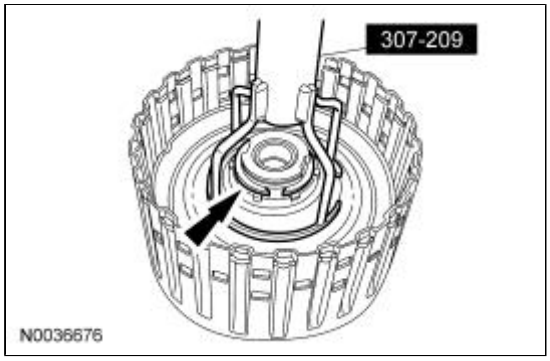
2. Remove the overdrive clutch pack snap ring.



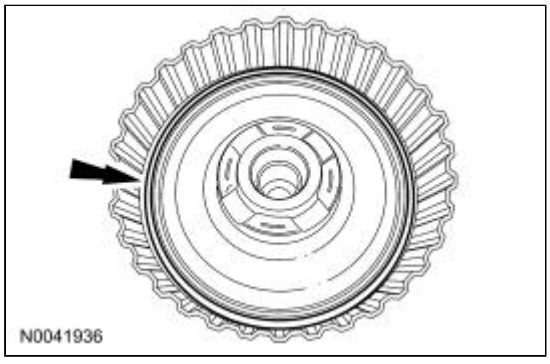
3. Remove the overdrive clutch pack.



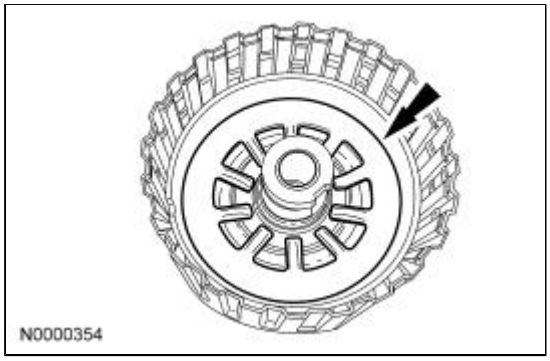
4. Using the special tool and a press, remove and discard the overdrive clutch balance piston retaining ring and keep the original spacer.



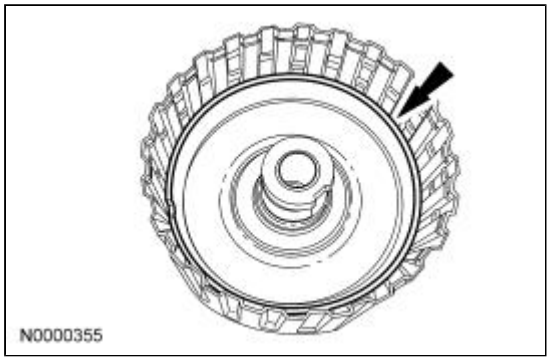
5. Remove the overdrive clutch balance piston.



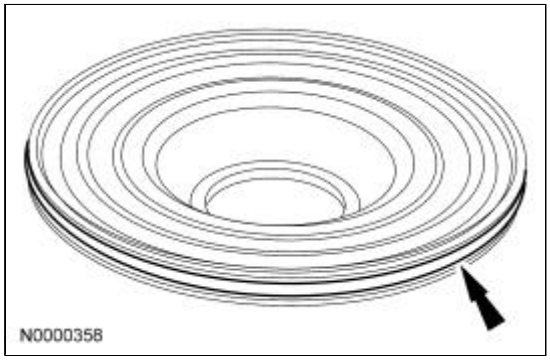
6. Remove the overdrive clutch return spring.



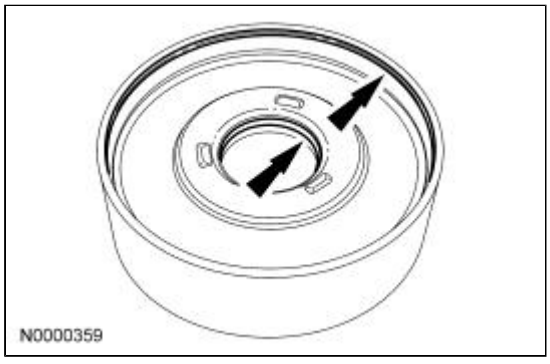
7. Remove the overdrive clutch apply piston.



8. Remove and discard the outer O-ring seal on the overdrive clutch balance piston.

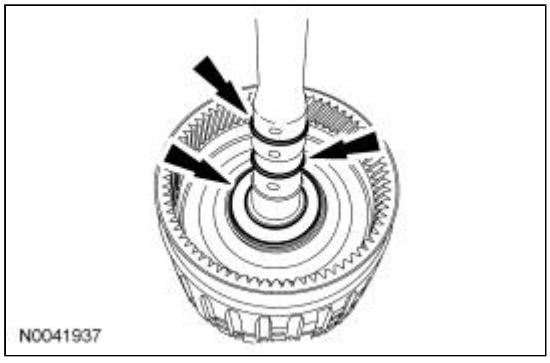


9. Remove and discard both the inner (one large and one small) O-ring seals on the overdrive clutch apply piston.



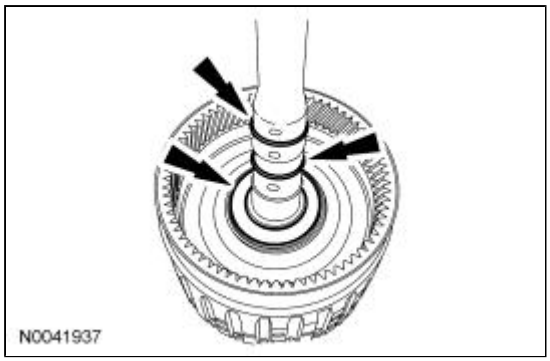
10. **NOTE:** The roller bearing may stick to the forward clutch assembly.

    Remove and discard the 2 scarf cut seals and the roller bearing.

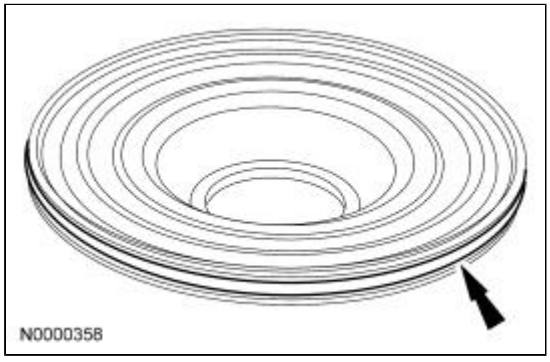


Assembly

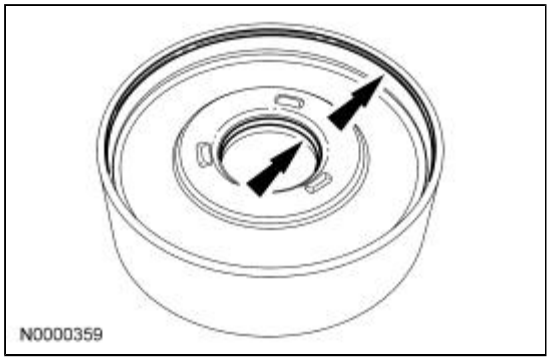
1. Install the 2 scarf cut seals and the roller bearing.



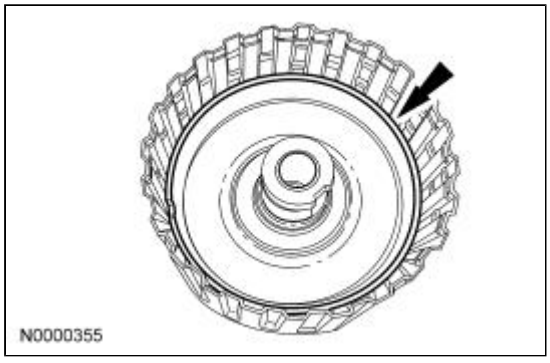
2. Install a new outer O-ring seal on the overdrive clutch balance piston.



3. Install 2 new inner O-ring seals on the overdrive clutch apply piston.

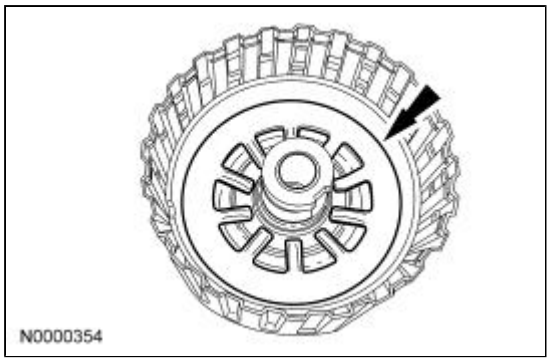


4. Lubricate all the O-ring seals with clean automatic transmission fluid. Install the overdrive clutch apply piston into the drum with the O-ring seals and the 3 pads facing down toward the drum.



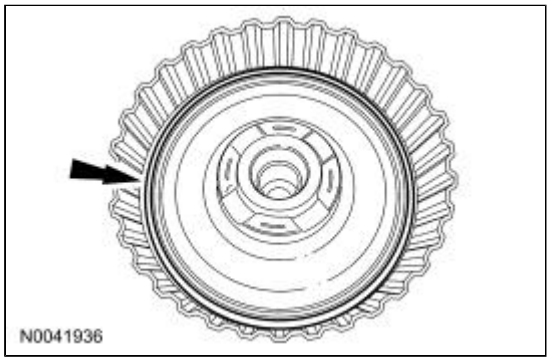
5. **NOTE:** The fingers on the return spring are facing down toward the piston.

Install the overdrive clutch return spring.

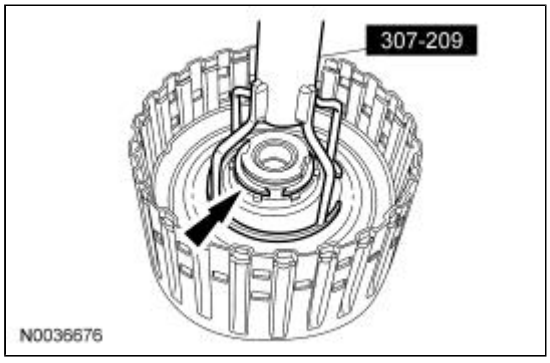


6. **NOTE:** The cone shape of the balance piston must face up when installed correctly.

   Lubricate all the O-ring seals with clean automatic transmission fluid. Install the overdrive clutch balance piston.

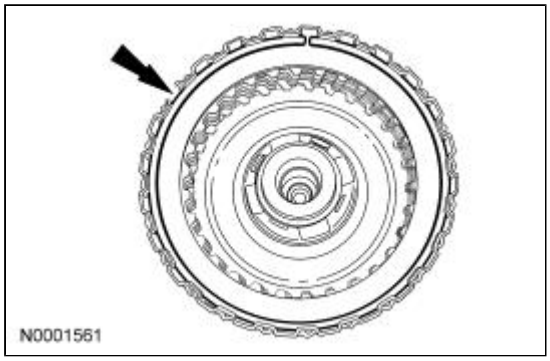


7. Using the special tool, install a new overdrive clutch balance piston retaining ring and the original spacer.



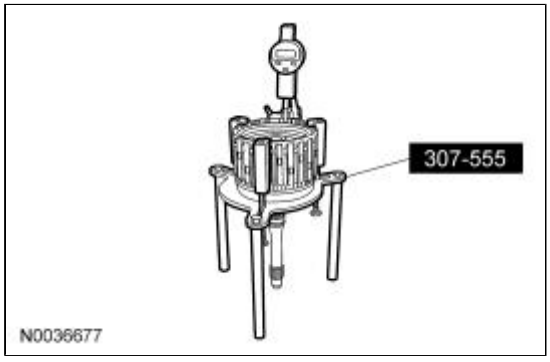
8. Install the new overdrive clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate on the top.

9. Install the overdrive clutch pack snap ring.



10. **NOTE:** All overdrive clutch plates, friction and steel are of a wave-type design.

    Install the overdrive clutch assembly into the special tool so the dial indicator fits into the opening of the snap ring.



11. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

12. Rotate the overdrive clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

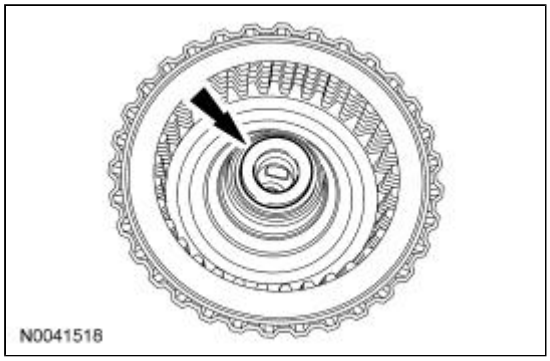
Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

13. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine — 0.5-0.9 mm (0.019-0.035 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

14. **NOTE:** Inspect and install new thrust bearings as required.

    Install a new thrust bearing (T3).


N0041518

Forward/Overdrive Clutch Assembly — Assembly

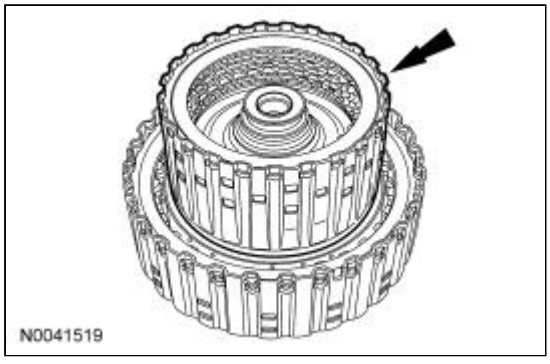
Printable View (244 KB)

Material

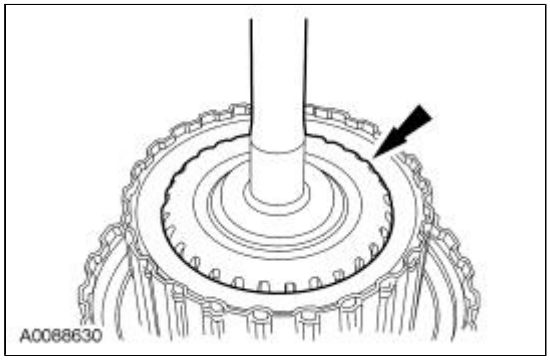
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Assembly

1. Install the overdrive clutch pack onto the forward clutch and planetary gear set.

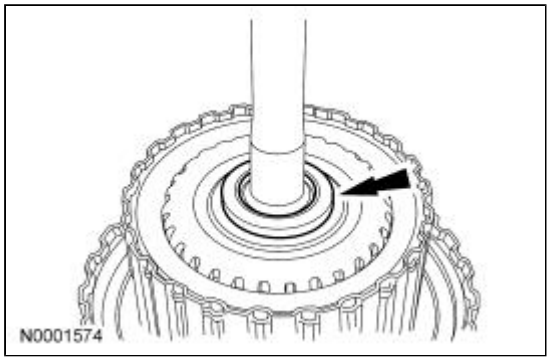


2. Install the intermediate shaft assembly.

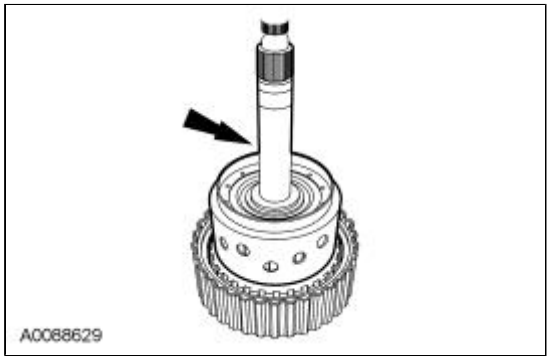


3. **NOTE:** Inspect and install new thrust bearings as required.

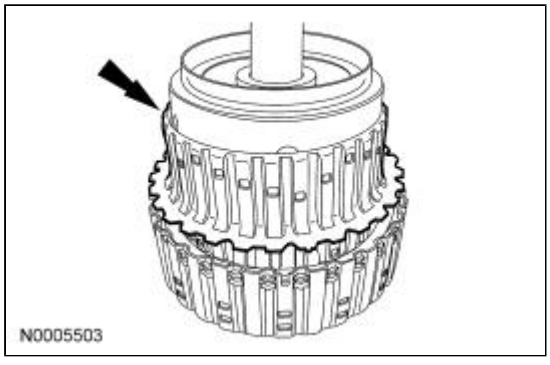
   Install the intermediate shaft bearing (T4).



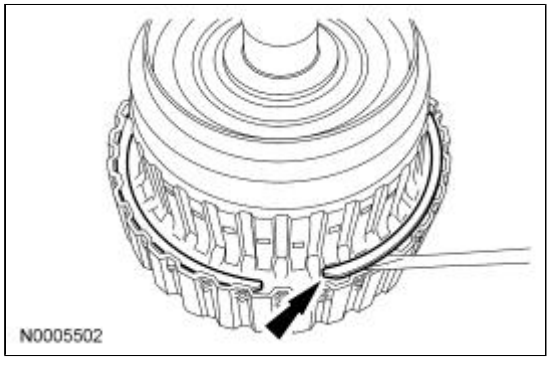
4. Install the forward clutch and sun shaft assembly.



5. Install the direct clutch hub.



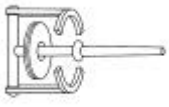
6. Install the direct clutch outer shell retaining ring.



Direct Clutch Assembly

Printable View (727 KB)

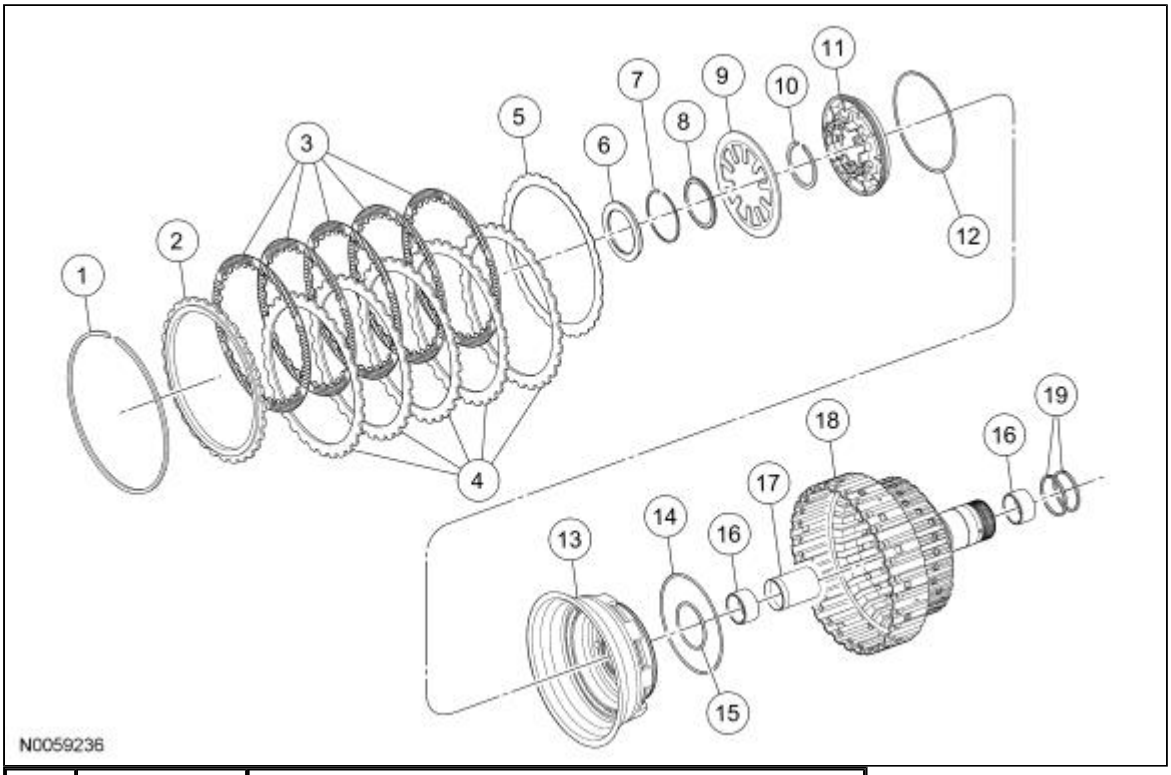
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
ST2892-A	Clutch Pack End Play Gauge 307-555
ST2893-A	Direct Clutch Pack Service Fixture 307-552

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

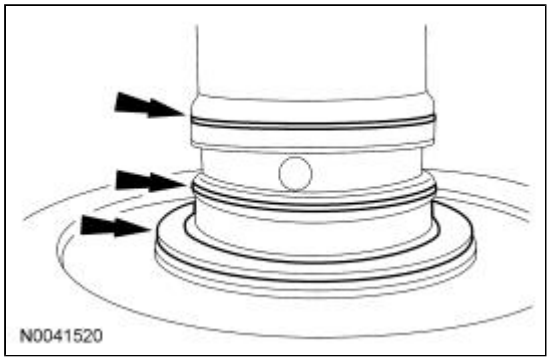
Direct Clutch Assembly



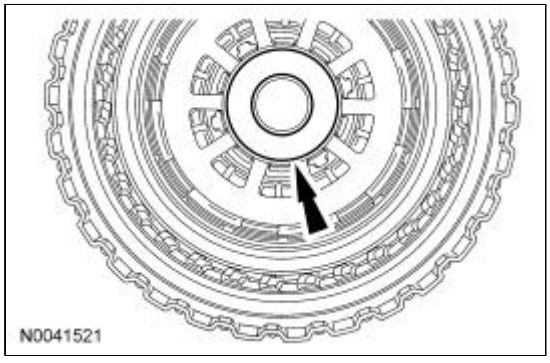
Item	Part Number	Description
1	7B421	Direct clutch pressure plate retaining ring
2	7B447	Direct clutch pressure plate
3	7B164	Direct clutch internal splined friction plates
4	7E314	Direct clutch external splined steel plates
5	—	Direct clutch cushion plate (wave spring)
6	7D283	Bearing (T5)
7	7H363	Direct clutch balance piston snap ring
8	7D427	Direct clutch piston spring retaining ring
9	7B488	Return spring
10	7B488	Piston retaining ring
11	7H359	Direct clutch balance piston
12	7C000	Direct clutch balance piston seal
13	7F254	Direct clutch apply piston
14	7C000	Direct clutch apply piston outer seal
15	7F234	Direct clutch apply piston inner seal
16	7F240	Direct clutch bushing hubs (2 required) (part of 7F281)
17	7C486	Gear shaft tube sleeve
18	7F281	Direct clutch cylinder
19	7B399	Seal shell cylinders

Disassembly

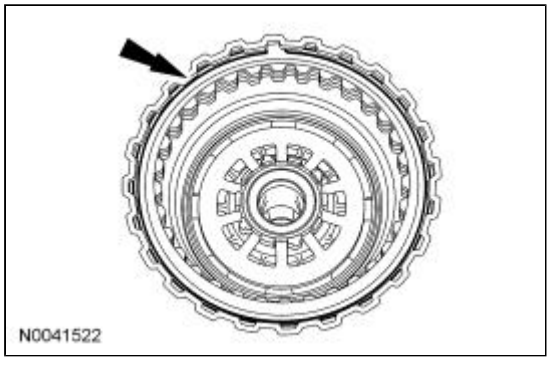
1. Remove and discard the 2 scarf cut seals and the roller bearing.



2. Remove the thrust bearing (T5).

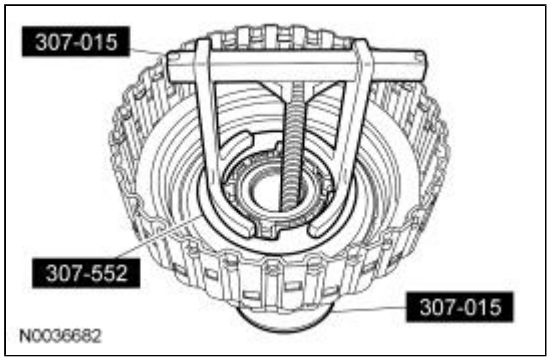


3. Remove the direct clutch snap ring.

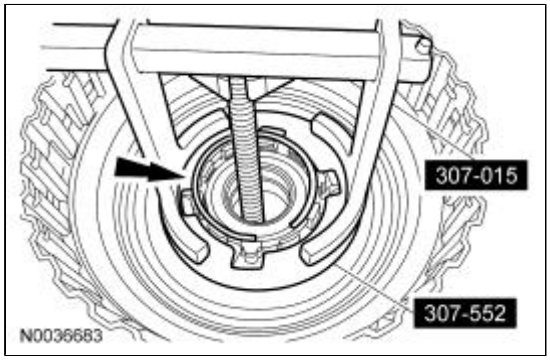


4. Remove the direct clutch steel and friction plates.

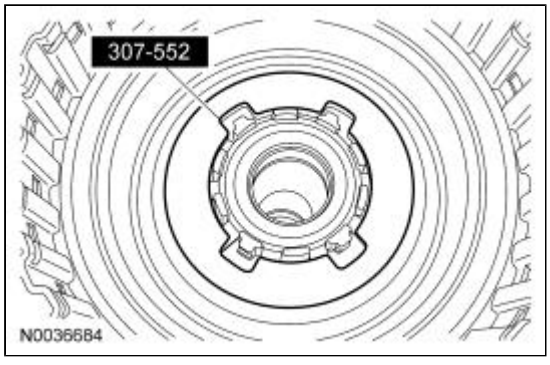
5. Install the special tools onto the direct clutch assembly.



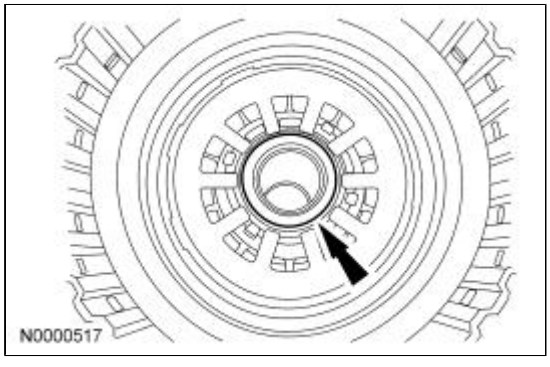
6. Using the special tool, remove the direct clutch return spring retainer.



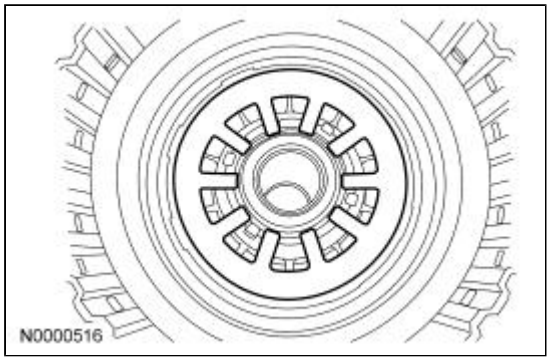
7. Remove the special tool.



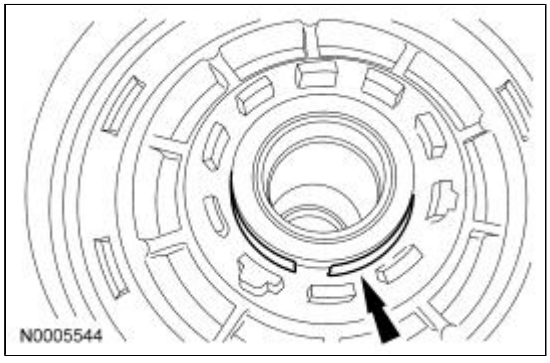
8. Remove the direct clutch return spring washer.



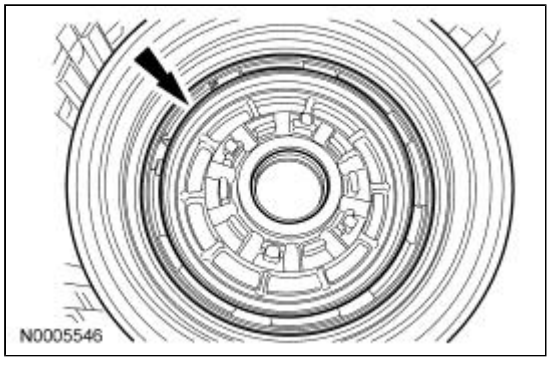
9. Remove the direct clutch return spring.



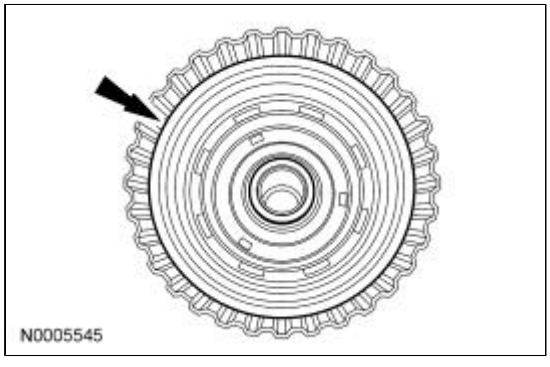
10. Slightly press down on the balance piston and remove and discard the snap ring.



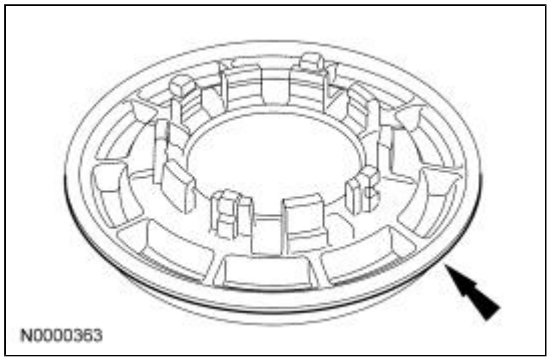
11. Remove the baffle plate from the direct clutch piston.



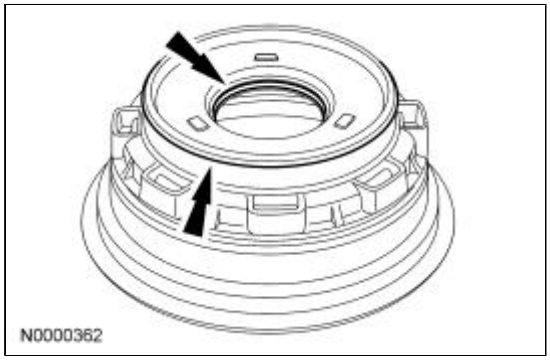
12. Remove the direct clutch piston.



13. Remove and discard the outer O-ring seal from the balance piston.



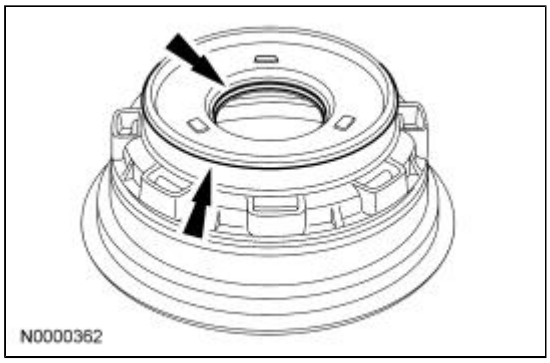
14. Remove and discard the outer and inner O-ring seal from the apply piston.



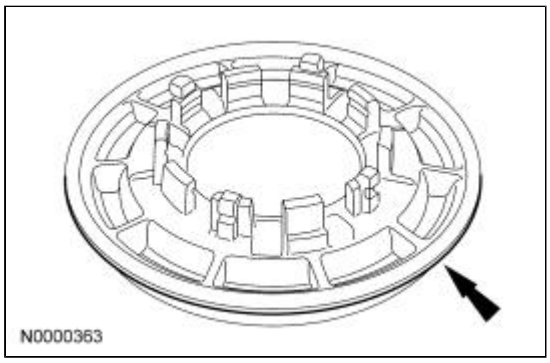
15. Inspect the direct clutch drum for damage. If damage is indicated, install a new direct clutch drum.

Assembly

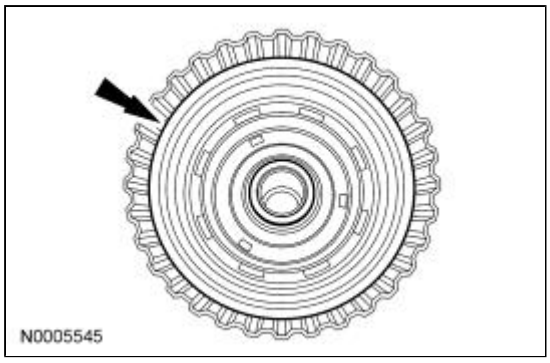
1. Install a new inner and outer O-ring seal on the apply piston.



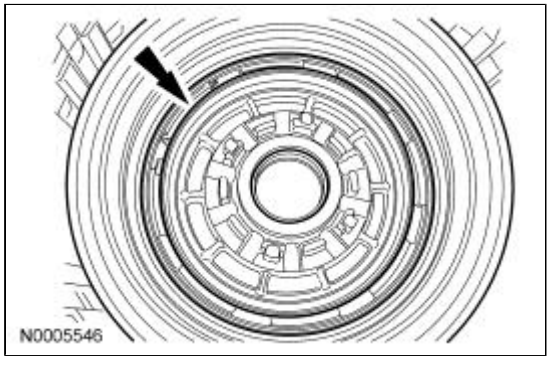
2. Install a new outer O-ring seal on the balance piston.



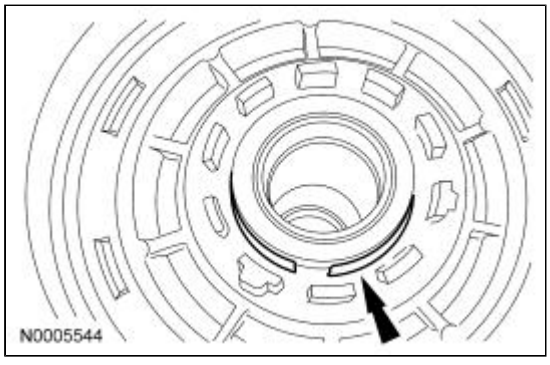
3. Lightly coat the O-ring seals in clean transmission fluid and install the direct clutch piston.



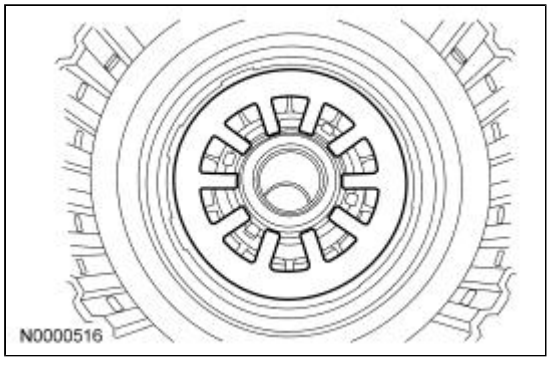
4. Lightly coat the O-ring seals in clean transmission fluid and install the apply piston into the direct clutch balance piston.



5. Slightly press down on the balance piston and install a new snap ring.

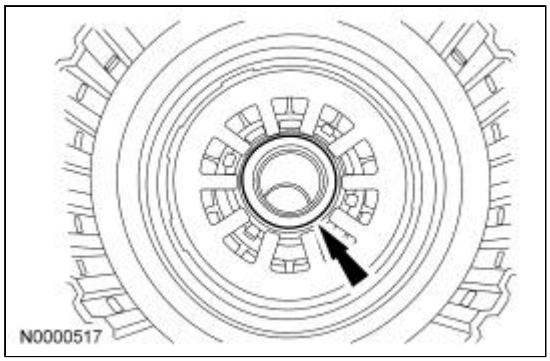


6. Install the direct clutch return spring.

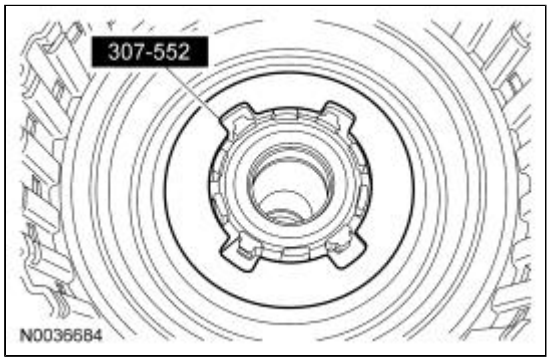


7. **NOTE:** When installing the washer, the stepped edge must face upward.

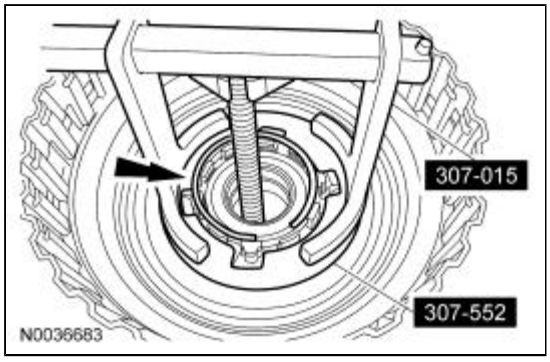
Install the direct clutch return spring washer.



8. Install the special tool.

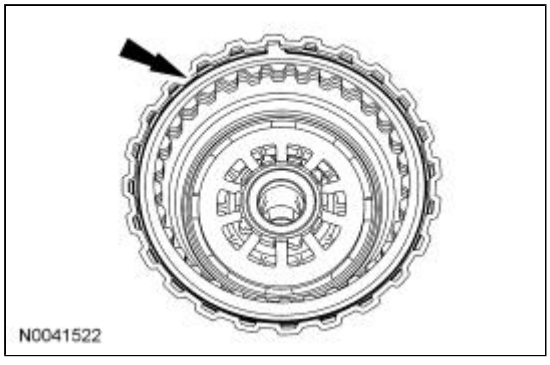


9. Using the special tool, install the direct clutch return spring retainer.



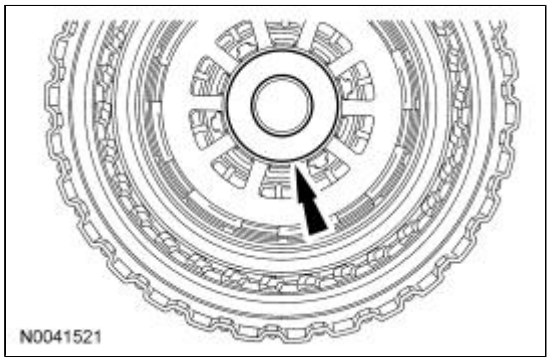
10. Install the new direct clutch plates, starting with the wave spring then a steel plate and alternating between steel and friction plates, and ending with the pressure plate on the top.

11. Install the direct clutch snap ring.



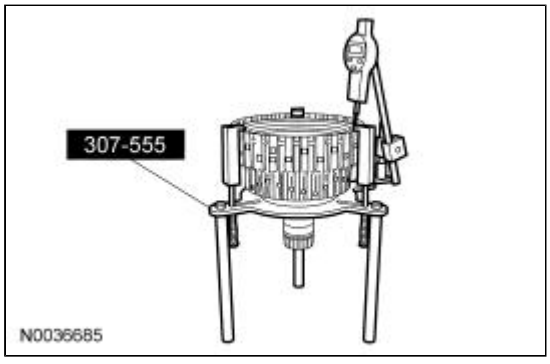
12. **NOTE:** Inspect and install new thrust bearings as required.

    Install a new thrust bearing (T5).



13. **NOTE:** All direct clutch plates, friction and steel are of a wave-type design.

    Install the direct clutch assembly into the special tool so the dial indicator fits into the opening of the snap ring.



14. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

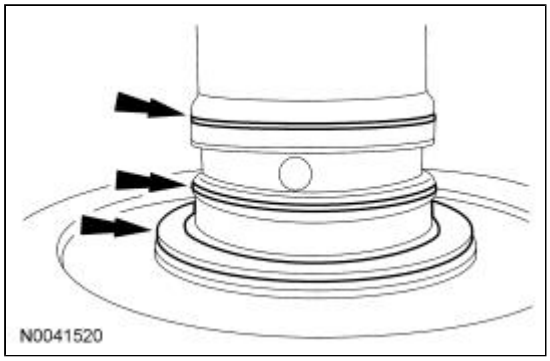
15. Rotate the direct clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

16. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine — 0.5-1.3 mm (0.019-0.051 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

17. Install 2 new scarf cut seals and the roller bearing.


N0041520

Intermediate Clutch Assembly

Printable View (515 KB)

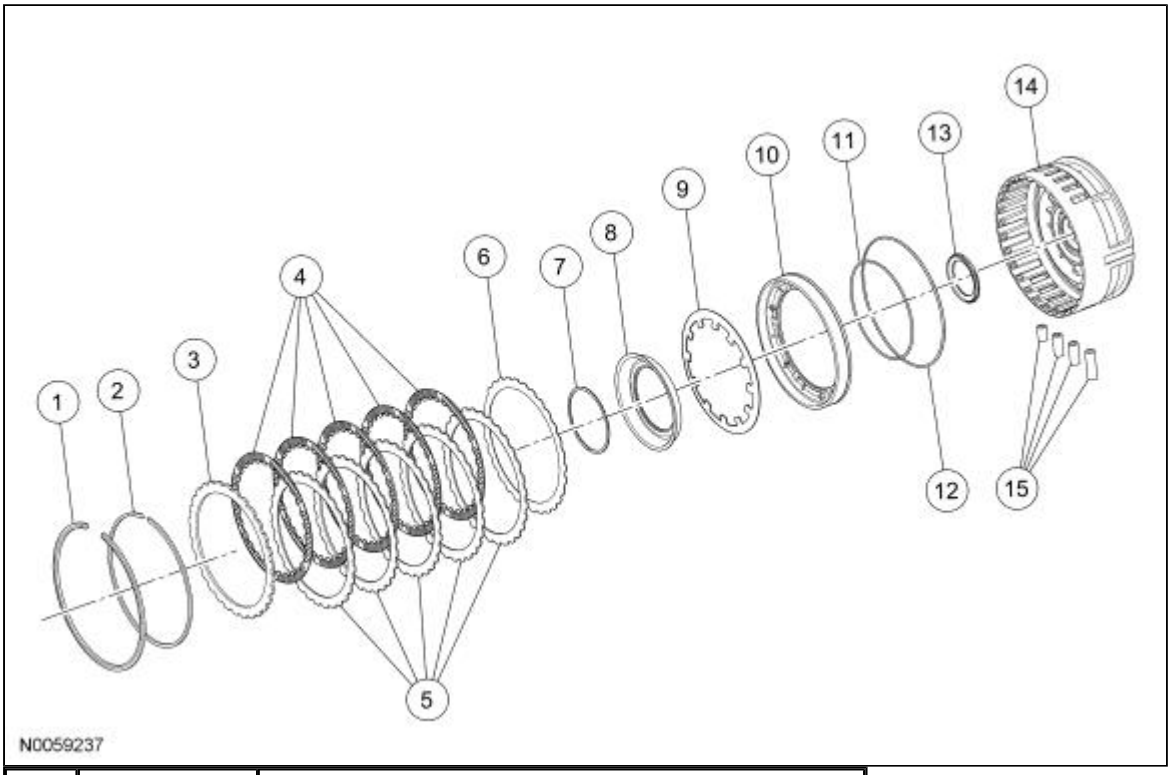
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2881-A	Piston Spring Compressor 307-525
ST2892-A	Clutch Pack End Play Gauge 307-555

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

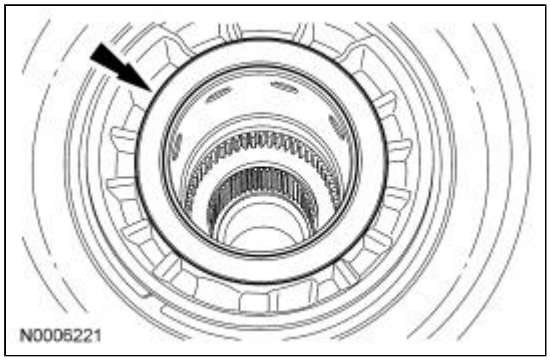
Intermediate Clutch Assembly



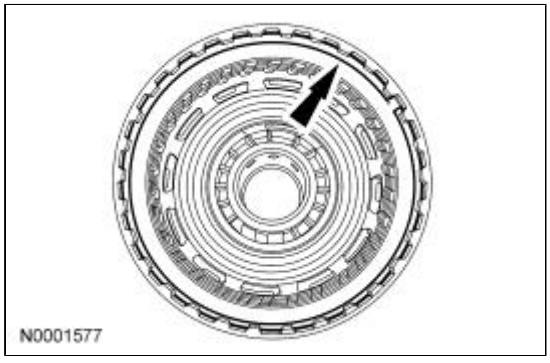
Item	Part Number	Description
1	7L327	Center support retaining ring
2	7B421	Intermediate clutch pack retaining ring
3	7E314	Intermediate clutch pressure plate
4	7B164	Intermediate clutch internal splined friction plates
5	7E314	Intermediate clutch external splined steel plates
6	7H136	Intermediate clutch cushion spring
7	7N169	Intermediate clutch snap ring
8	7B043	Intermediate clutch return spring retaining ring
9	7C151	Intermediate clutch piston return spring
10	7J015	Intermediate clutch piston
11	7F225	Intermediate clutch piston inner seal
12	7F224	Intermediate clutch piston outer seal
13	7F373	Bearing (T6)
14	7G033	Intermediate/low/reverse clutch center support
15	7J135	Center support seals (4 required)

Disassembly

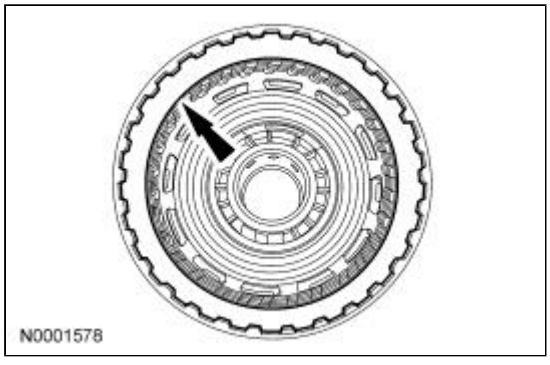
1. Remove the thrust bearing (T6).



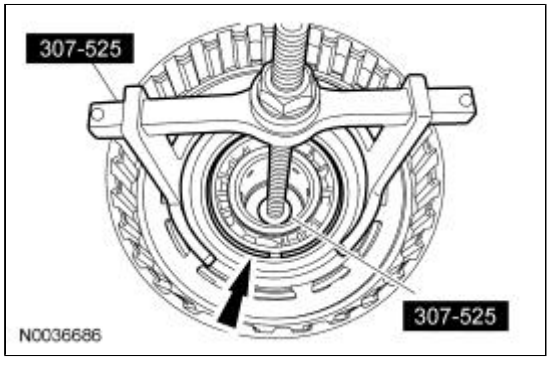
2. Remove the intermediate clutch plate snap ring.



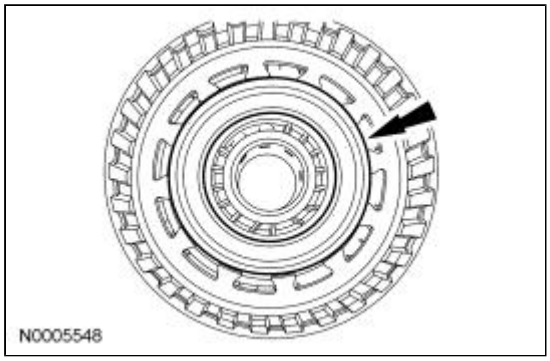
3. Remove the intermediate clutch plates.



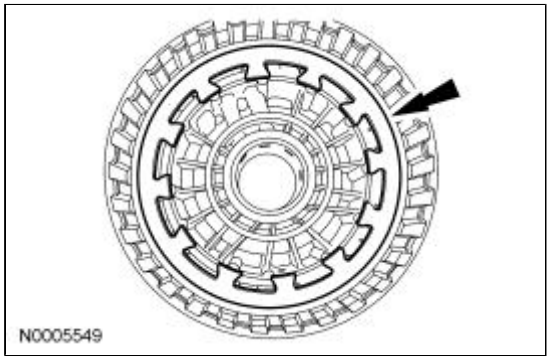
4. Using the special tool, remove and discard the intermediate clutch return spring retainer.



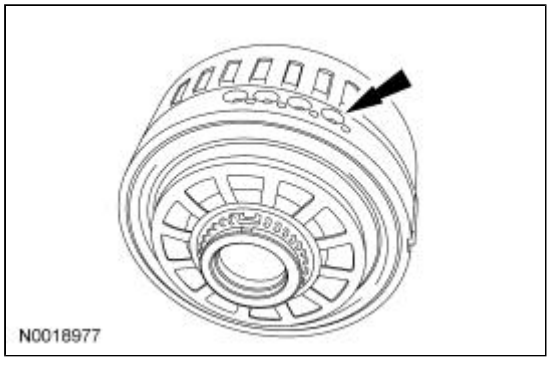
5. Remove the intermediate clutch return spring top plate.



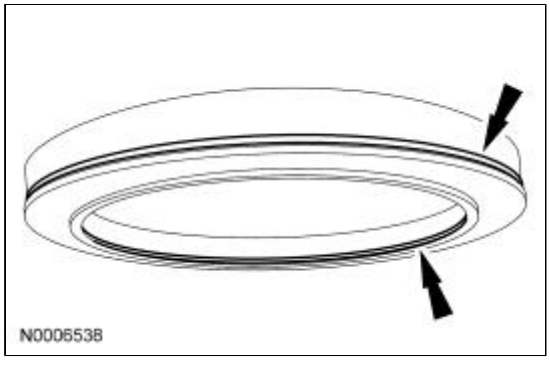
6. Remove the intermediate clutch return spring.



7. Applying a slight amount of air to the port, remove the intermediate clutch piston.

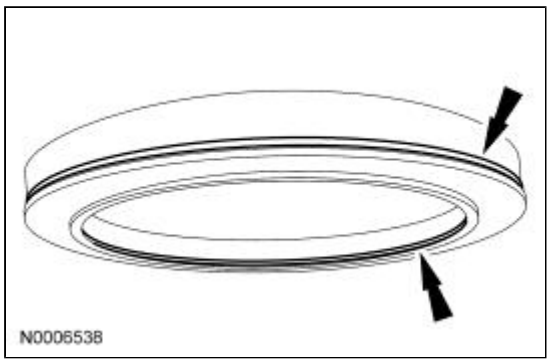


8. Remove and discard the inner and outer intermediate clutch piston O-ring seals.

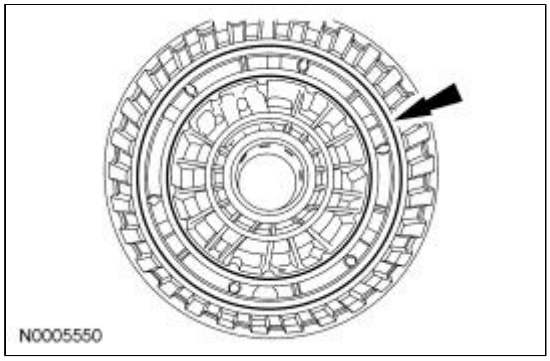


Assembly

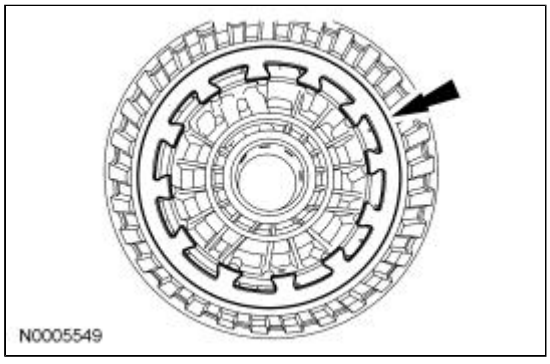
1. Install new inner and outer intermediate clutch piston O-ring seals.



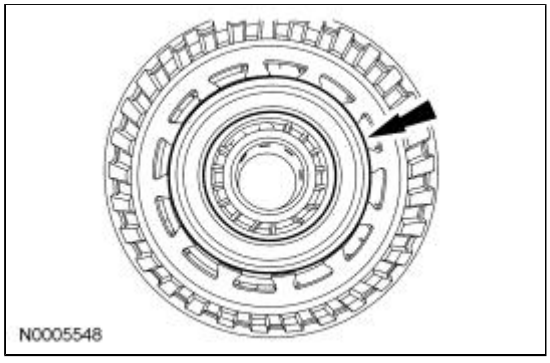
2. Lightly coat the O-ring seals in clean automatic transmission fluid and install the intermediate clutch piston.



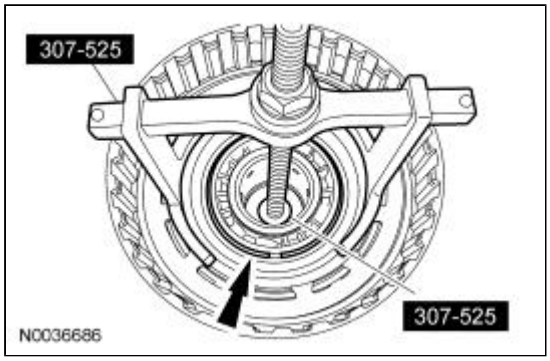
3. Install the intermediate clutch return spring.



4. Install the intermediate clutch return spring top plate.

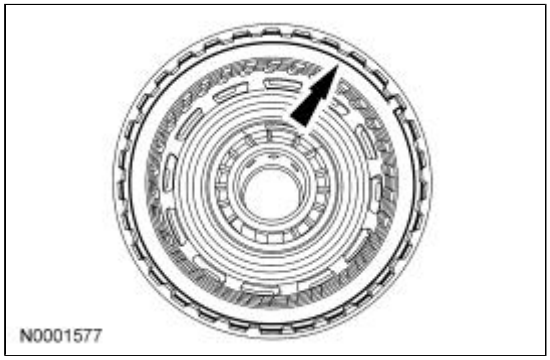


5. Using the special tool, install a new intermediate clutch return spring retainer.



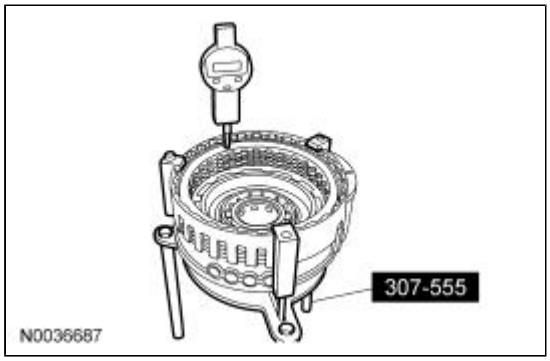
6. Install the new intermediate clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate.

7. Install the intermediate clutch plate snap ring.



8. **NOTE:** All intermediate clutch plates, friction and steel are of a wave-type design.

   Install the intermediate clutch assembly into the special tool so the dial indicator fits into the opening of the snap ring.



9. With the dial indicator set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

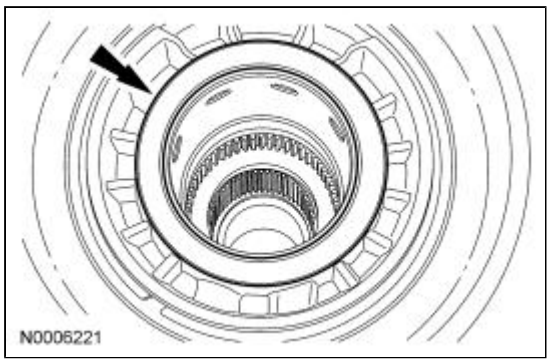
10. Rotate the intermediate clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

11. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
    - 5.4L engine — 0.7-1.1 mm (0.028-0.043 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

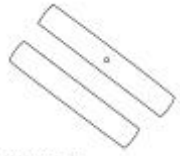
12. Install the thrust bearing (T6).



Low/Reverse Clutch Assembly

Printable View (518 KB)

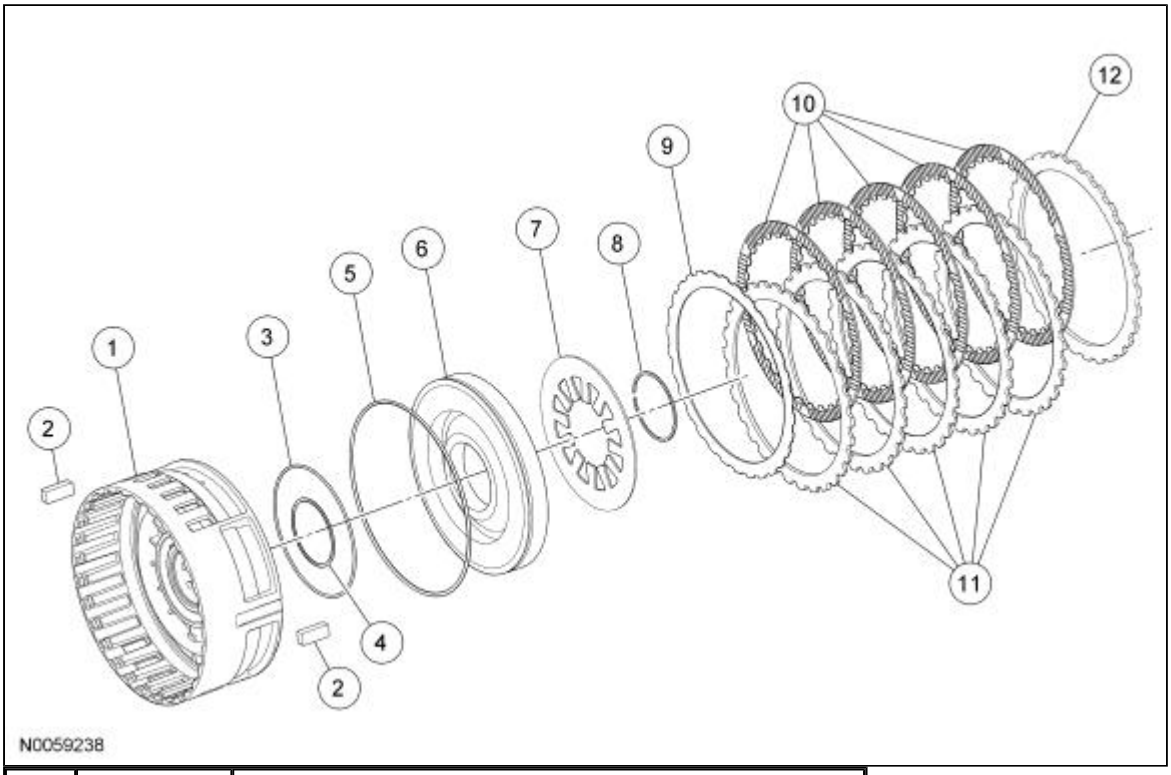
Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2881-A	Compressor, Clutch Spring 307-525
 ST2896-A	Gauge, D-Clutch Measurement 307-554
ST1274-A	Depth Micrometer 303-D075 (D92P-4201-A) or equivalent

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Low/Reverse Clutch Assembly

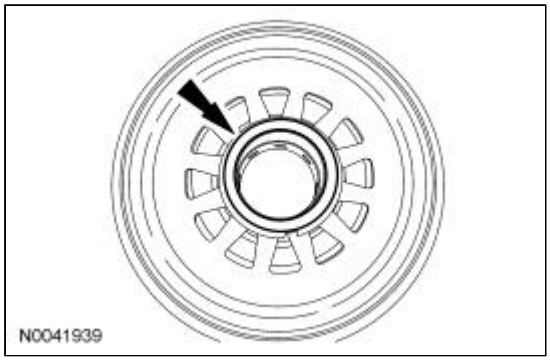


Item	Part Number	Description
1	7G033	Intermediate/low/reverse clutch center support
2	7J135	Center support keys (2 required)
3	7G446	Low/reverse clutch piston center seal
4	7G444	Low/reverse clutch cylinder inner seal
5	7F227	Low/reverse clutch cylinder outer seal
6	7D343	Low/reverse clutch piston
7	7D405	Low/reverse clutch return spring
8	7G494	Low/reverse clutch return spring retainer
9	7N572	Low/reverse clutch cushion spring
10	7B164	Low/reverse clutch internal splined friction plates (internal to case)
11	7E314	Low/reverse clutch external splined steel plates (internal to case)
12	7E314	Low/reverse clutch pressure plate (internal to case) (select fit)

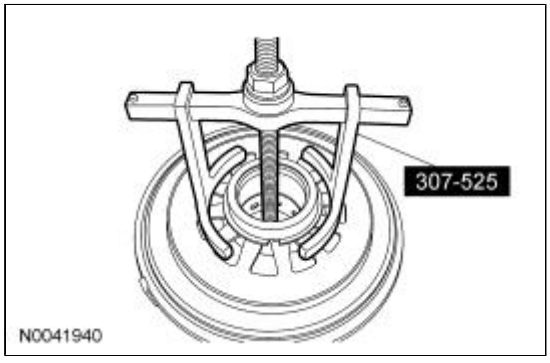
Disassembly

NOTE: The low/reverse clutch plates are installed in the case during the assembly procedure.

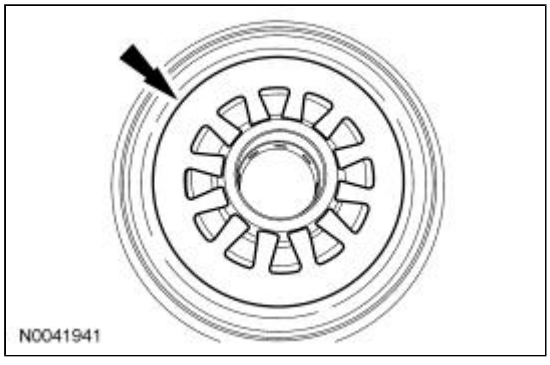
1. Remove the thrust bearing on the center support.



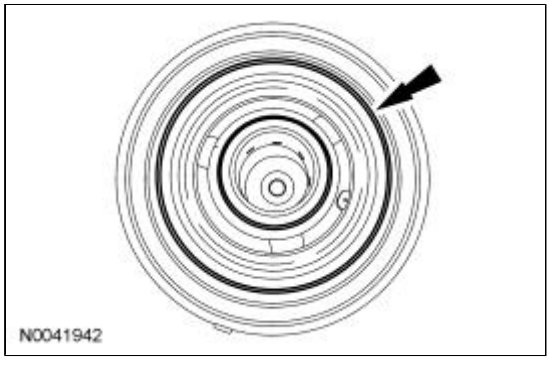
2. Using the special tool, remove the retaining ring.



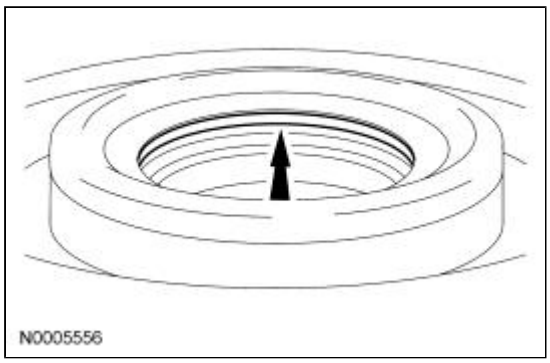
3. Remove the low/reverse clutch return spring.



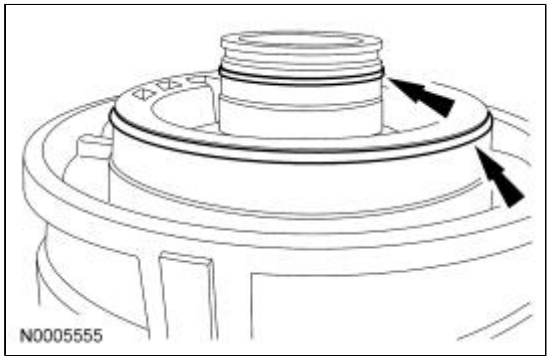
4. Remove the low/reverse clutch piston from the low/reverse clutch drum.



5. Remove and discard the low/reverse outer piston O-ring seals.



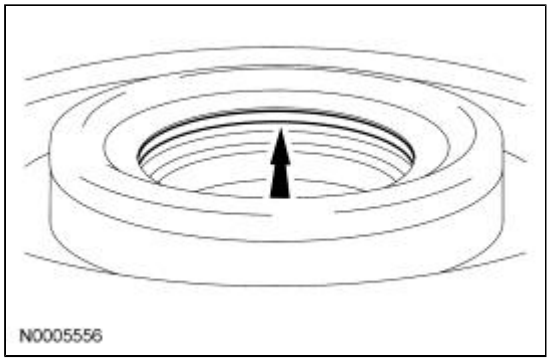
6. Remove and discard the low/reverse drum O-ring seals.



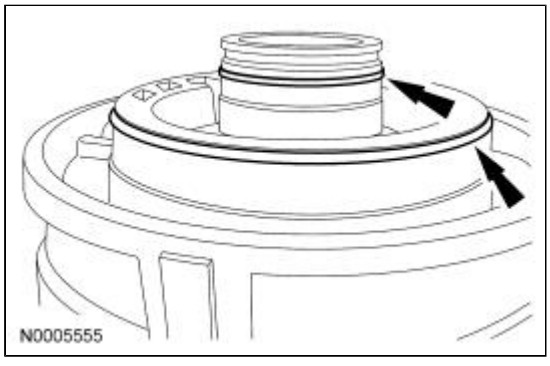
Assembly

Low/reverse piston

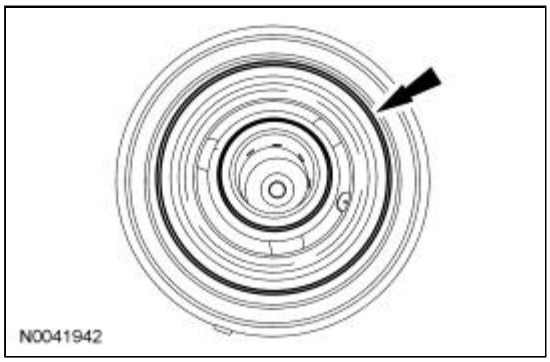
1. Install new low/reverse outer piston O-ring seals.



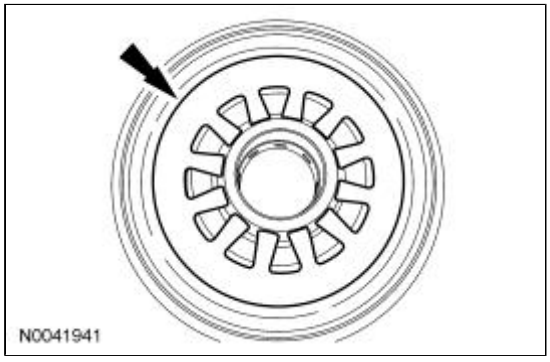
2. Install new low/reverse drum O-ring seals.



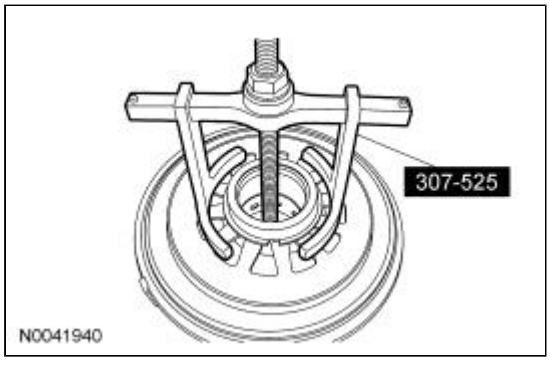
3. Lubricate the O-ring seal with clean automatic transmission fluid and install the low/reverse piston.



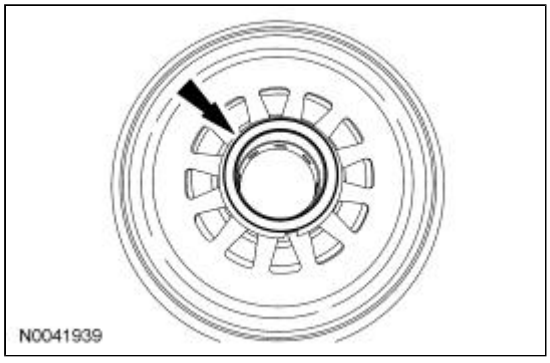
4. Install the low/reverse clutch return spring.



5. Using the special tool, install the retaining ring.



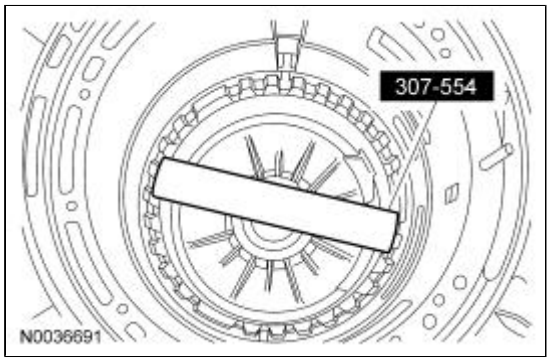
6. Install a new roller bearing on the center support.



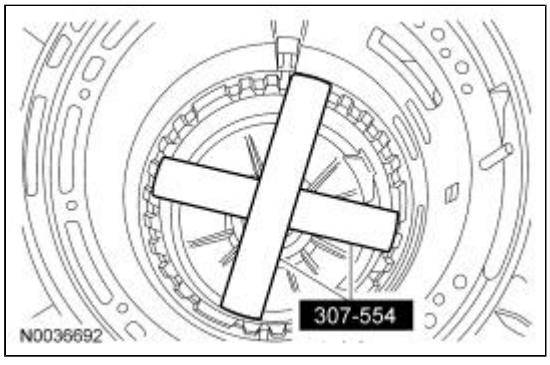
Low/reverse clutch stackup

7. **NOTE:** All intermediate clutch plates, friction and steel are of a wave-type design.

   Install the special tool into the case.

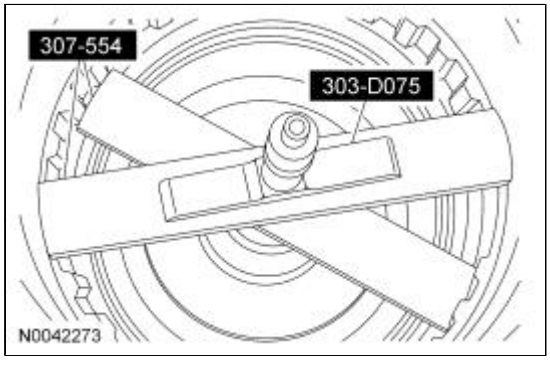


8. Install the special tool into the case as shown.



9. Measure case stop depth.

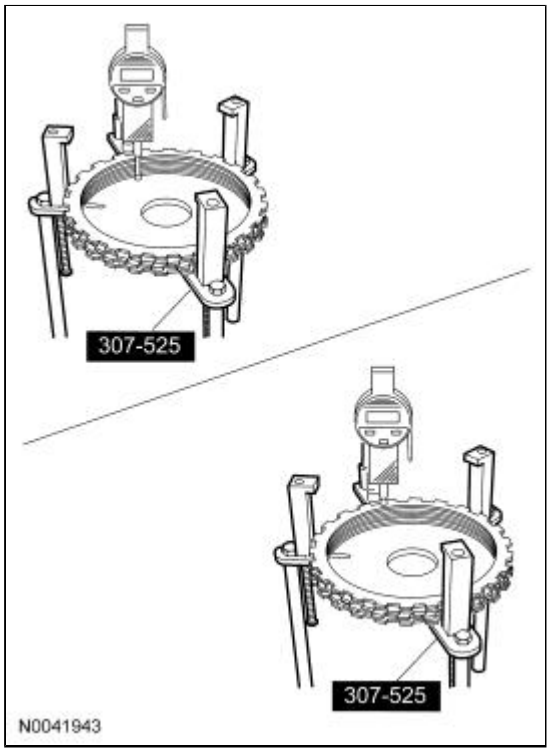
Description	Reading
Measure the distance from the top of the upper gauge bar to the top of the lower gauge bar. Record this reading as the case measurement. Record as reading A	



10. Measure the clutch pack height.

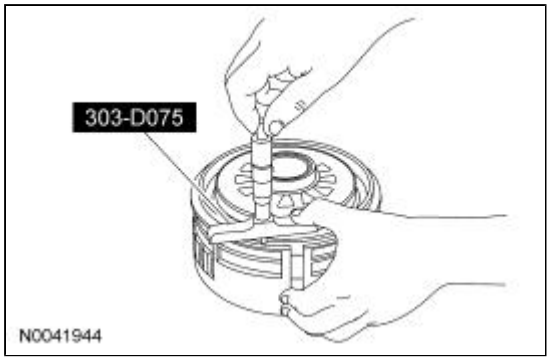
	Description	Reading
A.	Place the clutch pack with the pressure plate on to the special tool with the wave spring down. Slide the clutch off to the side so the probe of the dial indicator is touching the gauge plate of the special tool. Zero out the dial indicator.	
B.	Carefully lift the probe up enough to slide the clutch pack under the probe to take a reading. Record this reading. Rotate the clutch pack 180 degrees and take a second reading. Add the first and second readings together and divide the total by	

2. Record this reading as B.	



11. Measure the piston to center support shoulder height.

Description	Reading
Measure the piston to center support shoulder height. Record this measurement. Rotate the center support 180 degrees and record this measurement. Add the first and the second measurements, then divide by 2. Record this as reading C.	



12. Calculate the end clearance

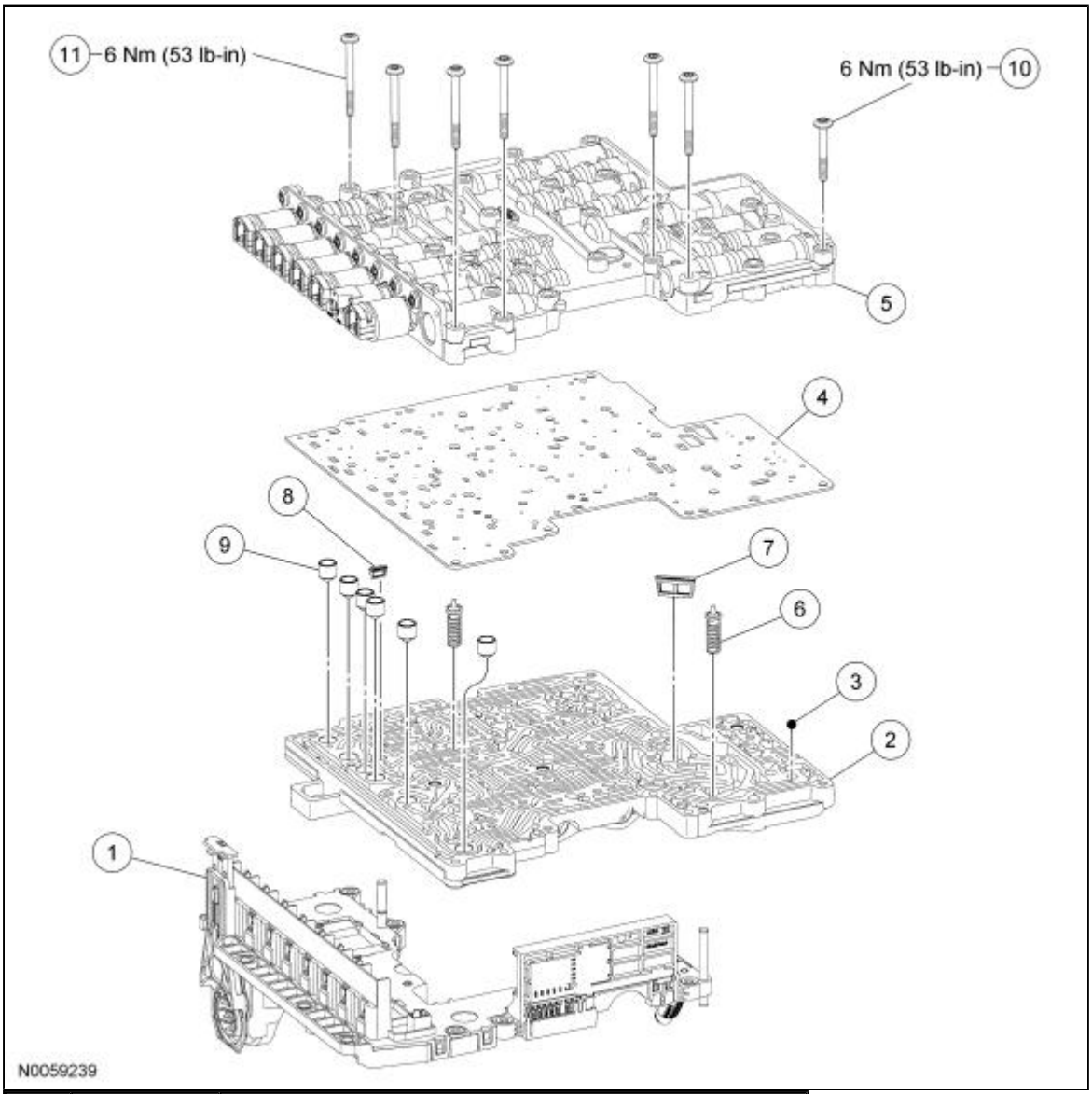
Description	Reading
Subtract B and C from A to determine end clearance	
Total C measurement	
End clearance specification	1.0-1.6 mm (0.039-0.063 in)

Compare the end clearance to the specification. If the end clearance is out of specification, select the next thinner or thicker plate as required and repeat Steps 10, 11 and 12.

Mechatronic Assembly

Printable View (878 KB)

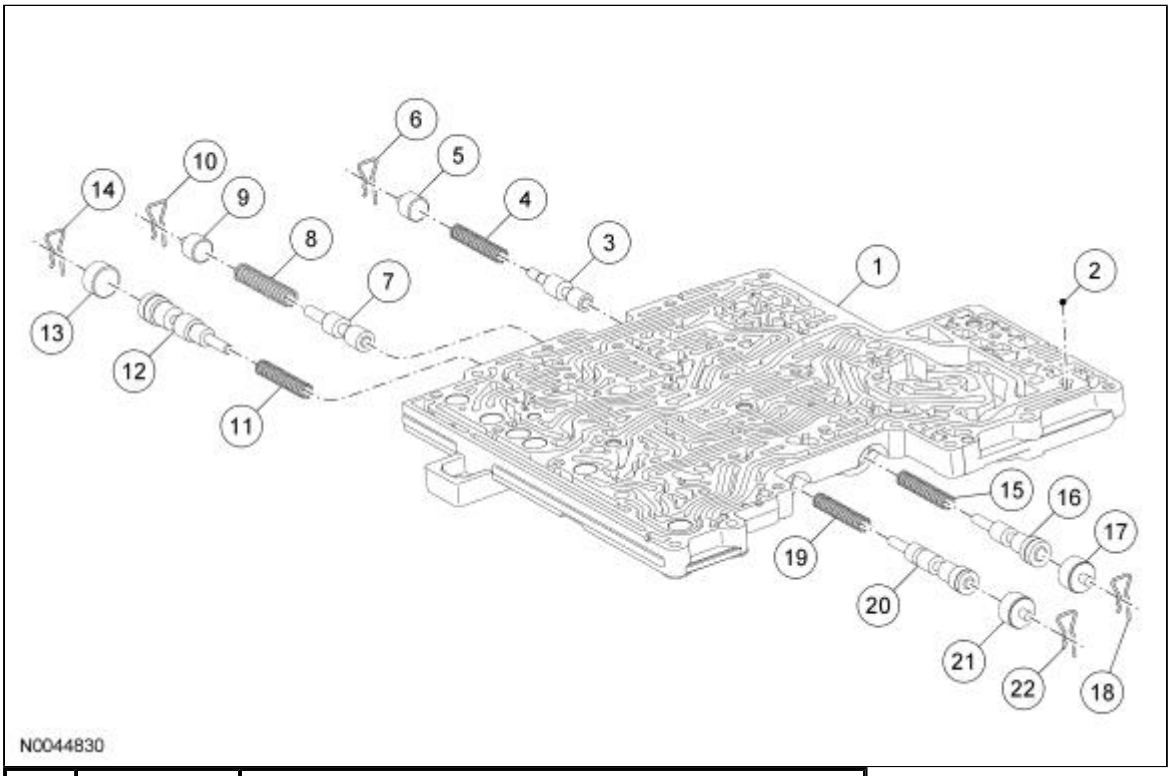
Mechatronic



Item	Part Number	Description
1	7Z369	Transmission control module (TCM)
2	7A092	Transmission control valve body (upper)
3	7E195	Transmission control valve check ball (8 required)
4	7Z490	Transmission control valve body separator plate
5	7A101	Transmission control valve body (lower)
6	7D142	Transmission control valve assembly
7	7K221	Transmission control filter assembly
8	7K172	Transmission fluid filter

9	7J191	Transmission solenoid damper valve assembly
10	W707886	Bolt — connects upper and lower half together (19 required)
11	W707884	Bolt — connects TCM to transmission control valve assembly (6 required)

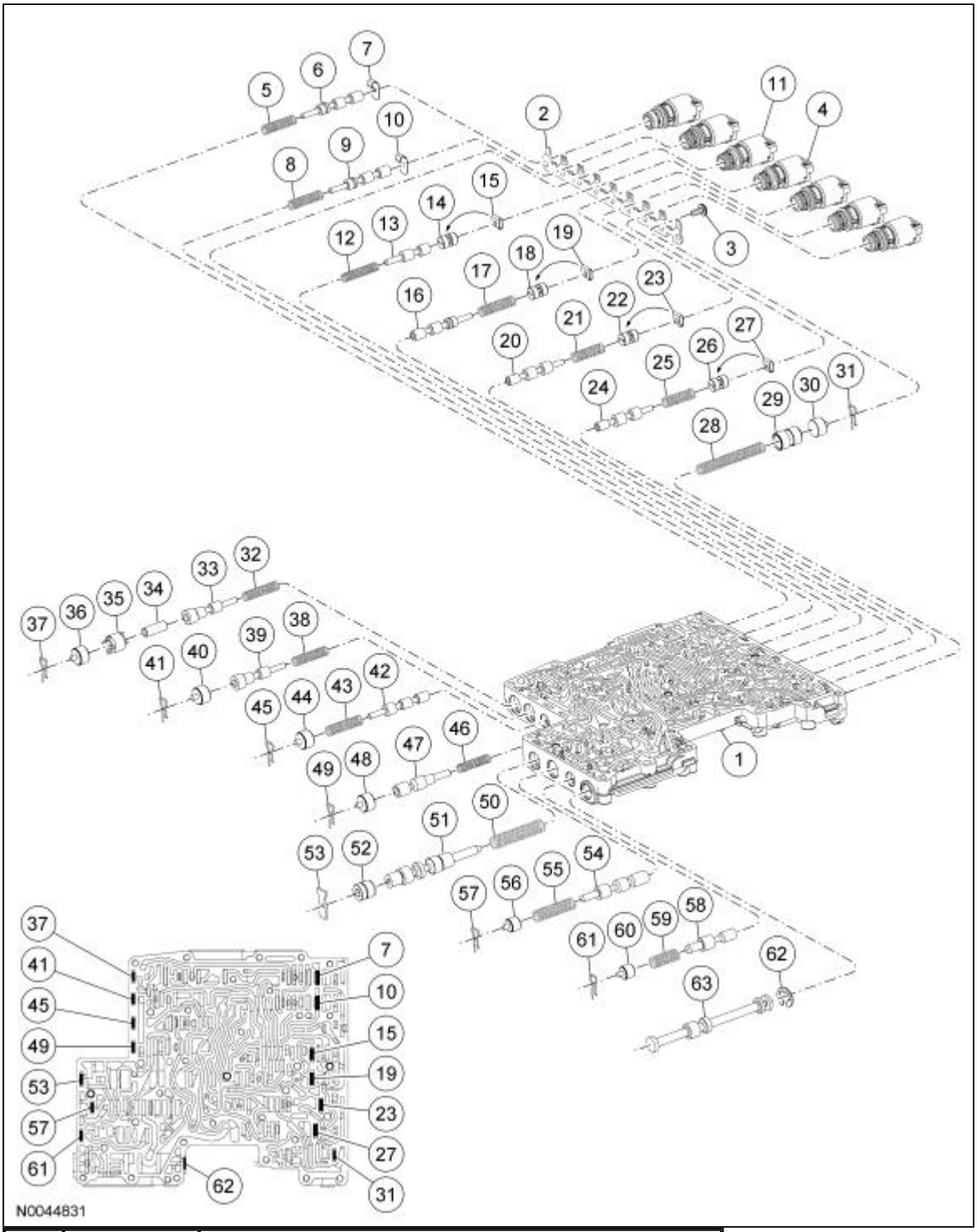
Mechatronic Upper Half



Item	Part Number	Description
1	7A092	Transmission control valve assembly (ditch plate) (upper half)
2	7E395	Transmission control valve check ball (8 required)
3	7J186	Transmission clutch valve
4	7L389	Transmission clutch valve spring
5	7F187	Transmission clutch valve spring plug
6	7J199	Transmission clutch valve spring plug retainer clip
7	7J183	Transmission clutch valve
8	7J196	Transmission clutch valve spring
9	7F187	Transmission clutch valve spring plug
10	7J199	Transmission clutch valve spring plug retainer clip
11	7L389	Transmission clutch valve
12	7J181	Transmission clutch valve spring
13	7F187	Transmission clutch valve spring plug
14	7J199	Transmission clutch valve spring plug retainer clip
15	7L389	Transmission clutch valve

16	7D102	Transmission clutch valve spring
17	7F187	Transmission clutch valve spring plug
18	7J199	Transmission clutch valve spring plug retainer clip
19	7L389	Transmission clutch valve
20	7J182	Transmission clutch valve spring
21	7F187	Transmission clutch valve spring plug
22	7J199	Transmission clutch valve spring plug retainer clip

Mechatronic Lower Half

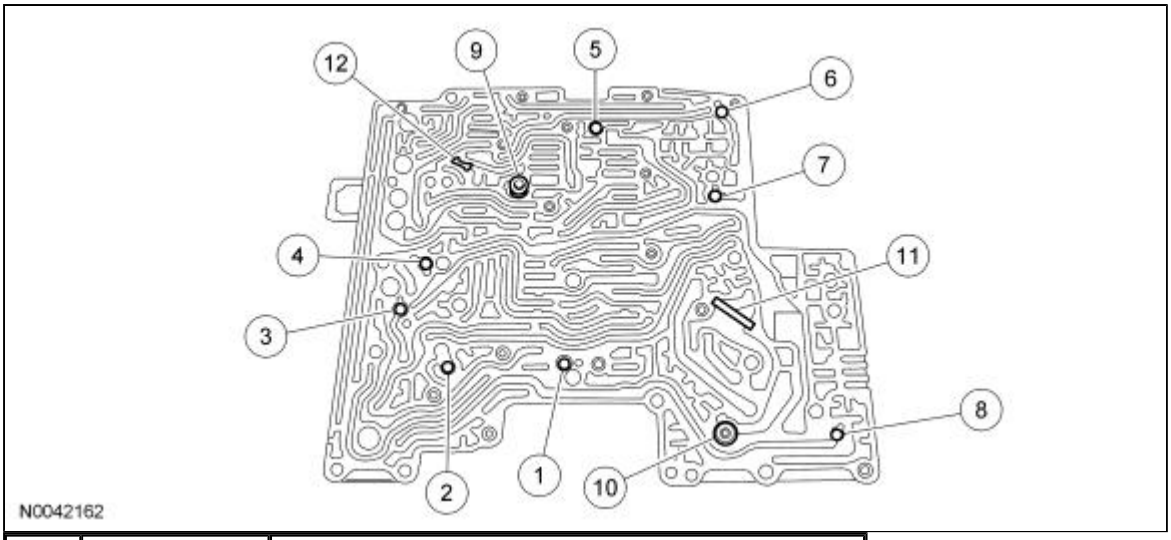


Item	Part Number	Description
1	7A101	Transmission control valve assembly (lower half)
2	7H186	Transmission shift control solenoid hold down bracket
3	W707885-S	Transmission shift control solenoid hold down bracket bolt M5 x 0.80 x 12
4	7G484	Transmission shift control solenoid
5	7J197	Transmission clutch valve spring
6	7J187	Transmission clutch valve

7	7F194	Transmission spring retainer plate
8	7J197	Transmission clutch valve spring
9	7J187	Transmission clutch valve
10	7F194	Transmission spring retainer plate
11	7G383	EPC solenoid
12	7G411	Transmission solenoid regulator valve spring
13	7G473	Transmission solenoid pressure regulator valve
14	7J185	Transmission solenoid plug
15	7G007	Transmission valve plug retainer
16	7J187	Transmission clutch valve
17	7J197	Transmission clutch valve spring
18	7J185	Transmission solenoid plug
19	7G007	Transmission valve plug retainer
20	7H392	Transmission solenoid valve
21	7H258	Transmission solenoid valve spring
22	7J185	Transmission solenoid plug
23	7G007	Transmission valve plug retainer
24	7H392	Transmission solenoid valve
25	7H258	Transmission solenoid valve spring
26	7J185	Transmission solenoid plug
27	7G007	Transmission valve plug retainer
28	7L389	Transmission accumulator valve spring
29	7H022	Transmission manual control oil accumulator
30	7F187	Transmission valve return plug
31	7J199	Transmission valve plug return clip
32	7L389	Transmission clutch valve spring
33	7D102	Transmission clutch control pressure regulator valve
34	7H571	Transmission clutch regulator valve sleeve
35	7J184	Transmission
36	7F187	Transmission valve return plug
37	7J199	Transmission valve plug return clip
38	7L389	Transmission clutch valve spring
39	7D102	Transmission control pressure regulator valve
40	7F187	Transmission valve return plug
41	7J199	Transmission valve plug return clip
42	7J194	Transmission clutch valve
43	7J196	Transmission clutch control valve spring
44	7F187	Transmission valve return plug
45	7J199	Transmission valve plug return clip
46	7H140	Transmission bypass clutch control valve spring
47	7H019	Transmission bypass clutch control valve

48	7F187	Transmission valve return plug
49	7J199	Transmission valve plug return clip
50	7A270	Transmission manual oil pressure regulator valve spring
51	7C388	Transmission manual oil pressure regulator valve
52	7D002	Transmission manual oil pressure regulator valve sleeve
53	7J199	Transmission valve plug return clip
54	7G307	Transmission converter regulator valve
55	7G316	Transmission converter regulator valve spring
56	7F187	Transmission valve return plug
57	7J199	Transmission valve plug return clip
58	7G413	Transmission lube control valve
59	7H143	Transmission lube control valve spring
60	7F187	Transmission valve return plug
61	7J199	Transmission valve plug return clip
62	W527007-S	Retaining ring
63	7C389	Transmission control manual valve

Check Ball Location



Item	Part Number	Description
1	—	Reverse/drive control check ball
2	—	Shift solenoid control check ball
3	—	Intermediate clutch exhaust control check ball
4	—	Direct clutch exhaust control check ball
5	—	Low/reverse clutch exhaust control check ball
6	—	Forward clutch exhaust control check ball
7	—	Overdrive clutch exhaust control check ball
8	—	Reverse exhaust control check ball

9	—	Clutch exhaust valve
10	—	Converter drain back valve
11	—	Large screen
12	—	Small screen

Disassembly

CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission control module (TCM). An electrostatic discharge may occur and may cause damage to the TCM/Mechatronic assembly.

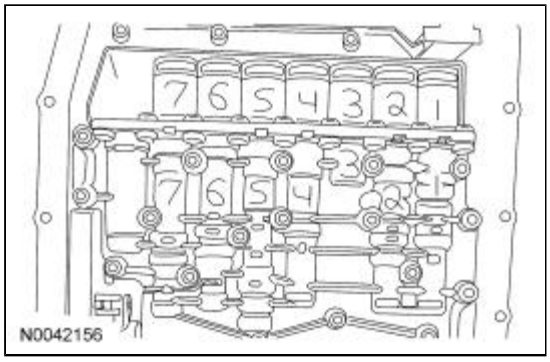
NOTE: Make an identifying mark on each solenoid and the corresponding bore for correct assembly.

NOTE: Solenoids may visually appear the same but their designs/functions are different. Caution must be taken not to assemble the mechatronics assembly incorrectly. Incorrect solenoid installation will result in poor transmission shift quality.

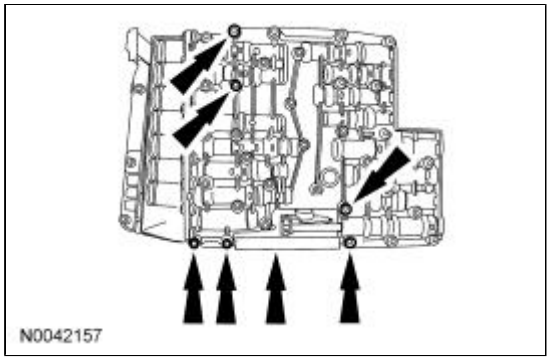
NOTE: Note where the 8 check balls, 6 solenoid dampers, 2 internal valves and springs and 2 internal filters are located for reassembly.

Mechatronic assembly upper half

1. Make an identifying mark on each solenoid and the corresponding bore for correct assembly.

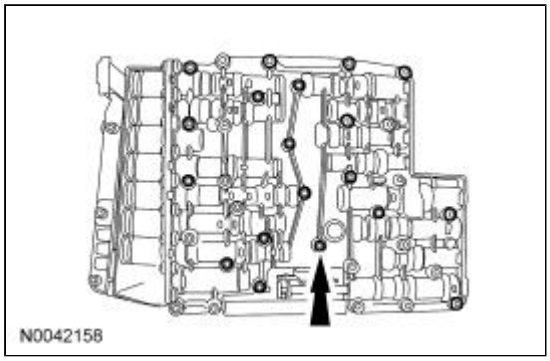


2. Remove the 6 long bolts from the TCM unit.



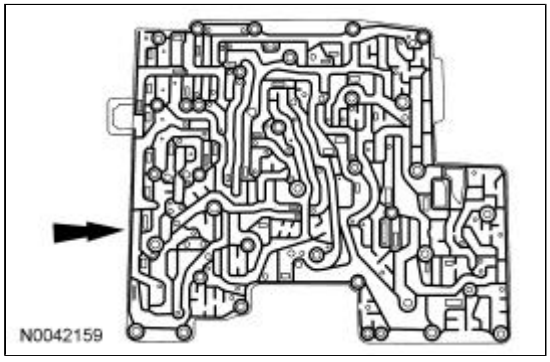
3. Carefully separate the TCM from the mechatronic assembly.

4. Remove 19 short bolts from the mechatronic assembly.



5. Separate the lower half of the mechatronic assembly from the upper half of the mechatronic assembly.

6. Remove and discard the separator plate.



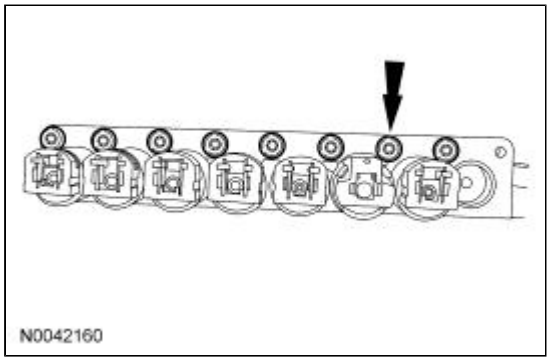
7. Remove from the mechatronic assembly the clips, caps, valves and spring from each bore. Note the location and order for reassembly. Refer to the preceding exploded views.

8. Remove from the mechatronic assembly the transmission control valves, check balls and filter screens. Note the location and order for reassembly. Refer to the preceding exploded views.

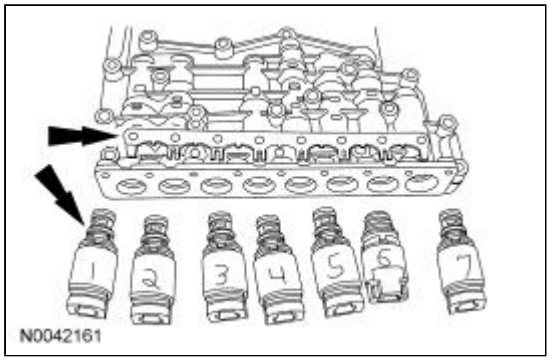
9. Using clean mineral spirits, clean the upper half of the mechatronic assembly.

Mechatronic assembly lower half

10. Remove the 8 solenoid bracket bolts and the solenoid bracket.



11. Remove the solenoids.



12. Remove from the mechatronic assembly the clips, caps, valves and spring from each bore. Note the location and order for reassembly. Refer to the preceding exploded views.

13. Using clean mineral spirits, clean the lower half of the mechatronic assembly.

Assembly

CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. An electrostatic discharge may occur and may cause damage to the TCM/Mechatronic assembly.

Mechatronic assembly upper half

1. **NOTE:** Many components and surfaces in the mechatronic valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly will prevent unnecessary damage to machined surfaces.

   Install the clips, caps, valves and spring into each bore. Refer to the preceding exploded views.

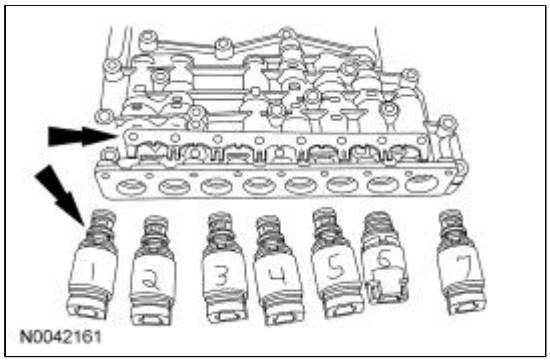
Mechatronic assembly lower half

2. **NOTE:** Many components and surfaces in the mechatronic valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly will prevent unnecessary damage to machined surfaces.

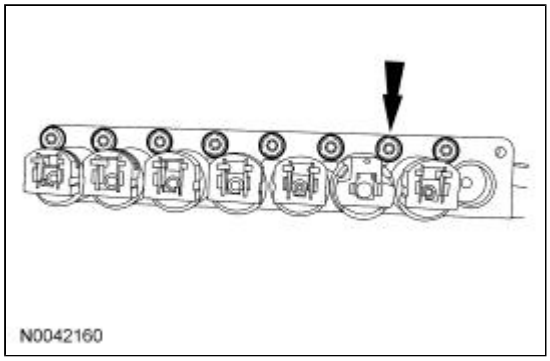
   Install the clips, caps, valves and spring into each bore.

3. **NOTE:** Lubricate the O-ring seals of the solenoids with clean automatic transmission fluid when installing them into the valve body.

   Install the solenoids into their correct bores as indicated during disassembly.

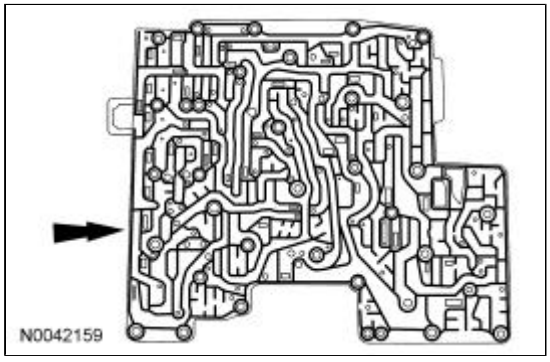


4. Install the solenoid bracket and the 8 bolts.
   - Tighten to 6 Nm (53 lb-in).



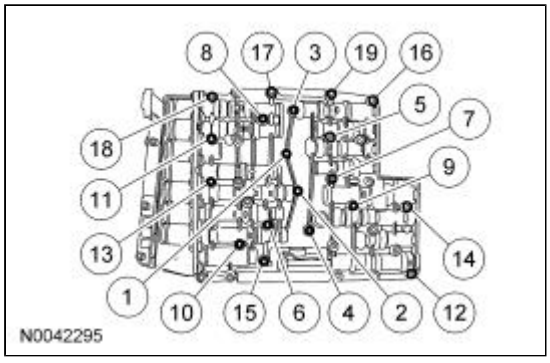
5. Install into the mechatronic assembly the transmission control valves, check balls and filter screens. Refer to the preceding exploded views.

6. Install a new separator plate.



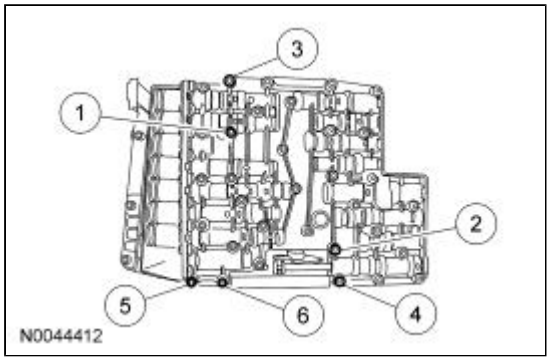
7. Assemble the lower half and the upper half of the mechatronic assembly.

8. Install the 19 short bolts into the mechatronic assembly. Tighten the bolts in the sequence shown.
    - Tighten to 6 Nm (53 lb-in).



9. Carefully install the TCM onto the mechatronic assembly.

10. Install the 6 long bolts into the TCM unit. Tighten the bolts in the sequence shown.
    - Tighten to 6 Nm (53 lb-in).


3
1
2
5
6
4
N0044412

Pump Assembly

Printable View (280 KB)

Special Tool(s)

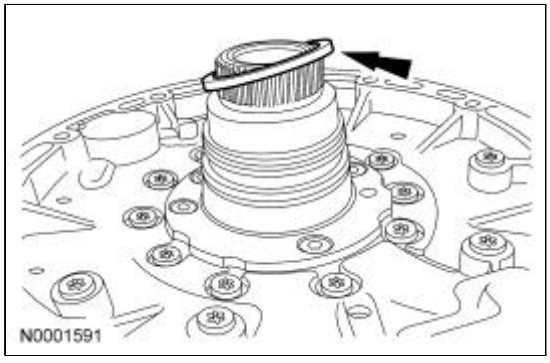
ST2687-A	Installer, Fluid Pump Seal 307-556

Material

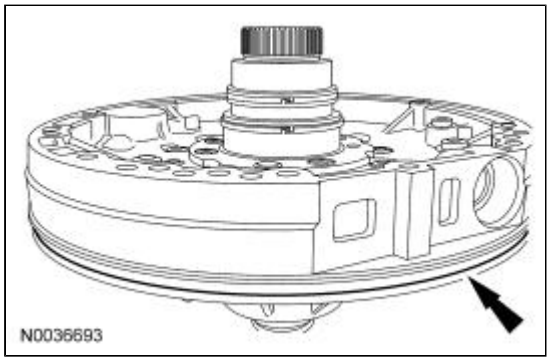
Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Disassembly

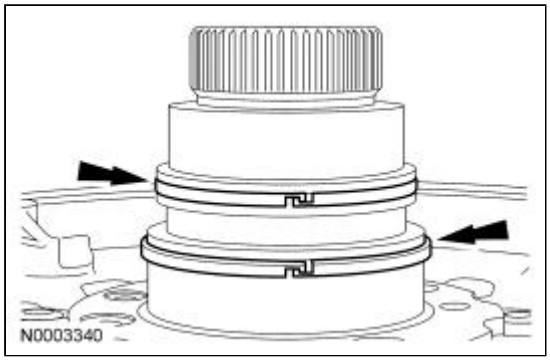
1. Remove the front pump washer.



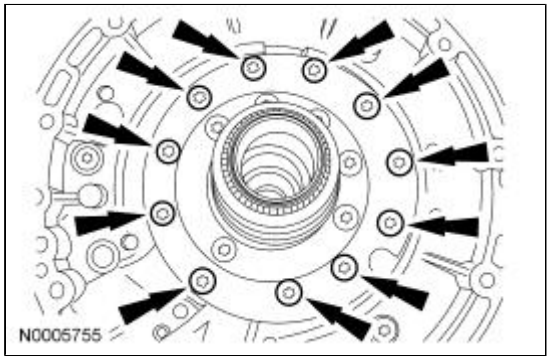
2. Remove and discard the front pump O-ring seal from the plate assembly.



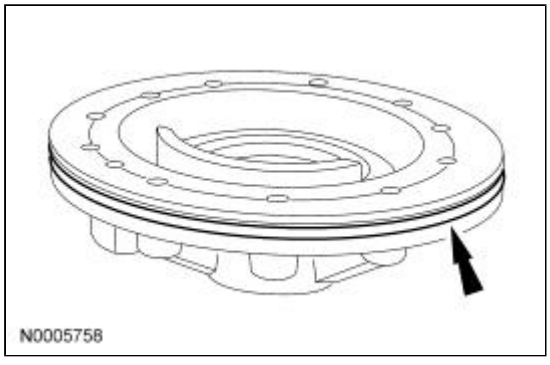
3. Remove and discard the front pump seal rings from the stator support.



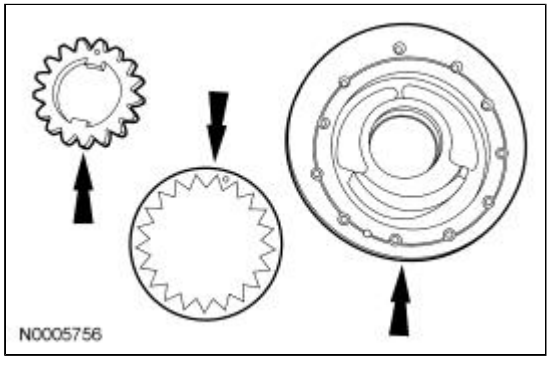
4. Remove the 11 bolts and separate the pump plate assembly from the pump body.



5. Remove and discard the pump body outer seal.



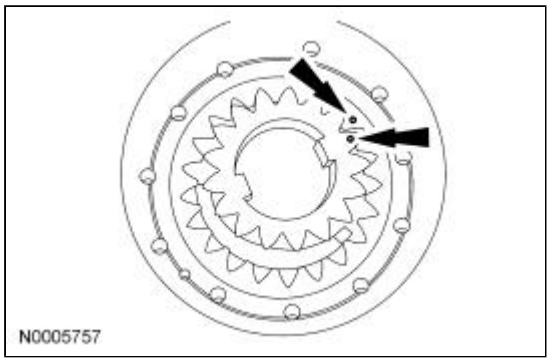
6. Remove and inspect the inner and the outer pump gears.
    - Clean all pump components in solvent.
    - Dry the parts with compressed air.
    - Inspect the pump gears, faces, gear teeth, pump housing and mating surfaces for damage or scoring.
    - Install a new pump as necessary.



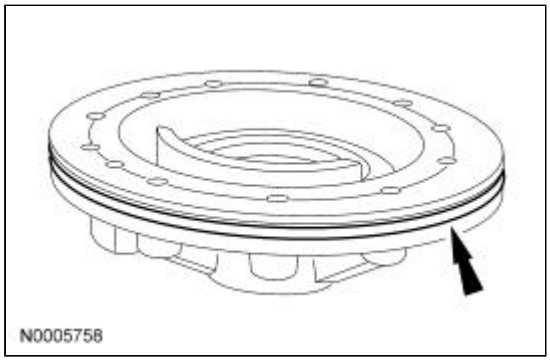
Assembly

1. **NOTE:** Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.

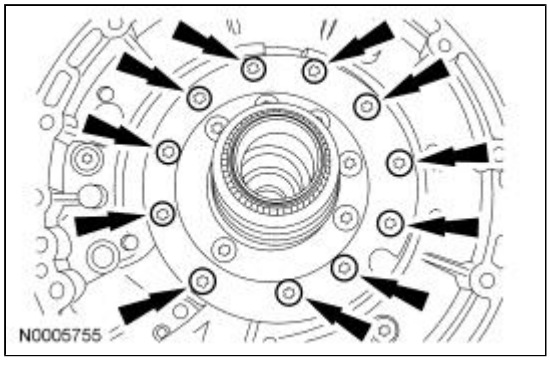
   Install the pump gears with the dot facing the pump plate assembly.



2. Install a new pump body outer seal.

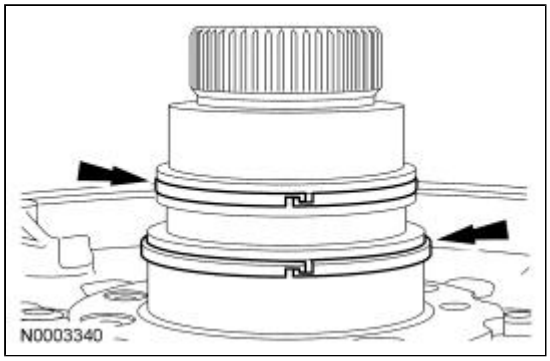


3. Assemble the plate assembly and the pump body assembly.
   - Tighten to 15 Nm (11 lb-ft).

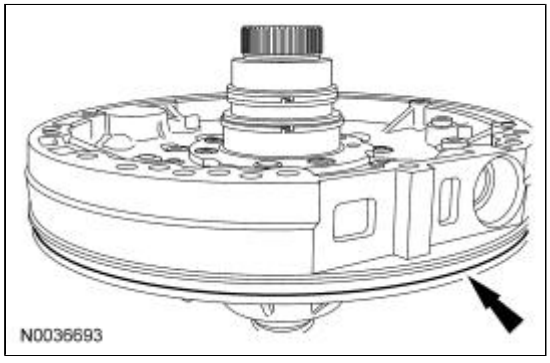


4. **CAUTION: Make sure the seal ends are correctly positioned together and not separated.**

   Install the 2 front pump seal rings onto the stator support. Make sure the seals are fully seated in the stator support seal grooves and the seal ends are oriented 180 degrees apart.

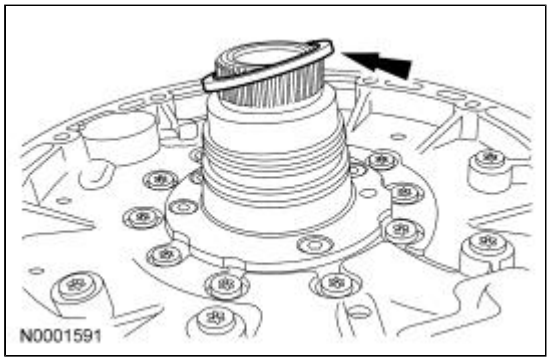


5. Install the pump outer diameter front pump O-ring seal.

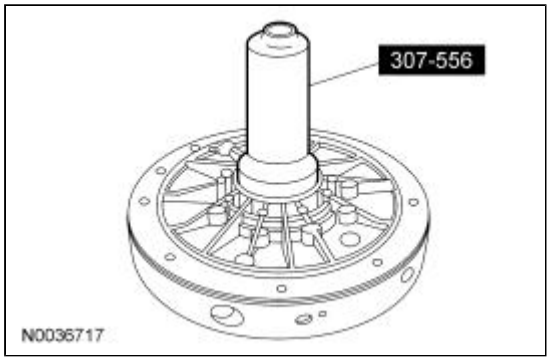


6. **NOTE:** Lightly lubricate the thrust washer and the bearing with petroleum jelly to hold them in place during assembly.

   Install the pump thrust washer.



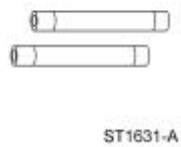
7. Using the special tool, install the front pump seal.



Transmission

Printable View (2720 KB)

Special Tool(s)

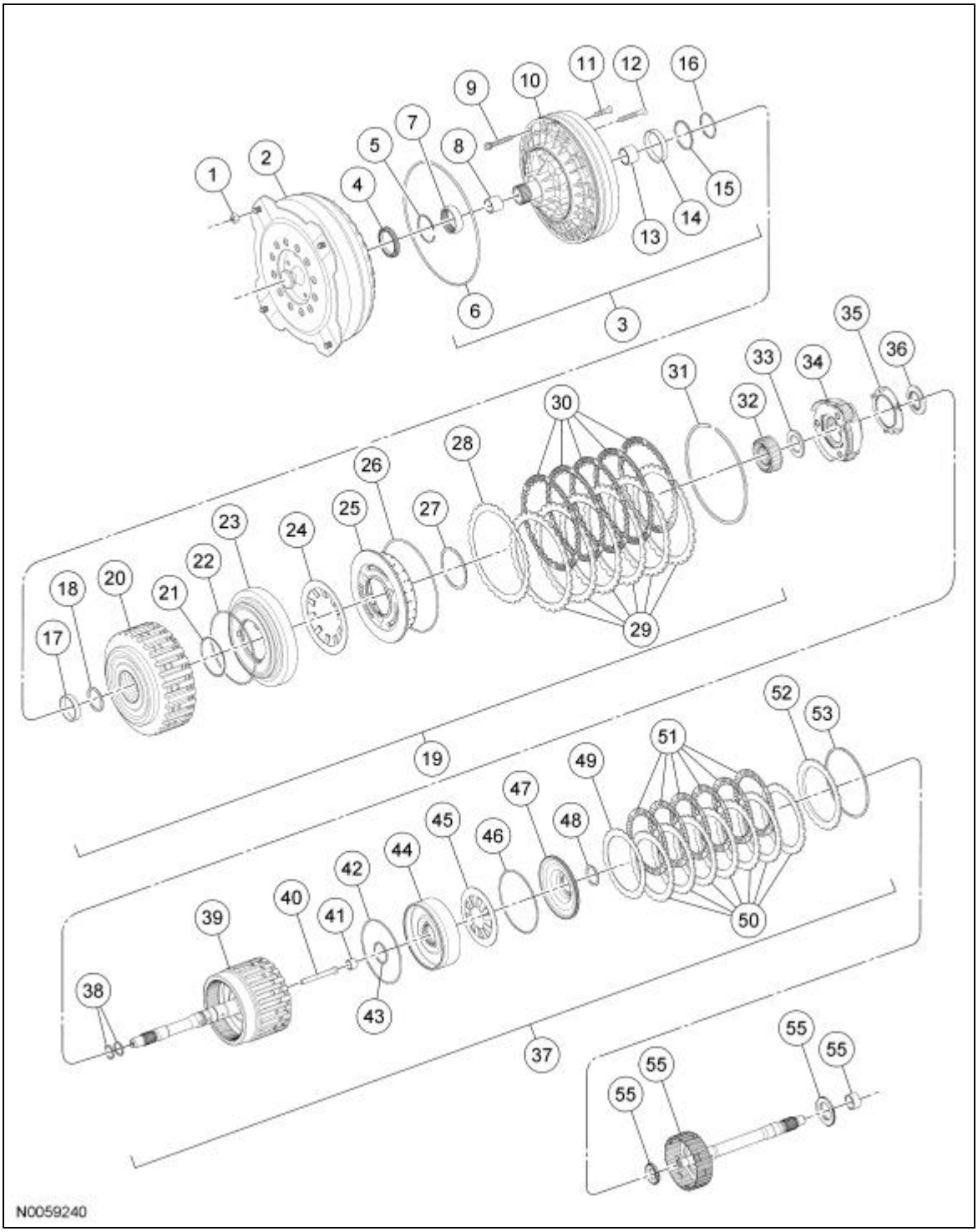
ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
ST2890-A	Installer, Shifter Fluid Seal 307-559
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
ST2888-A	Installer, Transmission Extension Housing Fluid Seal 307-560
ST2887-A	Installer, Fluid Pump Seal 307-556
ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)
ST1754-A	Aligner, Valve Body 307-334 (T95L-70010-C)
	Installer, Ball Bearing 307-557

ST2895-A	
ST2894-A	Installer, Needle Bearing 307-558
ST2891-A	Remover, Transmission Fluid Pump 307-553
ST1255-A	Handle, Driver 205-153 (T80T-4000-W)
ST2883-A	End Play Gauge, Transmission 307-534

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Disassembled Views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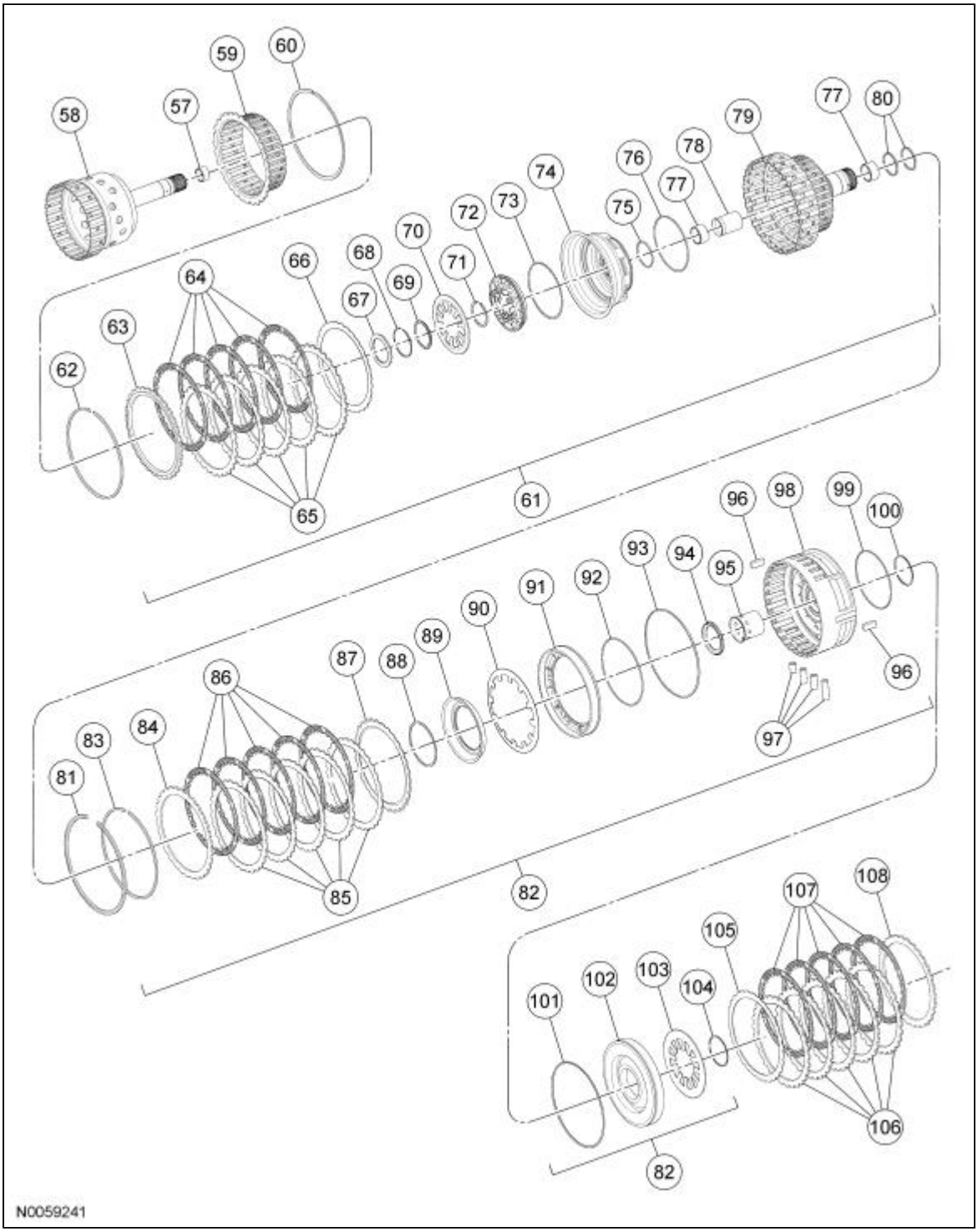
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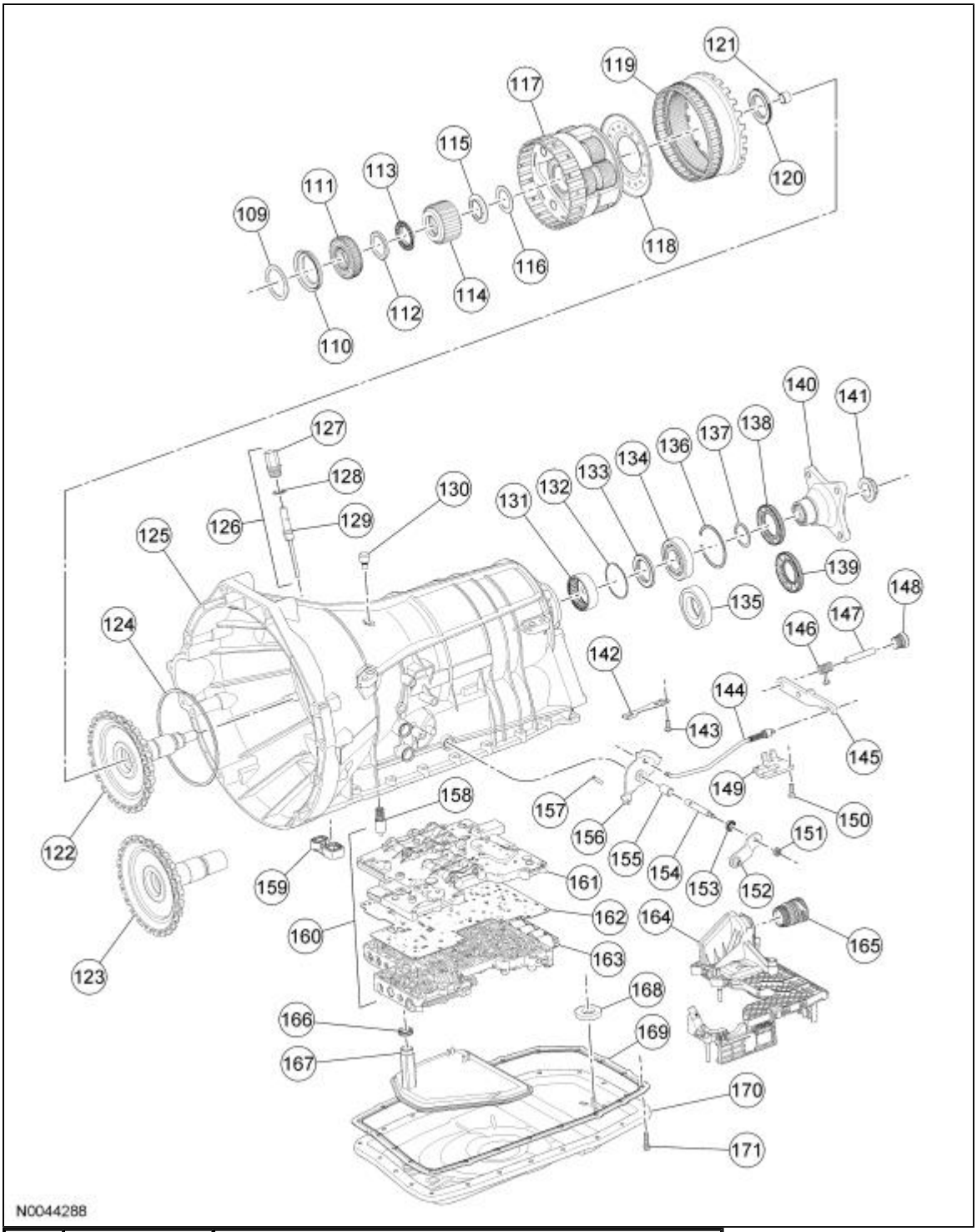


Item	Part Number	Description
1	N800750-S437	Flex plate-to-torque converter nut (4 required)
2	7902	Torque converter
3	7A103	Pump assembly
4	7A248	Front pump oil seal
5	7N877	Torque converter pump retaining ring
6	7B031	Front pump outer oil seal
7	7R166	Front oil pump bearing assembly
8	7N817	Bushing converter stator support

9	7N134	Front pump-to-case bolts (13 required)
10	7A103	Front pump assembly
11	7R078	Bolt — attaches stator support to pump adapter assembly (6 required)
12	W707871-S300	Bolt — attaches pump to pump adapter assembly (11 required)
13	7B261	Converter stator support bushing
14	7G427	Front bushing forward clutch drum
15	7Z463	Clutch support fluid seal
16	7L323	Front pump support seal
17	7G428	Forward clutch rear bushing
18	7D014	Front pump support thrust washer
19	7A511	Forward clutch assembly (clutch A)
20	7J011	Forward clutch cylinder and hub assembly
21	7G242	Forward clutch inner piston seal
22	7F227	Forward clutch outer piston seal
23	7L140	Forward clutch piston
24	7F230	Forward clutch piston retaining spring
25	7J032	Forward clutch balance piston assembly
26	7F227	Forward clutch balance piston outer seal
27	7H365	Forward clutch balance piston snap ring
28	7N572	Forward clutch cushion spring
29	7E314	Forward clutch steel plates (externally splined)
30	7B164	Forward clutch friction plates (internally splined)
31	7B421	Pressure plate retaining snap ring
32	7G231	Front planetary sun gear (No. 1)
33	7H375	Bearing (T1)
34	7G218	Front planetary carrier assembly
35	7H578	Plate transmission fluid collector
36	7L495	Bearing (T2)
37	7L668	Overdrive clutch assembly (clutch E)
38	7G091	Turbine shaft seals (2 required)
39	7J006	Input shaft
40	7C232	Fluid distributor sleeve
41	7B256	Output shaft bushing
42	7J008	Overdrive clutch piston outer seal
43	7G007	Overdrive clutch piston inner seal
44	7G418	Overdrive clutch piston
45	7N529	Overdrive clutch piston spring
46	7J009	Balance piston outer seal
47	7J029	Overdrive balance piston
48	7J010	Balance piston snap ring

49	7N572	Clutch cushion plate
50	7B442	Overdrive clutch steel plates (externally splined)
51	7B164	Overdrive clutch friction plates (internally splined)
52	7C576	Overdrive pressure plate
53	7M157	Overdrive clutch retaining ring
54	7A453	Bearing (T3)
55	7F351	Intermediate clutch shaft
56	7H375	Bearing (T4)
57	7D065	Sun gear bushings (2 required) (part of 7R193)
58	7R193	Sun gear hub and shaft assembly
59	7F236	Direct clutch hub
60	7H076	Direct clutch cylinder retaining ring
61	7C108	Direct clutch assembly (clutch B)
62	7B421	Direct clutch pressure plate retaining ring
63	7B477	Direct clutch pressure plate
64	7B164	Direct clutch friction plates (internally splined)
65	7E314	Direct clutch steel plates (externally splined)
66	7N572	Direct clutch cushion plate
67	7D283	Bearing (T5)
68	7H363	Direct clutch balance piston snap ring
69	7D427	Direct clutch piston spring retainer
70	7B488	Direct clutch piston return spring
71	7B492	Direct clutch piston retaining ring
72	7H359	Direct clutch balance piston
73	7C000	Direct clutch balance seal
74	7F254	Direct clutch piston
75	7C000	Direct clutch piston outer seal
76	7F234	Direct clutch piston inner seal
77	7H240	Direct clutch hub bushings (part of 7F281) (2 required)
78	7C486	Gear shaft tube sleeve
79	7F360	Direct clutch cylinder
80	7B399	Shell cylinder seals (2 required)
81	7L327	Center support retaining ring
82	7F388	Intermediate clutch assembly (clutch C)
83	7B421	Intermediate clutch pressure plate retaining ring
84	7E314	Intermediate clutch pressure plate
85	7E314	Intermediate clutch steel plates (externally splined)
86	7B164	Intermediate clutch friction plates (internally splined)
87	7H136	Intermediate clutch pressure plate spring

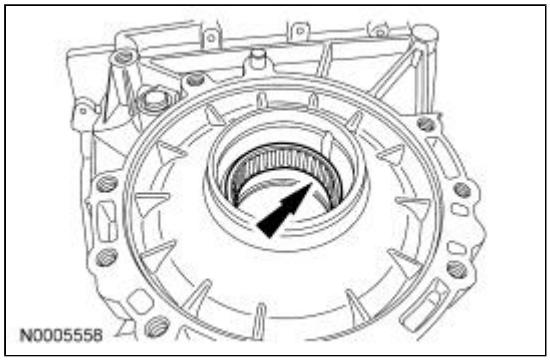
88	7N169	Intermediate clutch retaining ring
89	7B043	Intermediate clutch ring
90	7C151	Intermediate clutch piston spring
91	7J015	Intermediate clutch piston
92	7F225	Intermediate clutch piston inner seal
93	7F224	Intermediate clutch piston outer seal
94	7F373	Bearing (T6)
95	7B314	Center shaft sleeve (part of 7G033)
96	7J114	Center support keys (2 required)
97	7J135	Center support seals (4 required)
98	7G033	Support assembly
99	7G446	Low/reverse clutch piston center seal
100	7G444	Low/reverse clutch piston inner seal
101	7G445	Low/reverse clutch piston outer seal
102	7D343	Low/reverse clutch piston
103	7D405	Low/reverse clutch piston return spring
104	7G494	Low/reverse clutch piston retaining ring
105	7N572	Clutch disc cushion plate
106	7E314	Low/reverse clutch steel plates (externally splined)
107	7B164	Low/reverse clutch friction plates (internally splined)
108	7E314	Low/reverse clutch pressure plate (select fit)
109	7H286	Gear thrust shim (select fit)
110	7C041	Bearing (T7)
111	7H580	Sun gear No. 2
112	7D235	Thrust bearing outer race
113	7D234	Bearing (T8)
114	7A348	Sun gear No. 3
115	7D234	Bearing (T9)
116	7193	Bearing race (T9)
117	7G224	Rear planetary carrier assembly
118	7H583	Fluid collar rear planetary plate (part of 7G224)
119	7A153	Output shaft ring gear assembly
120	7M152	Bearing (T10)
121	7B256	Output shaft bushing (part of 7096)
122	7096	Output shaft parking gear assembly rear wheel drive (RWD)
123	7096	Output shaft parking gear assembly four wheel drive (4WD)
124	7N194	Output shaft retaining ring
125	7006	Transmission case assembly (model dependent)
126	7E389	Transmission case fluid fill plug assembly

127	7E380	Transmission case fluid fill plug
128	7E390	Transmission case fluid fill seal
129	7E049	Transmission oil level indicator
130	7034	Transmission case vent assembly (model dependent)
131	7A415	Output shaft bearing assembly
132	7030A	Output shaft retaining ring
133	7E413	Bearing (T11) (4WD only)
134	7R205	Output shaft bearing (RWD only)
135	7A433	Output shaft spacer (4WD only)
136	7030B	Output shaft bearing retainer shim
137	7N135	Anti-click washer
138	7052	Extension housing seal (RWD)
139	7052	Extension housing seal (4WD)
140	7A021	Output shaft flange (RWD)
141	7K440	Output shaft flange retaining nut (RWD)
142	7E332	Manual valve detent spring
143	W711235-S300	Manual valve detent spring retaining screw and washer
144	7D410	Parking pawl actuating rod
145	7A441	Parking pawl
146	7D070	Parking pawl return spring
147	7D071	Parking pawl shaft
148	7H398	Plug assembly transmission case housing
149	7G101	Parking pawl abutment
150	W711235-S300	Parking pawl abutment retaining screw and washer
151	W708455-S441	Manual control lever nut
152	7A256	Manual control lever
153	7B498	Manual control lever shaft seal
154	7C493	Manual control lever shaft
155	7C257	Manual control lever shaft spacer
156	7A115	Manual valve detent lever assembly
157	7G100	Manual valve detent lever retaining pin
158	7H322	Thermal bypass valve
159	7F401	Front pump adapter seal
160	7A100	Main control assembly
161	7A091	Main control valve body assembly
162	7Z490	Main control valve body separator plate
163	7G423	Lower main control valve body
164	14C247	Control module assembly
165	7H585	Bulkhead connector sleeve

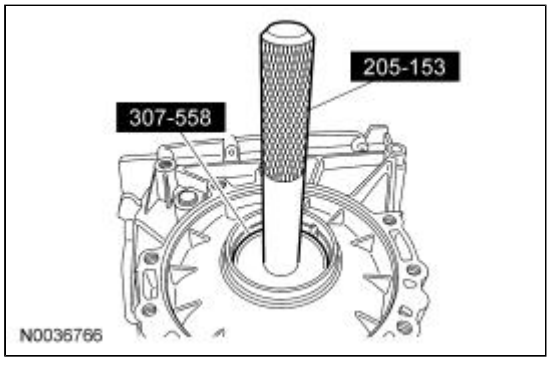
166	—	Transmission fluid filter seal (part of 7G186)
167	7G186	Transmission fluid filter
168	—	Transmission fluid pan magnet
169	7A191	Transmission fluid pan gasket
170	7A194	Transmission fluid pan
171	W500214-S437	Transmission fluid pan bolts

All vehicles

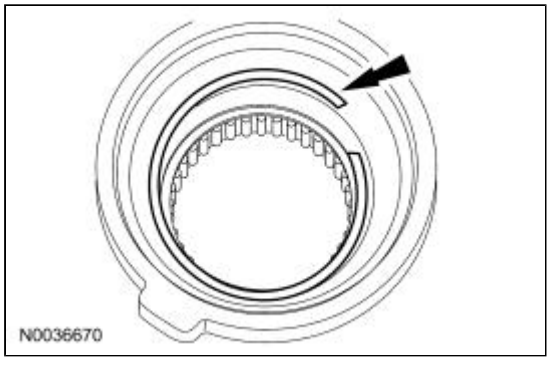
1. If removed, position the rear case roller bearing in the case.



2. Using the special tools, install the roller bearing.

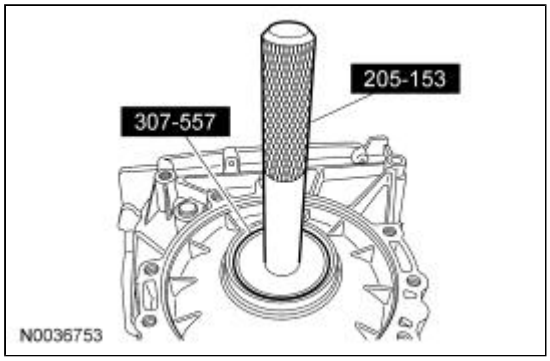


3. Install the snap ring.

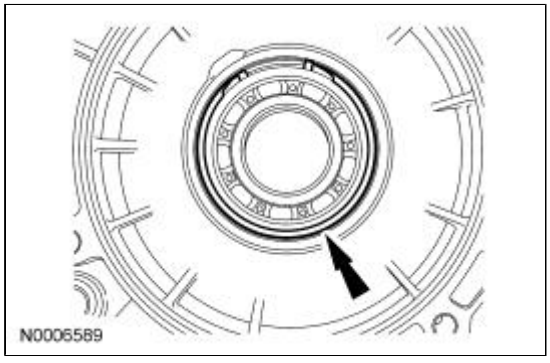


Rear wheel drive (RWD) vehicles

4. Using the special tools, install the rear case roller bearing in the case.

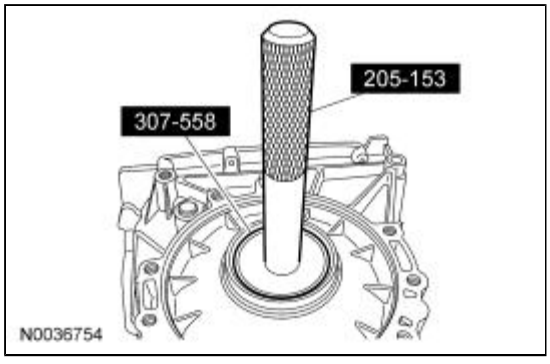


5. Install the roller bearing snap ring.

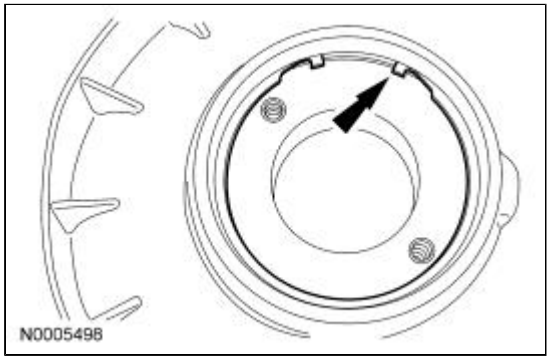


Four wheel drive (4WD) vehicles

6. Using the special tools, install the rear bearing spacer.



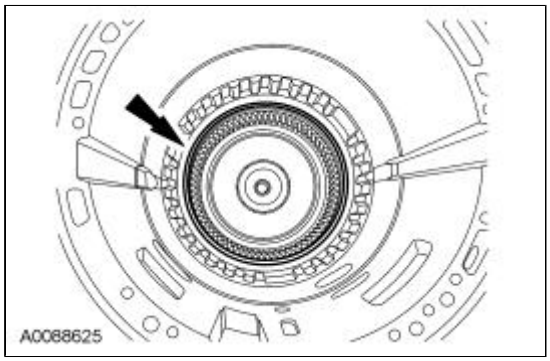
7. Install the rear bearing spacer snap ring.



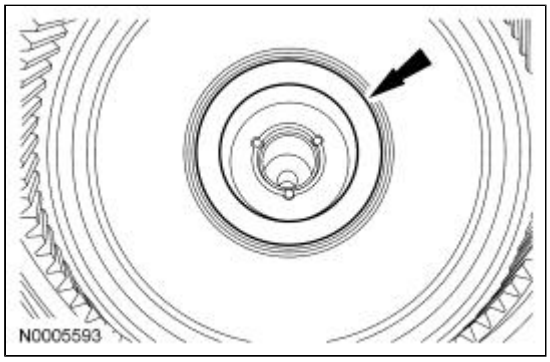
All vehicles

8. Place the transmission in the vertical position.

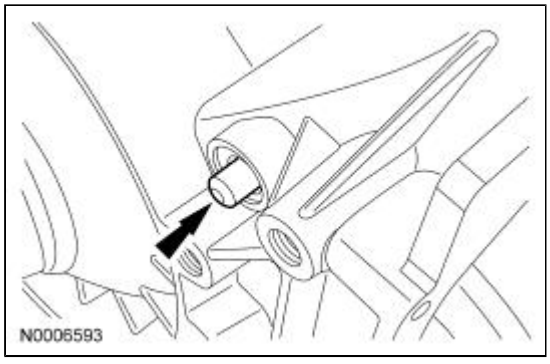
9. Install the planet carrier hub and output shaft assembly.



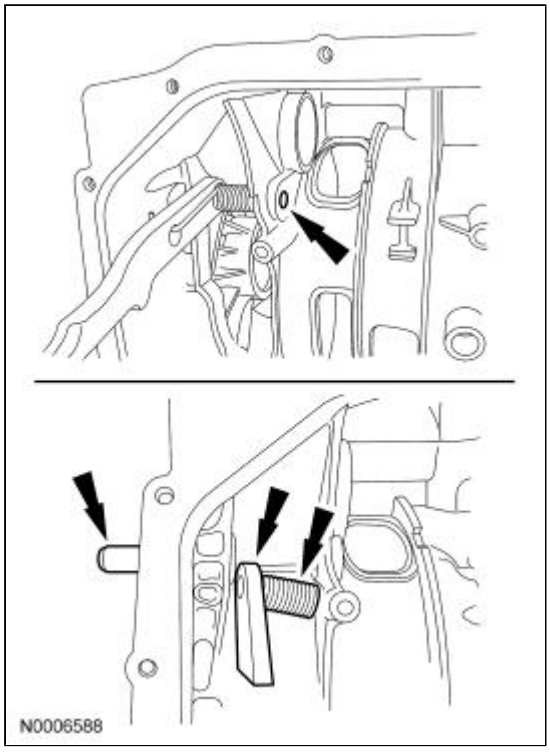
10. Install the silver shim (caged bearing) on the planet carrier hub and output shaft assembly.



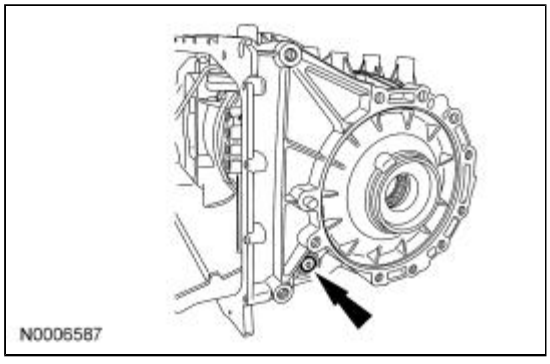
11. Position the park pawl pin into the case.



12. Position the park pawl into the case and push the park pawl pin in to hold the park pawl and spring in position.

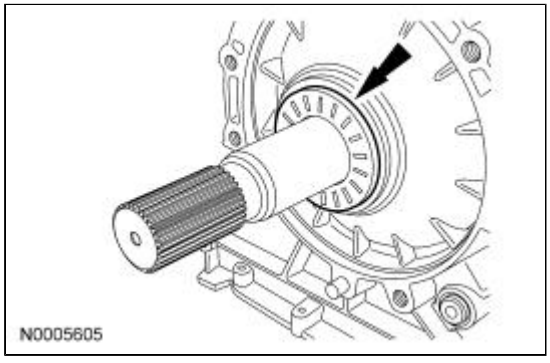


13. Install the park pawl pin bolt.
    - Tighten to 35 Nm (26 lb-ft).

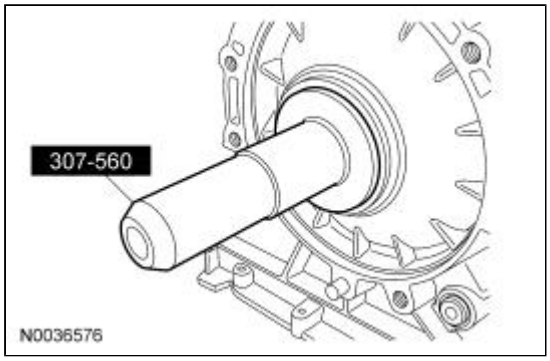


4WD vehicles

14. Position a new output shaft seal in place.

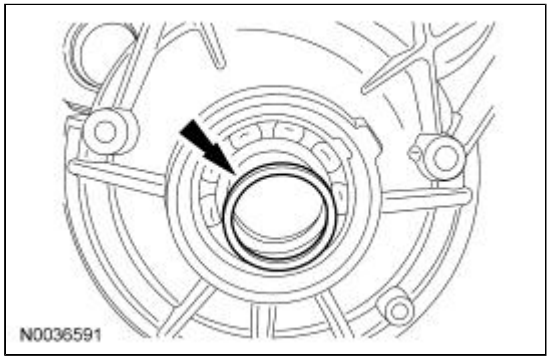


15. Using the special tool, install the output shaft seal.

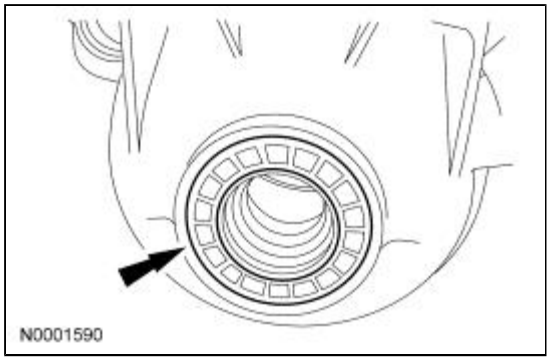


RWD vehicles

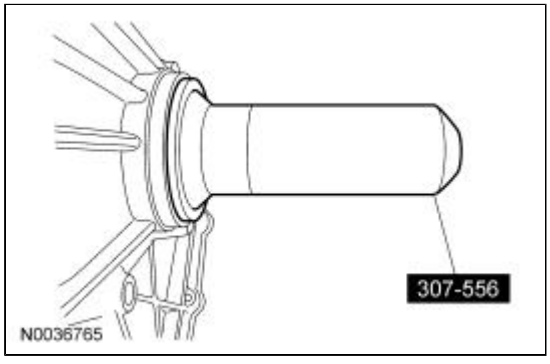
16. Install the anti-click washer.



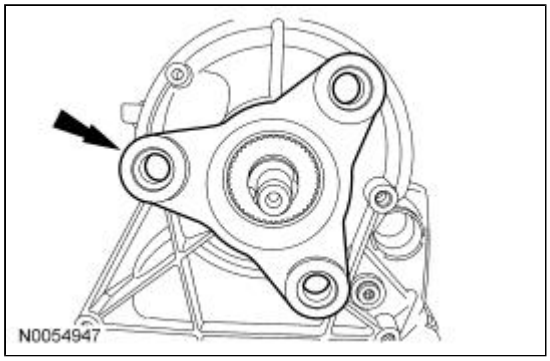
17. Position a new output shaft seal in place.



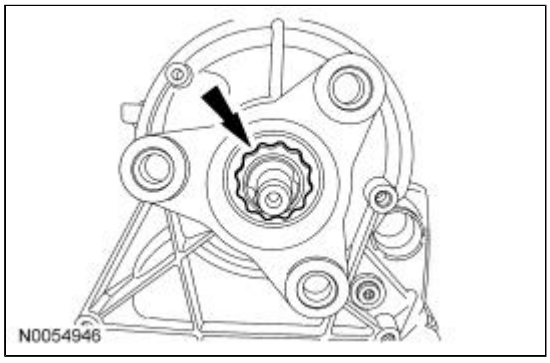
18. Using the special tool, install the output shaft seal.



19. Install the output shaft flange.

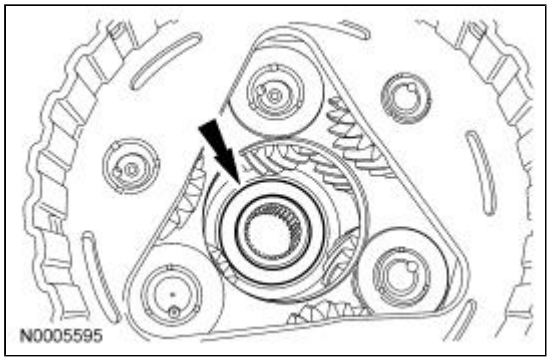


20. Install a new output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).

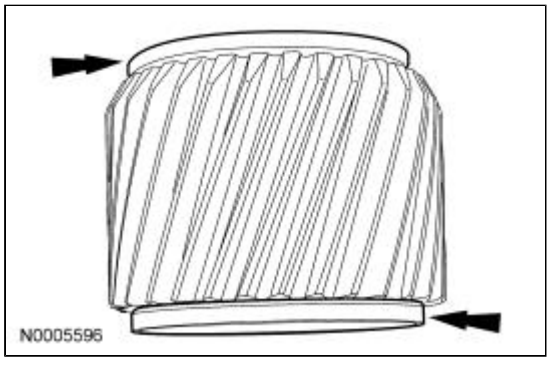


All vehicles

21. Install the roller bearing race in the bottom of the carrier.



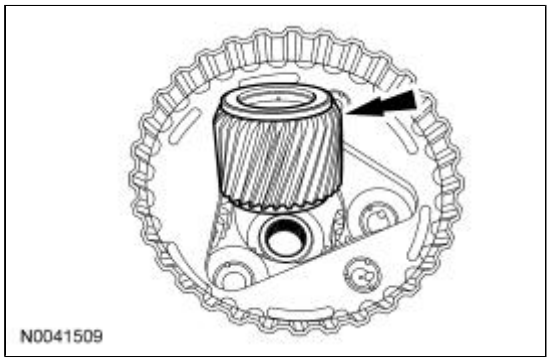
22. Snap the top and the bottom roller bearings onto the sun gear.



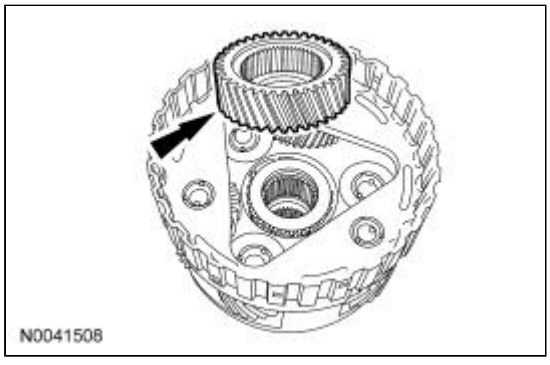
23. **NOTE:** When installing the sun gear, make sure that the taper edge is facing up toward the

torque converter housing.

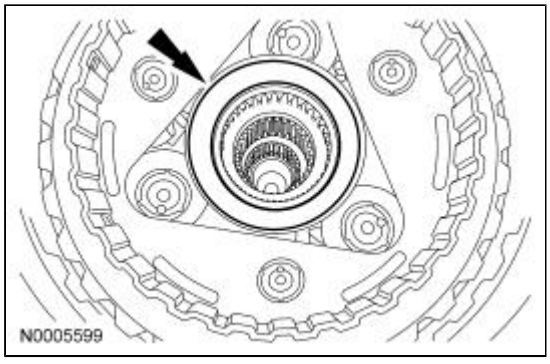
Install the sun gear into the planet assembly.



24. Install the low/reverse sun gear.



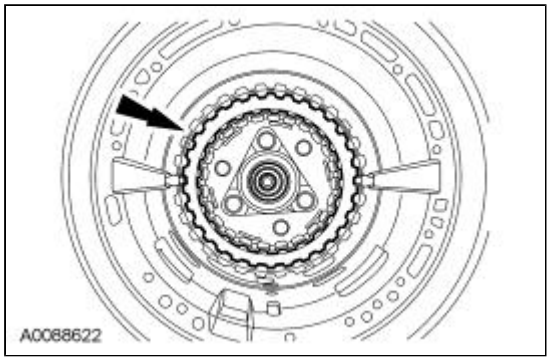
25. Install the low/reverse thrust bearing (T7).



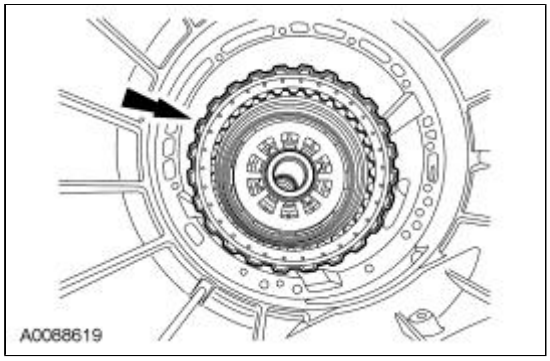
26. **NOTE:** Inspect and install new thrust bearings as required.

    Install the select fit thrust gear shim.

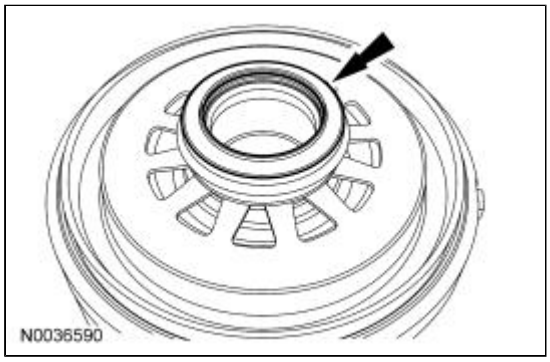
27. Install the planet carrier.



28. Install the low/reverse clutch plates, starting with the pressure plate and alternating between the friction and steel plates, and ending with the wave spring plate on the top.

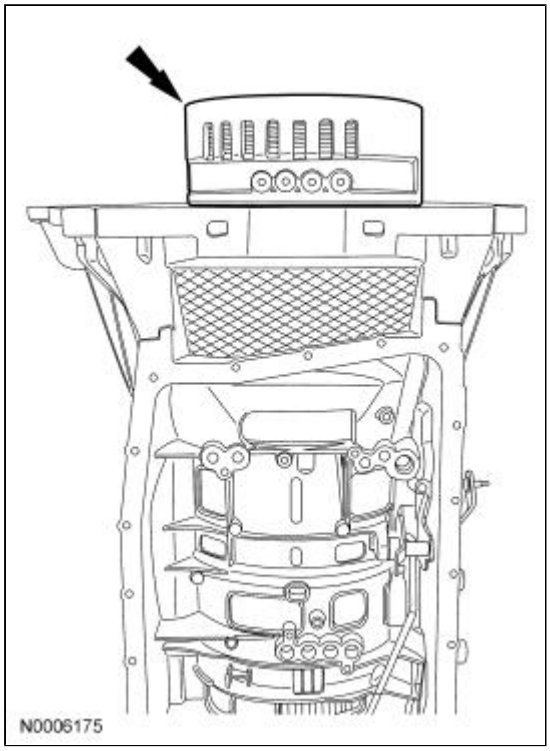


29. Install the roller bearing and shim onto the center support.



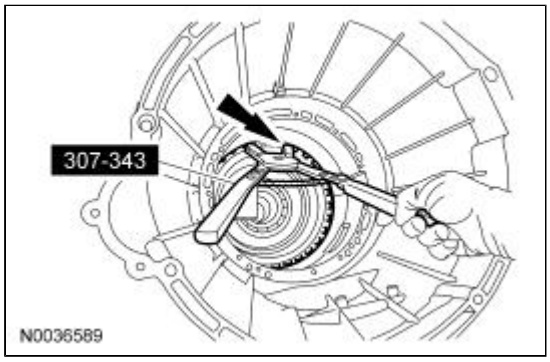
30. **NOTE:** Make sure that when installing the center support the feed holes on the center support are lined up with the feed holes in the case.

    Install the center support into the case.

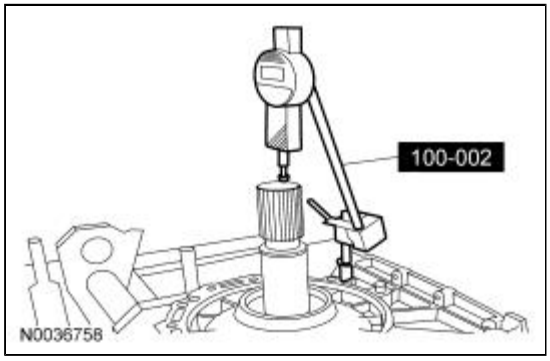


31. **NOTE:** Rotate case 180 degrees.

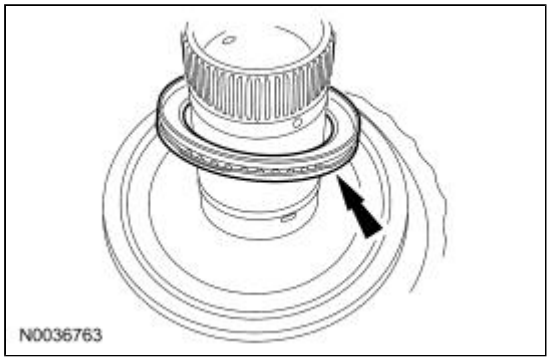
    Using the special tool, install the center support snap ring. Tap the snap ring into the case to make sure that it is seated into the case.



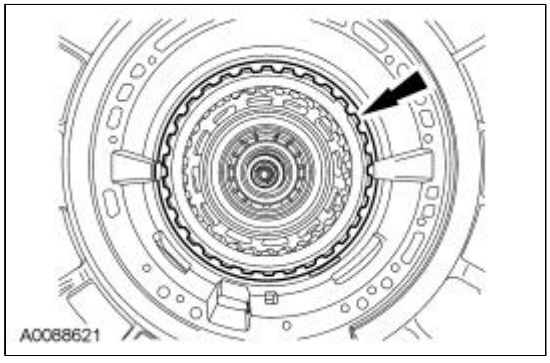
32. Using the special tool, lift up on the output shaft and record the reading. The reading should be within 0.15-0.35 mm (0.006-0.013 in).
    - If the reading is not within the specification, install a different (either thinner or thicker) select fit thrust gear shim.



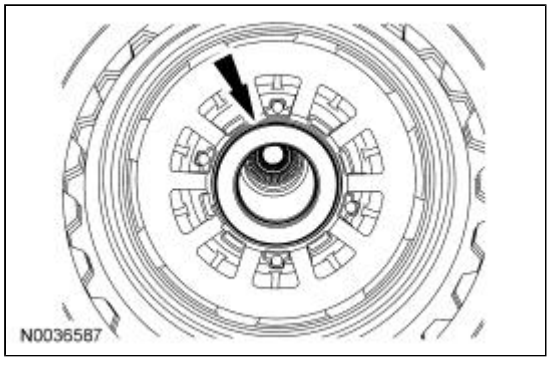
33. Install the roller bearing if not previously installed on the direct clutch drum.



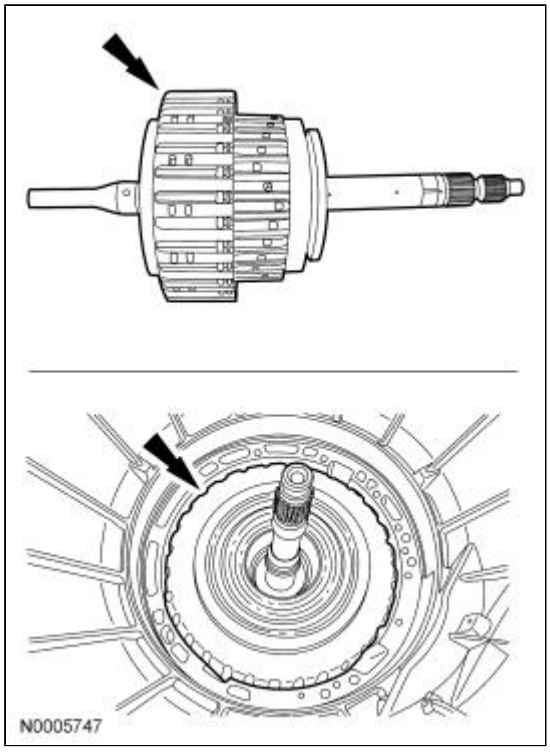
34. Install the direct clutch drum.



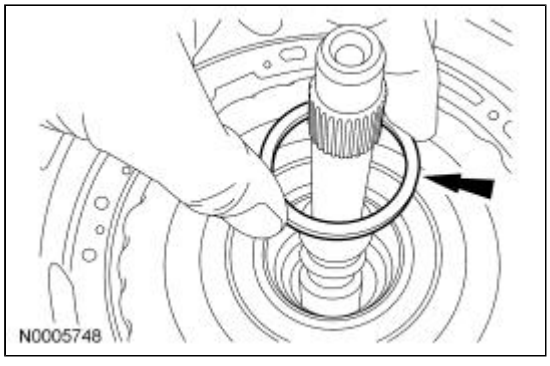
35. Install the bearing on the direct clutch assembly.



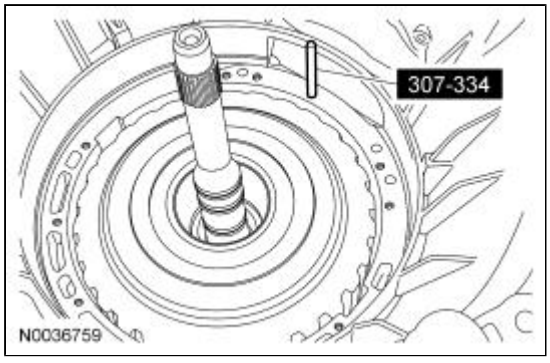
36. Install the forward and overdrive clutch assembly.



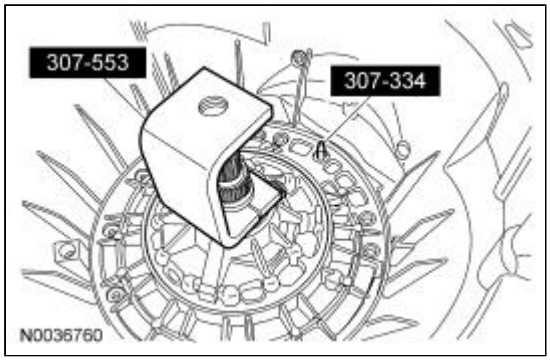
37. Install the pump washer.



38. Install the special tool into the case.

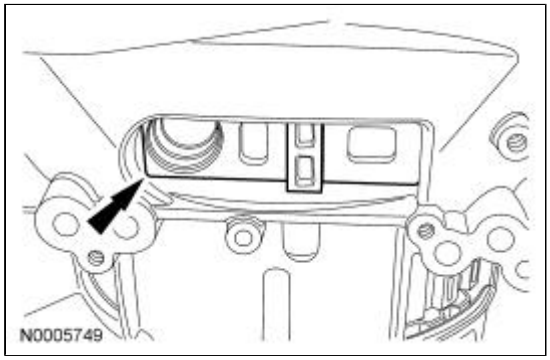


39. Using the special tools, install the front pump.

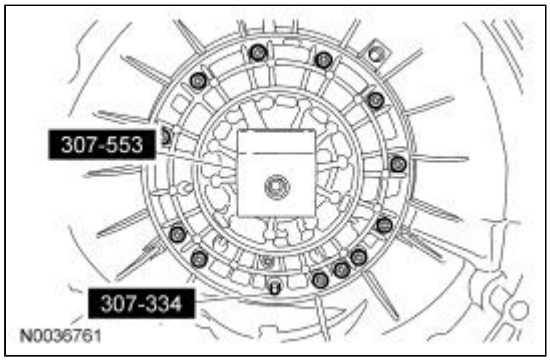


40. **NOTE:** Make sure that the fluid filter seal has been removed. If it has not, use a suitable pick and remove the seal.

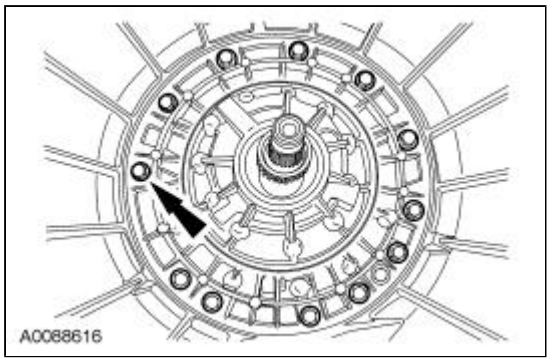
    Make sure that the pump is correctly aligned with the case.



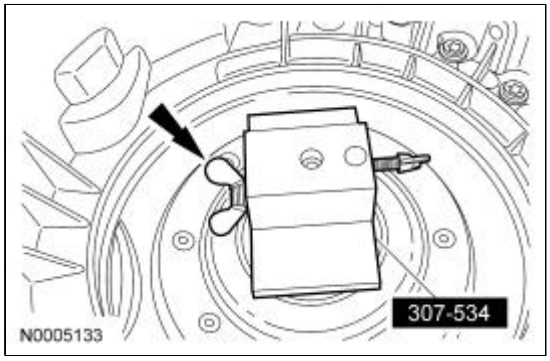
41. Loosely install the new front pump bolts with the new washers.



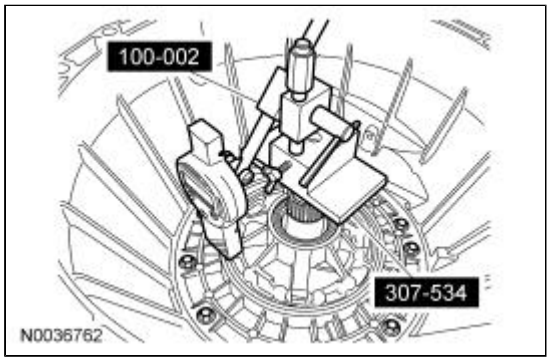
42. Install the remaining front pump bolt. Tighten the bolts in a crisscross pattern.
    - Tighten to 10 Nm (89 lb-in).



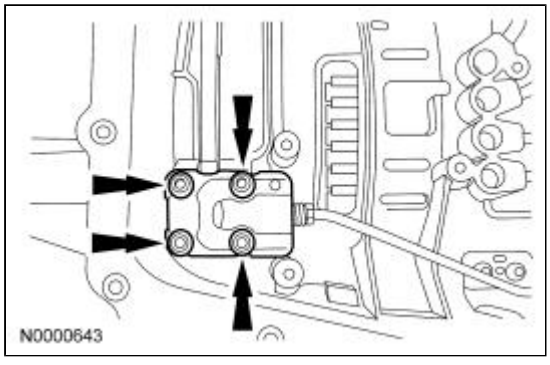
43. Install the special tool onto the input shaft to measure end play.
    - Tighten the wing nut.



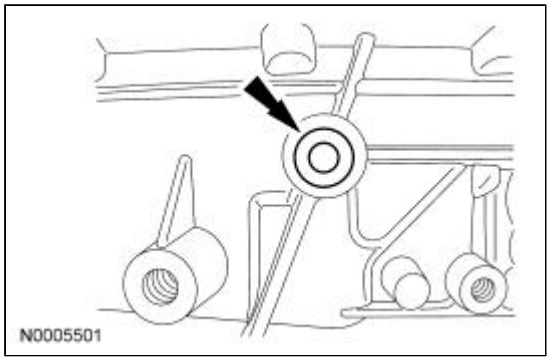
44. Install the remaining special tool.
    - Push down on the special tool and zero out the dial indicator.
    - Lift up on the special tool and record the measurement 0.2-0.4 mm (0.008-0.015 in). If the measurement is not within specification install a new pump washer.
    - Measure the original washer, install a thinner or a thicker washer to achieve the correct measurement.



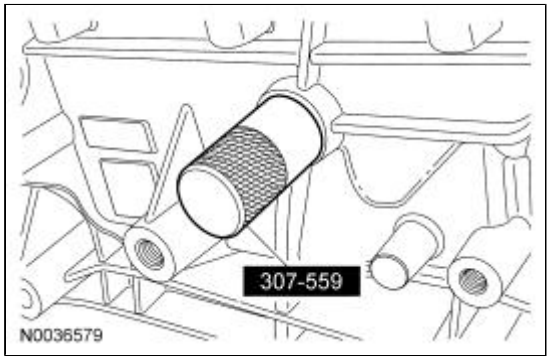
45. Install the park rod actuating plate.
    - Tighten to 10 Nm (89 lb-in).



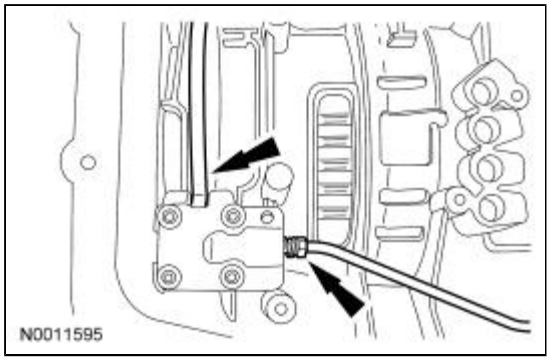
46. Position a new manual control lever seal in place.



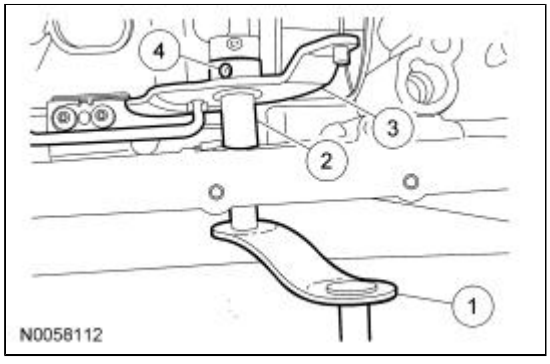
47. Using the special tool, install a new manual control lever shaft seal.



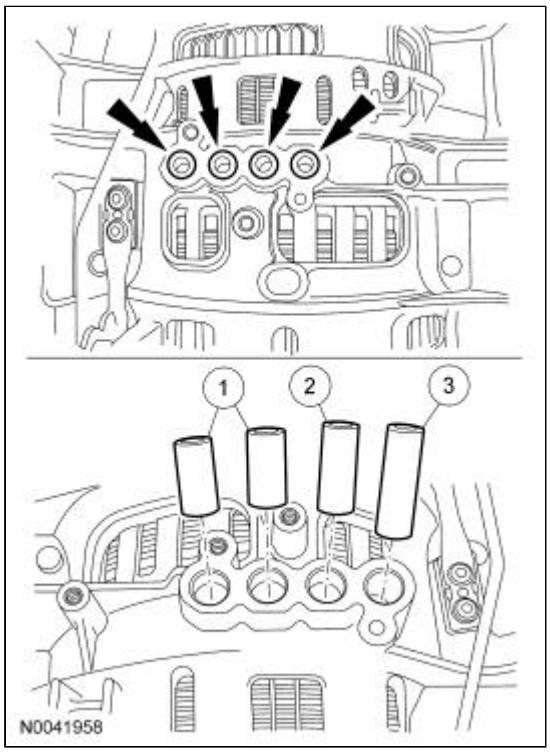
48. Position the manual lever and park rod in place.
    - Push down on the park pawl and slide the park rod in place.



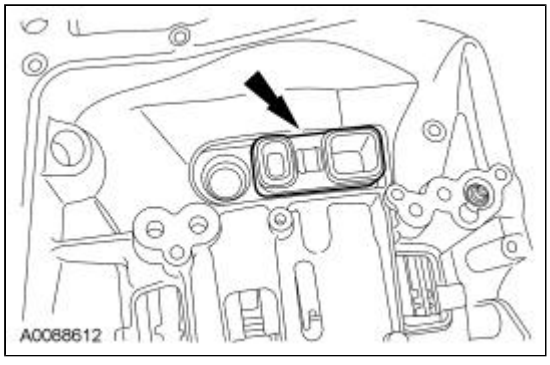
49. Install the manual lever in the case.
    1. Slide the manual lever in the case.
    2. Position the spacer in place while sliding the manual lever into the spacer.
    3. Position the manual valve inner lever while sliding the manual lever and lining up the roll pin hole.
    4. Install the roll pin.



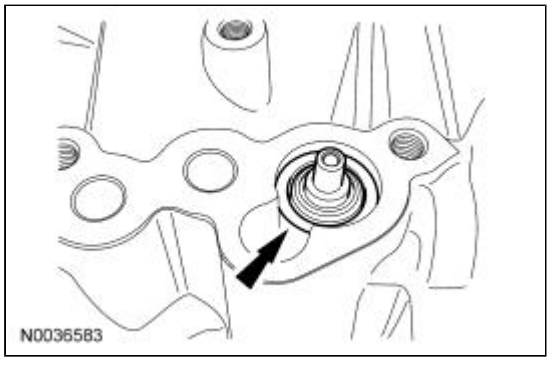
50. Install the 4 rubber feed tubes for the center support.
    1. Black feed tubes.
    2. Green feed tube.
    3. Blue feed tube.



51. Install the rubber adapter.



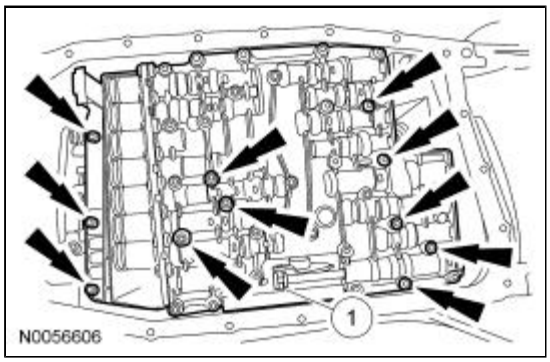
52. Install the thermal bypass valve into the case.



53. **NOTE:** The mechatronic assembly will not lay flush on the case, this is normal, the bolts will pull the mechatronic assembly down.

Loosely install the 11 mechatronic bolts.

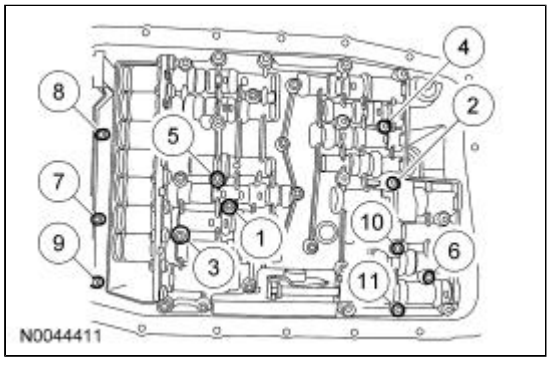
1. Align the manual valve and control lever linkage.



54. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

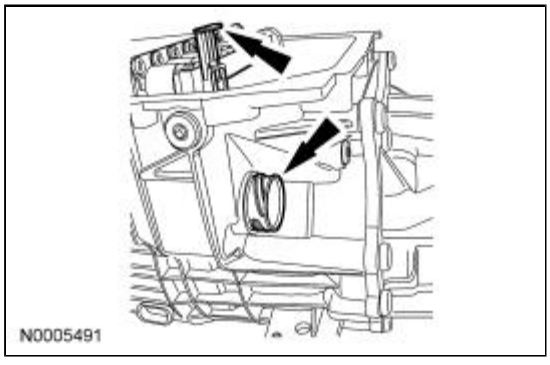
Tighten the bolts in the sequence shown.

- Tighten to 6 Nm (53 lb-in).

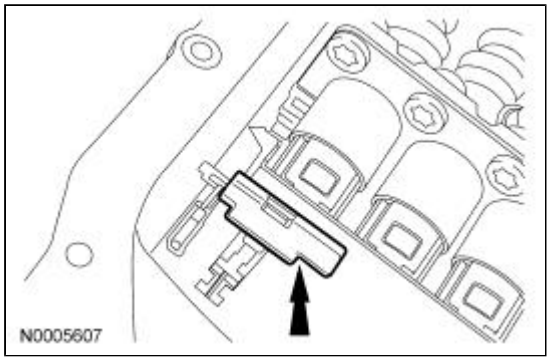


55. **CAUTION: Do not touch the electrical connector pins or the exposed solenoid tabs on the TCM. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

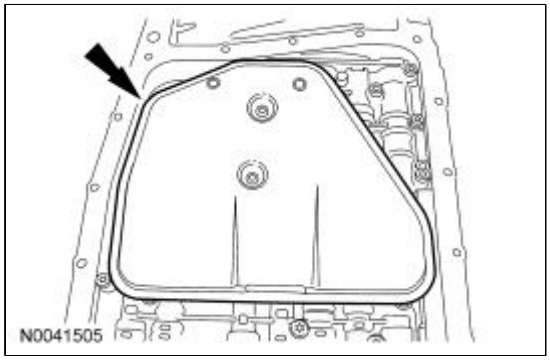
With the release tab up and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure that the bulkhead connector is fully seated into the TCM.



56. Press down on the tab and lock the outer shell of the bulkhead electrical connector in place. Make sure that the locking tab is securely locked.

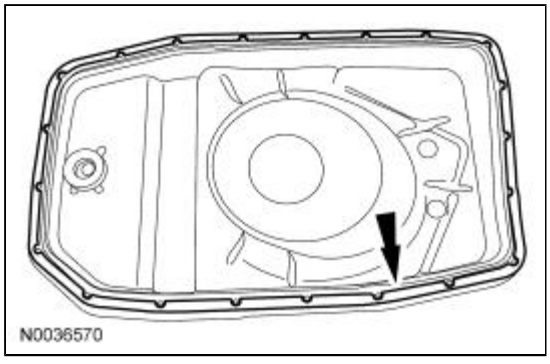


57. Install a new transmission fluid filter.

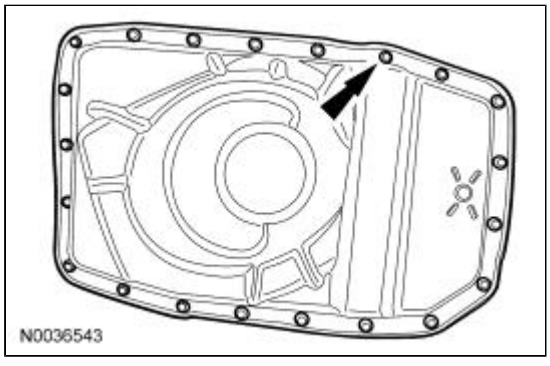


58. **NOTE:** The fluid pan gasket can be reused if not damaged.

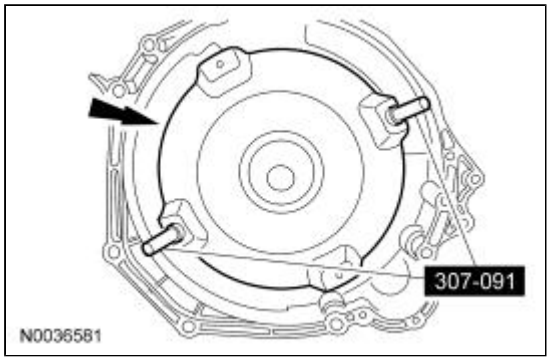
    Install a new transmission fluid pan gasket if required.



59. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 14 Nm (10 lb-ft).



60. Using the special tools, install the torque converter.


307-091
N0036581

Transmission — Four Wheel Drive (4WD)

Printable View (629 KB)

Special Tool(s)

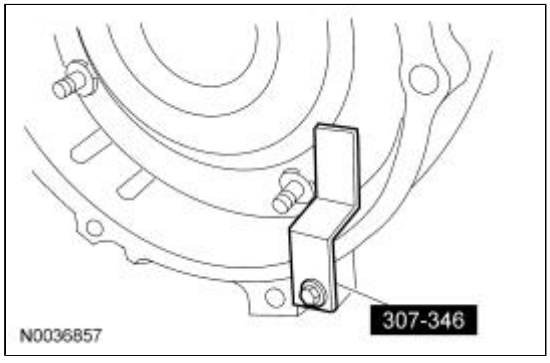
ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Installation

1. Install the special tool.



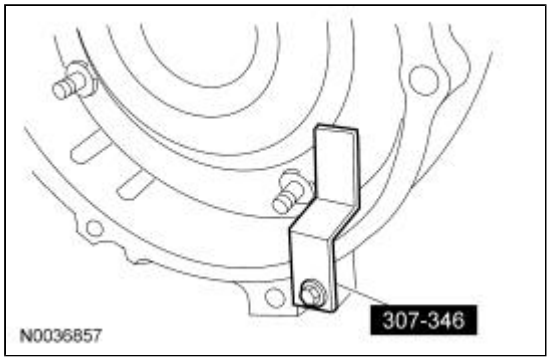
2. **CAUTION: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

   NOTE: Make sure that the transmission is securely fastened to the transmission jack.

   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

3. Remove the special tool.



4. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

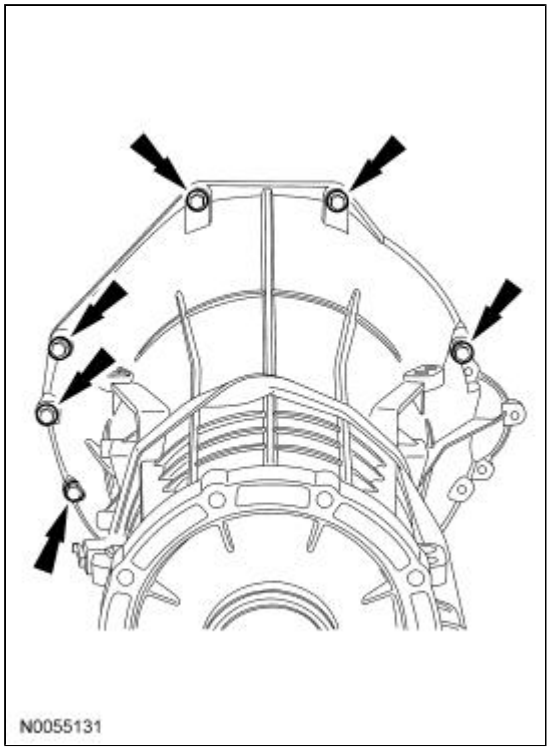
   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

5. **NOTE:** Install the transmission case bolts in their correct locations noted during removal.

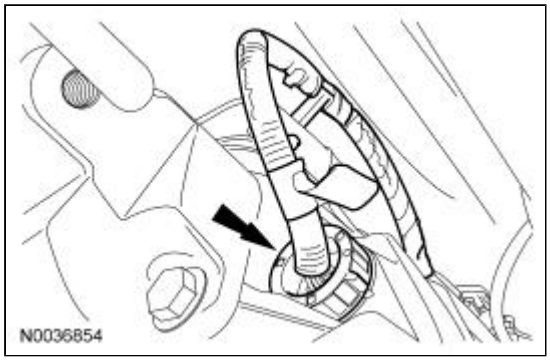
   NOTE: The top 2 transmission case bolts need to be installed prior to installing the rest of the bolts.

   NOTE: The top left bolt is inserted through the fuel line bracket first, then through the transmission case.

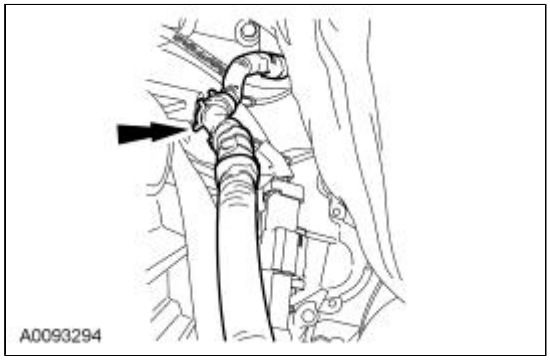
   Install 6 of the 7 transmission case bolts.
   - Tighten to 48 Nm (35 lb-ft).



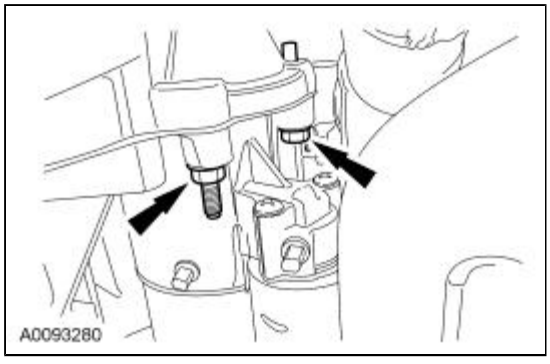
6. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.



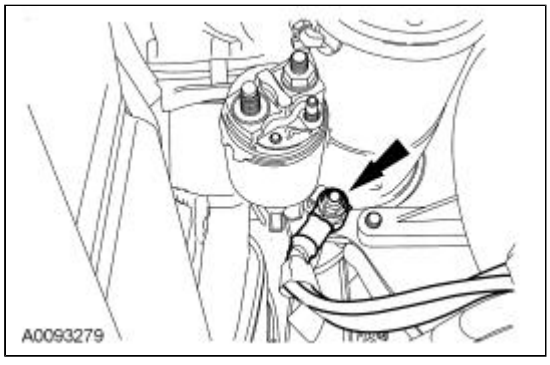
7. Connect the wire harness to the top of the transmission.



8. Install the starter motor and the 3 starter motor bolts.
    - Tighten to 26 Nm (19 lb-ft).

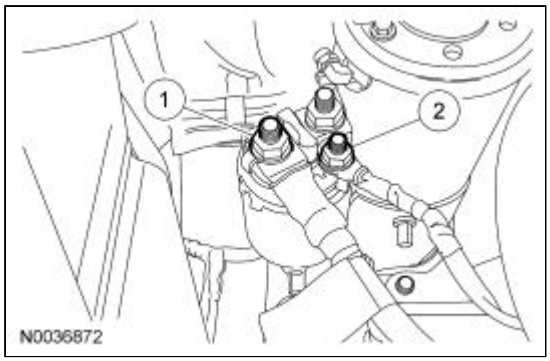


9. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).

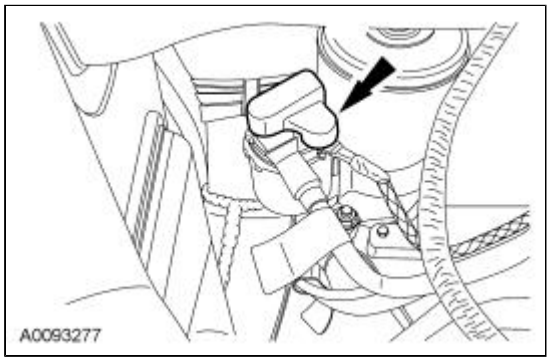


10. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (9 lb-ft).

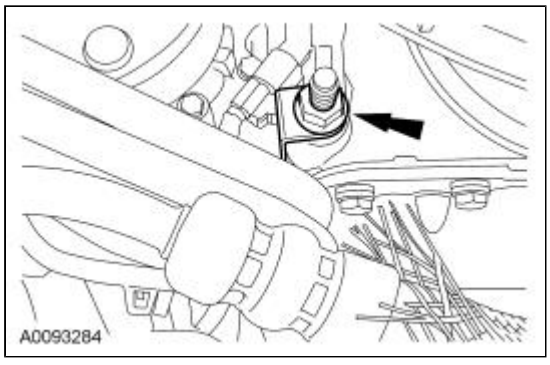
2. Tighten to 6 Nm (53 lb-in).



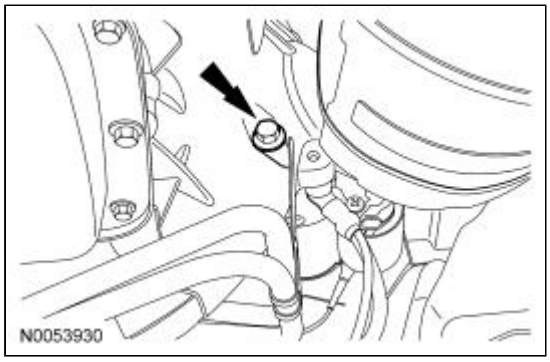
11. Install the plastic starter motor electrical connector cap.



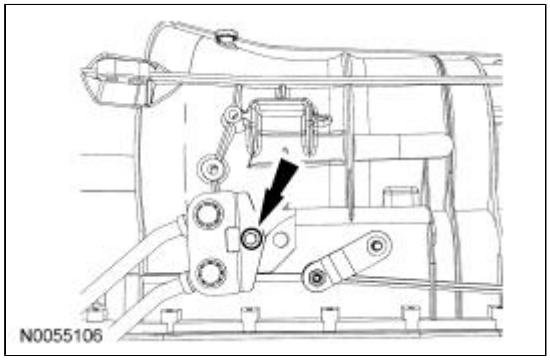
12. Position the transmission cooler tubes in place and install the cooler tube bracket nut.
    - Tighten to 27 Nm (20 lb-ft).



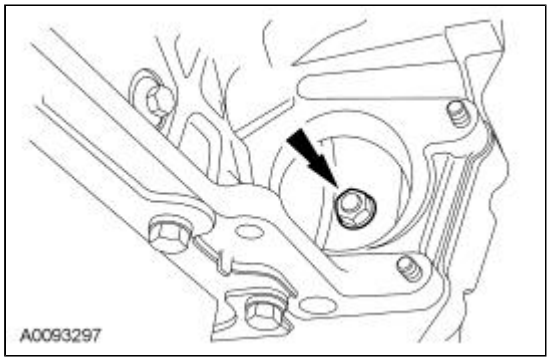
13. Align the bracket and install the remaining transmission case bolt.
    - Tighten to 48 Nm (35 lb-ft).



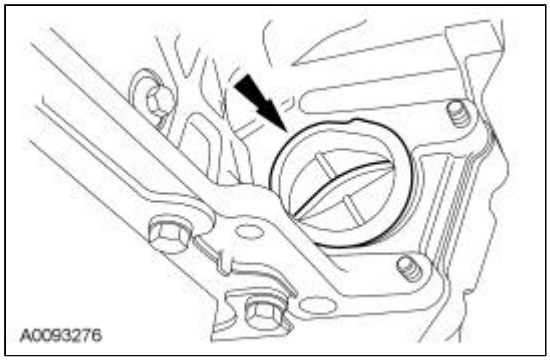
14. Install the transmission cooler tubes and the bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



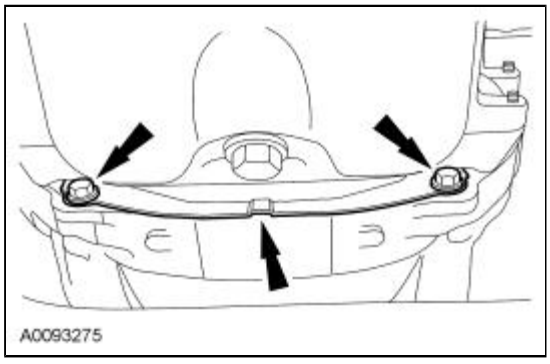
15. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



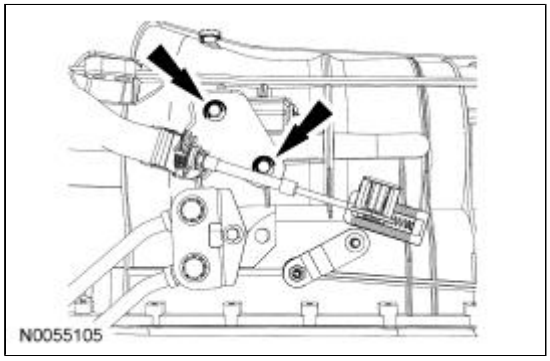
16. Install the rubber access plug.



17. Install the flexplate inspection cover and the inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).

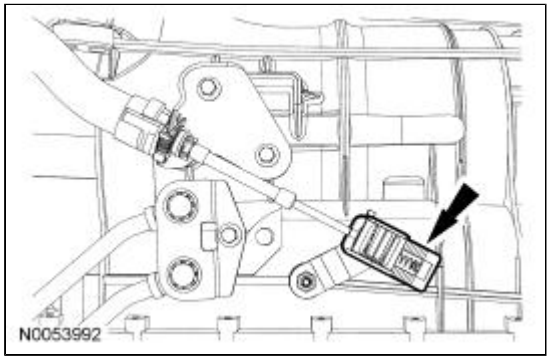


18. Install the selector lever bracket and bolts.
    - Tighten to 48 Nm (35 lb-ft).

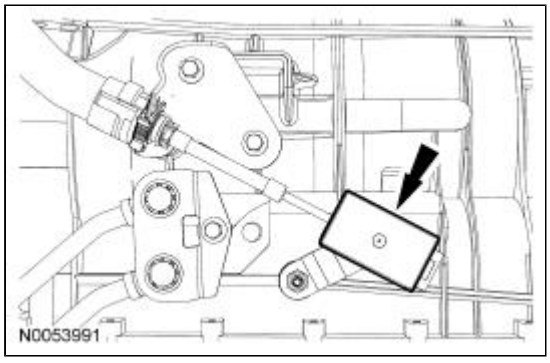


19. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

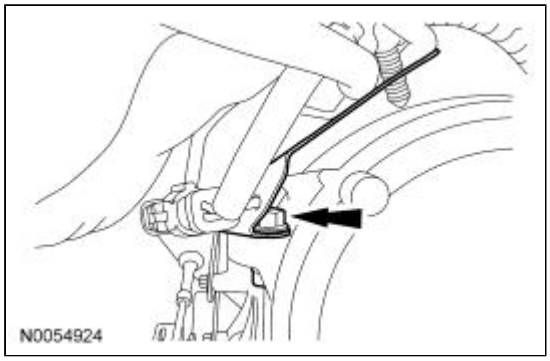
    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever ball stud and move the locking tab down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.



20. If equipped, install the heat shield.



21. Install the fuel line bracket and bolt.
    - Tighten to 25 Nm (18 lb-ft).



22. Install the transfer case. For additional information, refer to Section 308-07B .

23. Connect the battery ground cable. For additional information, refer to Section 414-01 .

24. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

25. Reflash the transmission control module (TCM) to the latest level of software.

26. Fill the transmission with clean automatic transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission — Rear Wheel Drive (RWD)

Printable View (912 KB)

Special Tool(s)

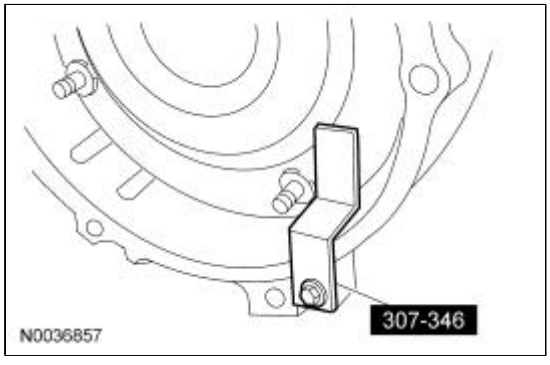
ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Material

Item	Specification
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Installation

1. Install the special tool.



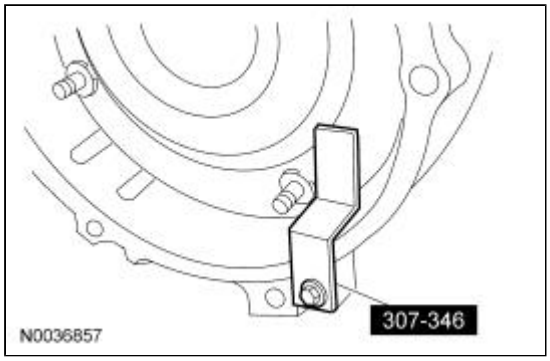
2. **CAUTION: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.

   NOTE: Make sure that the transmission is securely fastened to the transmission jack.

   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

3. Remove the special tool.



4. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

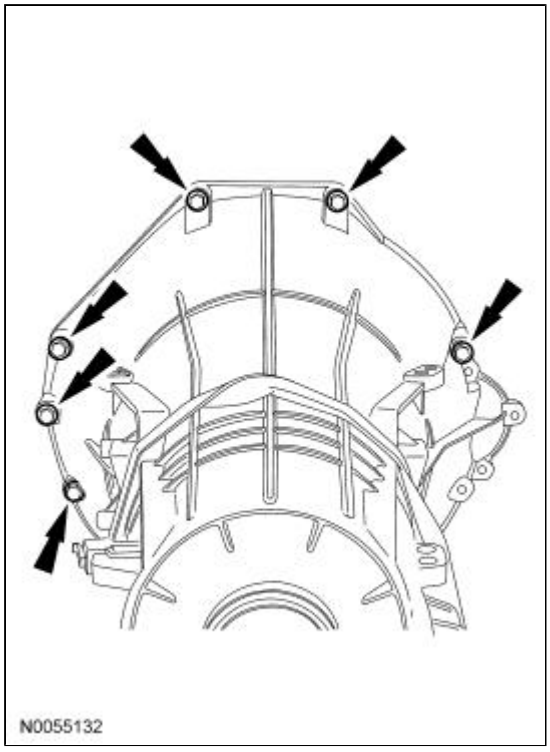
   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

5. **NOTE:** Install the transmission case bolts in their correct locations noted during removal.

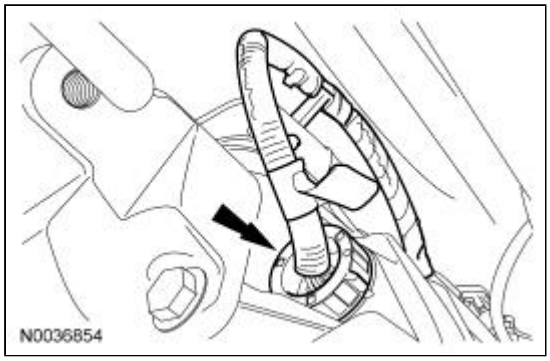
   NOTE: The top 2 transmission case bolts need to be installed prior to installing the rest of the bolts.

   NOTE: The top left bolt is inserted through the fuel line bracket first, then through the transmission case.

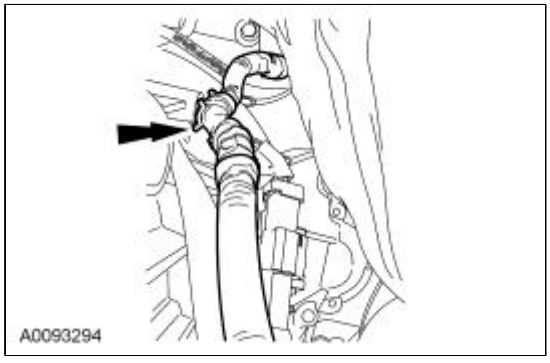
   Install 6 of the 7 transmission case bolts.
   - Tighten to 48 Nm (35 lb-ft).



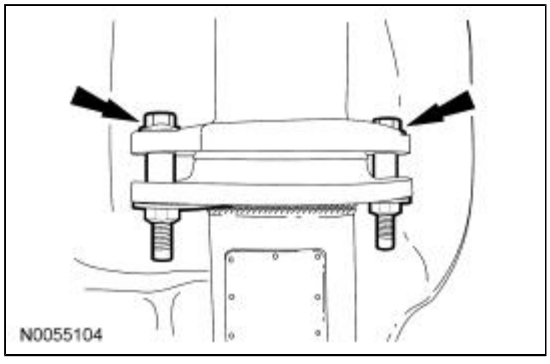
6. Connect the main transmission electrical harness by pushing it in and twisting the outer shell to lock it in place.



7. Connect the wire harness to the top of the transmission.

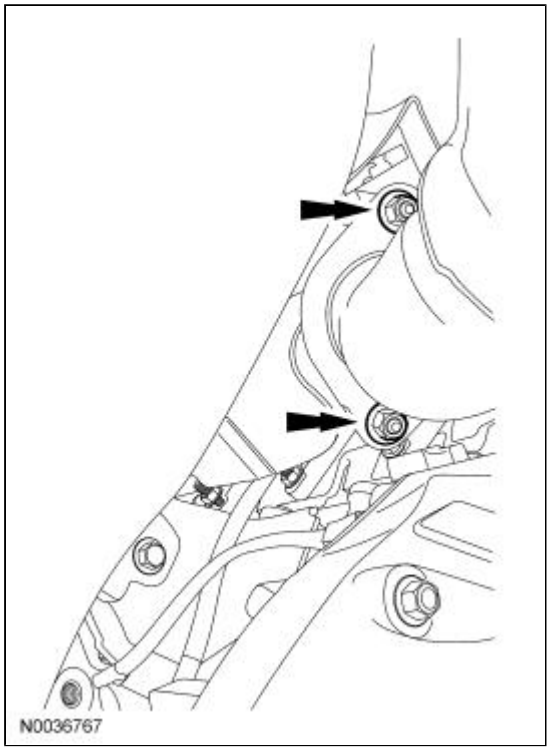


8. Position the dual converter Y-pipe in place and install the 2 dual converter Y-pipe bolts.
    - Tighten to 40 Nm (30 lb-ft).

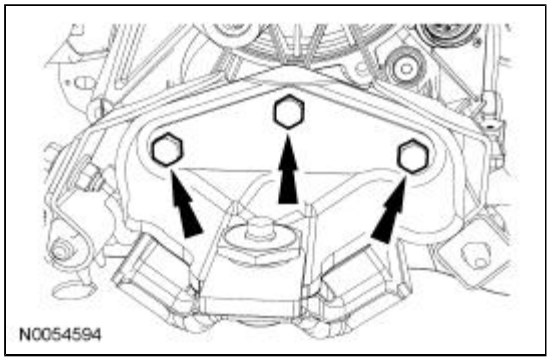


9. **NOTE:** LH shown, RH similar.

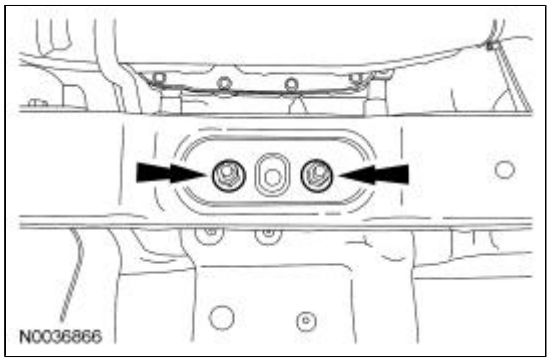
    Install the LH and RH exhaust flange nuts.
    - Tighten to 40 Nm (30 lb-ft).



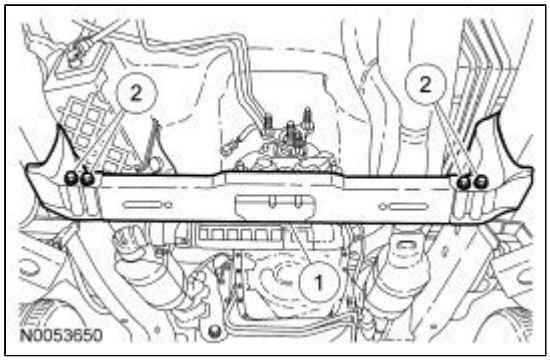
10. Install the 3 bolts and the insulator.
    - Tighten to 90 Nm (66 lb-ft).



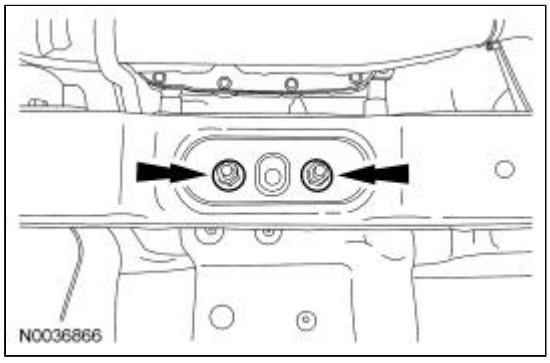
11. Position the rear crossmember in place and loosely install the transmission insulator nuts.



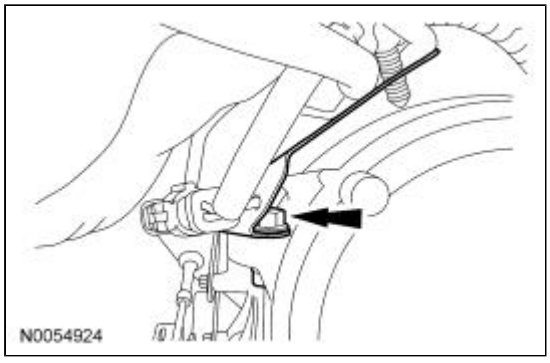
12. Install the rear crossmember.
    1. Install the crossmember.
    2. Install the 4 crossmember bolts and nuts.
        - Tighten to 90 Nm (66 lb-ft).



13. Tighten the transmission insulator nuts.
    - Tighten to 103 Nm (76 lb-ft).

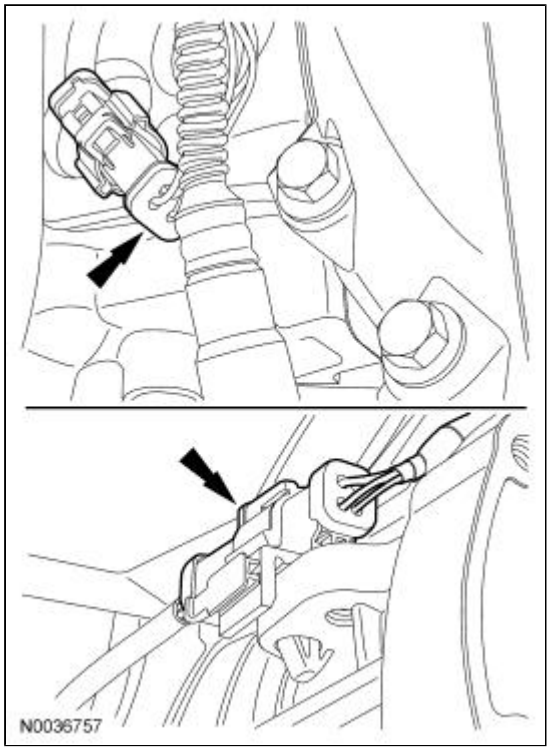


14. Install the fuel line bracket and bolt.
    - Tighten to 25 Nm (18 lb-ft).

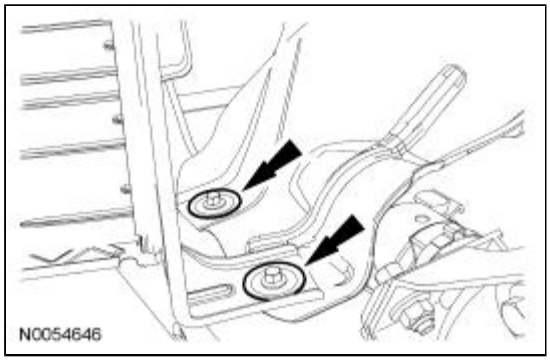


15. **NOTE:** LH shown, RH similar.

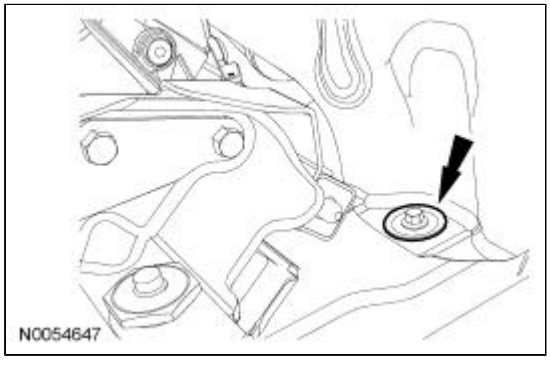
    Connect the RH and LH heated oxygen sensors (HO2S) electrical connectors and the CMS electrical connectors.



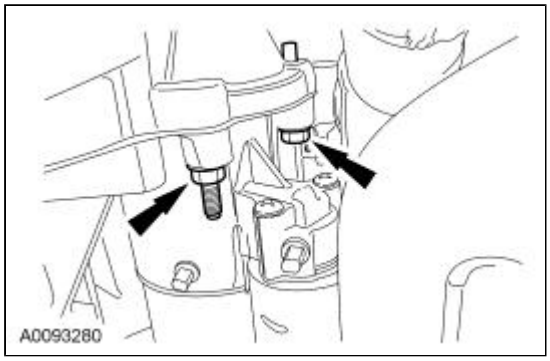
16. Install the LH exhaust heat shield and evaporative emissions canister assembly bolts.
    - Tighten to 15 Nm (11 lb-ft).



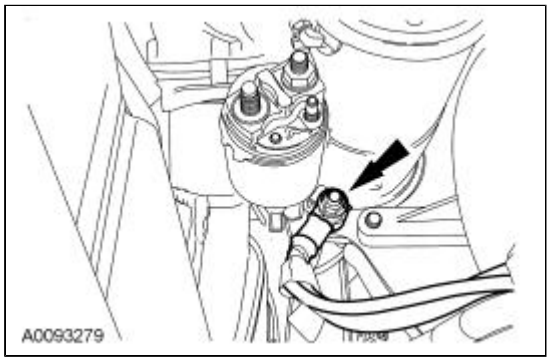
17. Install the RH exhaust heat shield bolt.
    - Tighten to 15 Nm (11 lb-ft).



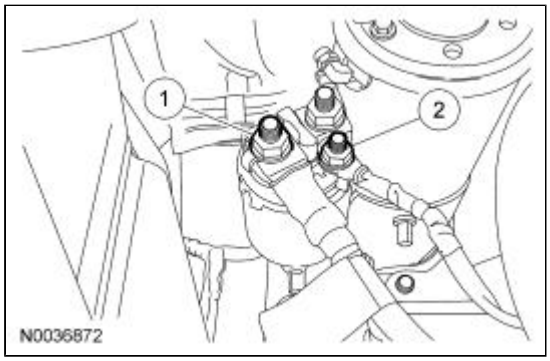
18. Position the starter motor in place and install the 3 starter motor bolts.
    - Tighten to 26 Nm (19 lb-ft).



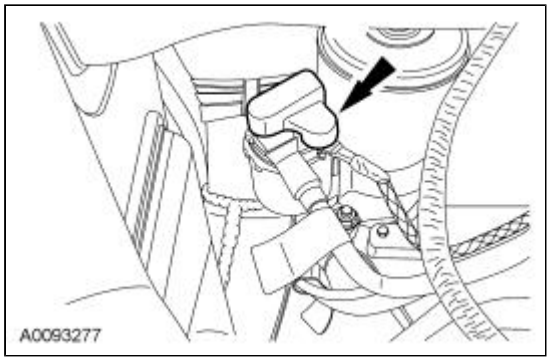
19. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).



20. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (9 lb-ft).
    2. Tighten to 6 Nm (53 lb-in).

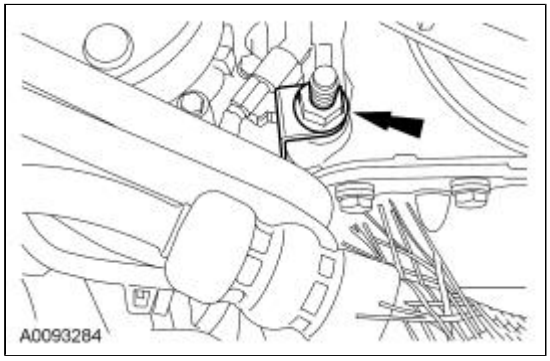


21. Install the plastic starter motor electrical connector cap.

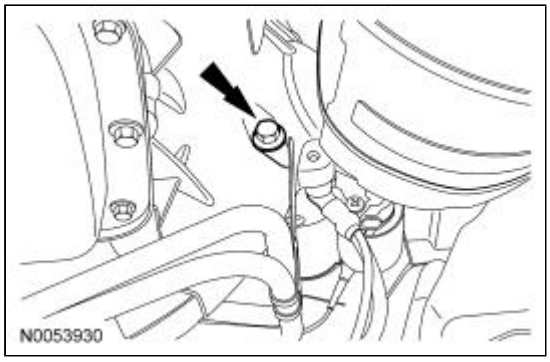


22. Position the transmission cooler tubes in place and install the bracket nut.

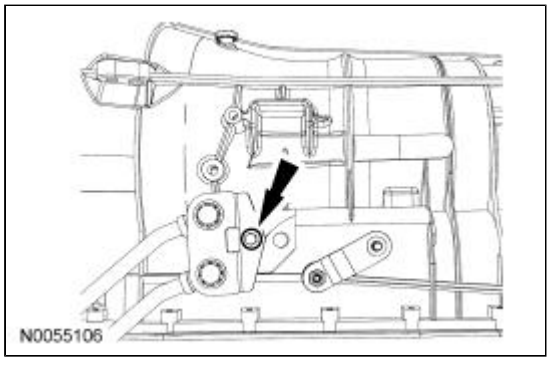
- Tighten to 27 Nm (20 lb-ft).



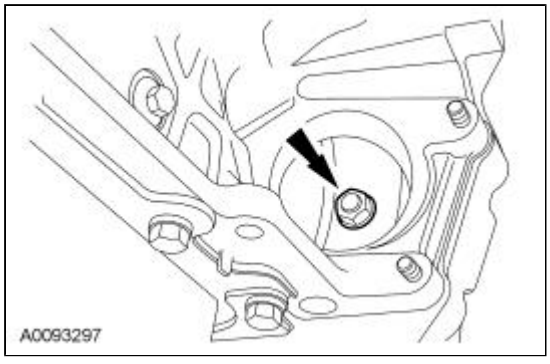
23. Align the bracket and install the remaining transmission case bolt.
    - Tighten to 48 Nm (35 lb-ft).



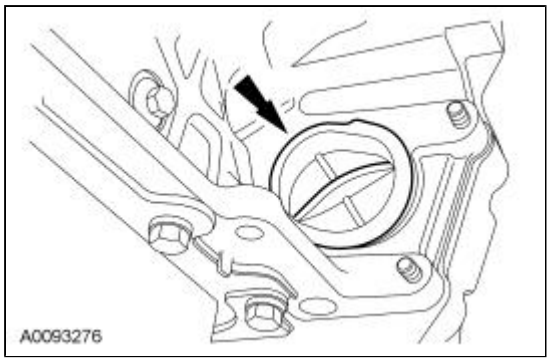
24. Install the transmission cooler tubes and the bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



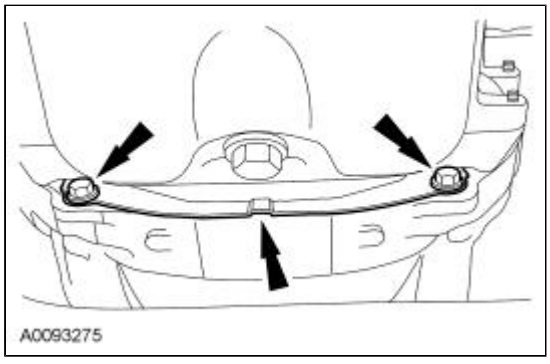
25. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



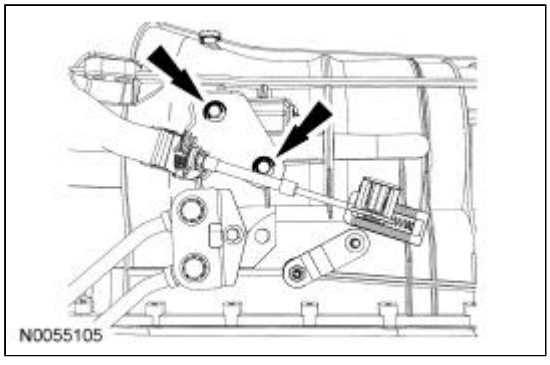
26. Install the rubber access plug.



27. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).

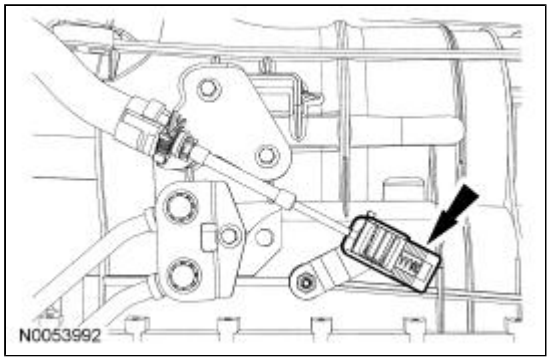


28. Install the selector lever bracket and bolts.
    - Tighten to 48 Nm (35 lb-ft).

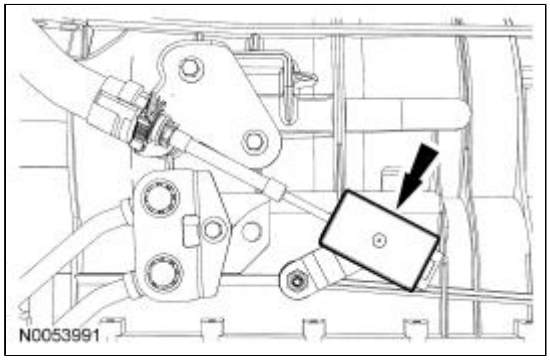


29. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever ball stud and move the locking tab down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.



30. If equipped, install the heat shield.



31. Install the driveshaft. For additional information, refer to Section 205-01 .

32. Connect the battery ground cable. For additional information, refer to Section 414-01 .

33. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

34. Reflash the transmission control module (TCM) to the latest level of software.

35. Fill the transmission with clean automatic transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Printable View (78 KB)

General Specifications

Item	Specification
Fluid	
MERCON® SP is not interchangeable with other transmission fluids. The use of any other fluid or cleaning agents will cause internal transmission damage.	
MERCON® SP Automatic Transmission Fluid XT-6-QSP (US); CXT-6-LSP12 (Canada)	MERCON® SP

Torque Specifications

Description	Nm	lb-ft
Engine mount nuts	175	129
Sway bar bracket nuts	55	41
Transmission fluid cooler tube bracket bolt at transmission	48	35
Transmission fluid cooler tube bracket nut to front of engine	40	30
Transmission fluid cooler tubes-to-transmission bracket bolt	25	18

Transmission Cooling

Printable View (390 KB)

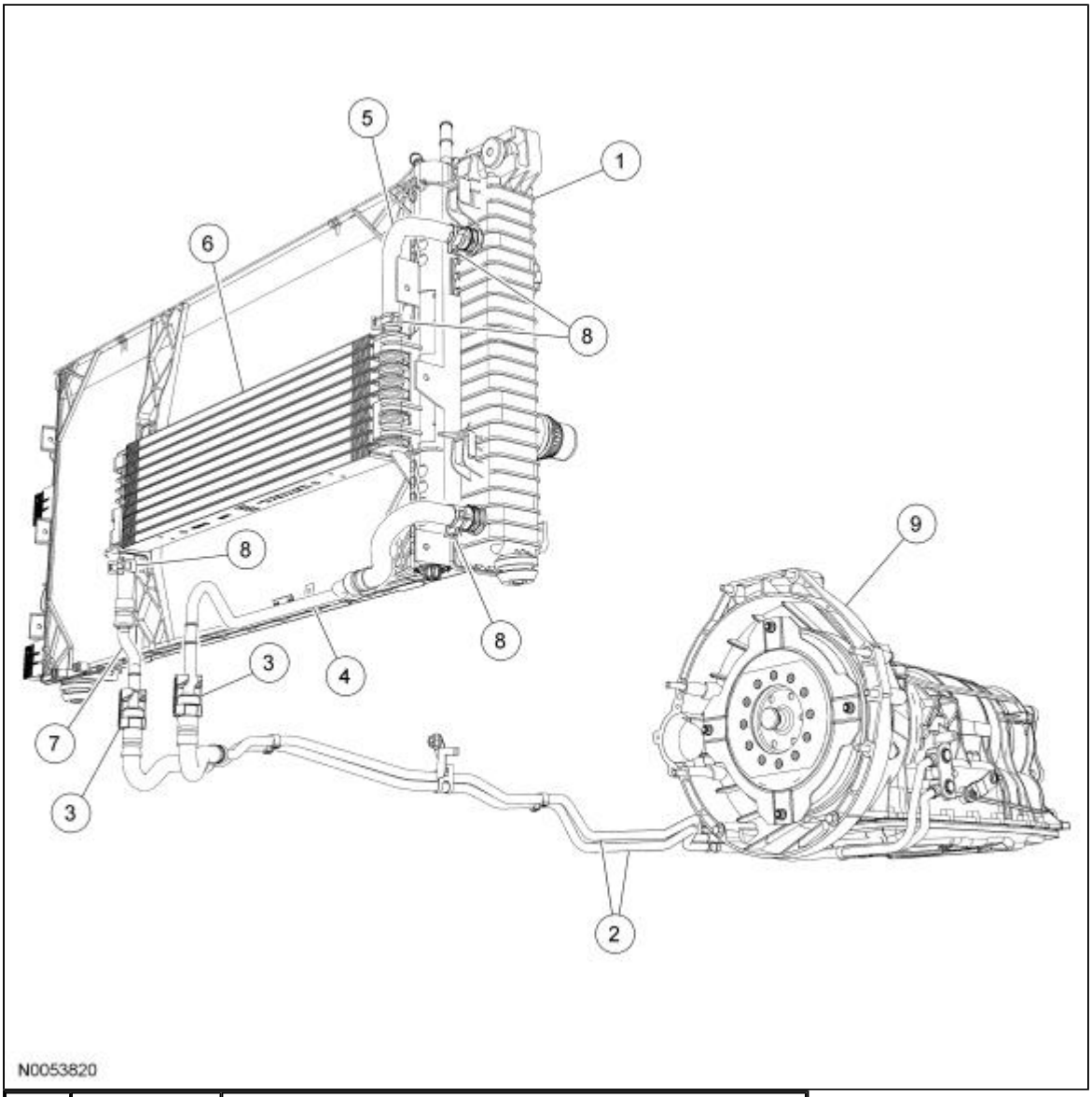
The transmission fluid cooling system consists of:

- fluid cooler inlet and outlet tubes.
- an in-tank fluid cooler inlet tube.
- a non-repairable in-tank transmission fluid cooler.
- an auxiliary fluid cooler inlet tube.
- an auxiliary transmission fluid cooler.
- an auxiliary fluid cooler return tube.

The transmission fluid flows from the transmission to the in-tank transmission fluid cooler, to the auxiliary transmission fluid cooler and returns to the transmission.

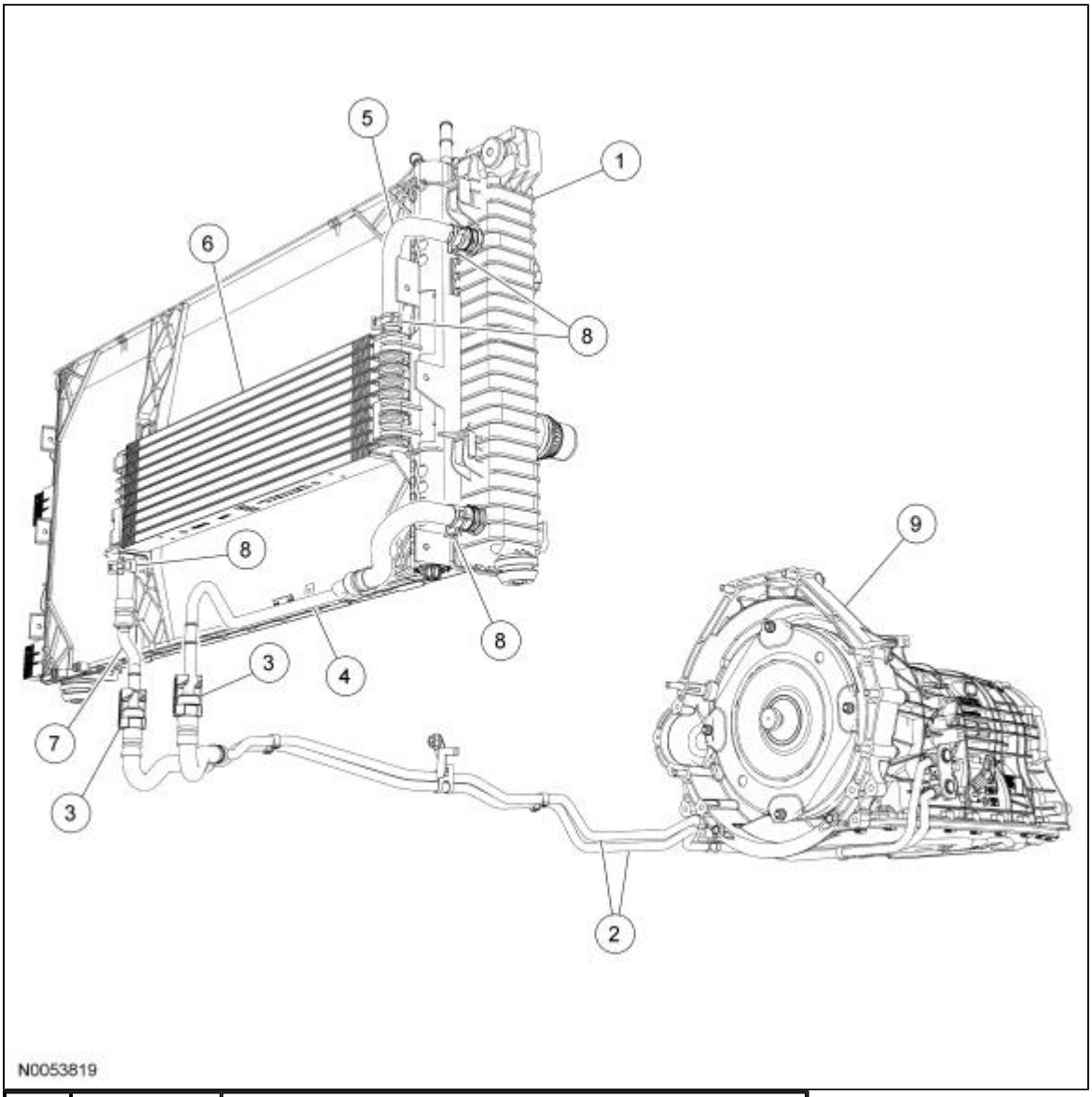
For fluid cooler flow testing, backflushing and cleaning procedures, refer to Section 307-01A or Section 307-01B .

6R75 Transmission With Auxiliary Transmission Fluid Cooler



Item	Part Number	Description
1	8005	Radiator
2	7H420	Transmission fluid cooler inlet and outlet tubes
3	7J081	Transmission fluid cooler inlet and outlet tube secondary latches
4	7B028	Transmission fluid cooler inlet hose
5	7F113	Transmission fluid cooler inlet hose
6	7A095	Auxiliary transmission fluid cooler
7	7F112	Transmission fluid cooler outlet hose
8	8287	Transmission fluid cooler hose clamp
9	7000	Transmission

6HP26 Transmission With Auxiliary Transmission Fluid Cooler



Item	Part Number	Description
1	8005	Radiator
2	7H420	Transmission fluid cooler inlet and outlet tubes
3	7J081	Transmission fluid cooler inlet and outlet tube secondary latches
4	7B028	Transmission fluid cooler inlet hose
5	7F113	Transmission fluid cooler inlet hose
6	7A095	Auxiliary transmission fluid cooler
7	7F112	Transmission fluid cooler outlet hose
8	8287	Transmission fluid cooler hose clamp
9	7000	Transmission

Transmission Cooling

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Inspection and Verification

CAUTION: When internal wear or damage occurs in the transmission, metal particles, clutch plate material and band material can travel into the torque converter, the fluid cooler tubes, the in-tank transmission fluid cooler and the auxiliary transmission fluid cooler, if so equipped. These contaminants are a major cause of recurring transmission concerns. To prevent future concerns, remove these contaminants from the cooling system before placing the transmission back into use. Refer to Section 307-01A or Section 307-01B for fluid cooler flow testing, backflushing and cleaning.

1. Visually inspect for obvious signs of mechanical damage, incorrect component installation and system leaks. Repair as necessary.
   - Install a new or remanufactured radiator when fluid is found leaking from the in-tank transmission fluid cooler. Refer to Section 303-03 .
   - Install a new O-ring when transmission fluid is found leaking between the radiator transmission oil cooler and the transmission oil cooler fitting (not the cooler line into the fitting). Refer to the Component Test in this section.
   - Install a new auxiliary transmission fluid cooler if there is leakage from the fluid cooler. Refer to Auxiliary Transmission Fluid Cooler in this section.
2. If the fault is not visually evident, GO to Symptom Chart .

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• Transmission overheating	• Excessive vehicle or towing loads, severe vehicle use	• REFER to the vehicle specification manual for load and GVW/GCW information. REFER to the owner's guide.
	• Incorrect fluid level	• CHECK and, if necessary, ADJUST the fluid to the correct level. REFER to Section 307-01A or Section 307-01B .
	• Fluid condition	• CHECK fluid condition. REFER to Section 307-01A or Section 307-01B .
	• Incorrect fluid type	• REFER to Specifications in this section.
	• Transmission cooling system damaged, blocked, restricted or	• CARRY OUT the transmission fluid cooler flow test. REFER to Section

	installed incorrectly	307-01A or Section 307-01B .
	• System leaks	• REFER to Section 307-01A or Section 307-01B .
	• Engine overheating	• REFER to Section 303-03 .
	• Powertrain control system electrical inputs/outputs, vehicle wiring harnesses, powertrain control module (PCM), torque converter clutch (TCC) solenoid	• CARRY OUT on-board diagnostics. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, and Section 307-01A or Section 307-01B .
	• Internal transmission concerns	• REFER to Section 307-01A or Section 307-01B .
• Fluid leak at transmission in-tank cooler	• Transmission fluid cooler fitting	• REFER to the Component Test in this section.

Component Test

Transmission Fluid Cooler Leaks at Radiator

Transmission fluid may leak between the radiator transmission fluid cooler and the transmission fluid cooler fitting (not the cooler line into the fitting), which may result in a residue of transmission fluid on the radiator tank around the fluid cooler fitting. The in-tank transmission fluid cooler is not serviceable. If installation of a new transmission fluid cooler is required, refer to Section 303-03 .

Auxiliary Transmission Fluid Cooler

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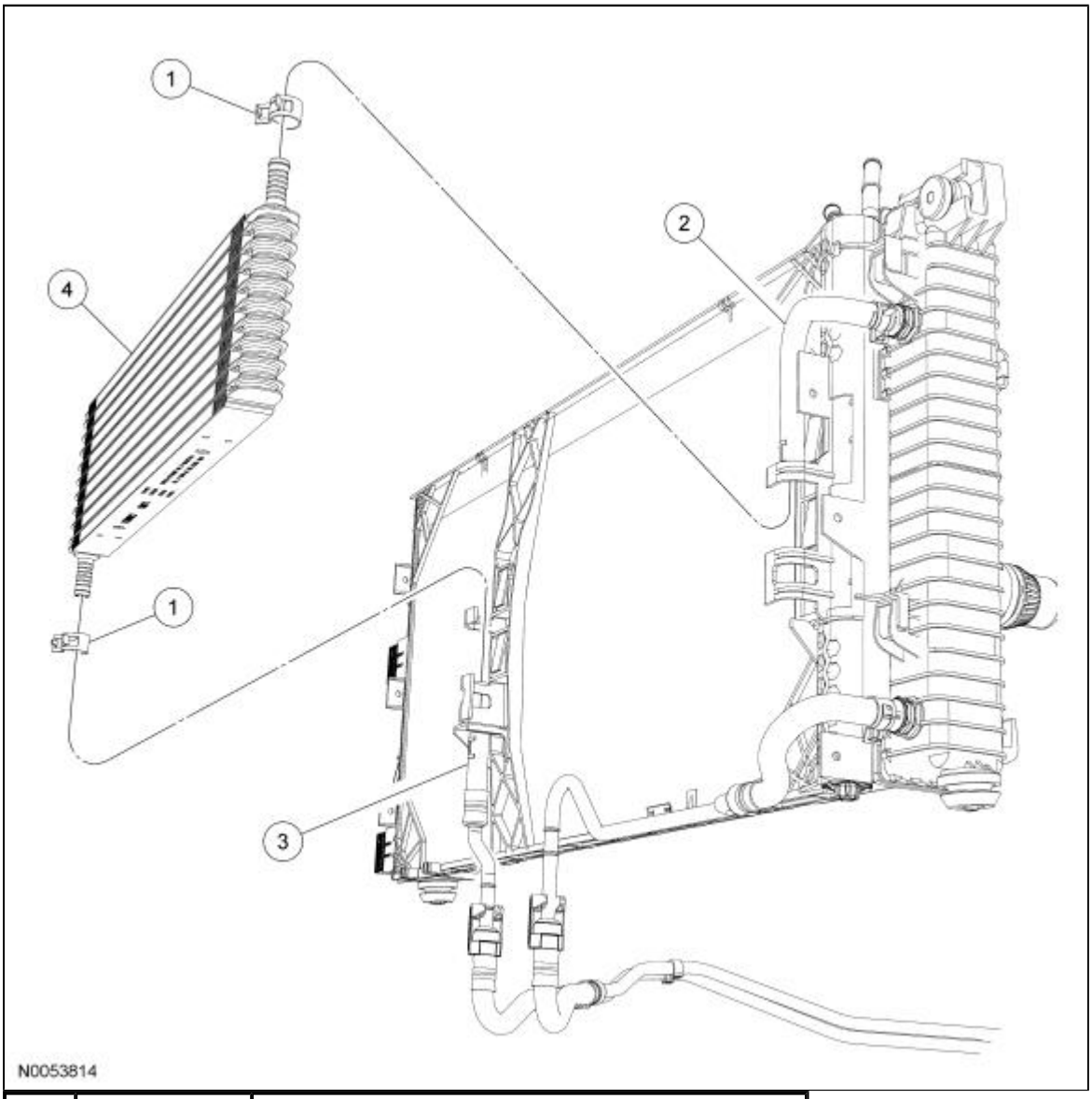
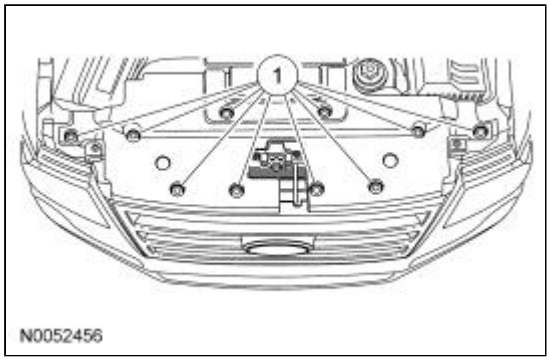


Item	Part Number	Description
1	8287	Auxiliary transmission fluid cooler hose clamp
2	7F113	Auxiliary transmission fluid cooler inlet hose
3	7F112	Auxiliary transmission fluid cooler outlet hose
4	7A095	Auxiliary transmission fluid cooler

Removal

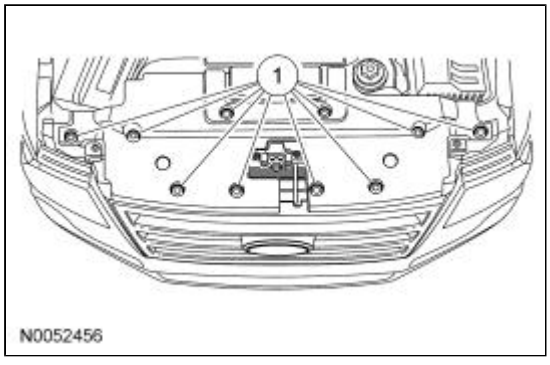
1. Remove the upper radiator cover.
    1. Remove the fasteners.



2. Remove and discard the auxiliary transmission fluid cooler inlet hose clamp.
3. Disconnect the auxiliary transmission fluid cooler inlet hose from the cooler.
4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
5. Move the flexible air deflector aside, then remove and discard the auxiliary transmission fluid cooler outlet hose clamp.
6. Disconnect the auxiliary transmission fluid cooler outlet hose from the cooler.
7. Remove the auxiliary transmission fluid cooler.

Installation

1. Install the auxiliary transmission fluid cooler.
2. Connect the auxiliary transmission fluid cooler outlet hose to the cooler.
3. Install a new auxiliary transmission fluid cooler outlet hose clamp, then move the flexible air deflector back into place.
4. Connect the auxiliary transmission fluid cooler inlet hose to the cooler.
5. Install a new auxiliary transmission fluid cooler inlet hose clamp.
6. Install the upper radiator cover.
    1. Install the fasteners.



7. Fill the transmission with fluid and verify correct operation. Refer to Section 307-01A or Section 307-01B .

Transmission Fluid Cooler Hoses

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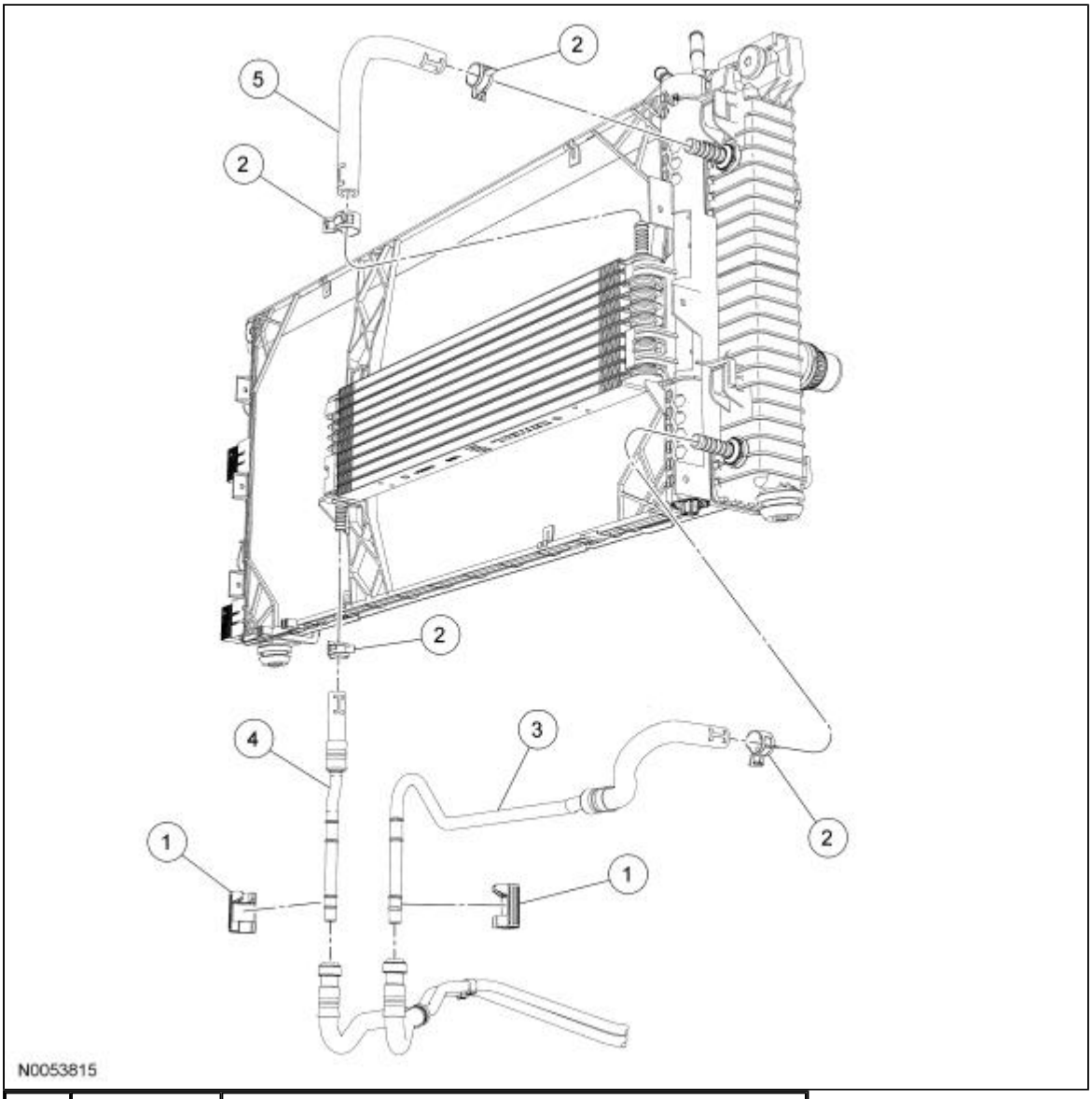
Special Tool(s)

ST2935A	Disconnect Tool, Transmission Cooler Line 307-459

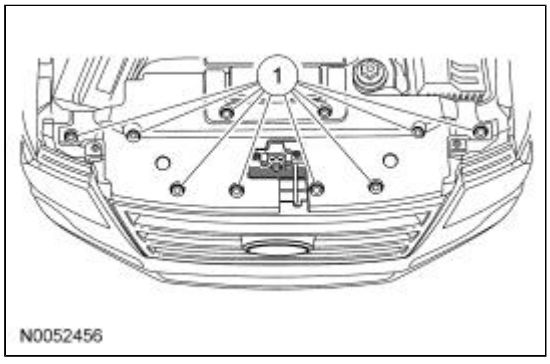


Item	Part Number	Description
1	7J081	Transmission fluid cooler inlet and outlet tube secondary latches

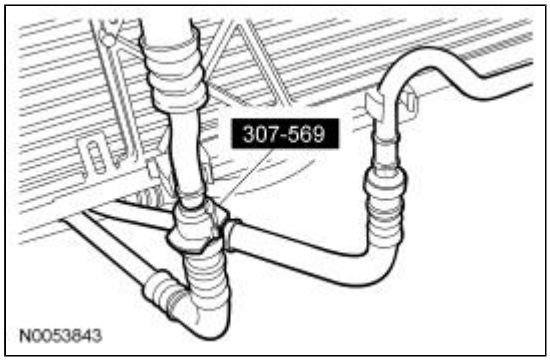
2	8287	Transmission fluid cooler hose clamp
3	7B028	Transmission fluid cooler inlet hose
4	7F112	Auxiliary transmission fluid cooler outlet hose
5	7F113	Auxiliary transmission fluid cooler inlet hose

Removal

1. Remove the upper radiator cover.
    1. Remove the fasteners.



2. Remove and discard the auxiliary transmission fluid cooler inlet hose clamps.
3. Disconnect the auxiliary transmission fluid cooler inlet hose from the coolers.
4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
5. Move the flexible air deflector aside, then remove and discard the transmission fluid cooler tube secondary latches.
6. Using the special tool, disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.



7. Remove and discard the transmission fluid cooler hose clamps.
8. Disconnect the transmission fluid cooler hoses from the coolers.

Installation

1. Connect the transmission fluid cooler hoses to the coolers.
2. Install new transmission fluid cooler hose clamps.

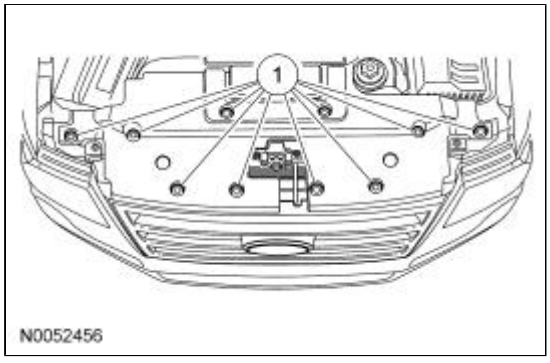
3. Connect the transmission fluid cooler hoses to the transmission fluid cooler tubes.

4. Install new transmission fluid cooler tube secondary latches, then move the flexible air deflector back into place.

5. Connect the auxiliary transmission fluid cooler inlet hose to the coolers.

6. Install new auxiliary transmission fluid cooler inlet hose clamps.

7. Install the upper radiator cover.
    1. Install the fasteners.



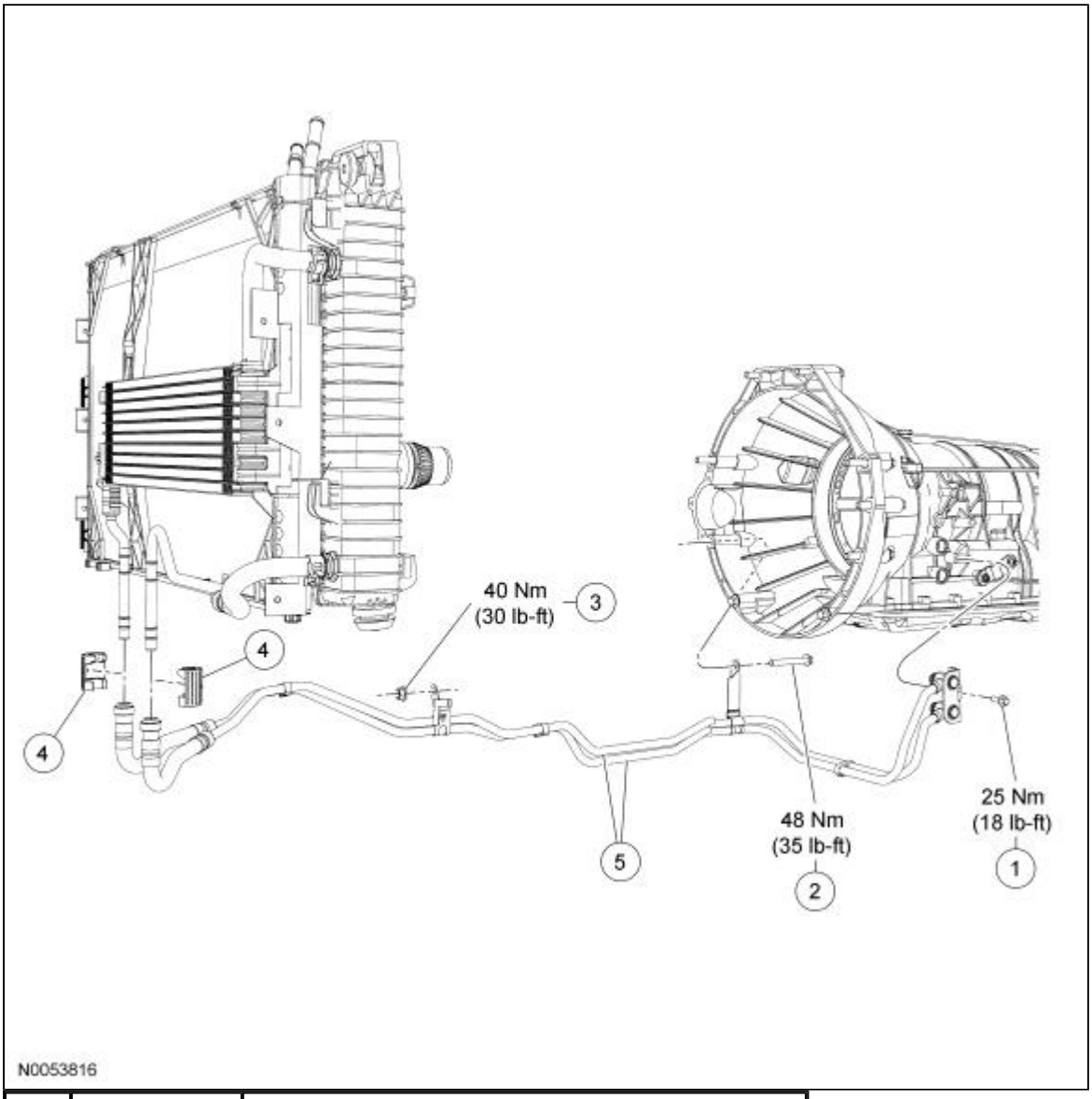
8. Fill the transmission with fluid and verify correct operation. Refer to Section 307-01A or Section 307-01B .

Transmission Fluid Cooler Tubes

Printable View (508 KB)

Special Tool(s)

ST2935A	Disconnect Tool, Transmission Cooler Line 307-569



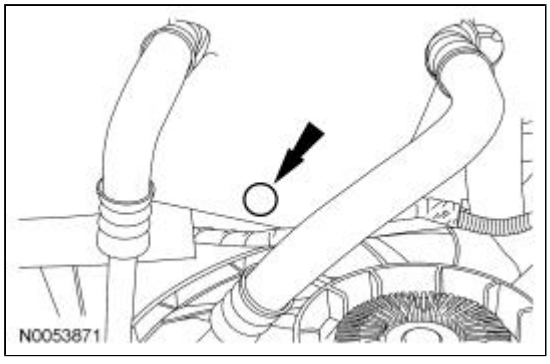
Item	Part Number	Description
1	W500023-S439	Transmission fluid cooler tube bracket bolt
2	—	Transmission fluid cooler tube bracket bolt at

		transmission
3	W707014-S441	Transmission fluid cooler tube bracket nut
4	7J081	Transmission fluid cooler inlet and outlet tube secondary latches
5	7H420	Transmission fluid cooler inlet and outlet tubes

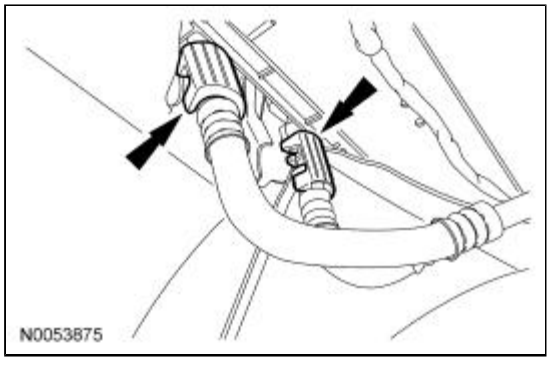
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

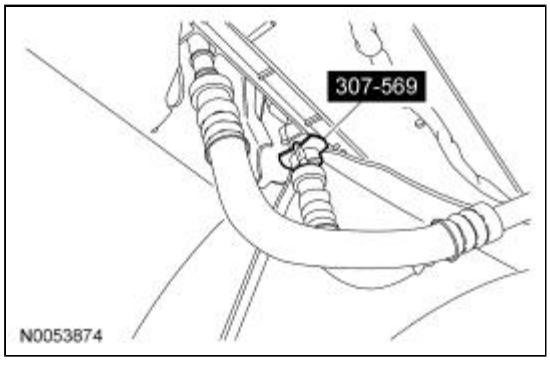
2. Remove the pushpin and move the air deflector aside.



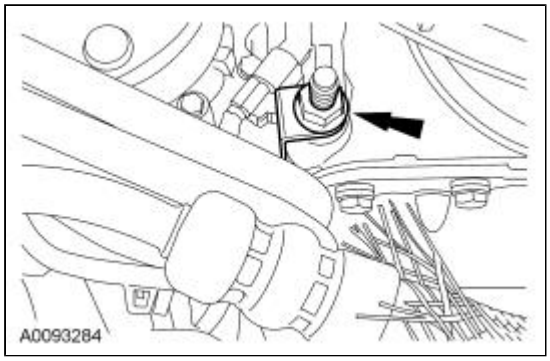
3. Remove the transmission cooler tube secondary latches.



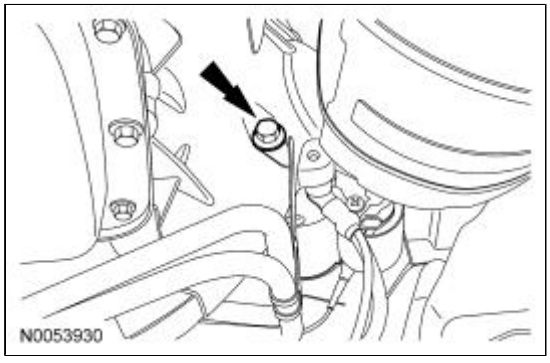
4. Using the special tool, disconnect the transmission fluid cooler tubes from the transmission fluid cooler hoses.



5. Remove the transmission fluid cooler tube bracket nut from the front of the engine.

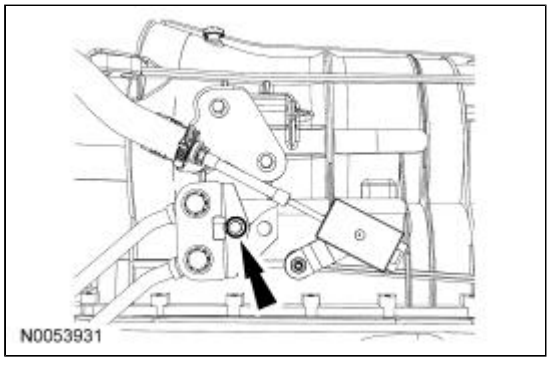


6. Remove the transmission fluid cooler tube bracket from the side of the transmission.

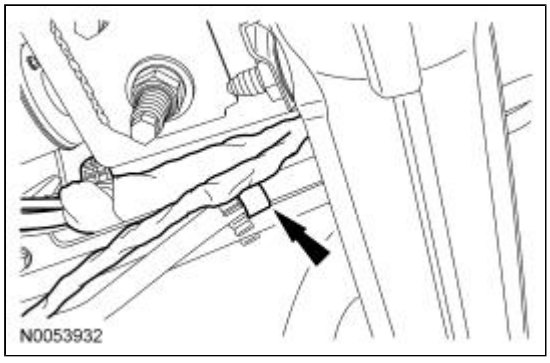


7. **NOTE:** The transmission fluid cooler tube O-rings may remain in the transmission case. Carefully remove them from the case if retained.

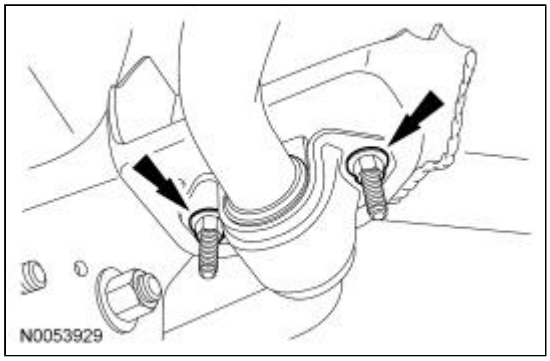
   Remove the bolt and disconnect the transmission fluid cooler tubes from the transmission.



8. Disconnect the electrical harness from the transmission cooler tubes.

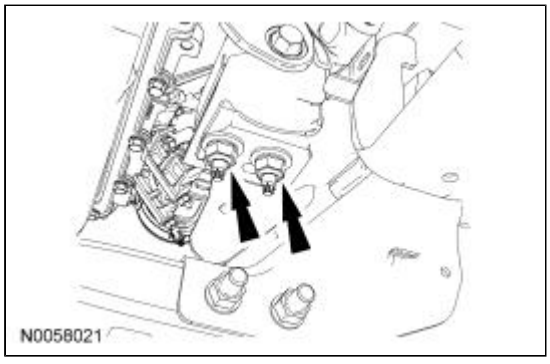


9. Remove the 4 nuts and lower the front sway bar.



10. **CAUTION: Only use hand tools when removing the engine mount nuts or damage to the engine mount may occur.**

    For four wheel drive (4WD), remove the LH engine mount nuts and lift the engine to gain clearance for the trans cooler tubes.

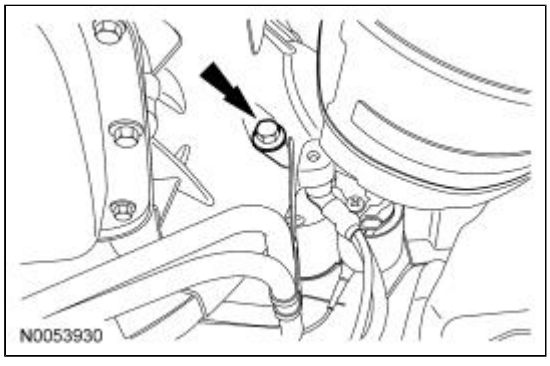


11. Remove the transmission fluid cooler tubes from the vehicle.

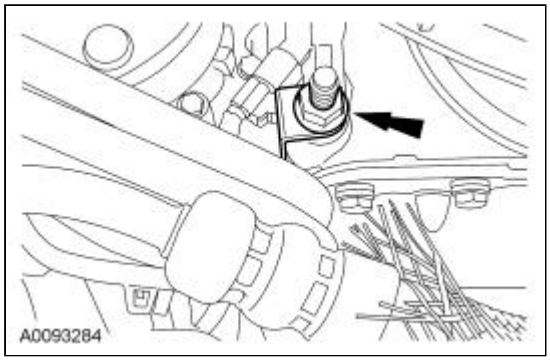
Installation

1. Position the transmission fluid cooler tubes in the vehicle.

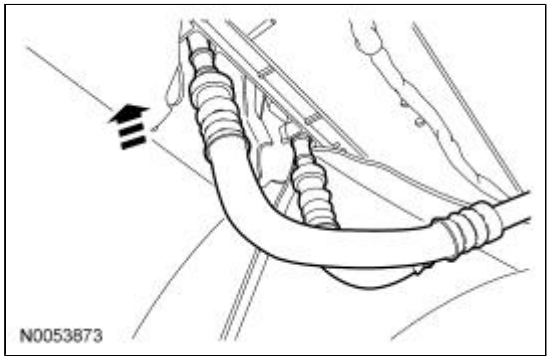
2. Install the bolt and transmission fluid cooler tube bracket to the side of the transmission.
   - Tighten to 48 Nm (35 lb-ft).



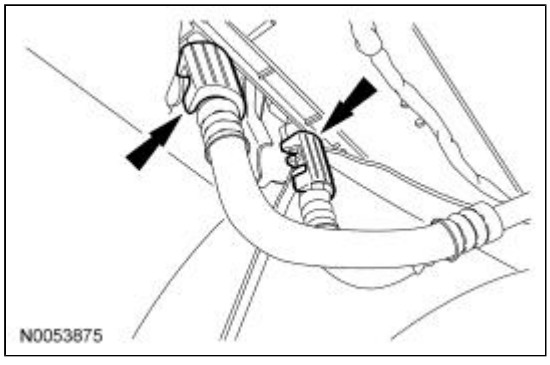
3. Install the nut and transmission fluid cooler tube bracket to the front of the engine.
   - Tighten to 40 Nm (30 lb-ft).



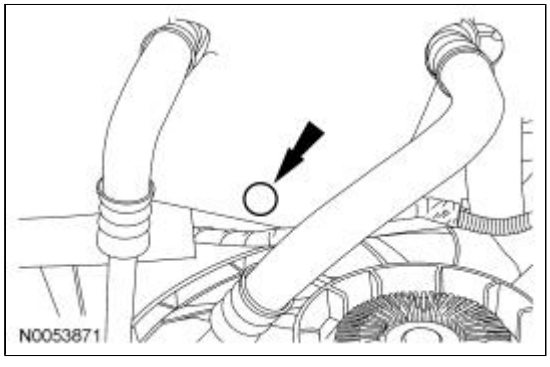
4. Connect the transmission fluid cooler tubes to the transmission fluid cooler hoses.



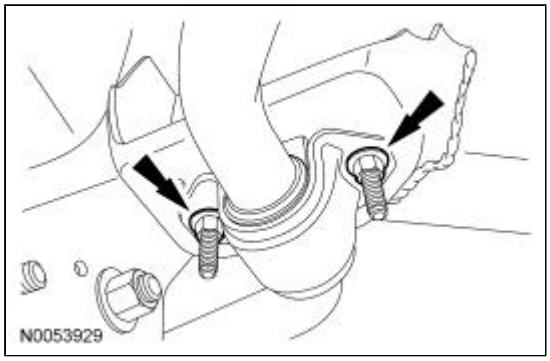
5. Install the transmission cooler tube secondary latches.



6. Reposition the air deflector and install the pushpin.

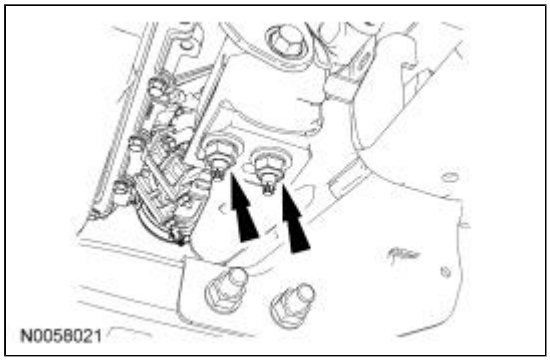


7. Position the sway bar in place and install the 4 nuts.
    - Tighten to 55 Nm (41 lb-ft).

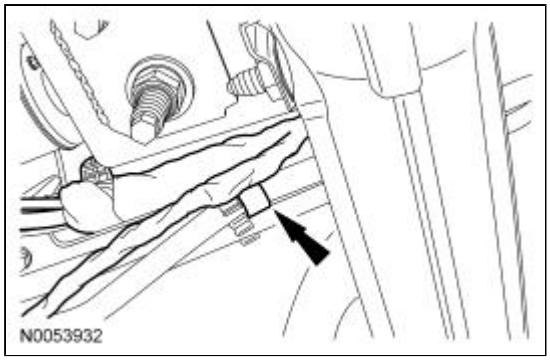


8. **CAUTION: Only use hand tools when installing the engine mount nuts or damage to the engine mount may occur.**

   For 4WD, lower the engine and install the LH engine mount nuts.
   - Tighten to 175 Nm (129 lb-ft).



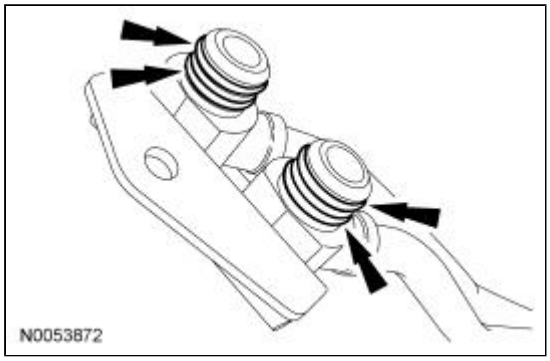
9. Connect the electrical harness to the transmission cooler tubes.



10. **NOTE:** Inspect the case to make sure that the old O-rings are not stuck in the case.

    NOTE: Install new O-rings on the ends of the cooler lines prior to installing.

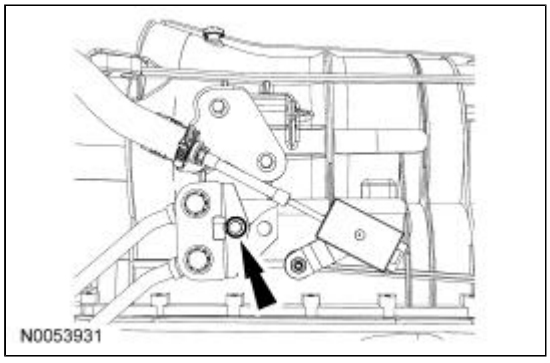
    Install new O-rings on the transmission fluid cooler tubes.



11. **NOTE:** Inspect the case to make sure that the old O-rings are not stuck in the case.

    NOTE: Install new O-rings on the ends of the cooler lines prior to installing.

    Position the transmission fluid cooler tubes into the transmission, then install the bolt.
    - Tighten to 25 Nm (18 lb-ft).



12. Fill the transmission with fluid and verify correct operation. Refer to Section 307-01A or Section 307-01B .

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Hood release cable lever bolts	9	—	80
Instrument panel lower reinforcement panel screws	9	—	80
Selector lever assembly-to-console bolts	8	—	71
Selector lever cable bracket bolts (6HP26)	25	18	—
Selector lever cable bracket bolts (6R75)	25	18	—
Selector lever knob screw (floor shift)	2	—	18
Selector lever mechanism (column shift)	6	—	53
Selector lever-to-mechanism bolt (column shift)	18	13	—

External Controls

Printable View (63 KB)

The transmission selector lever cable transfers the transmission operating mode from the selector lever to the automatic transmission. The indicated position of the transmission selector lever is transferred to the transmission through the steering column mounted selector lever on the 6R75 transmission, or the floor mounted selector lever on 6HP26 and 6R75 transmissions, then to the cable and down to the manual control lever on the transmission.

Shift Interlock System — Column

The shift interlock system prevents shifting from PARK unless the brake pedal is depressed. The shift interlock system consists of a shift interlock actuator mounted at the upper end of the steering column. If the ignition switch is in the RUN position, the shift interlock actuator is on unless the brake pedal is depressed.

Shift Interlock System — Floor

The shift interlock system prevents shifting from PARK unless the brake pedal is depressed. The shift interlock system consists of a shift interlock actuator mounted on the floor selector lever. If the ignition switch is in the RUN position, the shift lock actuator is on unless the brake pedal is depressed.

Transmission Control (TC) Switch

The transmission control (TC) switch is a momentary contact switch that is located on the end of the column selector lever or on the floor selector lever knob. Pushing the TC switch will either disengage or engage the overdrive function of the automatic transmission. If OVERDRIVE is disengaged, the word OD/OFF will illuminate on the instrument panel.

External Controls — Column Shift

Printable View (141 KB)

Refer to Wiring Diagrams Cell 37 , Shift Lock for schematic and connector information.

Special Tool(s)

ST1137-A	73 Digital Multimeter 105-R0051 or equivalent

Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical

• Damaged brake shift interlock actuator (BSIA)
• Damaged transmission control (TC) switch
	• Failed fuse(s)
	  ▪ Smart power distribution junction box (SPDJB) 5 (10A)
	  ▪ Power distribution box (PDB) 31 (15A)
	• Damaged wiring harness
	• Loose or corroded connections

3. If the fault is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

• The brake shift interlock system does not release/lock correctly	• Circuitry
	• Fuse(s):
	  ▪ SPDJB 5 (10A)
	  ▪ PDB 31 (15A)
	• BSIA
	• Brake pedal position (BPP) switch
		• Go To Pinpoint Test A .

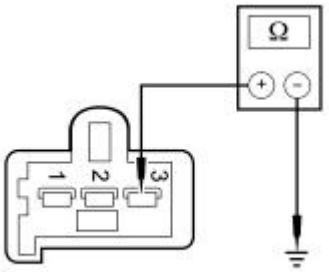
• The shift control is out of correct gear relationship	• Transmission selector lever cable and bracket	• Go To Pinpoint Test B .

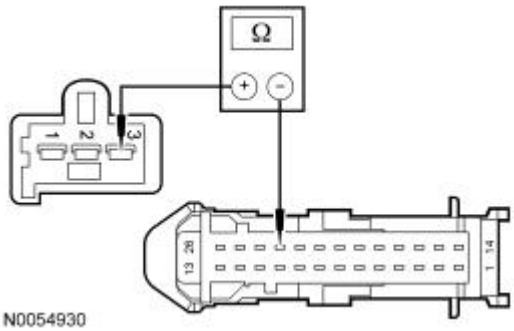
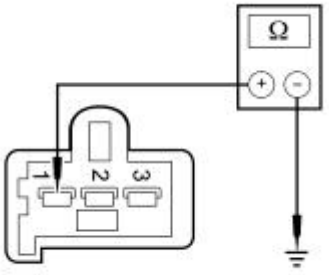
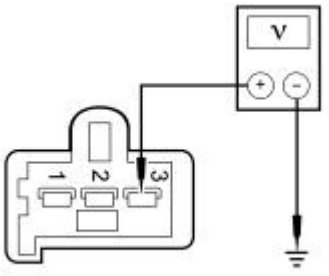
	• Selector lever indicator • Shift control linkage	
• Transmission range (TR) indicator does not correspond to the gear	• Transmission selector lever cable bracket	• TIGHTEN bolts holding the transmission selector lever cable bracket.
	• EPRNDL malfunction	• REFER to Section 413-01 .
	• Transmission selector lever cable loose in the transmission retainer bracket	• VERIFY cable is fully seated in the transmission bracket.
	• Shift linkage	• VERIFY transmission selector lever cable adjustment. REFER to Selector Lever Cable Adjustment in this section.
	• Clip securing the transmission selector lever cable to the steering column bracket	• INSTALL clip correctly.
• Transmission range indicator lamp does not illuminate	• EPRNDL • Circuitry	• REFER to Section 413-00 .
• TC switch does not operate correctly	• TC switch • TC switch not cycled during self-test • Transmission control module (TCM) • Circuitry	• Go To Pinpoint Test C .
• The transmission control indicator lamp (TCIL) is not operating correctly	• Bulb • Instrument cluster • TCM	• REFER to Section 413-01 .
• Rattle, buzz or other noise	• Selector lever knob	• INSTALL a new selector lever knob.
	• Selector lever	• TIGHTEN housing bolts.
	• Cable assembly grommet	• SECURE grommet to floor panel.
• Water enters inside the vehicle	• Cable assembly grommet	• SECURE grommet to floor panel.
	• Torn cable assembly grommet	• INSTALL a new transmission selector lever cable.
• Excessive shift effort	• Transmission selector lever cable	• INSTALL a new transmission selector lever cable.
	• Cable bracket	• ADJUST cable. TIGHTEN cable bracket screws.
• Transmission selector lever will not shift	• Transmission selector lever cable	• INSTALL a new transmission selector lever cable.

	• Column bracket clip • Broken transmission selector lever cable	• INSTALL a new bracket clip. • INSTALL a new transmission selector lever cable.

Pinpoint Tests

PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

Test Step	Result / Action to Take
A1 TEST THE BRAKE LIGHTS	
• Key in ON position. • Apply the brake pedal and observe the brake lights. • **Do the brake lights illuminate?**	**Yes** GO to A2 . **No** REFER to Section 417-01 .
A2 TEST SPDJB FUSE 5 (10A)	
• Check fuse: SPDJB FUSE 5 (10A). • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** GO to A3 .
A3 CHECK CIRCUIT CDC37 (GY/VT) FOR A SHORT TO GROUND	
• Disconnect: BSIA C2008. • Disconnect: SPDJB C2280e. • Inspect for damaged or pushed-out pins, corrosion or loose wires. Repair as necessary. • Measure the resistance between brake shift interlock actuator (BSIA) C2008-3, circuit CDC37 (GY/VT), harness side and ground.  N0054929 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A4 . **No** SERVICE circuit CDC37 (GY/VT) for short to ground. TEST the system for normal operation.
A4 CHECK CIRCUIT CDC37 (GY/VT) FOR AN OPEN	
• Measure the resistance between BSIA C2008-3, circuit CDC37 (GY/VT), harness side and smart power distribution junction box (SPDJB) C2280e-23, circuit CDC37 (GY/VT), harness side.	**Yes** GO to A5 . **No** SERVICE circuit CDC37 (GY/VT) for an open. TEST the system for normal

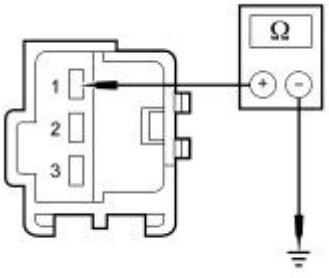
 N0054930 • **Is the resistance less than 5 ohms?**	operation.
A5 TEST CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between BSIA C2008-1, circuit GD138 (BK/WH), harness side and ground.  N0054931 • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** SERVICE circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
A6 TEST CIRCUIT CDC37 (GY/VT) FOR VOLTAGE	
• Connect: SPDJB C2280e. • Measure the voltage at the BSIA C2008-3, circuit CDC37 (GY/VT), harness side, while applying the brake pedal  N0054932 • **Is the voltage greater than 10 volts with the brake pedal applied?**	**Yes** INSTALL a new BSIA. Refer to Brake Shift Interlock Actuator — Column Shift in this section. **No** INSTALL a new SPDJB. Refer to Section 418-00 .

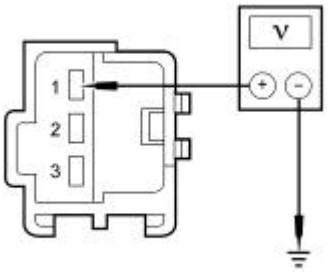
PINPOINT TEST B: THE SHIFT CONTROL IS OUT OF CORRECT GEAR RELATIONSHIP

Test Step	Result / Action to Take
B1 CHECK THE SHIFT CONTROL LINKAGE	
• Apply the brake pedal. • Gain access to the column shift control linkage. • Actuate the transmission selector lever in all ranges.	**Yes** INSTALL new column shift control linkage. TEST the system for normal operation. **No**

• Observe all linkages during operation. • **Is the linkage damaged?**	GO to B2 .
B2 CHECK THE TRANSMISSION SELECTOR LEVER CABLE	
• Check transmission selector lever cable and bracket for installation and tightness. • **Is the transmission selector lever cable correctly installed and adjusted?**	**Yes** VERIFY the transmission selector lever cable adjustment. REFER to Selector Lever Cable Adjustment in this section. ADJUST the transmission selector lever cable if necessary. GO to B3 . **No** REPAIR as necessary. TEST the system for normal operation.
B3 CHECK THE LINKAGE/CABLE FOR CORRECT GEAR RELATIONSHIP	
• Apply the brake pedal. • Actuate the transmission selector lever in all ranges. • **Does the indicator match the gear selection?**	**Yes** System OK. TEST the system for normal operation. **No** REFER to Section 413-01 .

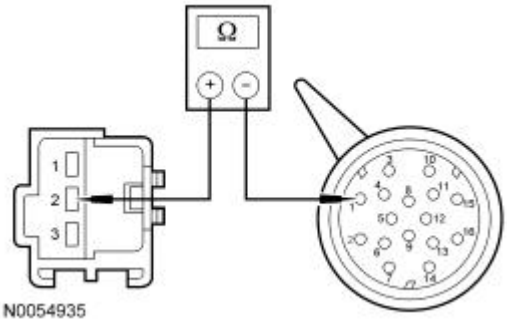
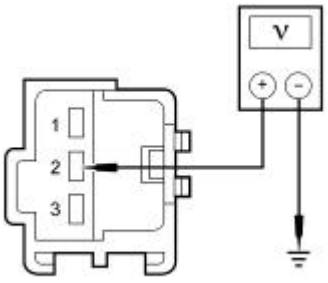
PINPOINT TEST C: THE TRANSMISSION CONTROL (TC) SWITCH DOES NOT OPERATE CORRECTLY

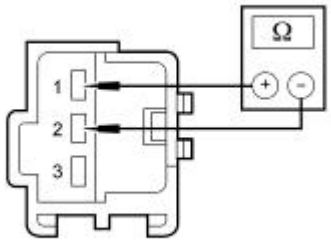
Test Step	Result / Action to Take
C1 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Disconnect: TC switch C2135. • Inspect for damaged or pushed-out pins, corrosion or loose wires. Repair as necessary. • Measure the resistance between TC switch C2135-1, circuit GD133 (BK), harness side and ground.  N0054933 • **Is the resistance less than 5 ohms?**	**Yes** GO to C2 . **No** REPAIR circuit GD133 (BK). RECONNECT all components. TEST the system for normal operation.
C2 CHECK CIRCUIT GD133 (BK) FOR A SHORT TO VOLTAGE	
• Measure the voltage between TC switch C2135-1, circuit GD133 (BK), harness side and ground.	**Yes** REPAIR circuit GD133 (BK). RECONNECT all components. TEST the system for normal operation. **No** GO to C3 .



N0054934

- **Is the voltage greater than 10 volts?**

C3 CHECK CIRCUIT CET34 (BN/GN) FOR AN OPEN • Disconnect: TCM C1548. • Inspect for damaged or pushed-out pins, corrosion or loose wires. Repair as necessary. • Measure the resistance between TC switch C2135-2, circuit CET34 (BN/GN) harness side, and TCM C1548-1, circuit CET34 (BN/GN) harness side.  N0054935 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR circuit CET34 (BN/GN). RECONNECT all components. TEST the system for normal operation.
C4 CHECK CIRCUIT CET34 (BN/GN) FOR A SHORT TO VOLTAGE • Measure the voltage between TC switch C2135-2, circuit CET34 (BN/GN) harness side, and ground.  N0054936 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit CET34 (BN/GN). RECONNECT all components. TEST the system for normal operation. **No** GO to C5 .
C5 CHECK THE TC SWITCH • Measure the resistance between TC switch C2135-1 and C2135-2, while cycling the switch.	**Yes** INSTALL a new TCM. REFER to Section 307-01B . RECONNECT all components. TEST the system for normal operation. **No** INSTALL a new transmission selector lever. REFER to

 N0054937 • **Is the resistance less than 5 ohms while pressed and greater than 10k ohms when released?**	Selector Lever — Column Shift in this section. RECONNECT all components. TEST the system for normal operation.

External Controls — Floor Shift

Printable View (169 KB)

Refer to Wiring Diagrams Cell 37 , Shift Lock for schematic and connector information.

Special Tool(s)

ST1137-A	73 Digital Multimeter 105-R0051 or equivalent

Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical

• Damaged brake shift interlock actuator (BSIA)
• Damaged transmission control (TC) switch
	• Failed fuse(s)
	  ▪ Smart power distribution junction box (SPDJB) 5 (10A)
	  ▪ Power distribution box (PDB) 31 (15A)
	• Damaged wiring harness
	• Loose or corroded connections

3. If the fault is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action

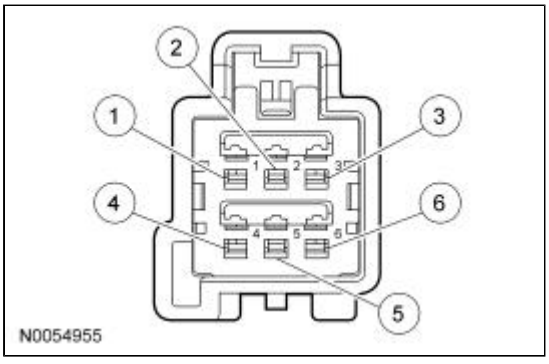
• The shift interlock system does not release/lock correctly	• Circuitry
	• Fuse(s):
	  ▪ SPDJB 5 (10A)
	  ▪ PDB 31 (15A)
	• BSIA
	• Brake on/off (BOO) switch
		• Go To Pinpoint Test D .

• The shift control	• Transmission	• Go To Pinpoint Test E .

is out of correct gear relationship	selector lever cable and bracket • Retainer bracket • Shift control linkage	
• Transmission range indicator does not correspond to the gear	• Transmission selector lever cable bracket	• TIGHTEN bolts holding transmission selector lever cable bracket.
	• Transmission selector lever cable loose from the transmission retainer bracket	• SECURE transmission selector lever cable.
	• Shift linkage	• VERIFY transmission selector lever cable adjustment. REFER to Selector Lever Cable Adjustment in this section. ADJUST transmission selector lever cable if necessary. If selector lever cable adjustment is correct, INSTALL a new main control valve body. REFER to Section 307-01A or Section 307-01B .
• Transmission range indicator does not illuminate	• Bulb • Circuitry	• REFER to Section 413-00 .
• The transmission control (TC) switch does not operate correctly	• TC switch • TC switch not cycled during self-test • Powertrain control module • Circuitry	• Go To Pinpoint Test F .
• The transmission control indicator lamp (TCIL) is not operating correctly	• Bulb • Instrument cluster • Powertrain control module	• REFER to Section 413-01 .
• Rattle, buzz or other noise	• Selector lever knob • Cable assembly grommet • Transmission selector lever	• INSTALL a new selector lever knob. • SECURE grommet to floor panel. • TIGHTEN housing bolts.
• Water enters inside the vehicle	• Cable assembly grommet • Torn selector lever cable assembly grommet	• SECURE grommet to floor panel. • INSTALL a new selector lever cable.
• Excessive shift effort	• Transmission selector lever cable	• INSTALL a new transmission selector lever cable.

	• Cable bracket	• ADJUST cable. TIGHTEN cable bracket screws.
• Transmission selector lever will not shift	• Transmission selector lever cable • Brake shift interlock failure • Selector lever knob • Broken transmission selector lever	• REINSTALL transmission selector lever cable. • Go To Pinpoint Test D . • INSTALL a new selector lever knob. • INSTALL a new transmission selector lever.

Pinpoint Tests

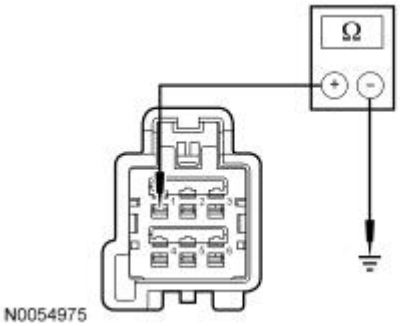
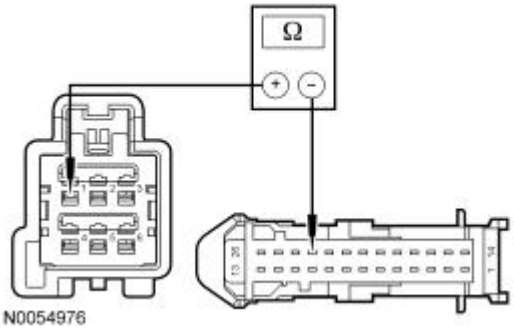


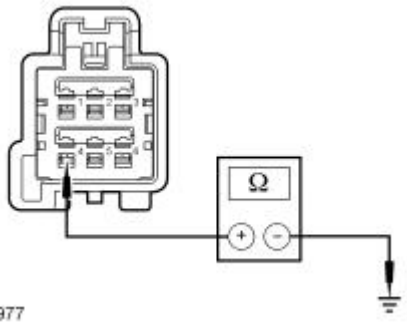
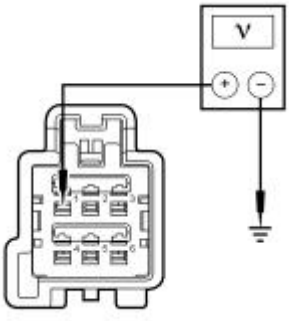
Pin Number	Circuit Function
1	Solenoid Control
2	Park Detect
3	Illumination
4	Ground
5	TC Switch
6	TC Switch

Pin-Out Table

Pin to Pin		Function	Resistance Reading	Selector Lever Position
1	4	BSIA Solenoid	22-26 ohms	Any
2	4	Park Detect Switch	Open (greater than 10K ohms)	P with knob release button not pressed (released)
2	4	Park Detect Switch	Closed (less than 5 ohms)	R, N, (D), 3, 2, 1
5	6	TC Switch	Open (greater than 10K ohms)	With button not pressed (released)
5	6	TC Switch	Closed (less than 5 ohms)	With button pressed

PINPOINT TEST D: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

Test Step	Result / Action to Take
D1 TEST THE BRAKE LIGHTS • Key in ON position. • Apply the brake pedal and observe the brake lights. • **Do the brake lights illuminate?**	**Yes** GO to D2 . **No** REFER to Section 417-01 .
D2 TEST SPDJB FUSE 5 (10A) • Check fuse: SPDJB FUSE 5 (10A). • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** GO to D3 .
D3 CHECK CIRCUIT CDC37 (GY/VT) FOR A SHORT TO GROUND • Disconnect: Selector Lever C2096. • Disconnect: SPDJB C2280e. • Inspect for damaged or pushed-out pins, corrosion or loose wires. Repair as necessary. • Measure the resistance between selector lever C2096-1, circuit CDC37 (GY/VT), harness side and ground.  N0054975 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D4 . **No** SERVICE circuit CDC37 (GY/VT) for short to ground. TEST the system for normal operation.
D4 CHECK CIRCUIT CDC37 (GY/VT) FOR AN OPEN • Measure the resistance between selector lever C2096-1, circuit CDC37 (GY/VT), harness side and smart power distribution junction box (SPDJB) C2280e-23, circuit CDC37 (GY/VT), harness side.  N0054976 • **Is the resistance less than 5 ohms?**	**Yes** GO to D5 . **No** SERVICE circuit CDC37 (GY/VT) for an open. TEST the system for normal operation.
D5 TEST CIRCUIT GD143 (BK/VT) FOR AN OPEN • Measure the resistance between selector lever C2096-4, circuit GD143 (BK/VT), harness side and ground.	**Yes** GO to D6 .

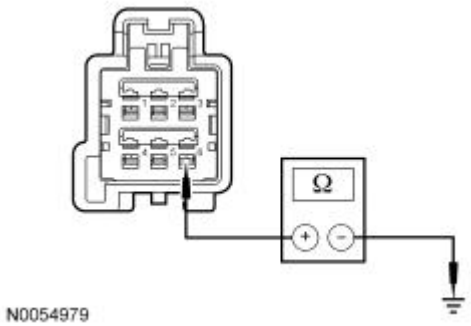
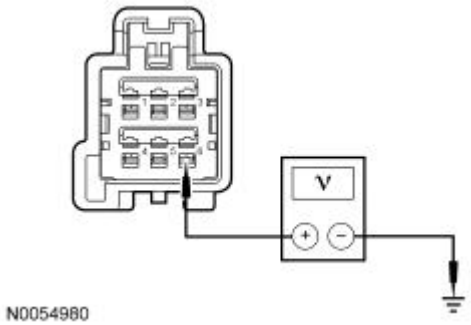
 N0054977 • **Is the resistance less than 5 ohms?**	**No** SERVICE circuit GD143 (BK/VT) for an open. TEST the system for normal operation.
D6 TEST CIRCUIT CDC37 (GY/VT) FOR VOLTAGE	**Yes** INSTALL a new selector lever. REFER to Selector Lever — Floor Shift in this section. **No** INSTALL a new SPDJB. REFER to Section 418-00.
• Connect: SPDJB C2280e. • Measure the voltage at selector lever C2096-1, circuit CDC37 (GY/VT), harness side, while applying the brake pedal  N0054978 • **Is the voltage greater than 10 volts with the brake pedal applied?**	

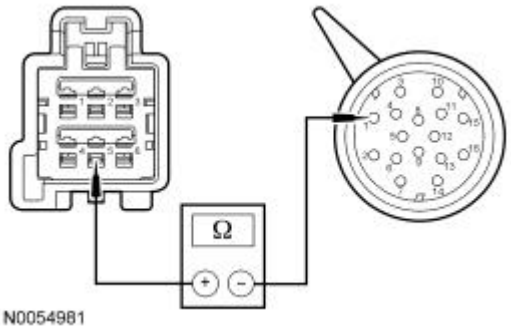
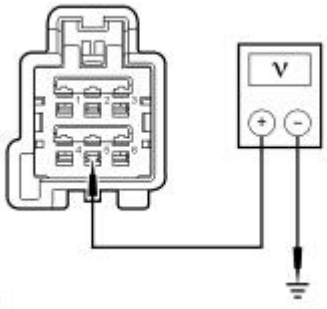
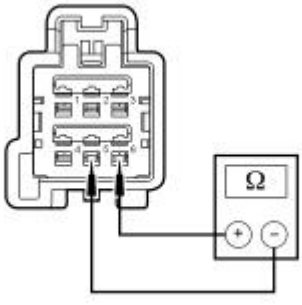
PINPOINT TEST E: THE SHIFT CONTROL IS OUT OF CORRECT GEAR RELATIONSHIP

Test Step	Result / Action to Take
E1 CHECK THE SHIFT CONTROL LINKAGE	
• Apply the brake pedal. • Gain access to the shift control linkage. • Actuate the transmission selector lever in all ranges. • Observe all linkages during operation. • **Is the shift linkage damaged?**	**Yes** INSTALL a new selector lever. REFER to Selector Lever — Floor Shift in this section. TEST the system for normal operation. **No** GO to E2.
E2 CHECK THE TRANSMISSION SELECTOR LEVER CABLE	
• Check the transmission selector lever cable and bracket installation and tightness. • **Is the transmission selector lever cable correctly installed and adjusted?**	**Yes** VERIFY the transmission selector lever cable adjustment. REFER to Selector Lever Cable Adjustment in this section. ADJUST the transmission selector lever cable if necessary. If selector lever cable adjustment is correct, INSTALL a new main control valve body. REFER to Section 307-01A or Section 307-01B. GO to E3.

	No REPAIR as necessary. TEST the system for normal operation.
E3 CHECK THE LINKAGE/CABLE FOR CORRECT GEAR RELATIONSHIP	
• Apply the brake pedal. • Actuate the transmission range selector lever in all ranges. • **Does the indicator match the gear selection?**	**Yes** System OK. TEST the system for normal operation. **No** REFER to Selector Lever Cable Adjustment in this section. TEST the system for normal operation.

PINPOINT TEST F: THE TRANSMISSION CONTROL (TC) SWITCH DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
F1 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Disconnect: Selector lever C2096. • Inspect for damaged or pushed-out pins, corrosion or loose wires. Repair as necessary. • Measure the resistance between selector lever C2096-6, circuit GD133 (BK), harness side, and ground.  N0054979 • **Is the resistance less than 5 ohms?**	**Yes** GO to F2. **No** REPAIR circuit GD133 (BK). RECONNECT all components. TEST the system for normal operation.
F2 CHECK CIRCUIT GD133 (BK) FOR A SHORT TO VOLTAGE	
• Measure the voltage between selector lever C2096-6, circuit GD133 (BK), harness side, and ground.  N0054980 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit GD133 (BK). RECONNECT all components. TEST the system for normal operation. **No** GO to F3.
F3 CHECK CIRCUIT CET34 (BN/GN) FOR AN OPEN	
• Disconnect: TCM C1548. • Inspect for damaged or pushed-out pins, corrosion or	**Yes** GO to F4.

loose wires. Repair as necessary. • Measure the resistance between selector lever C2096-5, circuit CET34 (BN/GN) harness side, and TCM C1548-1, circuit CET34 (BN/GN) harness side.  N0054981 • **Is the resistance less than 5 ohms?**	**No** REPAIR circuit CET34 (BN/GN). RECONNECT all components. TEST the system for normal operation.
F4 CHECK CIRCUIT CET34 (BN/GN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between selector lever C2096-5, circuit CET34 (BN/GN) harness side, and ground.  N0055560 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit CET34 (BN/GN). RECONNECT all components. TEST the system for normal operation. **No** GO to F5 .
F5 CHECK THE TC SWITCH	
• Measure the resistance between selector lever C2096-5 and C2096-6, while cycling the switch.  N0054983 • **Is the resistance less than 5 ohms while pressed and greater than 10k ohms when released?**	**Yes** INSTALL a new TCM. REFER to Section 307-01A or Section 307-01B . RECONNECT all components. TEST the system for normal operation. **No** INSTALL a new transmission selector lever. REFER to Selector Lever Knob in this section. RECONNECT all components. TEST the system for normal operation.

Brake Shift Interlock Override — Column Shift

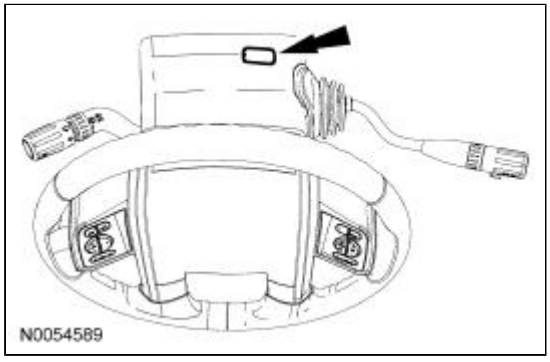
Printable View (119 KB)

NOTE: If it is necessary to use the override procedure to move the selector lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.

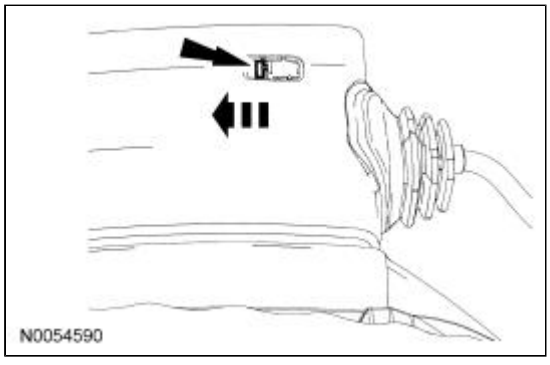
This vehicle is equipped with a brake shift interlock feature that prevents the selector lever from being moved out of PARK when the ignition is in the ON position unless the brake pedal is depressed.

If the selector lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is depressed:

1. Apply the parking brake.
2. Turn the key to the ON position.
3. Remove the access panel.



4. Using an suitable tool, move the brake shift interlock actuator spindle outward, apply the brake, and move the selector lever into NEUTRAL.



5. Start the vehicle.
6. To install, reverse the procedure.

Brake Shift Interlock Override — Floor Shift

Printable View (104 KB)

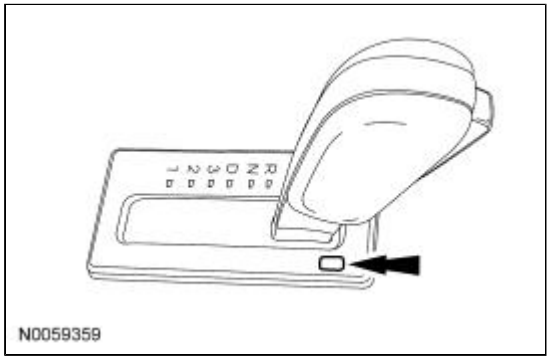
NOTE: If it is necessary to use the override procedure to move the selector lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.

This vehicle is equipped with a brake shift interlock feature that prevents the selector lever from being moved out of PARK when the ignition is in the ON position unless the brake pedal is depressed.

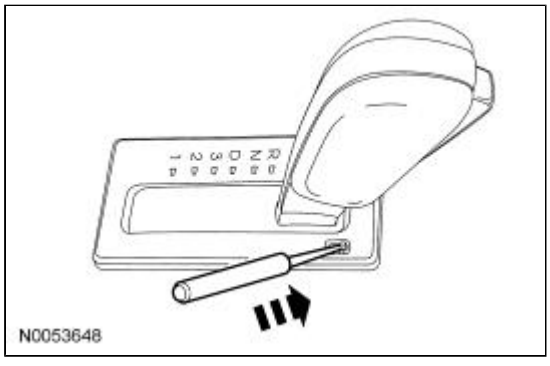
If the selector lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is depressed:

1. Apply the parking brake and remove the ignition key.
2. **NOTE:** Relief located at the front of the access panel.

   Remove the access panel.



3. Using an suitable tool, depress the brake shift interlock override mechanism on the selector lever, apply the brake, depress the button on the selector lever and move the selector lever into NEUTRAL.



4. Start the vehicle.
5. To install, reverse the procedure.

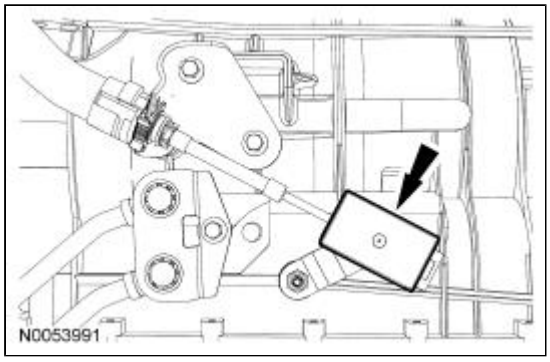
Selector Lever Cable Adjustment

Printable View (293 KB)

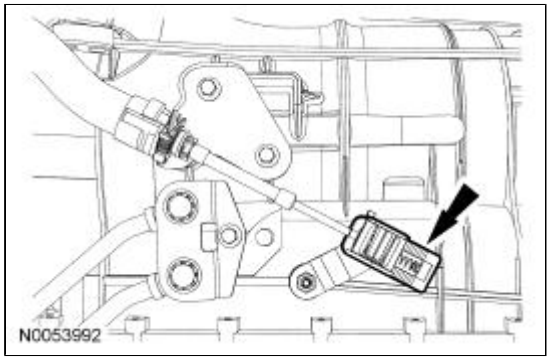
1. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .

2. Place the selector lever in the DRIVE position.

3. If equipped, remove the heat shield.

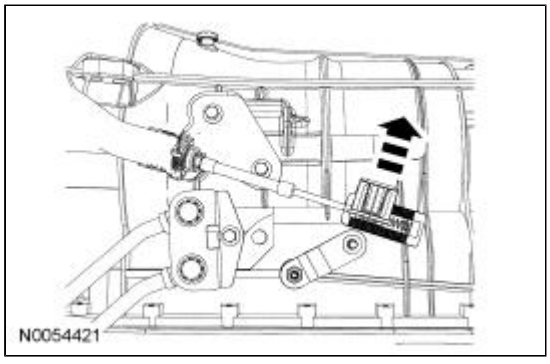


4. Disconnect the selector lever cable from the manual control lever.



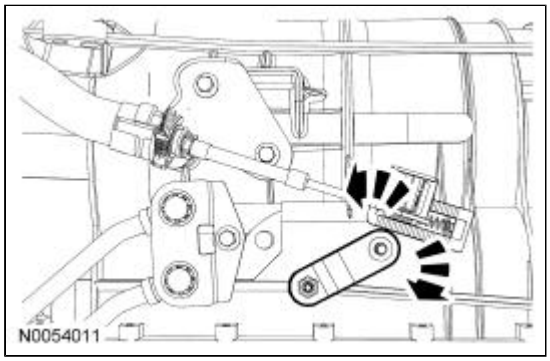
5. **NOTE:** Make sure the cable moves freely.

   Unlock the lock tab on the selector lever cable.



6. Place the manual control lever in the DRIVE position.

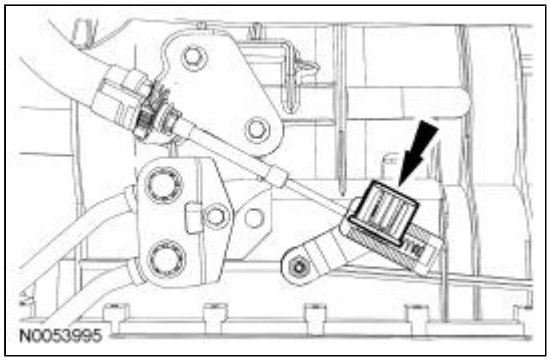
- Place the manual control lever in the 1st gear position.
- Move the manual control lever 3 detents to the DRIVE position.



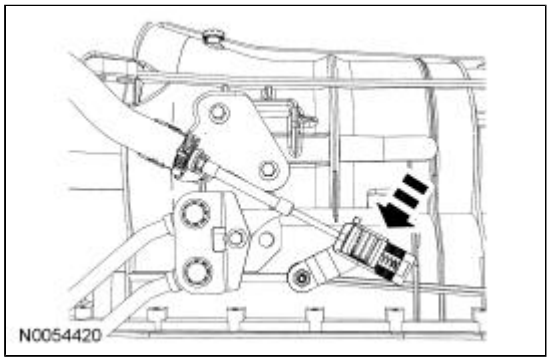
7. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   NOTE: Apply pressure to the selector lever cable end while connecting it to the manual lever to make sure the selector lever has not moved out of the DRIVE position.

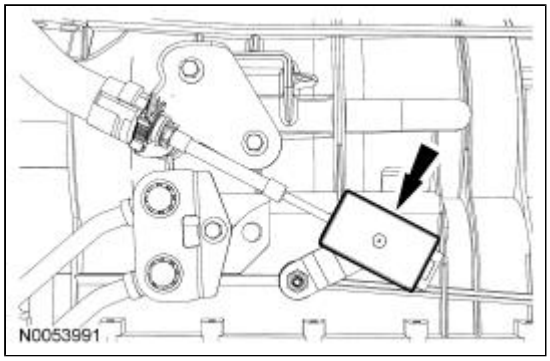
   Connect the selector lever cable to the manual control lever.
   - Listen for the audible click.
   - Pull back on the selector lever cable to make sure it is correctly installed.



8. Lock the selector lever cable lock tab.



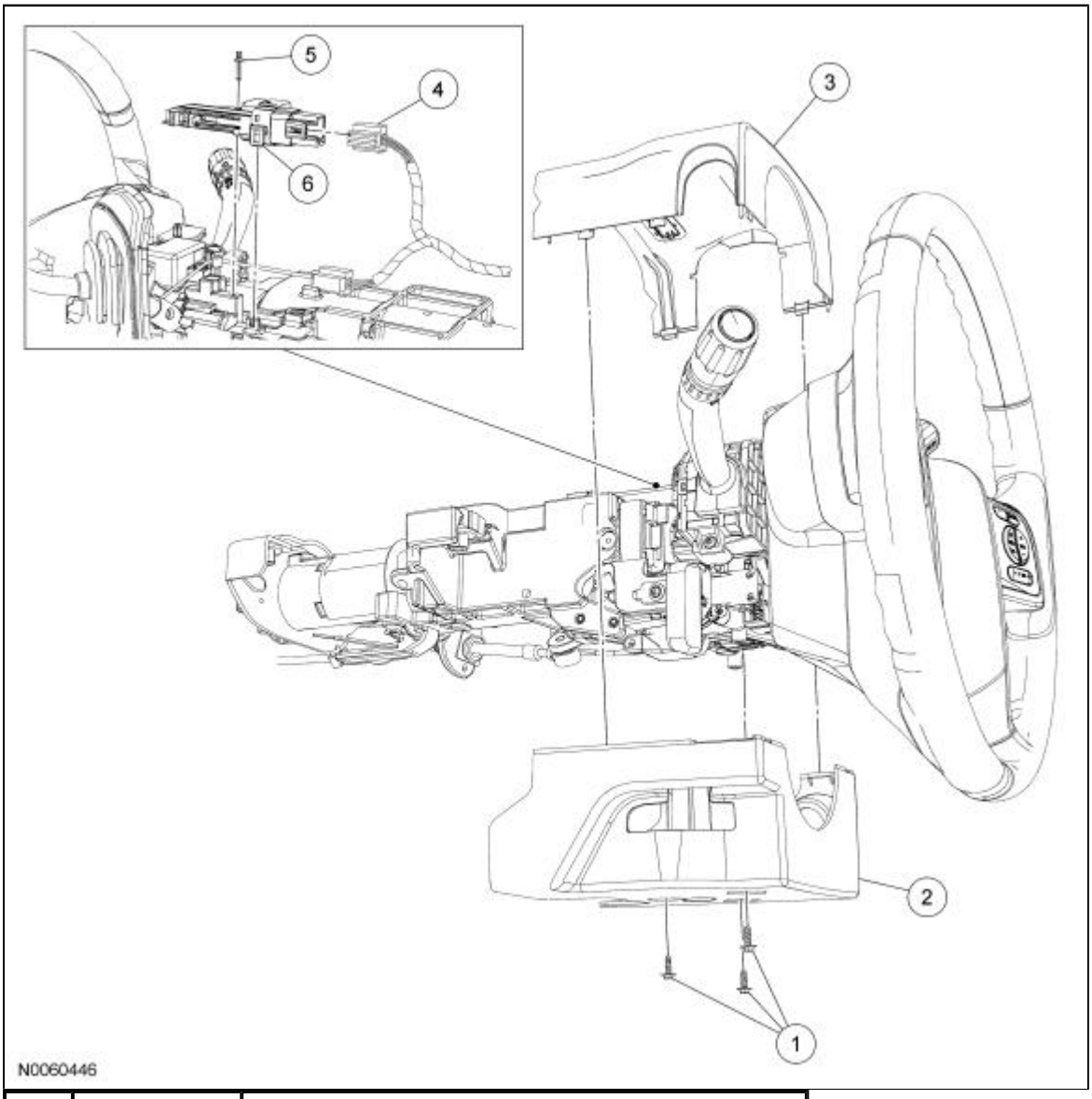
9. If equipped, install the heat shield.



10. Carefully move the manual control lever from detent to detent and compare with transmission settings. Verify that the vehicle will start in PARK or NEUTRAL and backup lamps illuminate in REVERSE. If not, Steps 1 through 9 must be repeated.
    - Readjust if necessary.

Brake Shift Interlock Actuator — Column Shift

Printable View (252 KB)



Item	Part Number	Description
1	W710485-S	Lower steering column shroud screws
2	3533-B	Lower steering column shroud
3	3530-B	Upper steering column shroud
4	—	Brake shift interlock actuator electrical connector
5	3F907-A	Brake shift interlock actuator screw
6	3F770	Brake shift interlock actuator (BSIA)

Removal and Installation

1. Set the parking brake.

2. Remove the steering column shrouds.

3. Turn the ignition to the accessory position and apply the brake or actuate the brake shift interlock actuator (BSIA) override.

4. Put the selector lever into the NEUTRAL position.

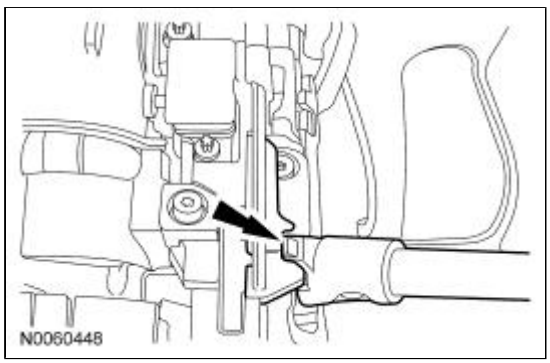
5. Disconnect the BSIA electrical connector.

6. Remove the BSIA screw.

7. Gently pry the clip up and remove the BSIA.

8. **NOTE:** During installation, verify that the BSIA override has been activated and the slider is fully rearward. Before rotating the selector lever from NEUTRAL into PARK, align the selector lever tab into the BSIA.

   To install, reverse the removal procedure.



Brake Shift Interlock Actuator — Floor Shift

Printable View (78 KB)

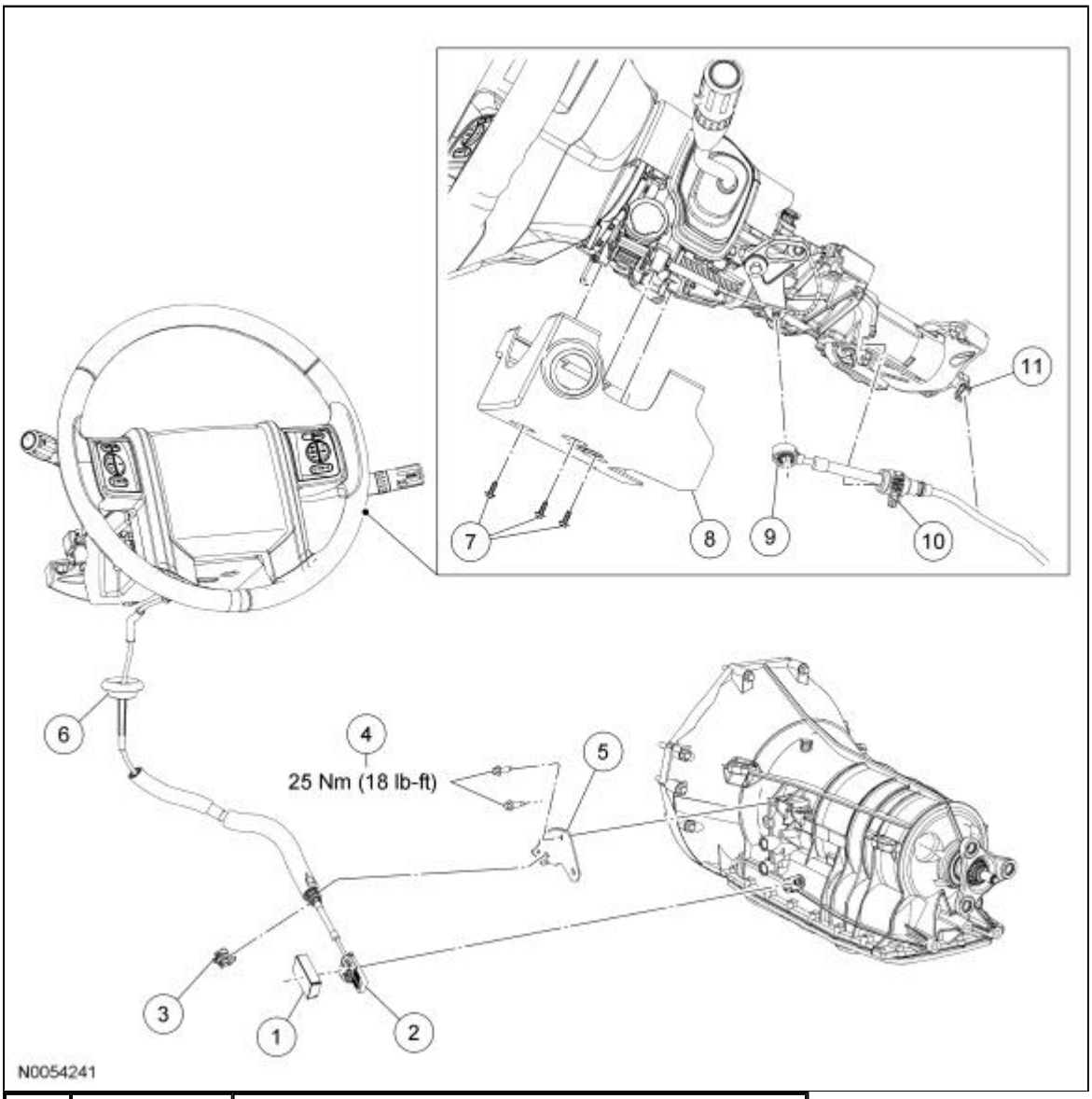
Removal and Installation

NOTE: The brake shift interlock actuator is not serviced individually. If replacement is required, install a new floor shift selector lever assembly.

For additional information, refer to Selector Lever — Floor Shift in this section.

Selector Lever Cable and Bracket — Column Shift

Printable View (645 KB)



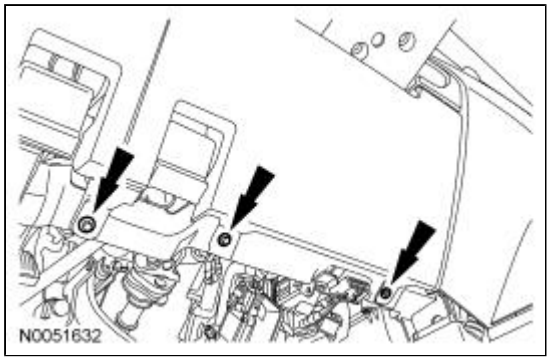
Item	Part Number	Description
1	—	Selector lever cable eyelet heat shield (part of 7E395)
2	7E395	Selector lever cable
3	7H181-A	Selector lever cable clip
4	W500223-S	Selector lever cable bracket bolts
5	7B229-A	Selector lever cable bracket
6	—	Selector lever cable grommet (part of 7E395)
7	W710485-S	Steering column lower shroud screws
8	3533-B	Steering column lower shroud

9	—	Selector lever cable eyelet (part of 7E395)
10	—	Selector lever cable clip (part of 7E395)
11	—	Selector lever cable retainer (part of 7E395)

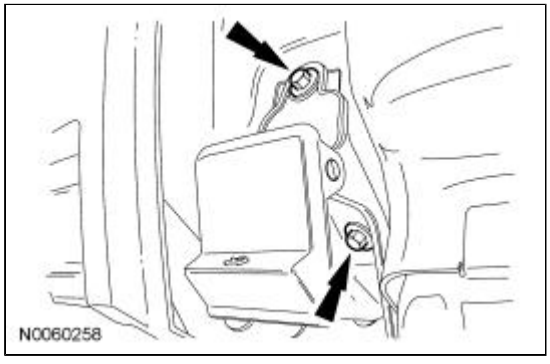
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

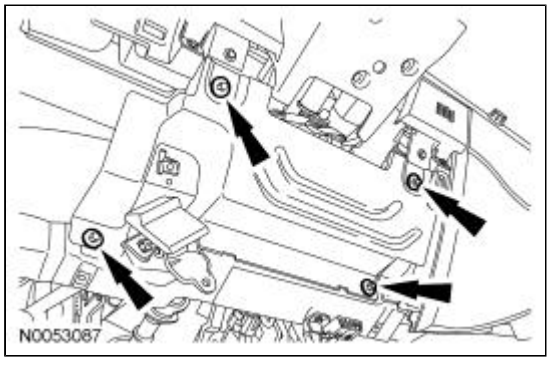
2. Remove the instrument panel lower finish panel.



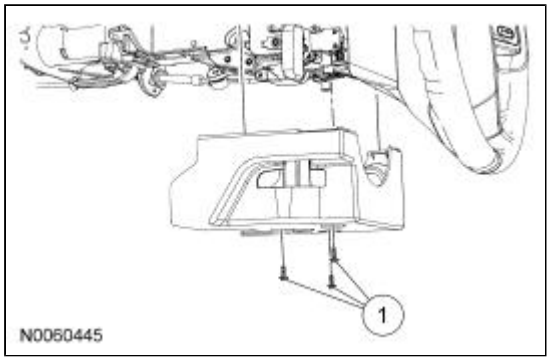
3. Remove the hood release cable lever.



4. Remove the instrument panel lower reinforcement panel.

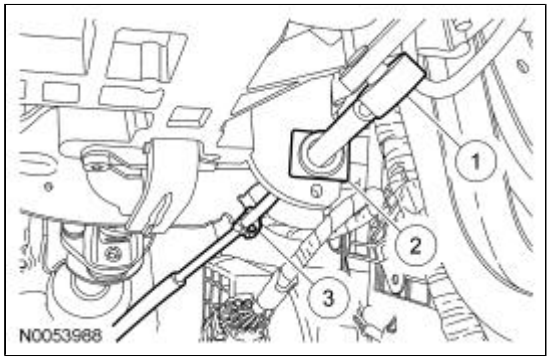


5. Remove the steering column lower shroud.
    1. Remove the screws and the lower shroud.

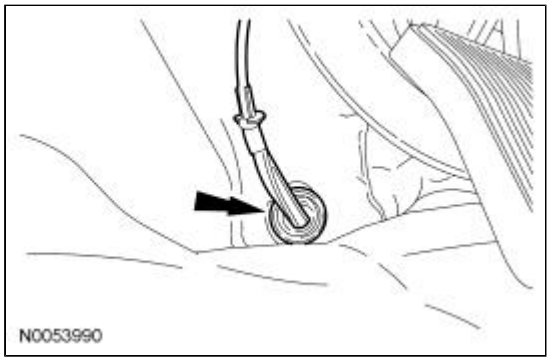


6. **NOTE:** To prevent cable damage, do not apply force to the selector lever cable assembly between the steering column selector lever arm and the steering column bracket.

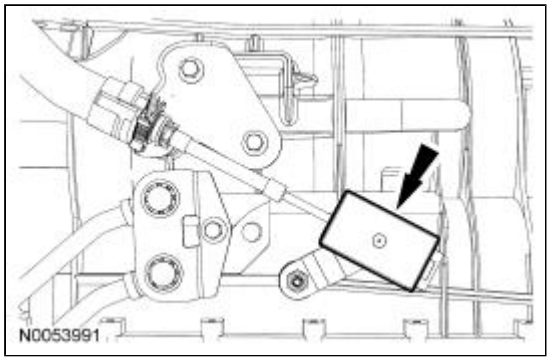
   Disconnect the selector lever cable from the steering column.
   1. Disconnect the selector lever cable from the selector lever arm ball stud.
   2. Carefully lift the locking tab and disconnect the selector lever cable from the steering column bracket.
   3. Disconnect the selector lever cable retainer.



7. Push the rubber grommet and selector lever cable down through the floor panel.

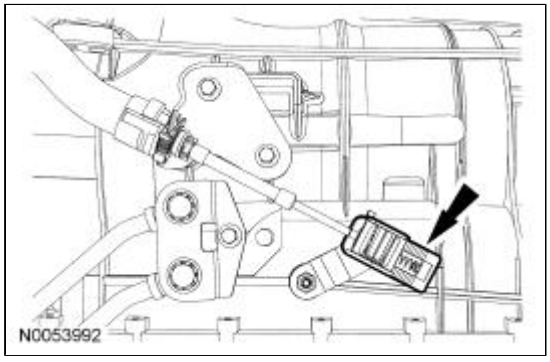


8. If equipped, remove the heat shield.

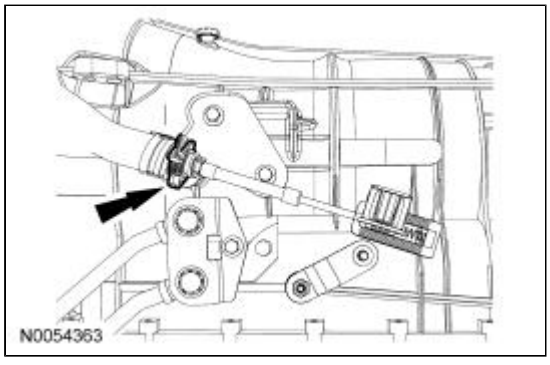


9. **NOTE:** To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

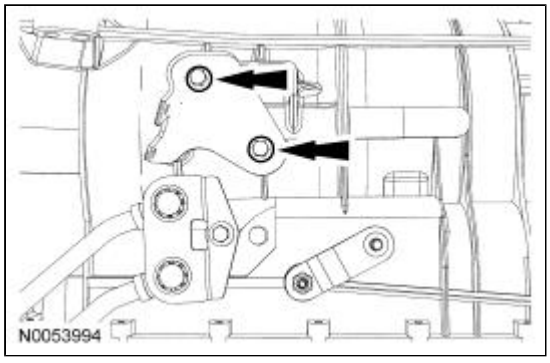
   Move the locking tab up and disconnect the selector lever cable from the manual control lever.



10. Remove the selector lever cable clip to release the selector lever cable from the bracket.

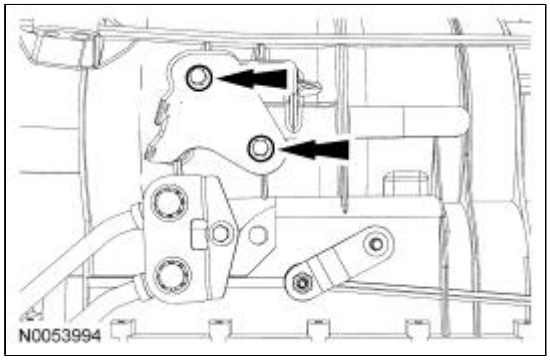


11. Remove the bolts and the selector lever cable bracket from the transmission.



Installation

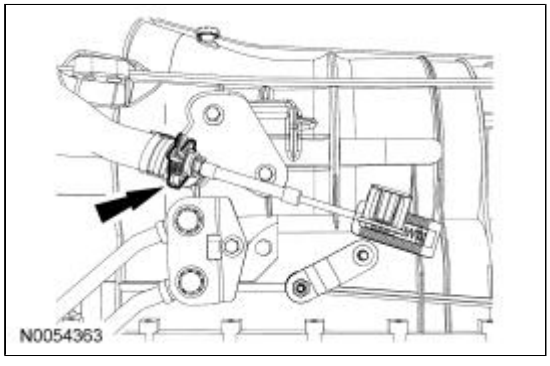
1. Install the selector lever cable bracket and bolts onto the transmission.
    - Tighten to 25 Nm (18 lb-ft).



2. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

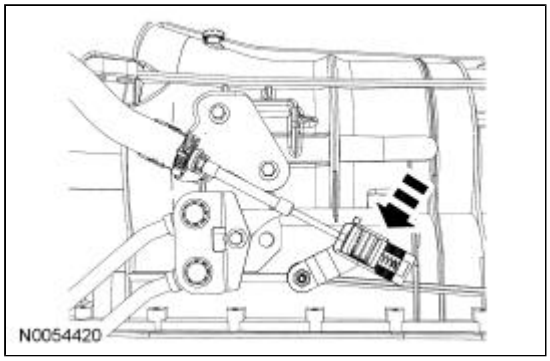
   NOTE: To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

   Install the selector lever cable into the bracket and install the clip.

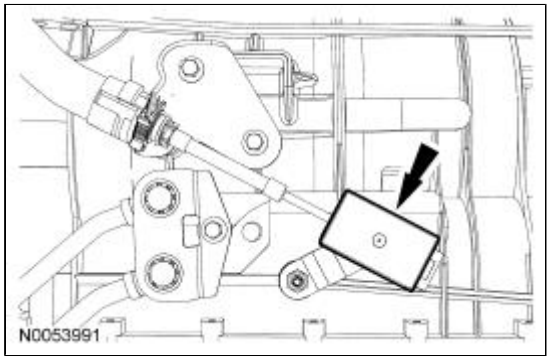


3. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

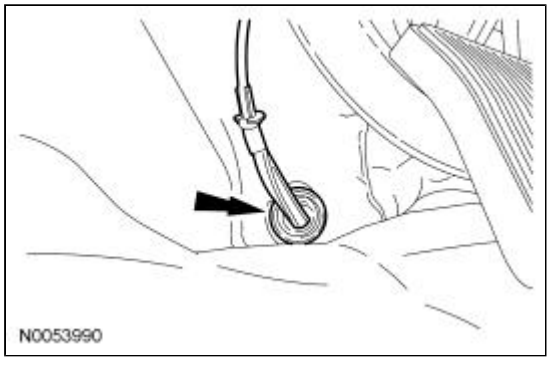
   Connect the selector lever cable onto the manual control lever and move the locking tab down.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.



4. If equipped, install the heat shield.



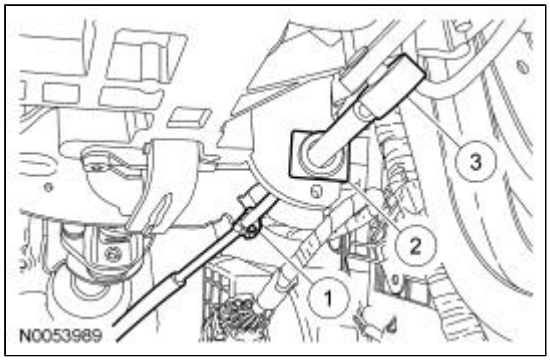
5. Push the selector lever cable and rubber grommet up through the floor panel.



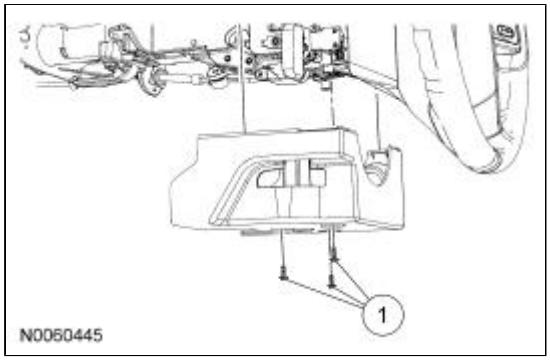
6. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   NOTE: To prevent cable damage, do not apply force to the selector lever cable assembly between the steering column selector lever arm and the steering column bracket.

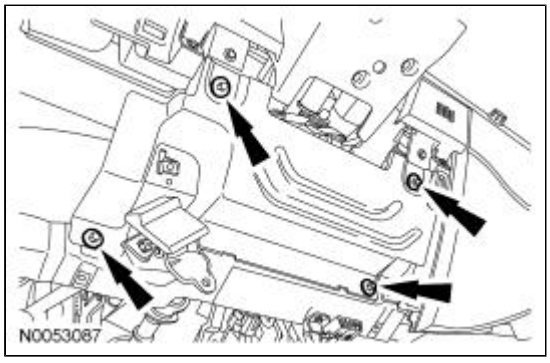
   Connect the selector lever cable onto the steering column.
   1. Connect the selector lever cable retainer.
   2. Connect the selector lever cable onto the steering column bracket.
   3. Connect the selector lever cable onto the selector lever arm ball stud.
      - Listen for the audible click.
      - Pull back on the selector lever cable to make sure that it is correctly installed.



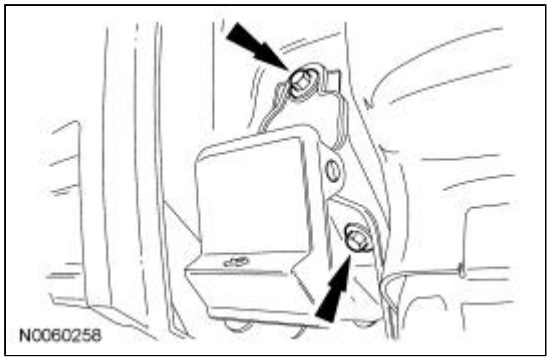
7. Install the steering column lower shroud.
    1. Install the lower shroud.



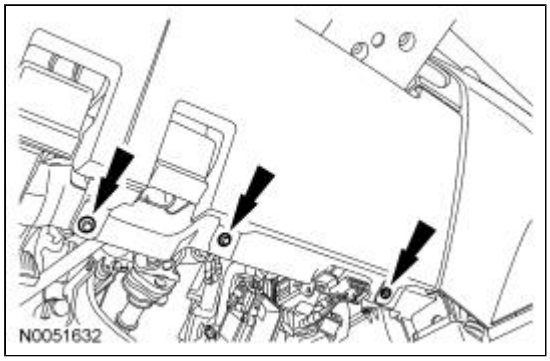
8. Install the instrument panel lower reinforcement panel.
    - Tighten to 9 Nm (80 lb-in).



9. Install the hood release cable lever.
    - Tighten to 9 Nm (80 lb-in).



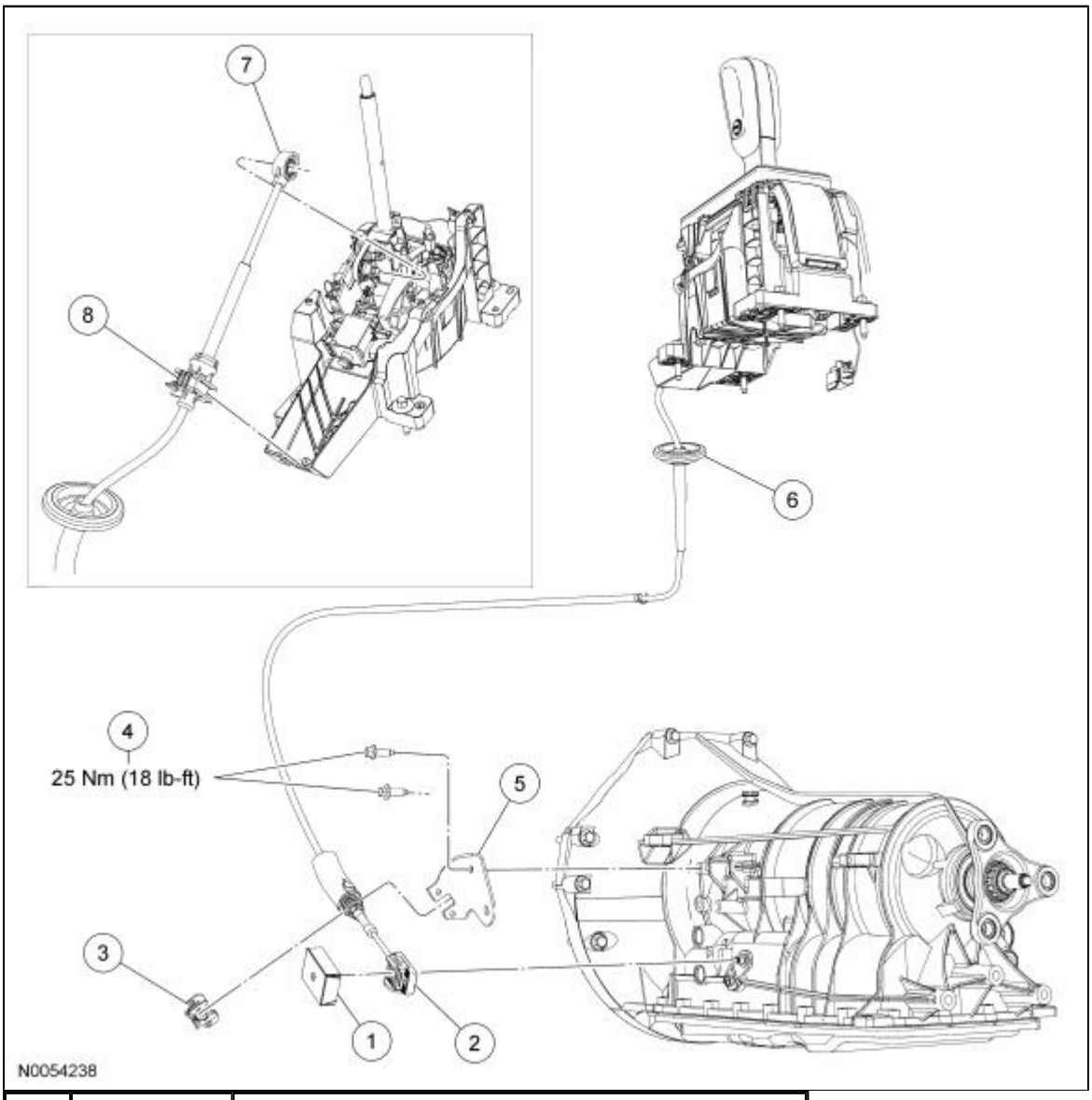
10. Install the instrument panel lower finish panel.



11. Adjust the selector lever cable. Refer to Selector Lever Cable Adjustment in this section.

Selector Lever Cable and Bracket — Floor Shift

Printable View (757 KB)



Item	Part Number	Description
1	—	Selector lever cable eyelet heat shield (part of 7E395)
2	7E395	Selector lever cable
3	7H181-A	Selector lever cable clip
4	W500223-S	Selector lever cable bracket bolts
5	7B229-A	Selector lever cable bracket
6	—	Selector lever cable grommet (part of 7E395)
7	—	Selector lever cable eyelet (part of 7E395)
8	—	Selector lever cable clip (part of 7E395)

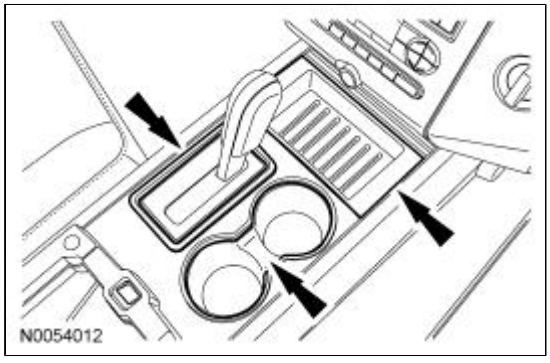
Removal

All vehicles

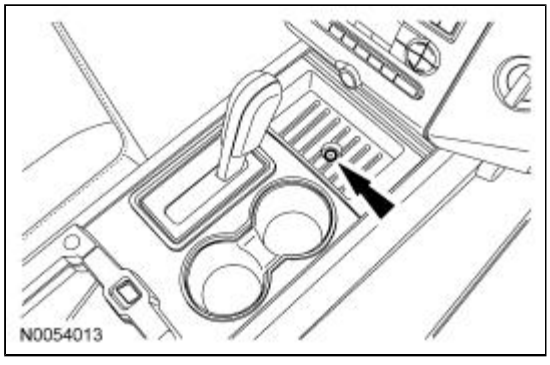
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Vehicles equipped with a 6R75 transmission

2. Remove the PRNDL trim, console tray and cup holder insert.

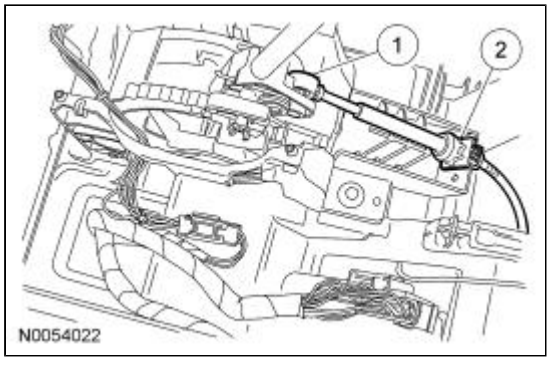


3. Remove the screw and the console upper trim.



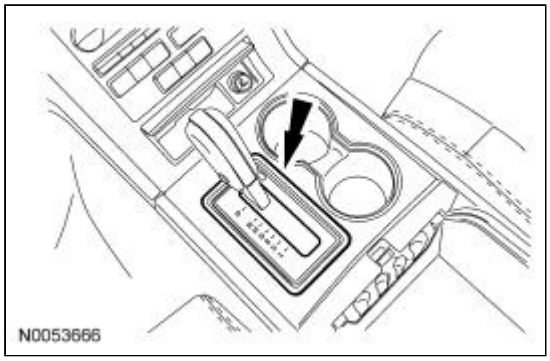
4. **NOTE:** Selector lever bezel removed for clarity.

   Disconnect the selector lever cable from the selector lever.
   1. Disconnect the selector lever cable from the selector lever arm ball stud.
   2. Disconnect the selector lever cable from the selector lever housing.



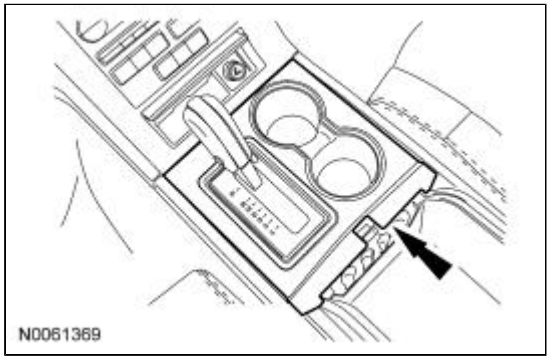
Vehicles equipped with a 6HP26 transmission

5. Remove the selector lever trim plate.



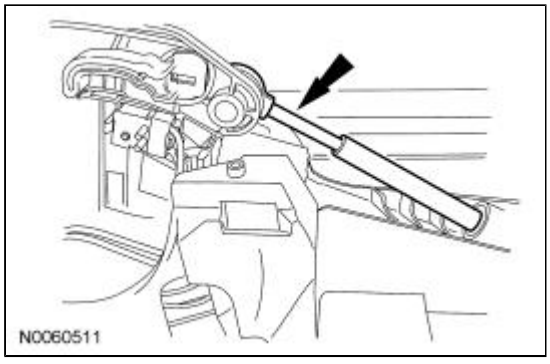
6. **NOTE:** Using a suitable tool, lift and remove the floor console upper panel from the rear.

   Remove the floor console upper panel.

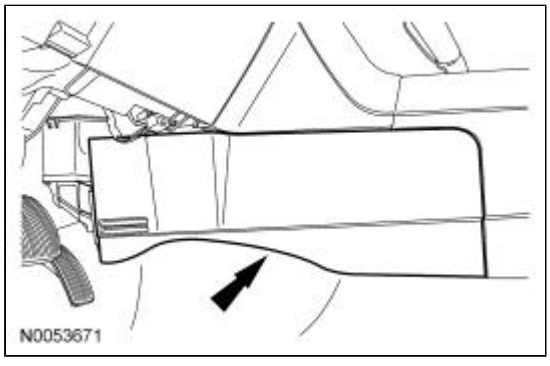


7. **NOTE:** Selector lever bezel removed for clarity.

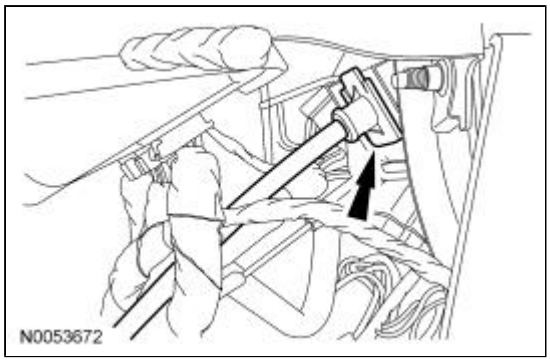
   Disconnect the selector lever cable from the selector lever arm ball stud.



8. Remove the center console LH kick panel.

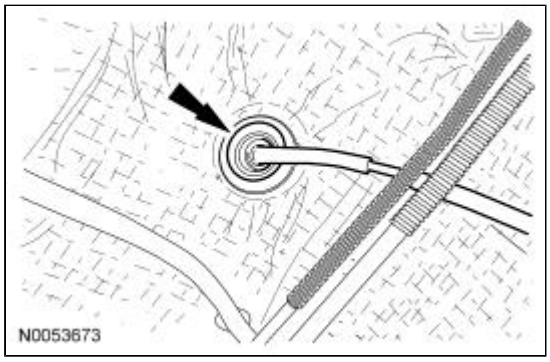


9. Disconnect the selector lever cable from the selector lever housing.

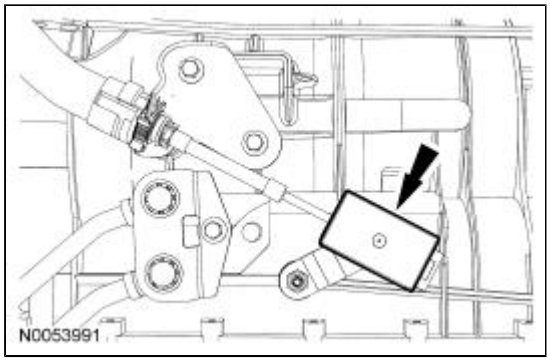


All vehicles

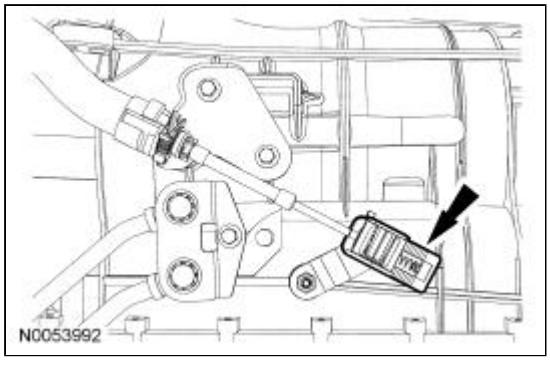
10. Remove the selector lever cable and grommet.



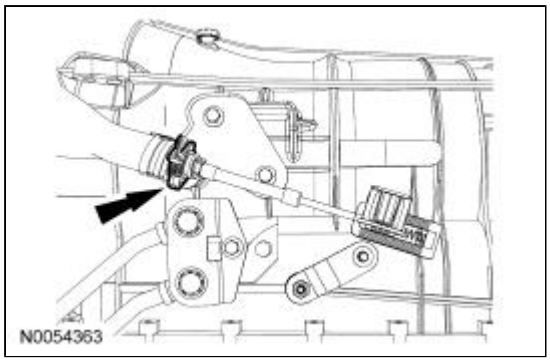
11. If equipped, remove the heat shield.



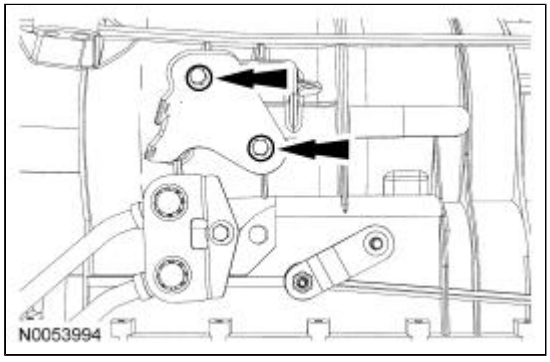
12. Move the locking tab up and disconnect the selector lever cable from the manual control lever ball stud.



13. Remove the selector lever cable clip to release the selector lever cable from the bracket.



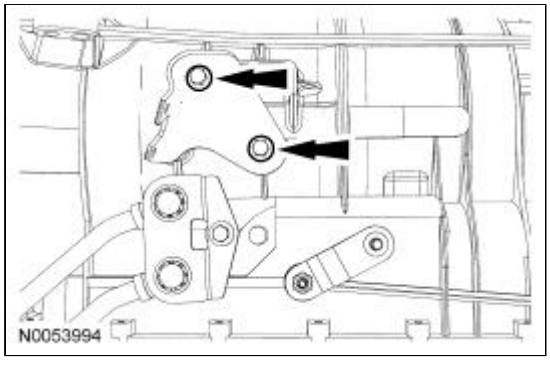
14. Remove the bolts and the selector lever cable bracket from the transmission.



Installation

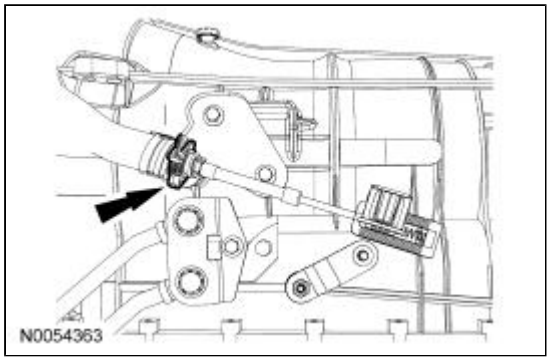
All vehicles

1. Install the selector lever cable bracket and bolts onto the transmission.
    - Tighten to 25 Nm (18 lb-ft).



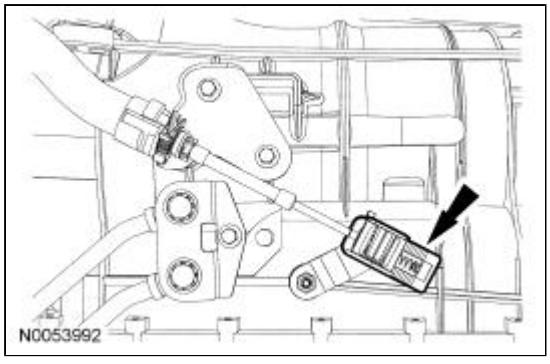
2. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   Install the selector lever cable into the bracket and install the clip.

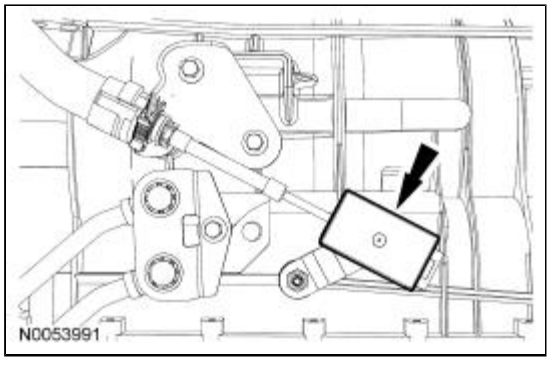


3. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

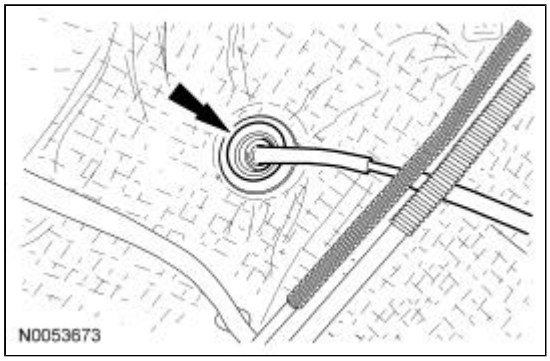
   Connect the selector lever cable onto the manual control lever ball stud and move the locking tab down.
   - Listen for the audible click.
   - Pull back on the selector lever cable to make sure that it is correctly installed.



4. If equipped, install the heat shield.



5. Install the selector lever cable and grommet.

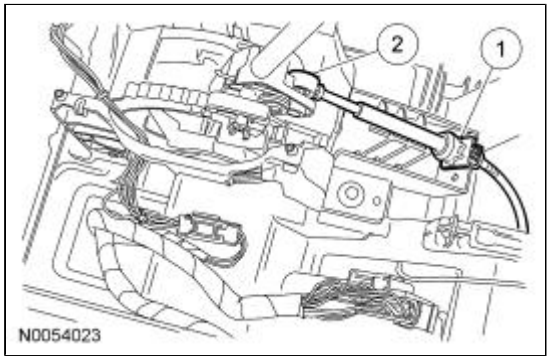


Vehicles equipped with a 6R75 transmission

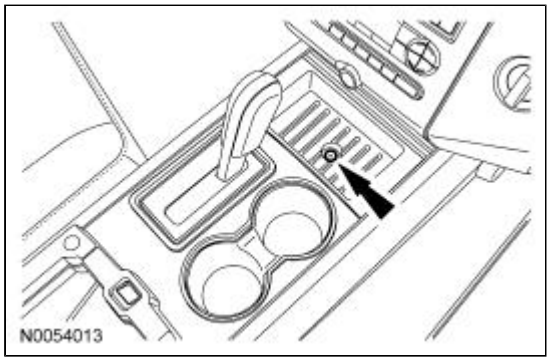
6. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   NOTE: Selector lever bezel removed for clarity.

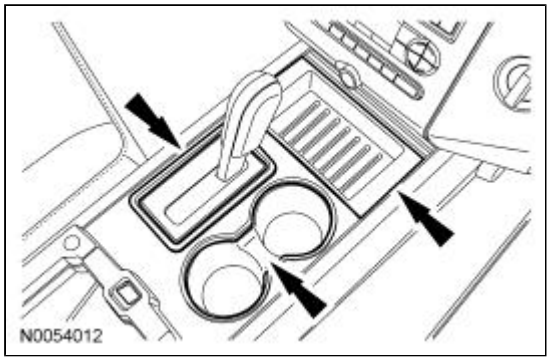
   Connect the selector lever cable onto the selector lever.
   1. Connect the selector lever cable onto the selector lever housing.
   2. Connect the selector lever cable onto the selector lever arm ball stud.
      - Listen for the audible click.
      - Pull back on the selector lever cable to make sure that it is correctly installed.



7. Install the console upper trim and the screw.



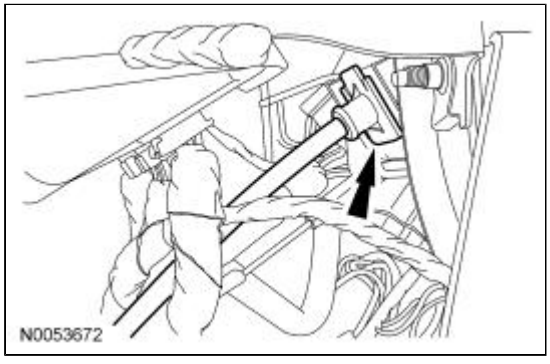
8. Install the PRNDL trim, console tray and cup holder insert.



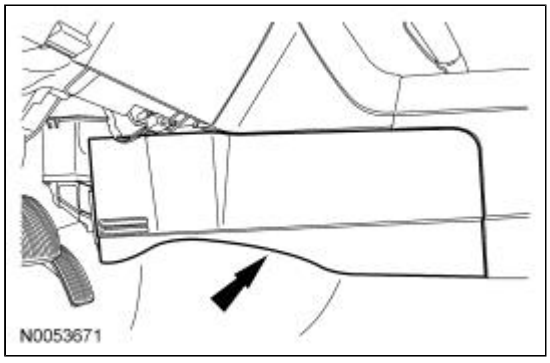
Vehicles equipped with a 6HP26 transmission

9. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   Connect the selector lever cable onto the selector lever housing.



10. Install the center console LH kick panel.

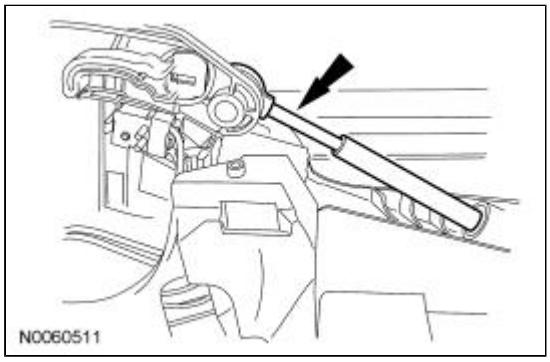


11. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

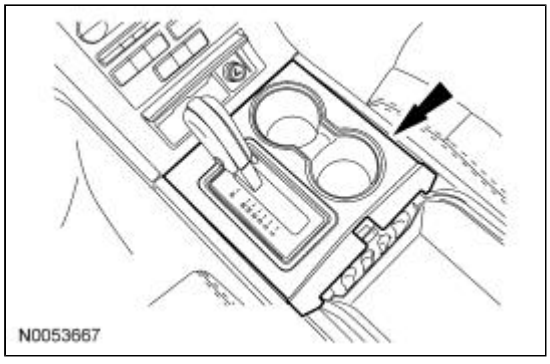
    NOTE: Selector lever bezel removed for clarity.

    Connect the selector lever cable onto the selector lever arm ball stud.

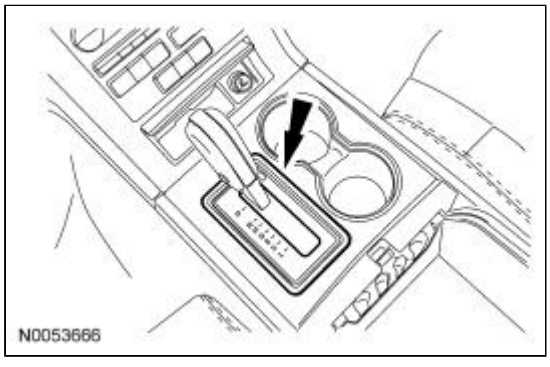
- Listen for the audible click.
- Pull back on the selector lever cable to make sure that it is correctly installed.



12. Install the floor console upper panel.



13. Install the selector lever trim plate.

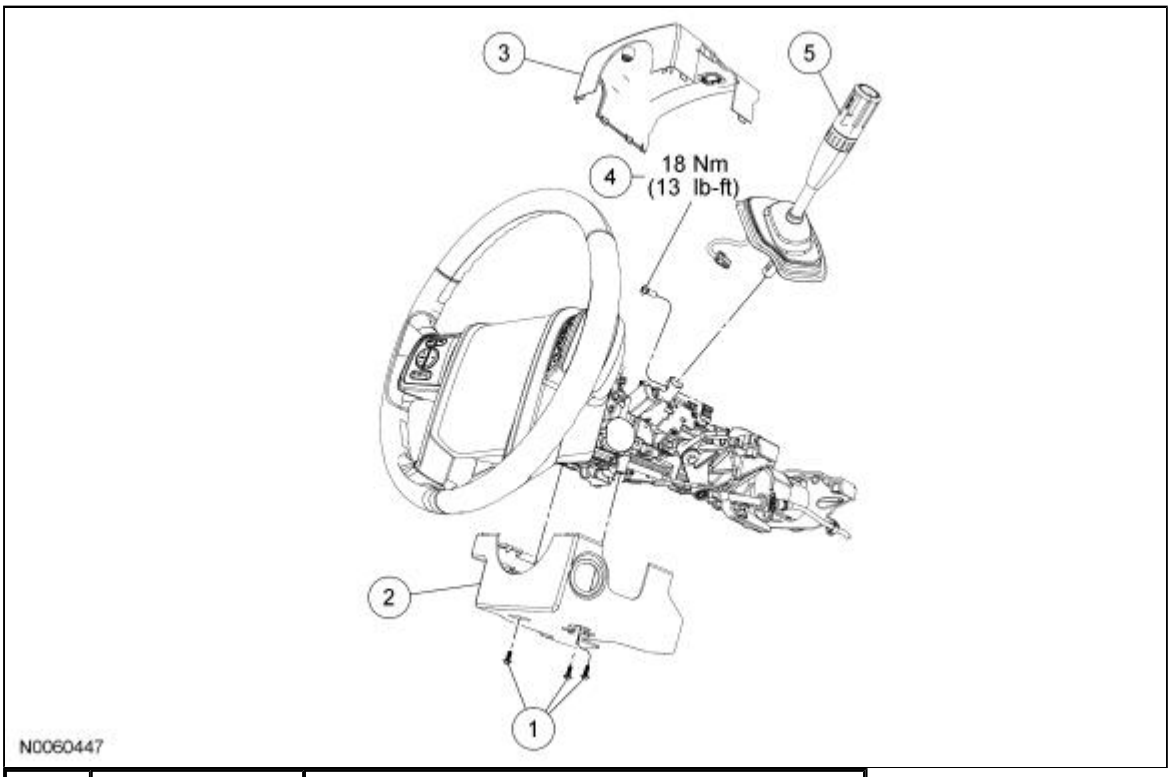


All vehicles

14. Adjust the selector lever cable. Refer to Selector Lever Cable Adjustment in this section.

Selector Lever — Column Shift

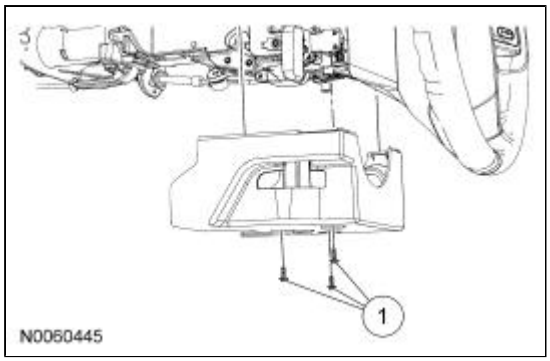
Printable View (258 KB)



Item	Part Number	Description
1	W710485-S	Lower steering column shroud screws
2	3533-B	Lower steering column shroud
3	3530-B	Upper steering column shroud
4	W712000-S	Selector lever bolt
5	7202	Selector lever

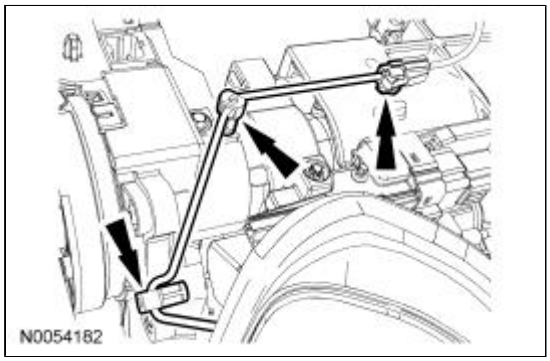
Removal and Installation

1. Remove the lower steering column shroud.
    1. Remove the screws and the lower steering column shroud.

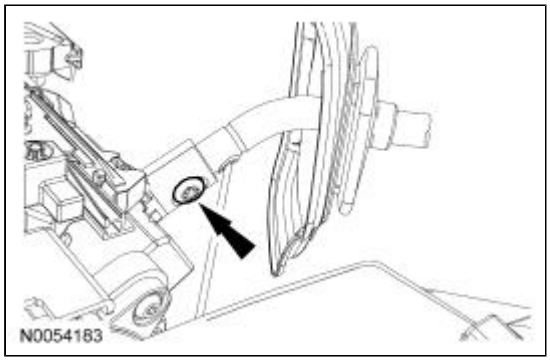


2. Remove the upper steering column shroud.

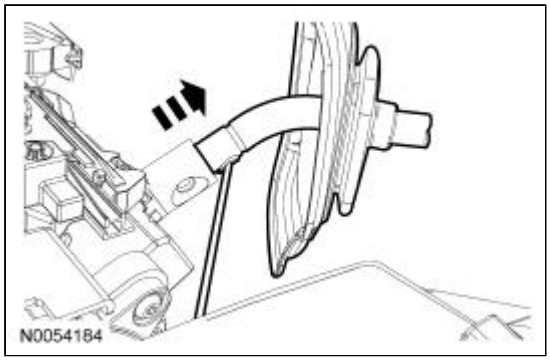
3. Disconnect the electrical connector and the harness from the retaining clips.



4. Remove the selector lever bolt.
    - To install, tighten to 18 Nm (13 lb-ft).



5. Remove the selector lever.



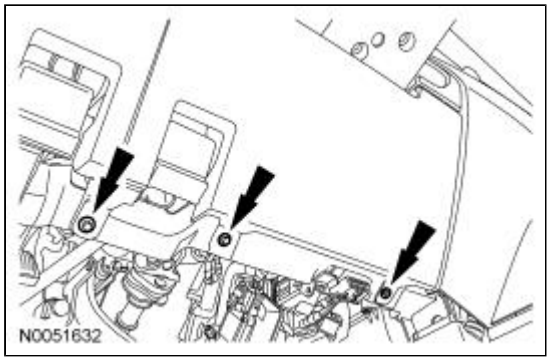
6. To install, reverse the removal procedure.

Selector Lever Mechanism

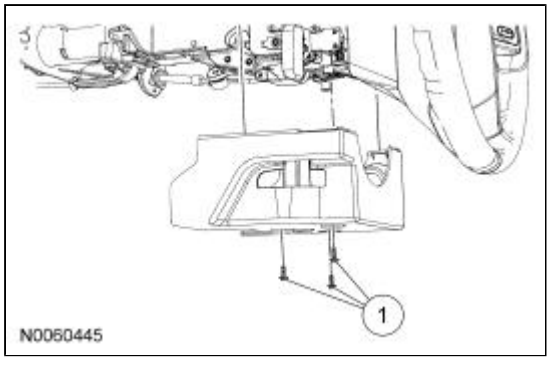
Printable View (688 KB)

Removal

1. Remove the instrument panel lower finish panel.

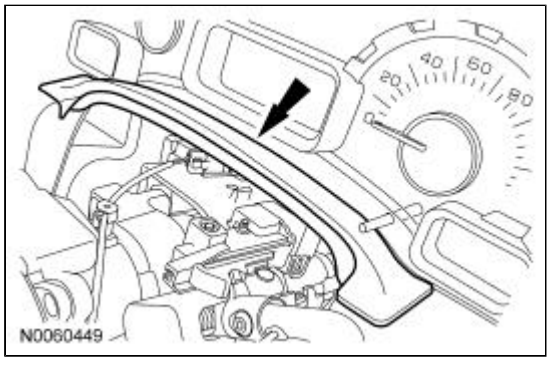


2. 2. Remove the steering column lower shroud.
    1. Remove the screws and the lower shroud.

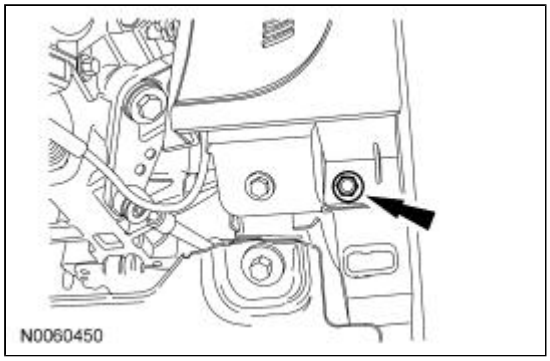


3. Remove the steering column upper shroud.

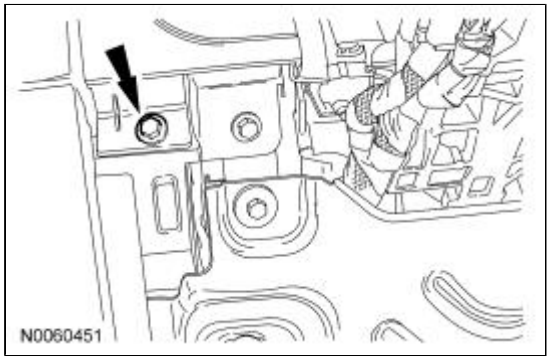
4. Remove the instrument panel (IP) cluster-to-shroud trim.



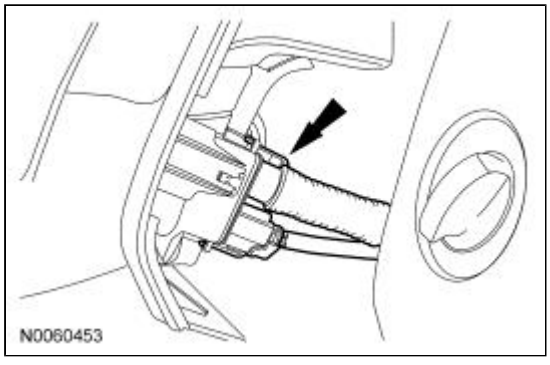
5. Remove the RH IP cluster trim screw.



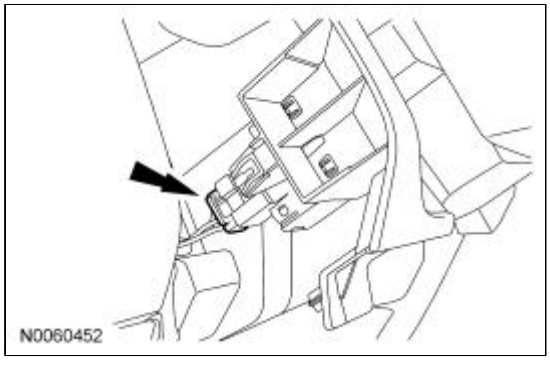
6. Remove the LH IP cluster trim screw and pull the IP cluster trim from the IP.



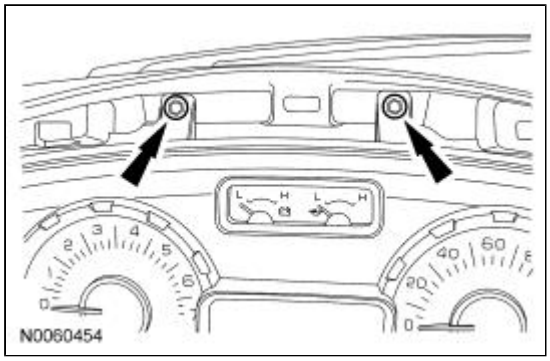
7. If equipped, disconnect the in-vehicle temperature sensor connector.



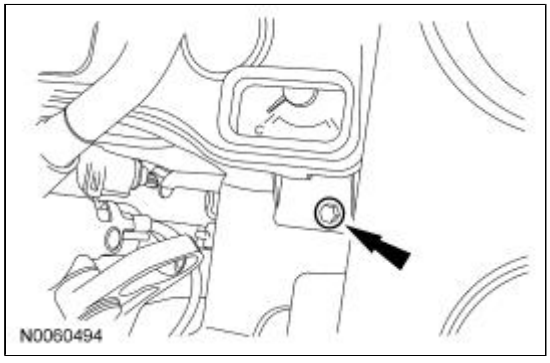
8. Disconnect the dimmer switch electrical connector and remove the IP cluster trim.



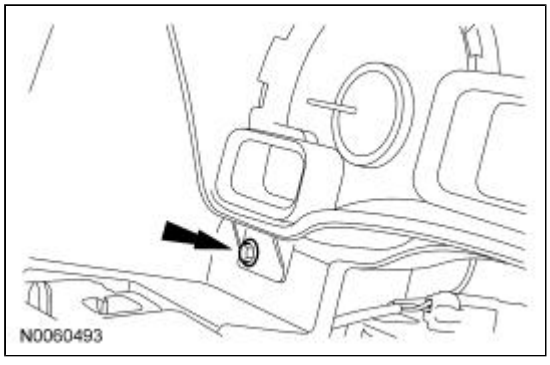
9. Remove the upper IP cluster screws.



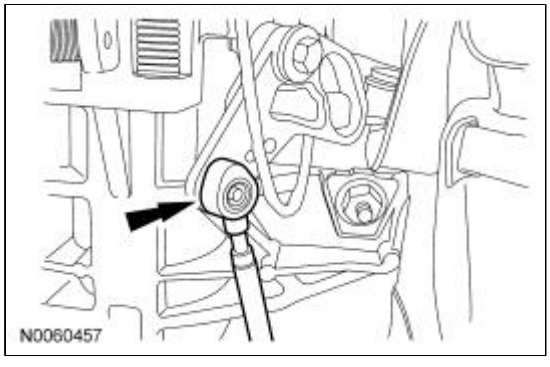
10. Remove the RH lower IP cluster screw.



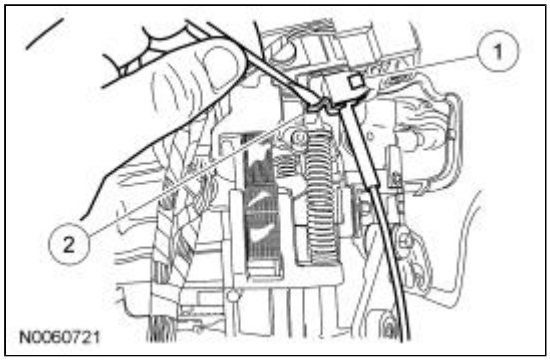
11. Remove the LH lower IP cluster screw and position the IP cluster aside.



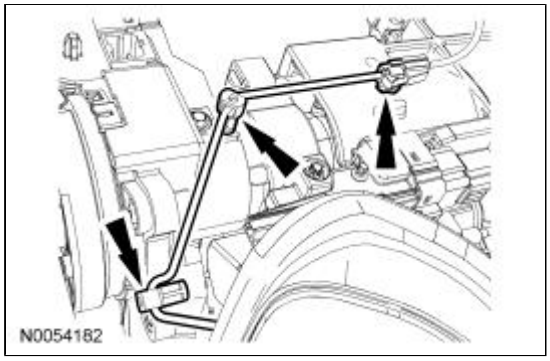
12. Disconnect the selector lever cable.



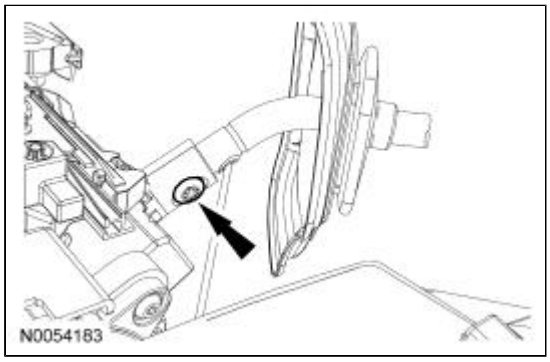
13. Remove the locking pin and the park lock cable (PLC).
    1. Remove and discard the locking pin.
    2. Disconnect the PLC.



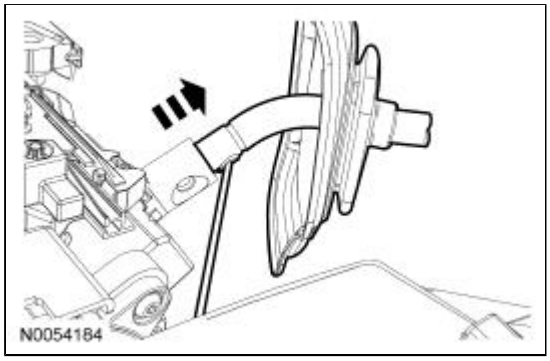
14. Disconnect the tranmission control (TC) switch electrical connector and the harness from the retaining clips.



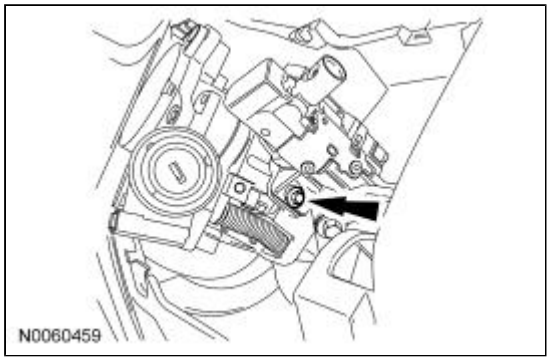
15. Remove the selector lever bolt.



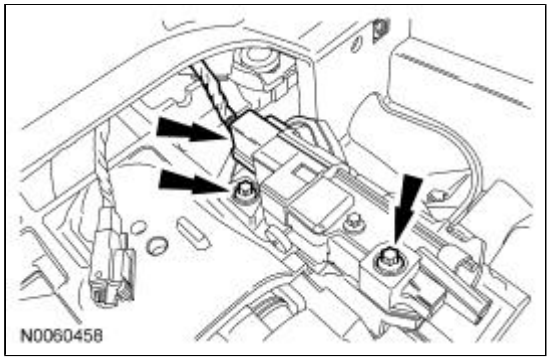
16. Remove the selector lever.



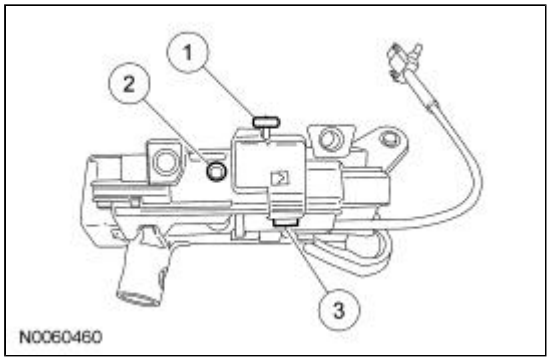
17. Remove the selector lever mechanism lower bolt.



18. Disconnect the brake shift interlock actuator (BSIA) electrical connector and remove the selector lever mechanism upper bolts and the selector lever mechanism from the vehicle.

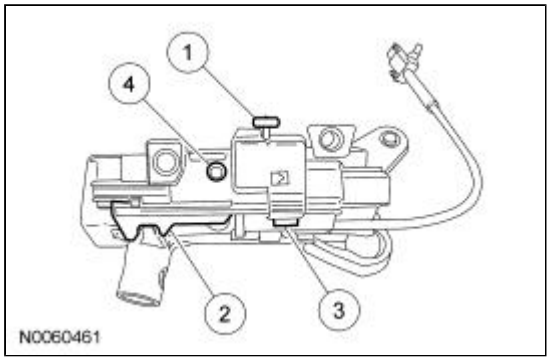


19. Remove the BSIA from the selector lever mechanism.
    1. Pull the BSIA override button.
    2. Remove the BSIA screw.
    3. Gently pry the clip up and remove the BSIA.

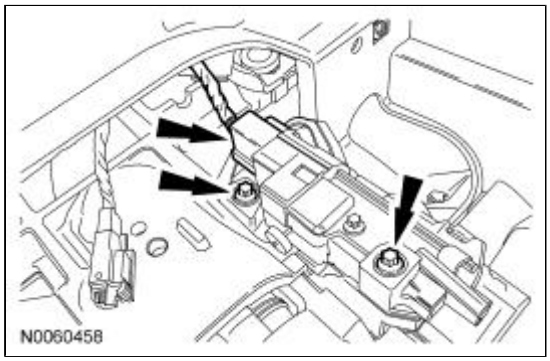


Installation

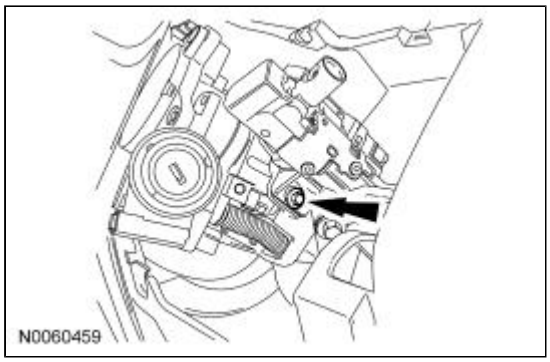
1. Install the BSIA onto the selector lever mechanism.
    1. Pull the BSIA override button.
    2. Align the selector lever tab into the BSIA.
    3. Position and secure the BSIA with the clip.
    4. Install the screw.



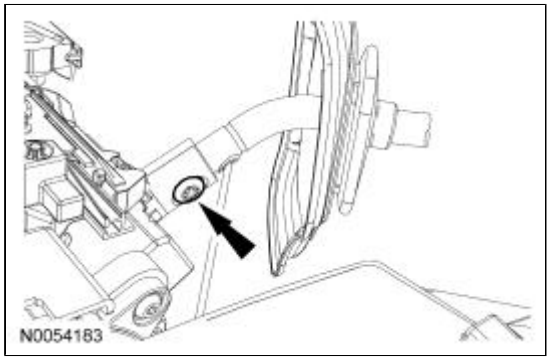
2. Install the selector lever mechanism into the vehicle, install the upper bolts and connect the BSIA electrical connector.
    - Tighten to 6 Nm (53 lb-in).



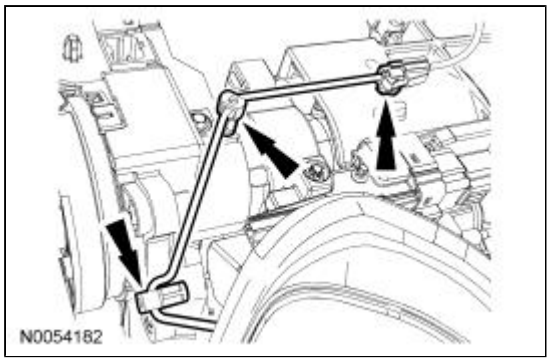
3. Install the selector lever mechanism lower bolt.
    - Tighten to 6 Nm (53 lb-in).



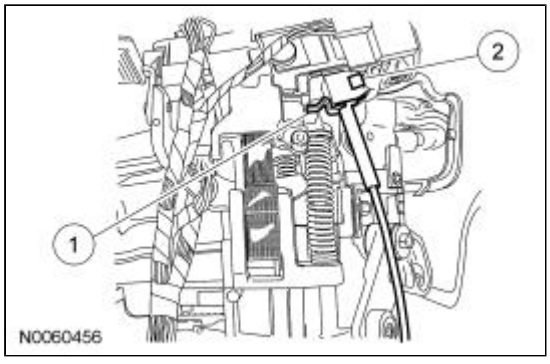
4. Install the selector lever.
    - Tighten to 18 Nm (13 lb-ft).



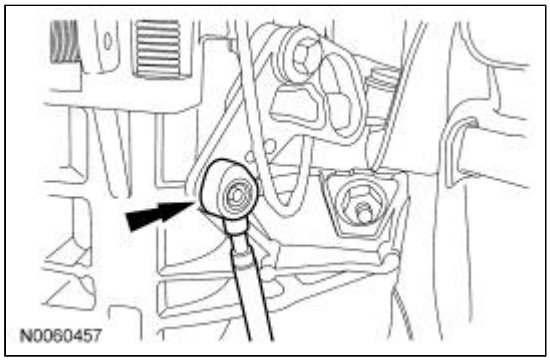
5. Connect the TC switch electrical connector and the harness into the retaining clips.



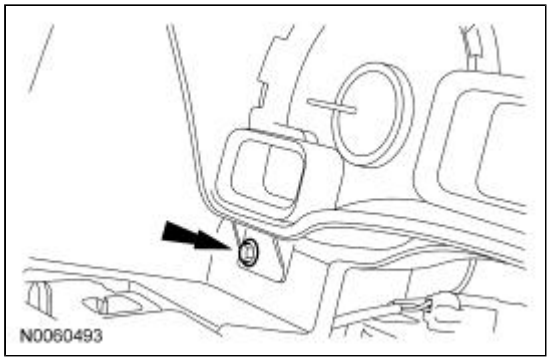
6. Install the locking pin and the PLC.
    1. Connect the PLC.
    2. Install a new locking pin.



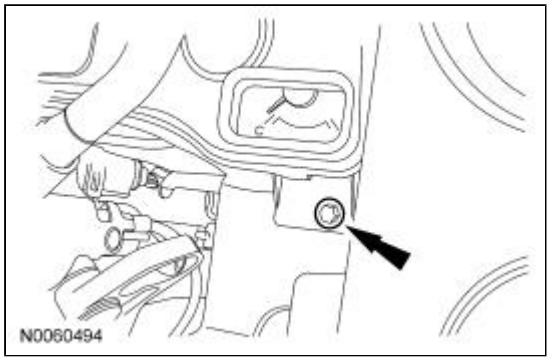
7. Connect the selector lever cable.



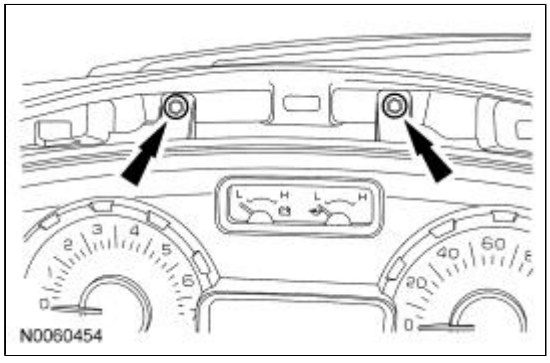
8. Position the IP cluster and install the LH lower IP cluster screw.



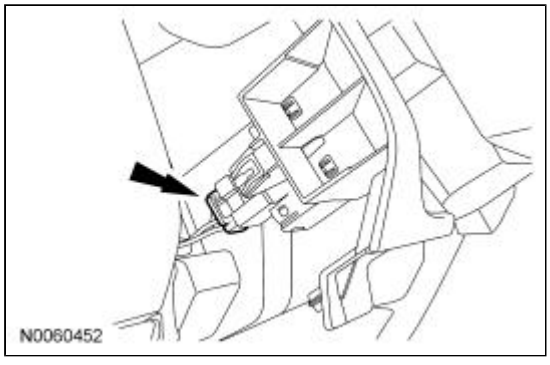
9. Install the RH lower IP cluster screw.



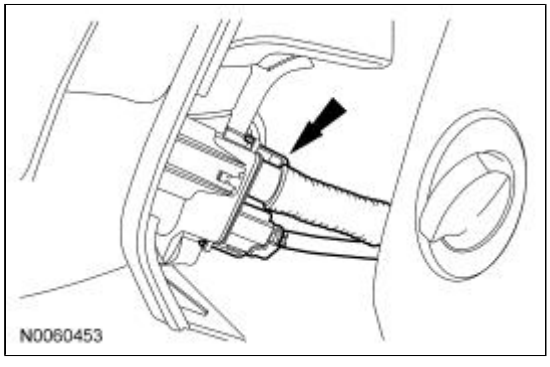
10. Install the upper IP cluster screws.



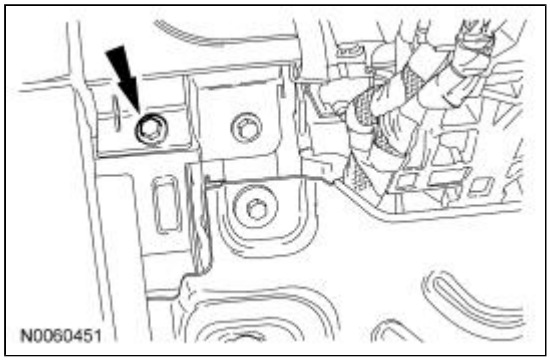
11. Position the IP cluster trim and connect the dimmer switch electrical connector.



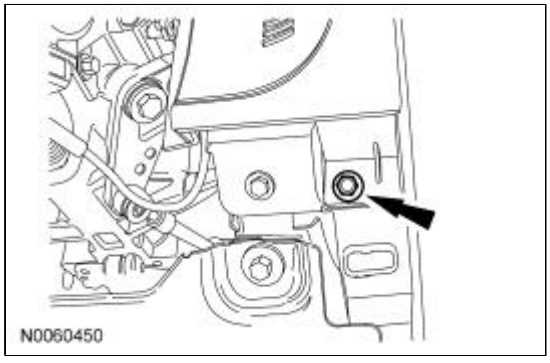
12. If equipped, connect the in-vehicle temperature sensor connector.



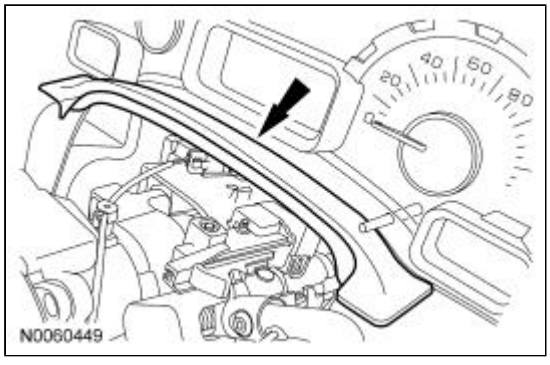
13. Install the LH IP cluster trim screw.



14. Install the RH IP cluster trim screw.

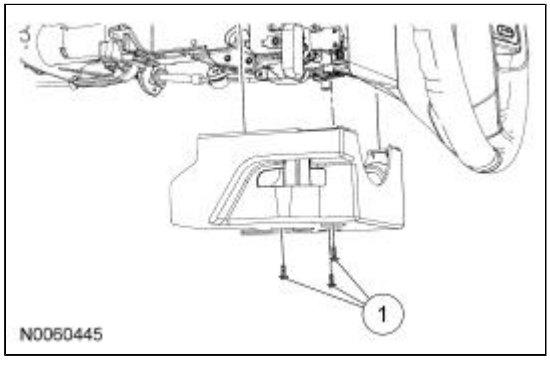


15. Install the IP cluster-to-shroud trim.

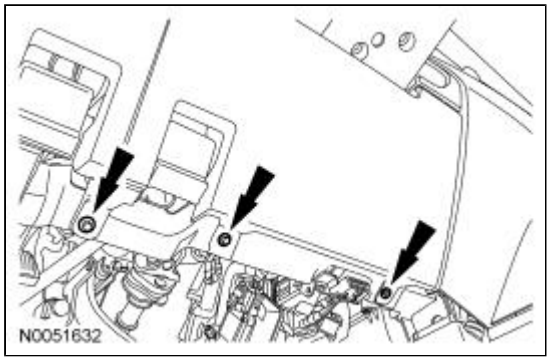


16. Install the steering column upper shroud.

17. Install the steering column lower shroud.



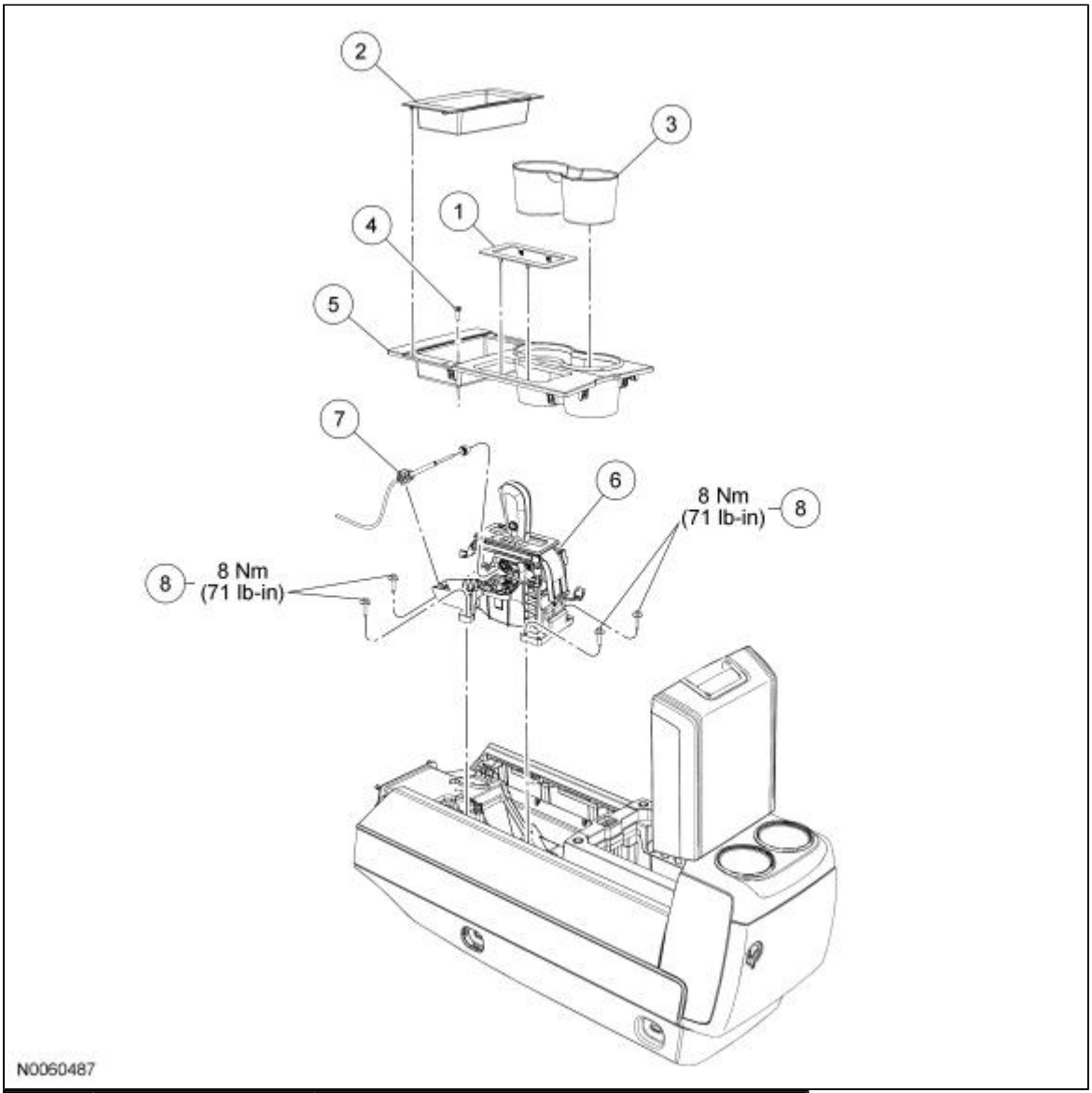
18. Install the instrument panel lower finish panel.


N0051632

Selector Lever — Floor Shift

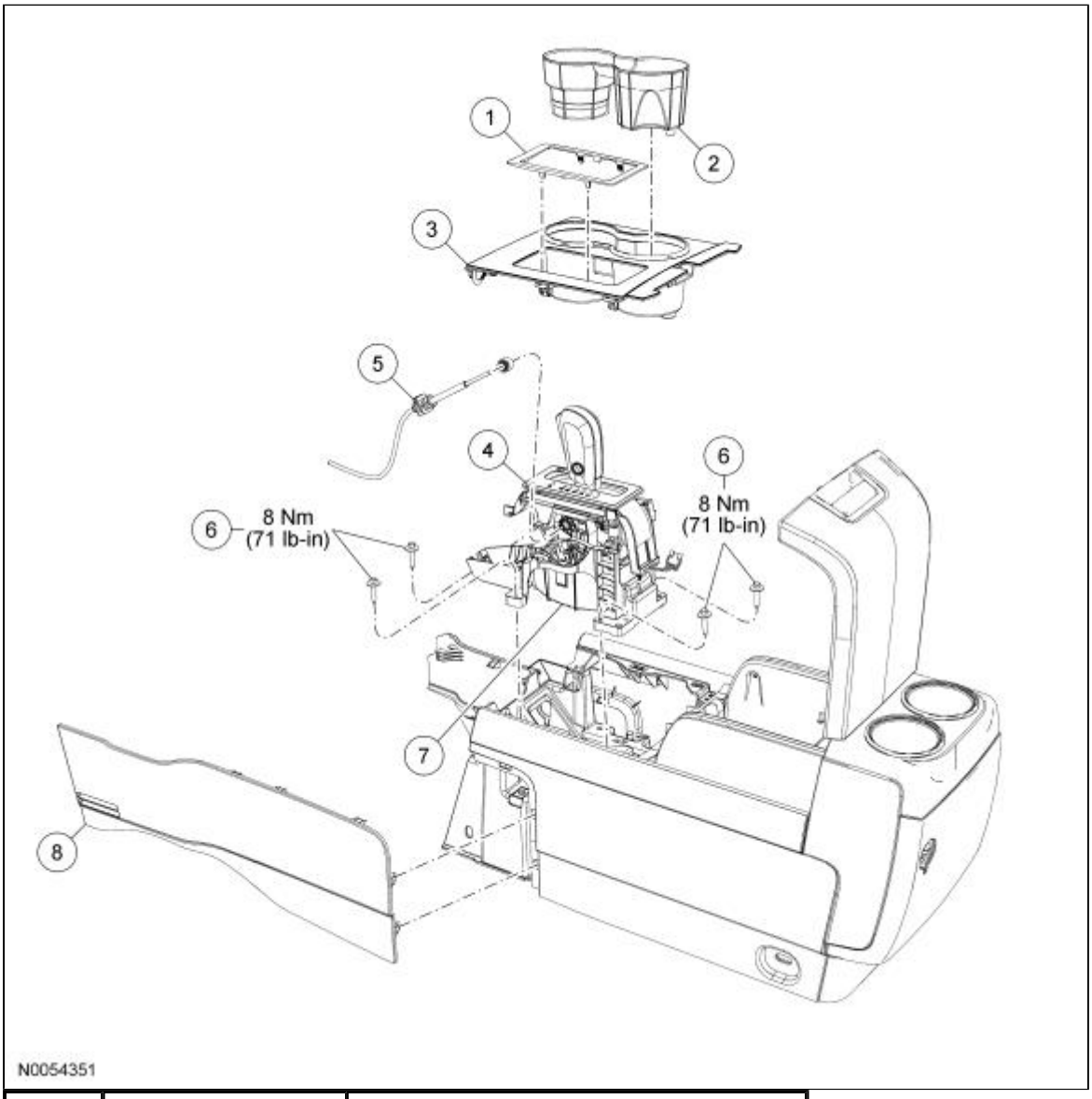
Printable View (691 KB)

Vehicles Equipped With a 6R75 Transmission



Item	Part Number	Description
1	—	PRNDL trim plate
2	78045G34-B	Console tray
3	78046B94-B	Console cup holder insert
4	—	Console upper trim panel screw
5	78045A76-A	Console upper trim panel
6	7C453-A	Selector lever assembly
7	7E395-A	Selector lever cable
8	N606678-S	Selector lever bolts

Vehicles Equipped With a 6HP26 Transmission

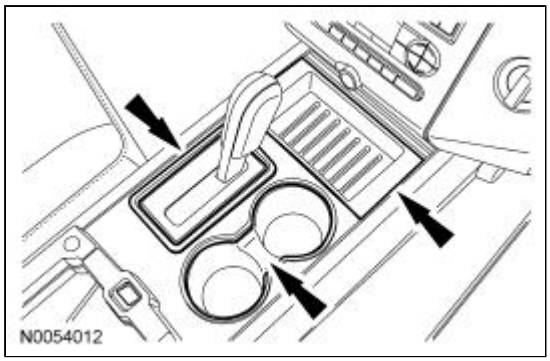


Item	Part Number	Description
1	—	PRNDL trim plate
2	78046B94-B	Console cup holder insert
3	78044J76-A	Console upper trim panel
4	7E034-A	Selector lever bezel
5	7E395-B	Selector lever cable
6	N606678-S	Selector lever bolts
7	7C453-A	Selector lever assembly
8	—	Side console access panel

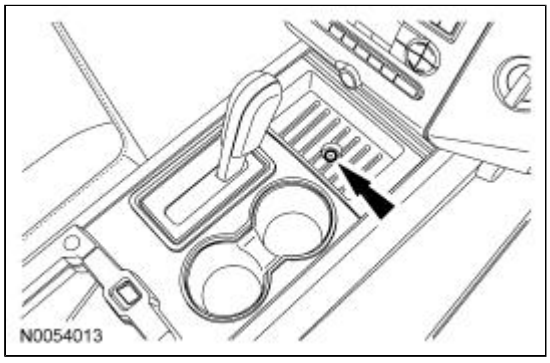
Removal

Vehicles equipped with a 6R75 transmission

1. Remove the PRNDL trim, console tray and cup holder insert.

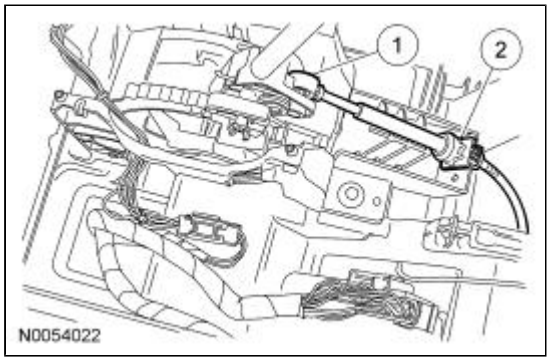


2. Remove the screw and the console upper trim.

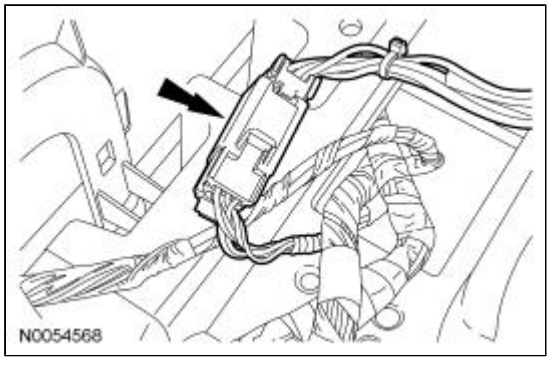


3. **NOTE:** Selector lever bezel removed for clarity.

   Disconnect the selector lever cable from the selector lever.
   1. Disconnect the selector lever cable from the selector lever arm ball stud.
   2. Disconnect the selector lever cable from the selector lever housing.

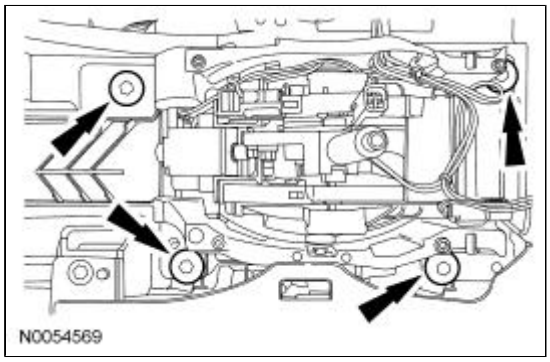


4. Disconnect the selector lever electrical connector.



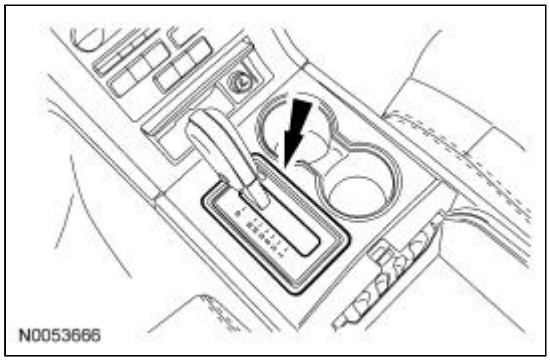
5. **NOTE:** Selector lever bezel removed for clarity.

   Remove the bolts and lift the selector lever out of the console.



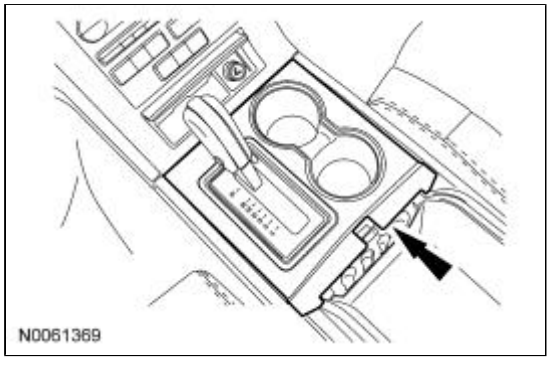
Vehicles equipped with a 6HP26 transmission

6. Remove the selector lever trim plate.



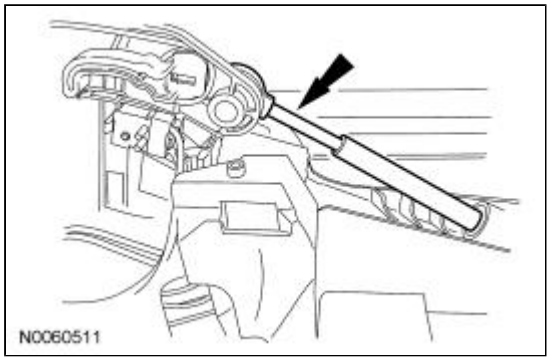
7. **NOTE:** Using a suitable tool, lift and remove the floor console upper panel from the rear.

   Remove the floor console upper panel.

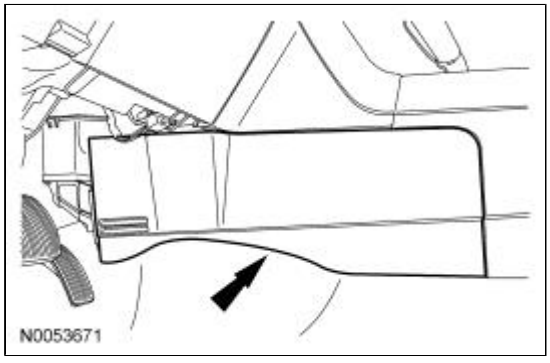


8. **NOTE:** Selector lever bezel removed for clarity.

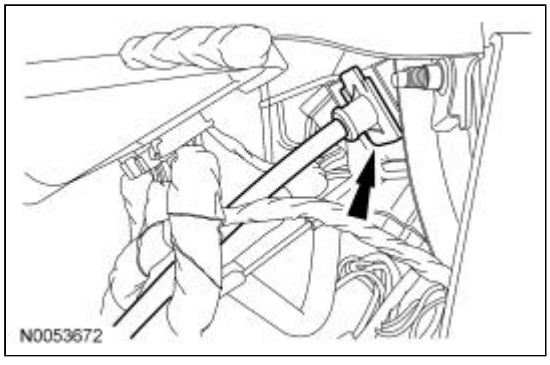
   Disconnect the selector lever cable from the selector lever arm ball stud.



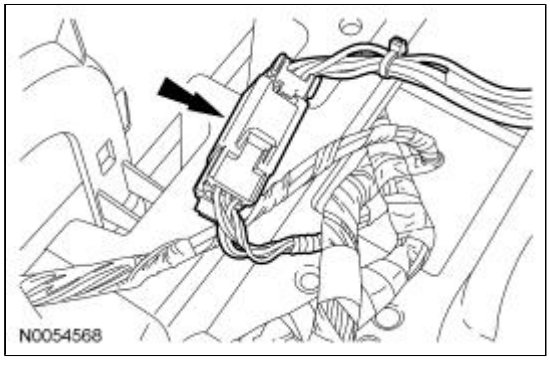
9. Remove the center console LH kick panel.



10. Disconnect the selector lever cable from the selector lever housing.

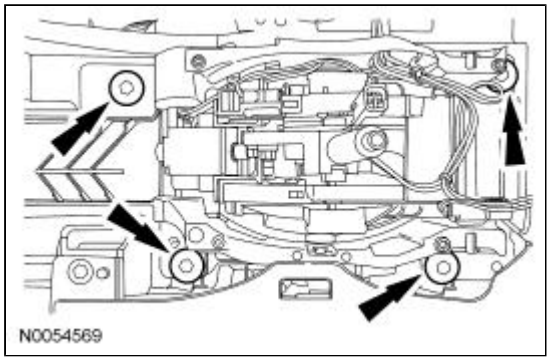


11. Disconnect the selector lever electrical connector.



12. **NOTE:** Selector lever bezel removed for clarity.

    Remove the bolts and lift the selector lever out of the console.

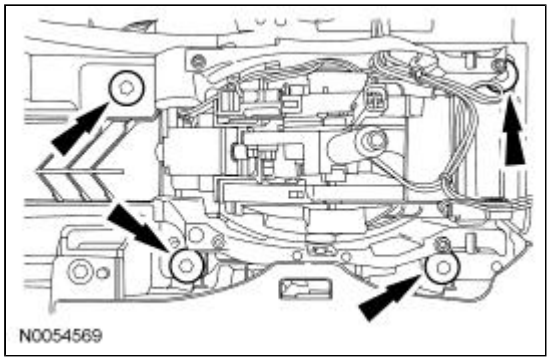


Installation

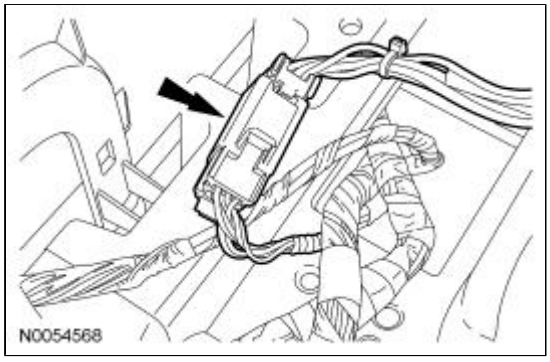
Vehicles equipped with a 6R75 transmission

1. **NOTE:** Selector lever bezel removed for clarity.

   Install the sector lever into the console.
   - Tighten to 8 Nm (71 lb-in).



2. Connect the selector lever electrical connector.

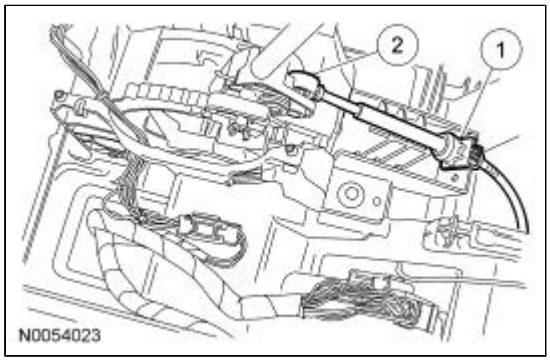


3. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

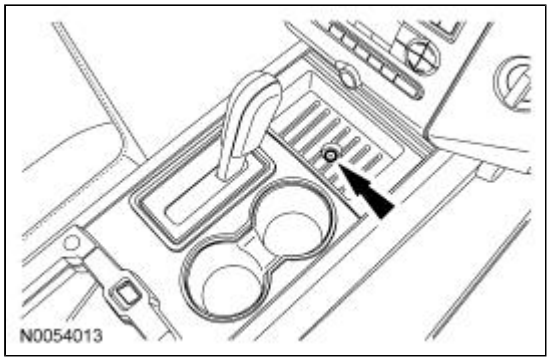
   NOTE: Selector lever bezel removed for clarity.

   Connect the selector lever cable onto the selector lever.
   1. Connect the selector lever cable onto the selector lever housing.
   2. Connect the selector lever cable onto the selector lever arm ball stud.

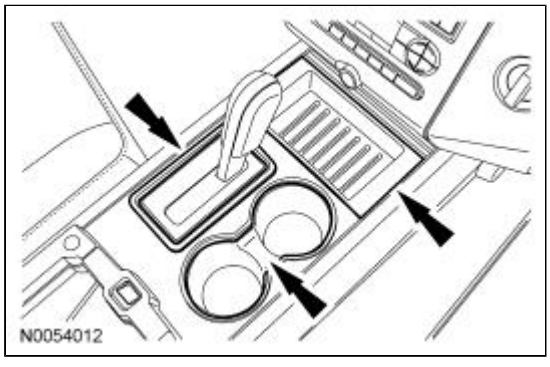
- Listen for the audible click.
- Pull back on the selector lever cable to make sure that it is correctly installed.



4. Install the console upper trim and the screw.



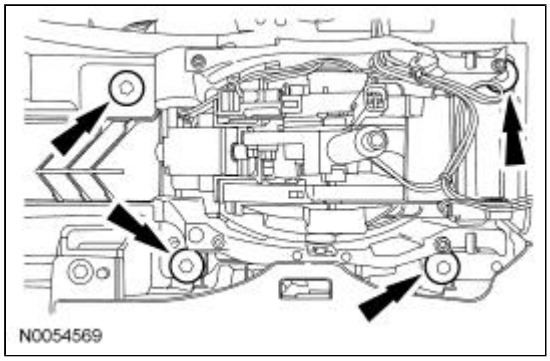
5. Install the PRNDL trim, console tray and cup holder insert.



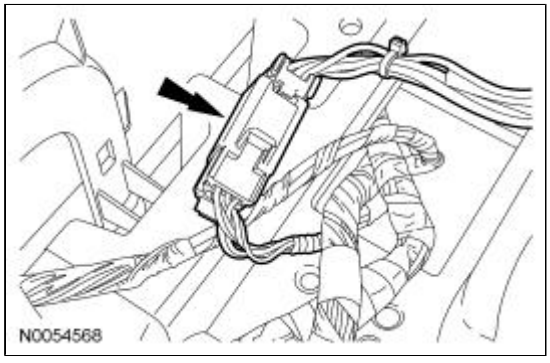
Vehicles equipped with a 6HP26 transmission

6. **NOTE:** Selector lever bezel removed for clarity.

   Install the selector lever into the console.
   - Tighten to 8 Nm (71 lb-in).

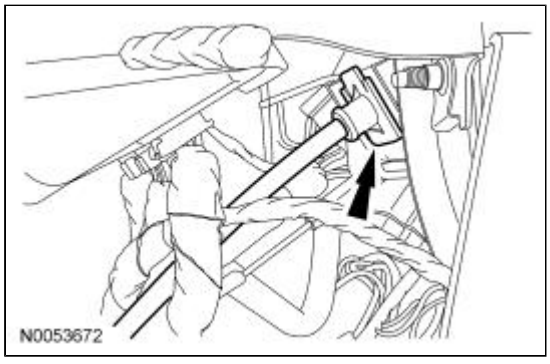


7. Connect the selector lever electrical connector.

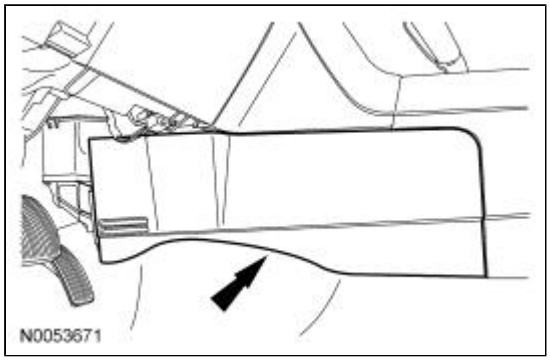


8. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

   Connect the selector lever cable onto the selector lever housing.



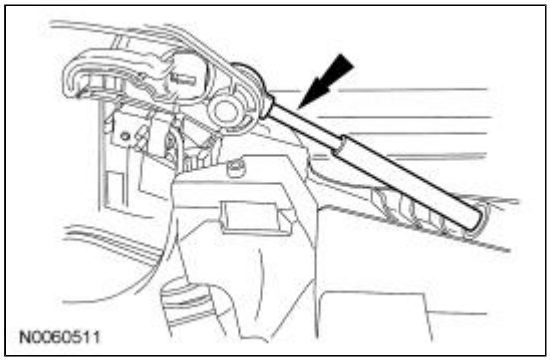
9. Install the center console LH kick panel.



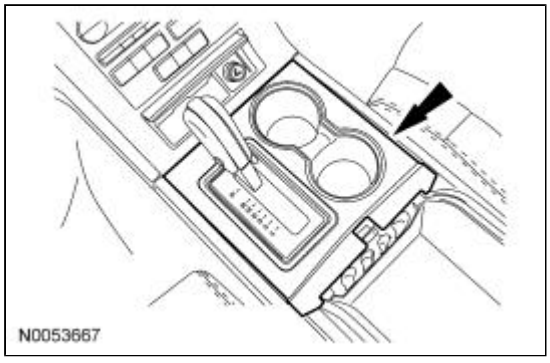
10. **NOTE:** When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the cable to click into place. Pull back on the selector lever cable to make sure that it is locked into the bracket. Also, make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable to make sure that the cable end is correctly installed.

    NOTE: Selector lever bezel removed for clarity.

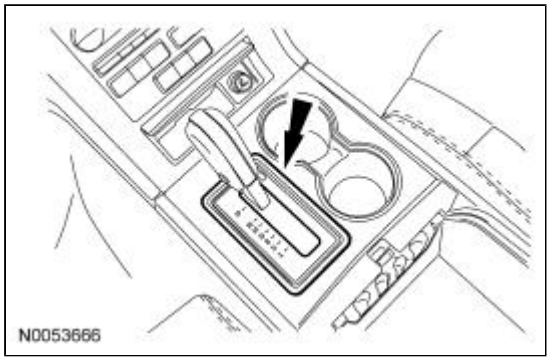
    Connect the selector lever cable onto the selector lever arm ball stud.
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is correctly installed.



11. Install the floor console upper panel.



12. Install the selector lever trim plate.



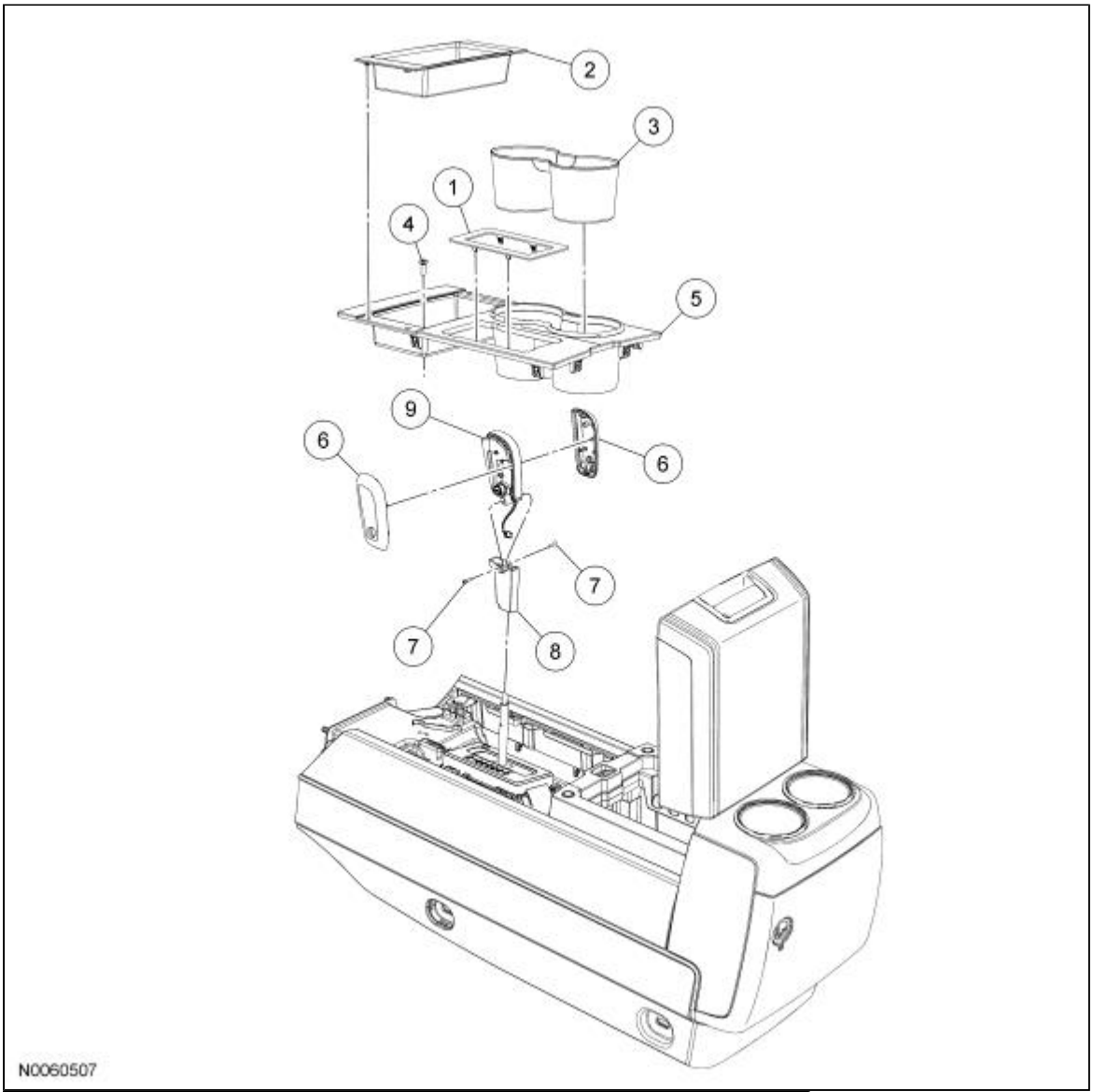
All vehicles

13. Adjust the selector lever cable. Refer to Selector Lever Cable Adjustment in this section.

Selector Lever Knob

Printable View (576 KB)

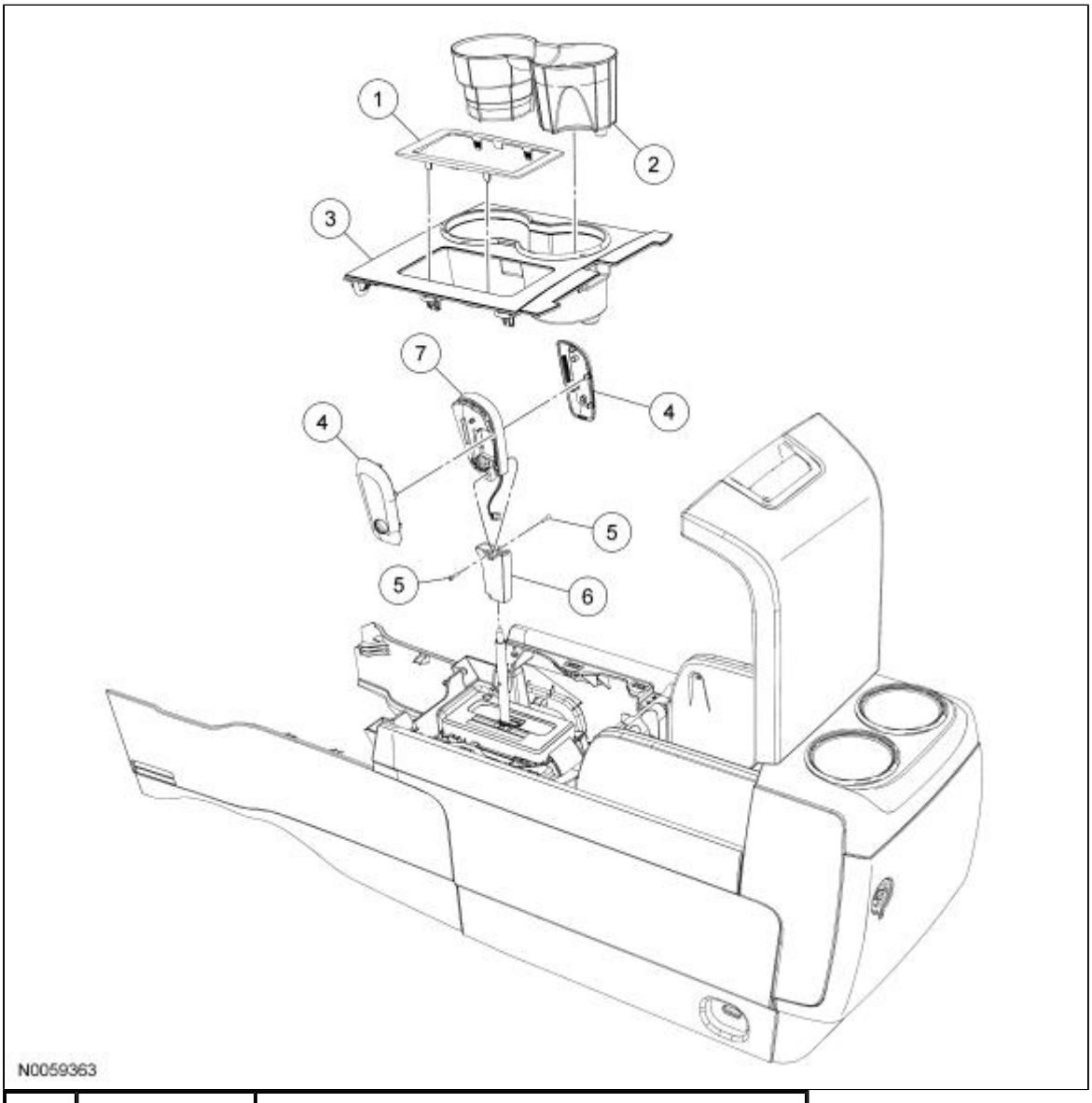
Vehicles Equipped With a 6R75 Transmission



Item	Part Number	Description
1	—	PRNDL trim plate
2	78045G34-B	Console tray
3	78046B94-B	Console cup holder insert
4	—	Console upper trim panel screw
5	78045A76-A	Console upper trim panel
6	7L468-A/B	Selector lever knob cover
7	W701894	Selector lever knob screws
8	7E026-A/B	Selector lever shroud

9	7L010-A/B	Selector lever knob

Vehicles Equipped With a 6HP26 Transmission

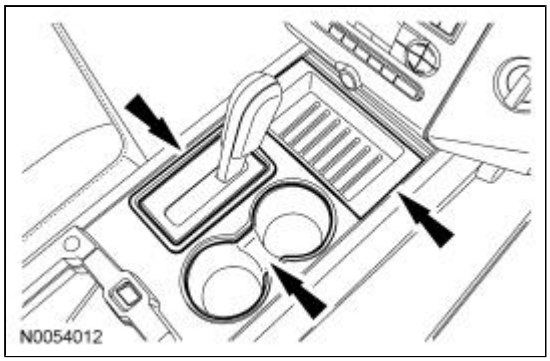


Item	Part Number	Description
1	—	PRNDL trim plate
2	78046B94-B	Console cup holder insert
3	78044J76-A	Console upper trim panel
4	7L468-A	Selector lever knob cover
5	W701894	Selector lever knob screws (part of 7L010-A)
6	7E026-B	Selector lever shroud
7	7L010-A	Selector lever knob

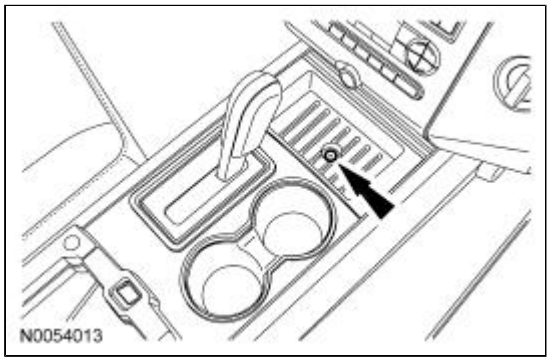
Removal

1. **NOTE:** 6R75 transmission selector lever shown, 6HP26 similar.

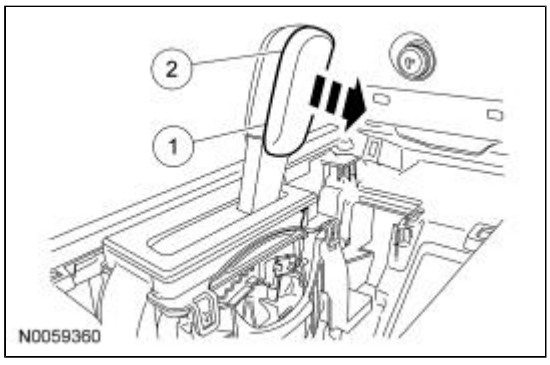
Remove the PRNDL trim, console tray and cup holder insert.



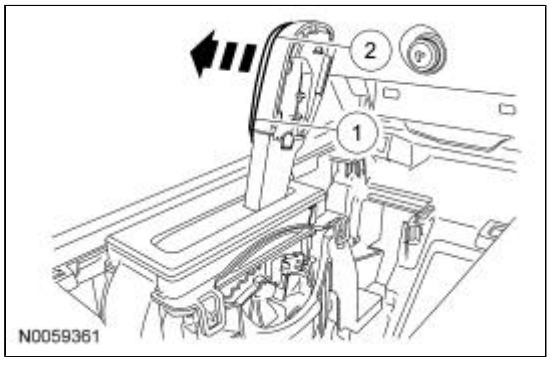
2. Remove the screw and the console upper trim.



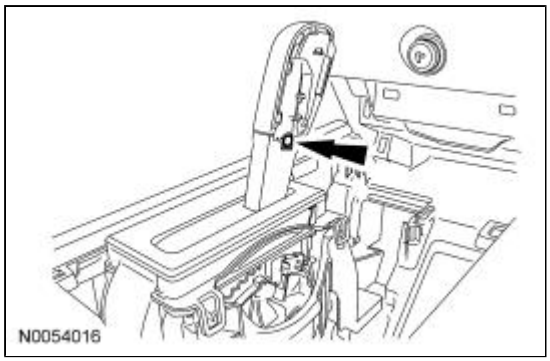
3. Remove and discard the RH selector lever knob cover.
    1. Start at the bottom rear only.
    2. Work towards the top.



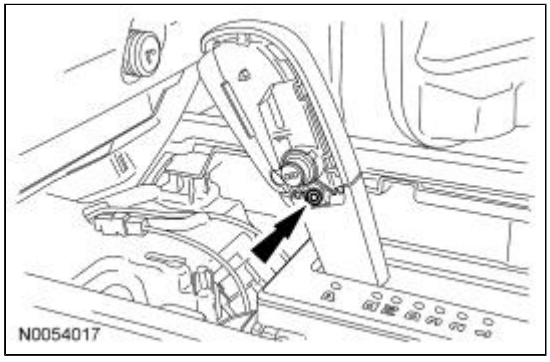
4. Remove and discard the LH selector lever knob cover.
    1. Start at the bottom rear only.
    2. Work towards the top.



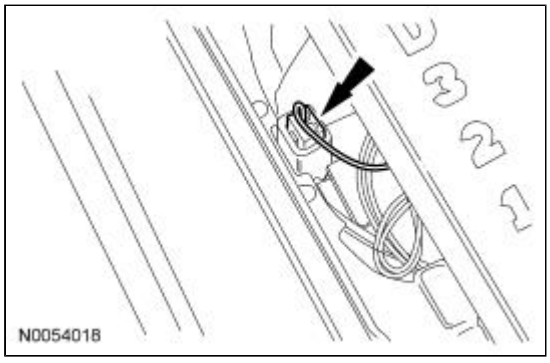
5. Remove and discard the RH selector lever knob screw.



6. Remove and discard the LH selector lever knob screw.

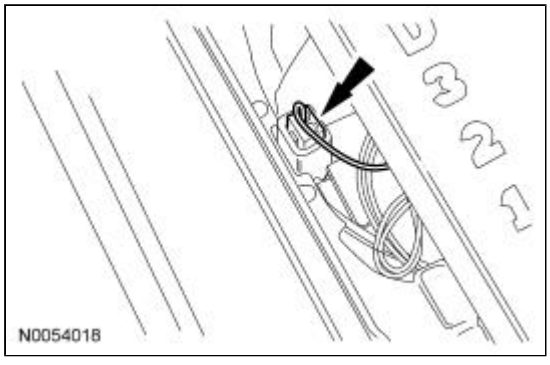


7. Disconnect the transmission control (TC) switch electrical connector and remove the selector lever knob.

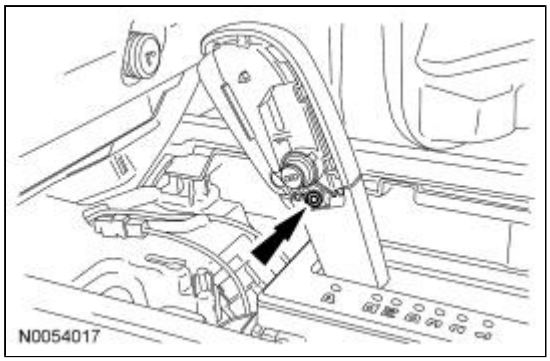


Installation

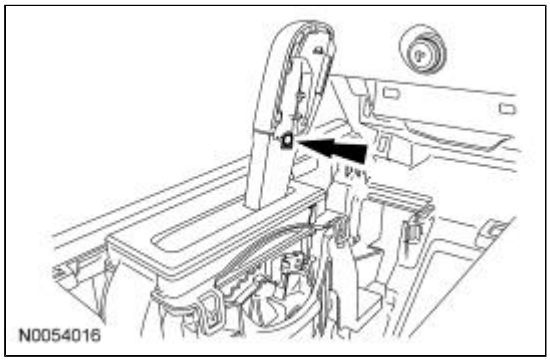
1. Connect the transmission control (TC) switch electrical connector and install the selector lever knob.



2. Install a new LH selector lever knob screw.

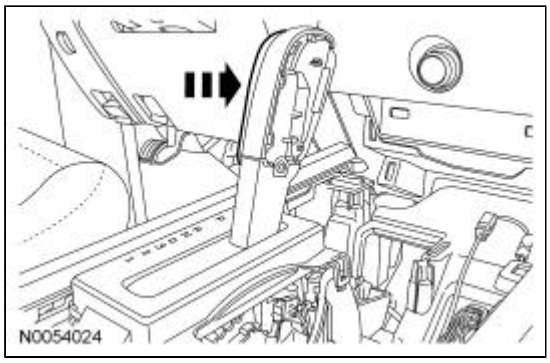


3. Install a new RH selector lever knob screw.



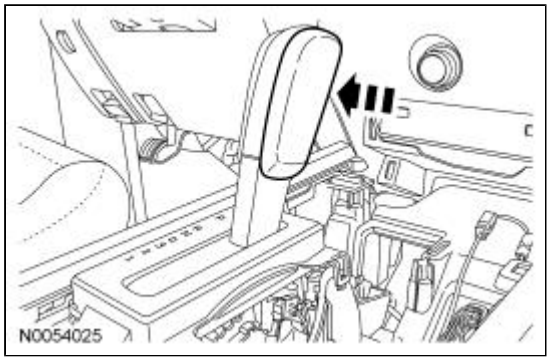
4. **NOTE:** Wood trimmed vehicles have a rubber damper not found on other trim levels.

   Install a new LH selector lever knob cover.

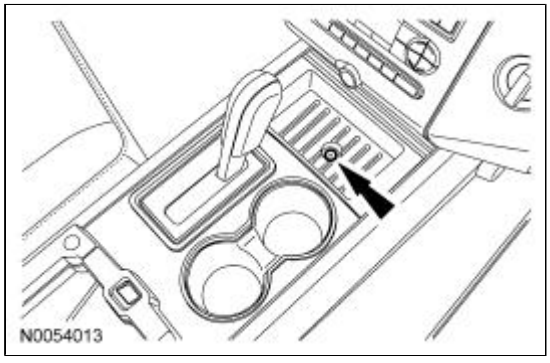


5. **NOTE:** Wood trimmed vehicles have a rubber damper not found on other trim levels.

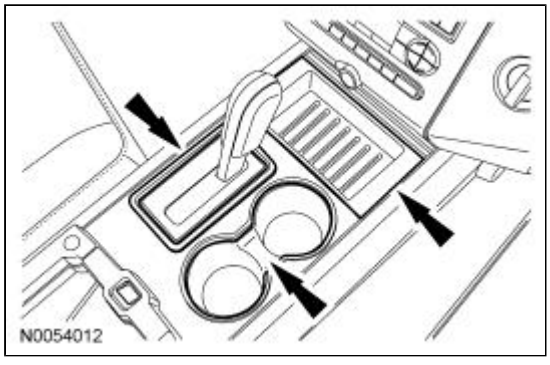
   Install a new RH selector lever knob cover.



6. Install the console upper trim and the screw.



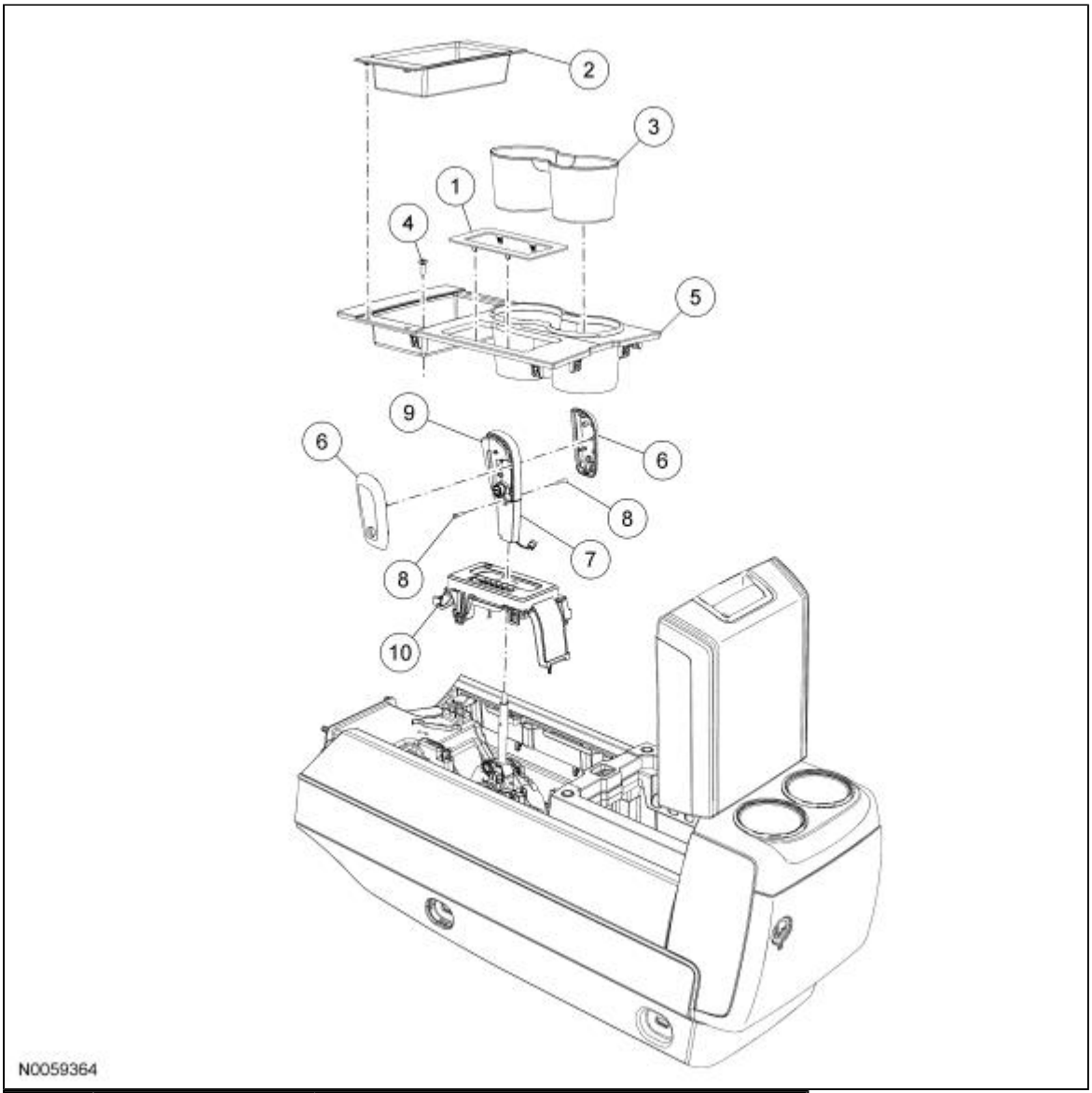
7. Install the PRNDL trim, console tray and cup holder insert.



Selector Lever Bezel

Printable View (694 KB)

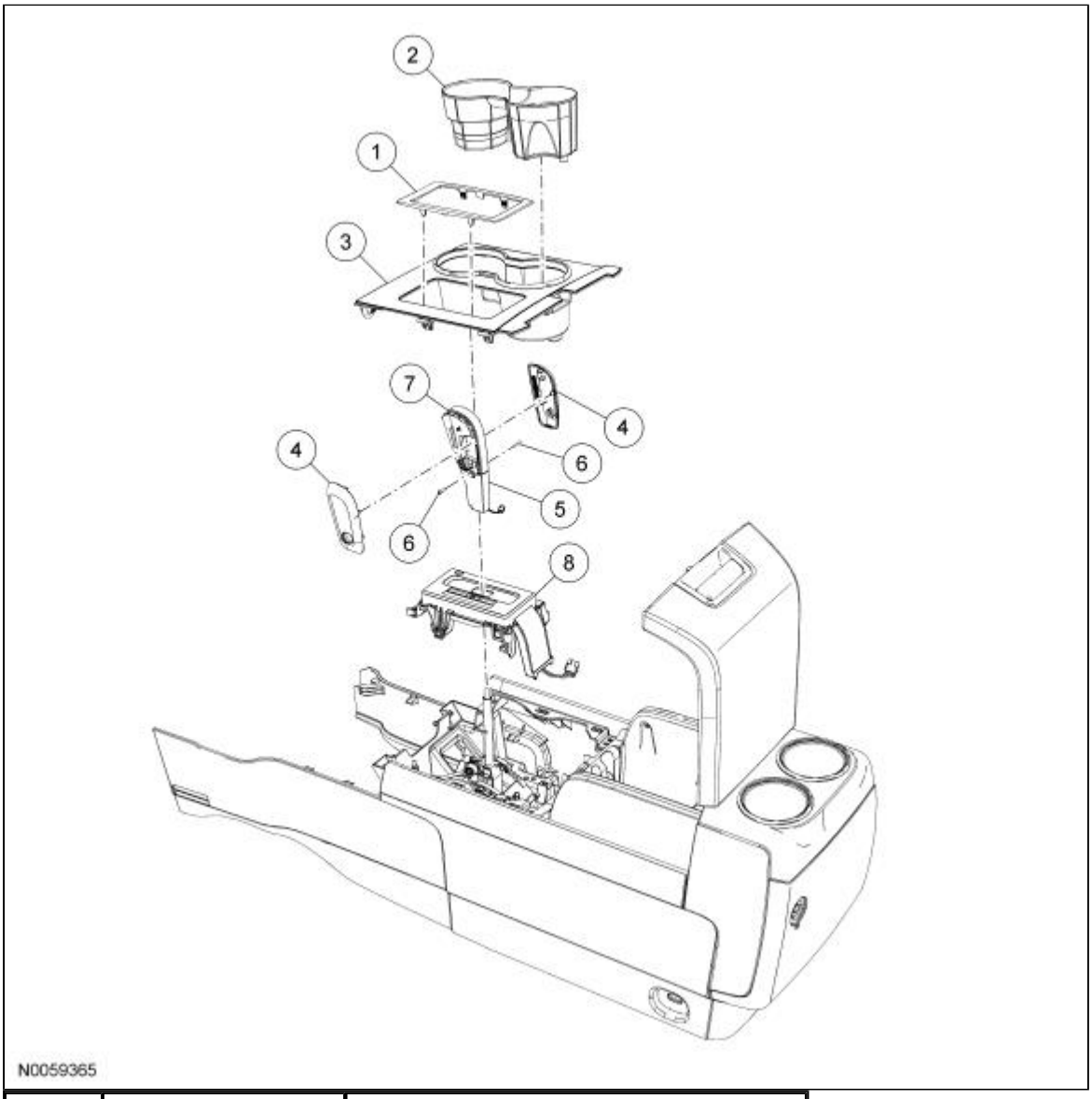
Vehicles Equipped With a 6R75 Transmission



Item	Part Number	Description
1	—	PRNDL trim plate
2	78045G34-B	Console tray
3	78046B94-B	Console cup holder insert
4	—	Console upper trim panel screw
5	78045A76-A	Console upper trim panel
6	7L468-A/B	Selector lever knob cover
7	7E026-A/B	Selector lever shroud
8	W701894	Selector lever knob screws

9	7L010-A	Selector lever knob
10	7E034-A	Selector lever bezel

Vehicles Equipped With a 6HP26 Transmission



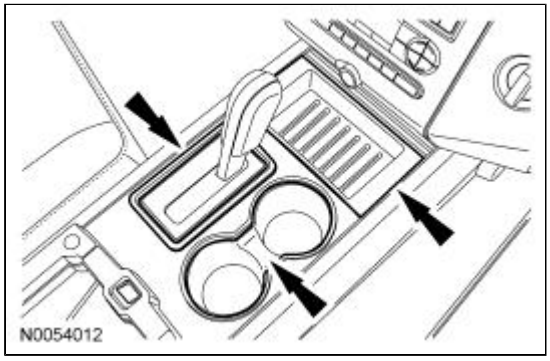
Item	Part Number	Description
1	—	PRNDL trim plate
2	78046B94-B	Console cup holder insert
3	78044J76-A	Console upper trim panel
4	7L468	Selector lever knob cover
5	7E26-B	Selector lever shroud
6	W701894	Selector lever knob screws
7	7L010-A	Selector lever knob
8	7E034-A	Selector lever bezel

Removal

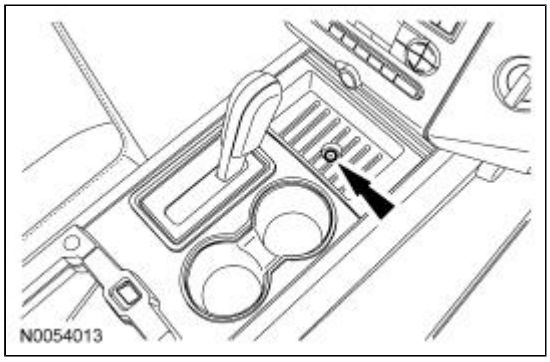
All vehicles

1. **NOTE:** 6R75 transmission selector lever shown, 6HP26 similar.

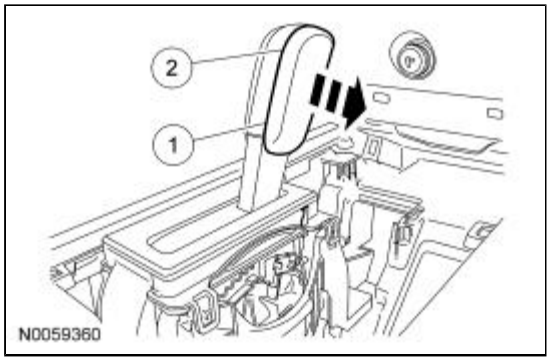
   Remove the PRNDL trim, console tray and cup holder insert.



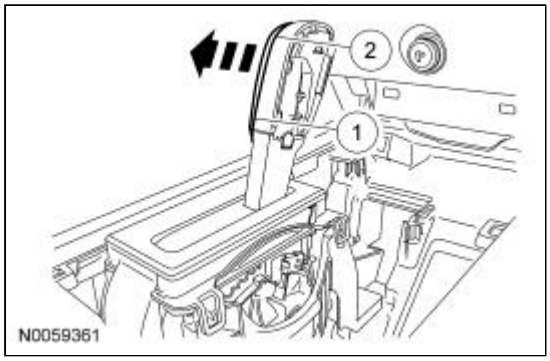
2. Remove the screw and the console upper trim.



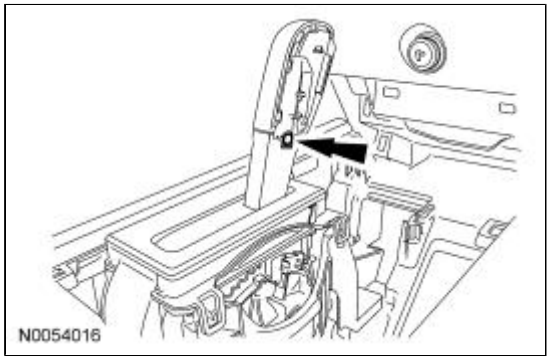
3. Remove and discard the RH selector lever knob cover.
   1. Start at the bottom rear only.
   2. Work towards the top.



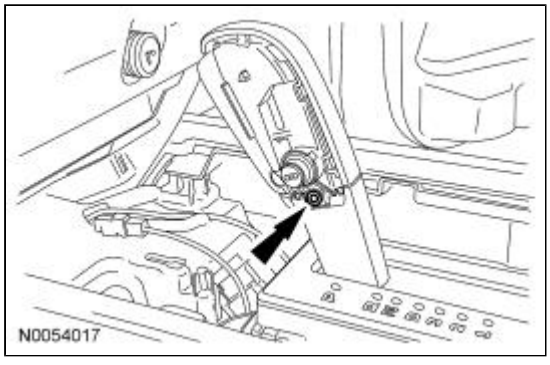
4. Remove and discard the LH selector lever knob cover.
   1. Start at the bottom rear only.
   2. Work towards the top.



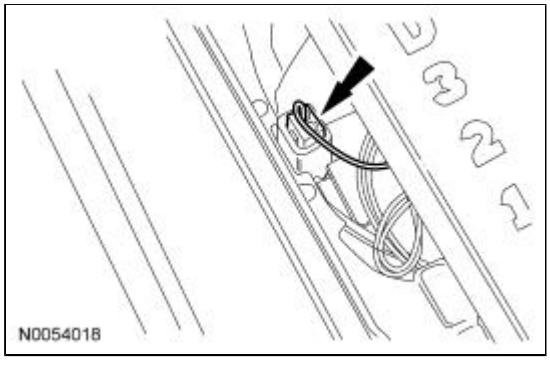
5. Remove and discard the RH selector lever knob screw.



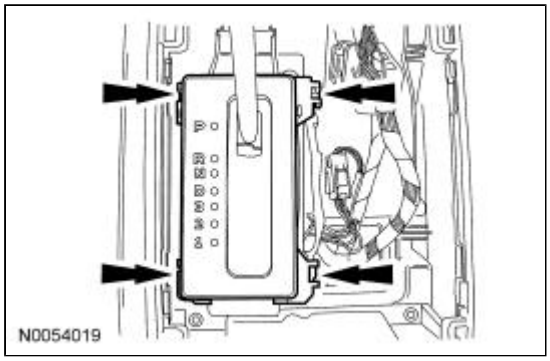
6. Remove and discard the LH selector lever knob screw.



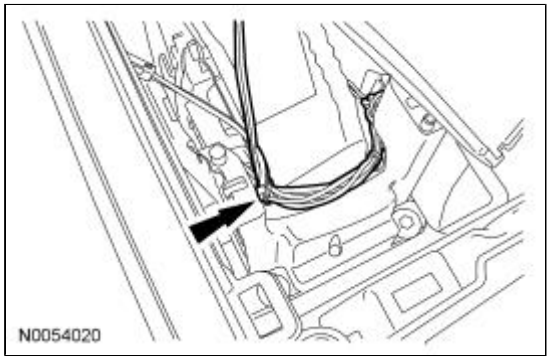
7. Disconnect the transmission control (TC) switch electrical connector and remove the selector lever knob.



8. Lift the tabs on the selector lever bezel and lift the bezel for access to the electrical harness.

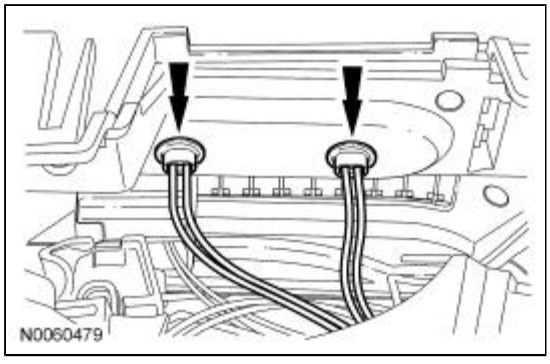


9. Disconnect the electrical harness from the selector lever housing.



Vehicles equipped with a 6R75 transmission

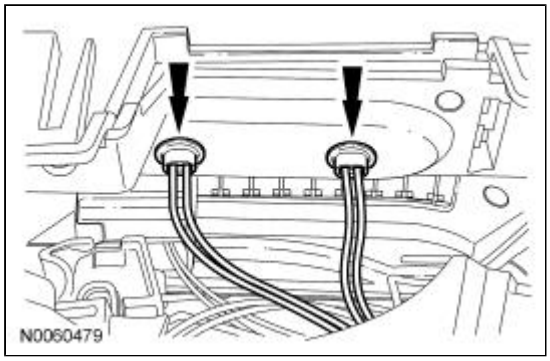
10. Disconnect the electrical harness from the bezel.



Installation

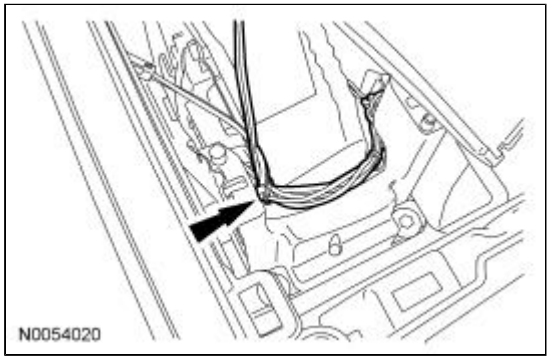
Vehicles equipped with a 6R75 transmission

1. Connect the electrical harness onto the bezel.

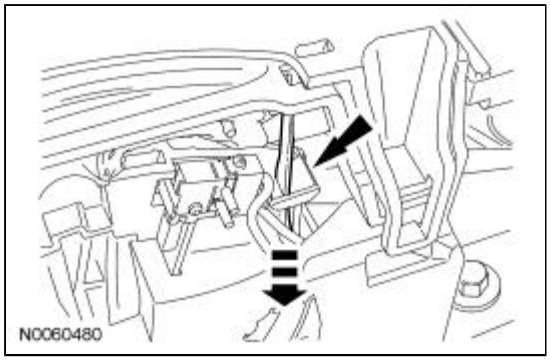


All vehicles

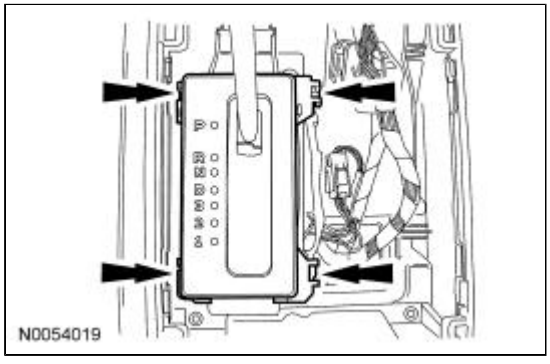
2. Connect the electrical harness onto the selector lever housing.



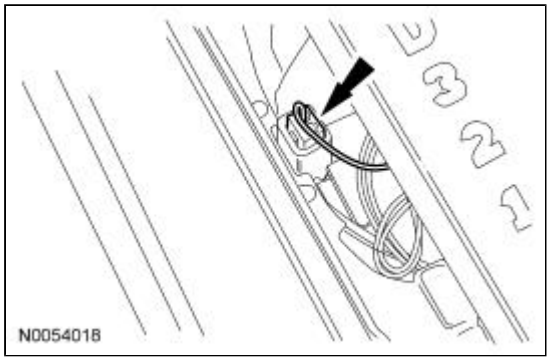
3. Align the brake shift interlock override tab into its guide.



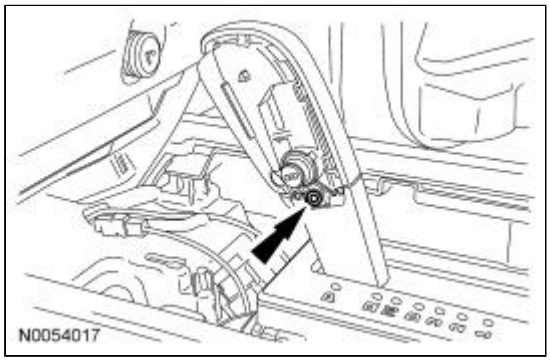
4. Install the selector lever bezel onto the selector lever housing.



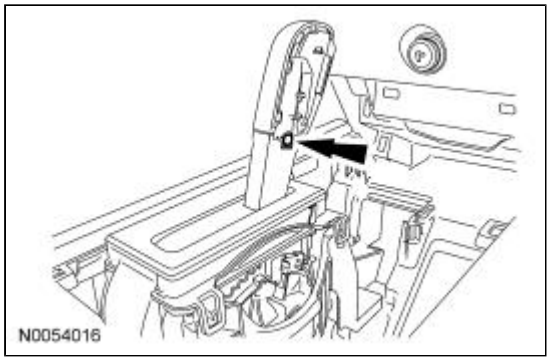
5. Connect the transmission control (TC) switch electrical connector and install the selector lever knob.



6. Install a new LH selector lever knob screw.
    - tighten to 2 Nm (18 lb-in).

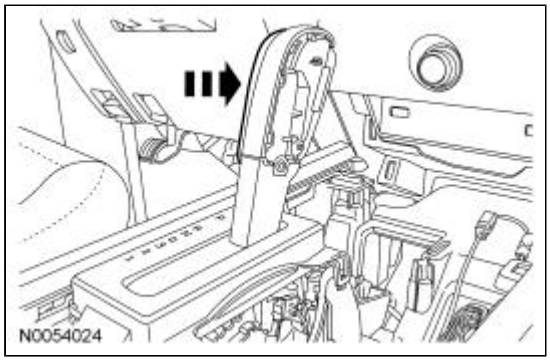


7. Install a new RH selector lever knob screw.
    - Tighten to 2 Nm (18 lb-in).



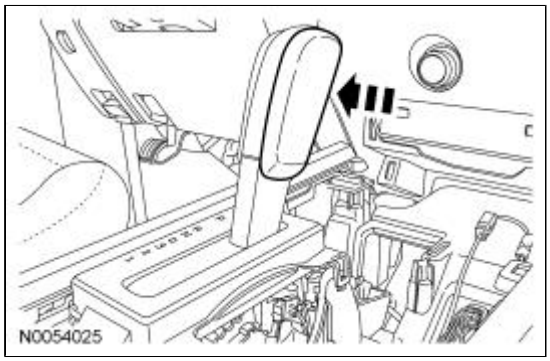
8. **NOTE:** Wood trimmed vehicles have a rubber damper not found on other trim levels.

   Install a new LH selector lever knob cover.

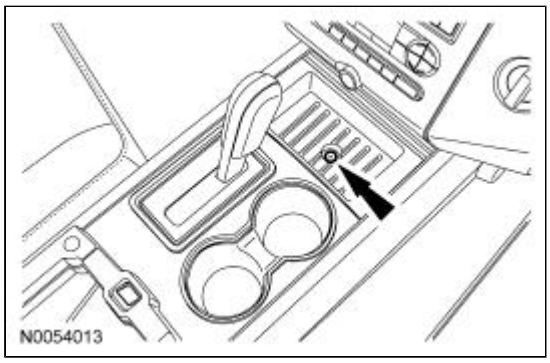


9. **NOTE:** Wood trimmed vehicles have a rubber damper not found on other trim levels.

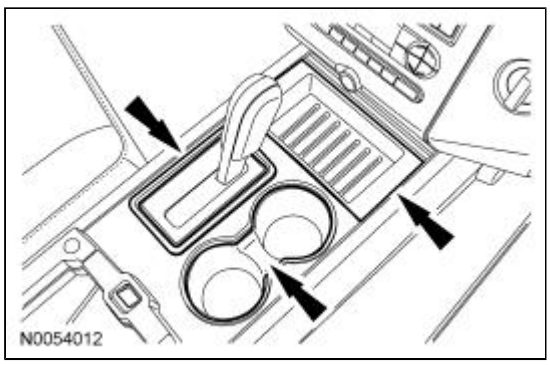
   Install a new RH selector lever knob cover.



10. Install the console upper trim and the screw.



11. Install the PRNDL trim, console tray and cup holder insert.



12. Verify brake shift interlock function.

Transmission Control (TC) Switch — Column Shift

Printable View (78 KB)

Removal and Installation

NOTE: The transmission control (TC) switch is not replaceable. If a new TC switch is required, install a new transmission selector lever assembly.

For additional information, refer to Selector Lever — Column Shift in this section.

Transmission Control (TC) Switch — Floor Shift

Printable View (78 KB)

Removal and Installation

NOTE: The transmission control (+/-) switch is not serviced. If a new switch is required, install a new selector lever assembly.

For additional information, refer to Selector Lever — Floor Shift in this section.

Four Wheel Drive (4WD) Systems

Printable View (63 KB)

The 1-speed torque on demand (TOD) (Navigator) and 2-speed torque on demand (TOD) (Expedition) 4 wheel drive (4WD) systems consist of the following:

- 4WD mode select switch (MSS)
- 4WD control module
- Integrated wheel ends (IWE) solenoid
- IWEs
- 4WD mode indicators and messages in the instrument cluster message center
- Transfer case assembly
- Transfer case shift motor
- Steering wheel angle (SWA) signal from anti-lock brake system (ABS) module
- Accelerator pedal position output from the powertrain control module (PCM)
- Wheel speed signals from the anti-lock brake system (ABS)

Integrated Wheel End (IWE) System

The IWE system contains the following:

- Vacuum reservoir
- IWE solenoid
- IWEs (spring loaded vacuum hubs)
- Vacuum hoses
- Check valve

The IWE system uses vacuum hubs that engage the front wheel hubs to the front halfshafts or disengage the front wheel hubs from the front halfshafts.

The IWE solenoid receives engine vacuum from the vacuum reservoir.

When the 4WD system is in 2 wheel drive (2WD) mode, the 4WD module supplies a ground path to the IWE solenoid to apply vacuum to the integrated wheel ends (disengaging the front hubs from the front halfshafts). In 4WD mode, the 4WD module does not supply the ground path to the IWE solenoid, vacuum is not applied to the integrated wheel ends and an internal spring keeps the front hubs engaged to the front halfshafts.

Four Wheel Drive (4WD) Systems — 1-Speed Torque-On-Demand

Printable
View (302 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R00057 or equivalent
ST1177-A	88 Digital Multimeter or equivalent 105-R0053
ST2574-A	Flex Probe Kit 105-R025B

Principles of Operation

The Navigator is equipped with an automatic, electronic-shift system that allows the operator to choose (by pressing the mode select buttons) between 3 different modes: 4x2, 4x4 AUTO and 4x4. The operator can switch between 4x2 and 4x4 AUTO mode or 4x4 mode at any speed below 88 kph (55 mph). The operator can switch between 4x4 AUTO mode and 4x4 mode at any speed.

Wheel slip is sensed by monitoring the average front and rear wheel speeds. Based on steering wheel angle (SWA), accelerator pedal position and wheel slip, a pulse width modulated (PWM) signal is transmitted to the transfer case as torque is required. The 4 wheel drive (4WD) control module will provide the anti-lock brake system (ABS) with current clutch duty cycle and whether or not ABS may command the clutch duty cycle.

The brake subsystem sends the following information signals to the 4WD system:

- Occurrences of brake events and failures. Refer to Section 206-09 .
- Steering wheel angle status. Refer to Section 206-09 .
- Wheel speeds. Refer to Section 206-09 .

A concern with any of the above listed brake system signals will affect operation of the 4WD system.

The accelerator pedal position output signal is provided to the 4WD control module from the powertrain control module (PCM). This signal is used by the 4WD control module in controlling the transfer case clutch.

The 4WD control module sends a duty cycle command to the clutch coil which activates the clutch within the transfer case.

The 4WD control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4WD control module activates the transfer case clutch a minimum duty cycle (percentage of time the clutch is turned on), which allows for the slight difference between the front and rear driveshafts which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4WD control module will increase the duty cycle in order to prevent or control slip:

- Slip is detected
- Heavy acceleration (accelerator pedal position)
- Straight-ahead steering wheel angle (SWA)

Feature inputs:

- Mode select switch (MSS)
- Accelerator pedal position (from the PCM)
- SWA (from the ABS module)
- Transmission range position (from the transmission control module [TCM])
- Transmission output torque (from the PCM)
- Wheel speed signal (transmitted from the ABS module)
- Accelerator pedal position information (transmitted from the PCM)

Feature outputs:

- Solid state PWM signal
- Message center 4WD mode indicators

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Halfshafts
• Integrated wheel ends (IWEs)
• Driveshaft and universal joints
• Vacuum leaks
• Fluid leaks
• Matching tire sizes
• Transfer case
	• Battery junction box (BJB) fuses:
	  ▪ 35 (20A)
	  ▪ 75 (5A)
	• Smart junction box (SJB) fuse 35 (10A)
	• 4WD control module
	• Mode select switch (MSS)
	• Integrated wheel end (IWE) solenoid
	• Wiring harness
	• Connector(s)

	• Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the DTCs and carry out the self-test diagnostics for the 4WD control module.

9. **NOTE:** Before carrying out the on-demand self test, make sure that:
   - the ignition is in RUN.
   - 4x2 mode is selected.

   If the DTCs retrieved are related to the concern, go to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B1317	Battery Voltage High	Four Wheel Drive (4WD) Control Module	CHECK the battery and charging system for faults. REFER to Section 414-00 . CLEAR the DTC. REPEAT the self-test.
B1318	Battery Voltage Low	4WD Control Module	CHECK the battery and charging system for faults. REFER to Section 414-00 . CLEAR the DTC. REPEAT the self-test.
B1342	ECU is Defective	4WD Control Module	CLEAR the DTC. REPEAT the self-test. If DTC B1342 is retrieved, INSTALL a 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the

			self-test.
C1979	IWE Solenoid Circuit Failure	4WD Control Module	Go To Pinpoint Test B .
C1980	IWE Solenoid Circuit Short to Battery	4WD Control Module	Go To Pinpoint Test B .
P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	4WD Control Module	Go To Pinpoint Test B .
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test B .
P1824	Transmission 4-Wheel Drive Clutch Relay Circuit Failure	4WD Control Module	Go To Pinpoint Test C .
P1825	Transmission 4-Wheel Drive Clutch Relay Open Circuit	4WD Control Module	Go To Pinpoint Test C .
P1826	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4WD Control Module	Go To Pinpoint Test C .
P1827	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test C .
P183B	4-Wheel Drive Clutch Coil Return Circuit Open	4WD Control Module	Go To Pinpoint Test C .
U0100	Lost Communication With PCM	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U0101	Lost Communication With Transaxle Control Module	Transmission Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U0121	Lost Communication With ABS Module	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U2023	External Node Fault	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U2050	Application Not Programmed	4WD Control Module	Method 3 programming fault. REFER to Section 418-00 for 4WD control module (PCM) programming information.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the four wheel drive (4WD) control module	• Scan tool • Battery junction box (BJB) fuse 35 (20A) • Power supply: ▪ SBB35 (BU/RD) hot at all	• REFER to Section 418-00 .

	times ■ CBB75 (YE/GY) run/start • Smart junction box (SJB) fuses: ■ 20 (15A) (OBD II) ■ 35 (10A) • Ground circuit GD133 (BK) • 4WD control module • Charging system	
• The vehicle does not shift between two wheel drive (2WD) and 4WD modes correctly	• 4WD indicator (s) • 4WD control module • BJB fuse 35 (20A) • SJB fuse 35 (10A) • Circuit CBB75 (YE/GY) • Transfer case clutch • Mode select switch (MSS)	• Go To Pinpoint Test B .
• The 4WD indicators do not operate correctly/do not operate	• Instrument cluster • 4WD system fault • CAN communication network • 4WD control module • Ignition switch and/or circuitry • SJB fuse 35 (10A) • Circuit CBP35 (YE/GY)	• Go To Pinpoint Test G .
• Four wheel drive (4WD) does not engage at speed correctly	• Transfer case clutch coil • 4WD control module • Integrated wheel ends (IWEs)	• Go To Pinpoint Test C .
• The front axle does not engage/disengage correctly/makes noise in 4x2 mode under heavy throttle	• Mode select switch • IWEs • IWE solenoid • Vacuum leaks • 4WD control module • Front halfshaft • Vacuum check	• Go To Pinpoint Test A .

	valve(s)	
• The four wheel drive (4WD) system jumps out of gear	• Transfer case • IWE vent • MSS	• Go To Pinpoint Test D .
• Straightline driveline wind-up	• Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios	• Go To Pinpoint Test E .
• Grinding noise during 4WD system engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed	• INSTALL the S-spring in the front differential. REFER to Section 205-03 for S-spring installation.
• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct.
	• Tire tread wear	• CHECK tire tread wear to see if there is more than 0.15 mm (0.06 in) difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again.
	• Internal components	• OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission. REFER to Section 307-01A . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to Section 308-07B . CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary.
	• Fluid level	• FILL with automatic transmission fluid. REFER to Section 308-07B .
• The vehicle binds in turns/resists turning/pulsates/shudders in a straight line	• Unmatched tire sizes • Unequal amounts of tire	• Go To Pinpoint Test H .

	wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios	
• The vehicle does not shift between 4x4 AUTO mode and 4x4 mode correctly	• MSS • Transfer case • Circuitry • 4WD control module	• Go To Pinpoint Test C .
• The vehicle has no torque or inadequate torque at rear wheels in 4x4 AUTO mode	• Transfer case • Circuitry • 4WD control module	• Go To Pinpoint Test F .
• Unable to duplicate customer concern	• 4WD indicator • 4WD control module • Transfer case and related components • Wheel/tire assemblies	• CARRY OUT the 4WD System Functional Test. Go To Pinpoint Test F .

Pinpoint Tests

Pinpoint Test A: The Front Axle Does Not Engage/Disengage Correctly/Makes Noise in 4x2 Mode Under Heavy Throttle

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

In 4x2 mode, the 4 wheel drive (4WD) control module supplies a ground path to the integrated wheel end (IWE) solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In 4x4 mode and 4x4 AUTO modes, the 4WD control module does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the 4WD control module, internal components of the transfer case, mode select switch, IWE components and drive axles.

Possible Causes

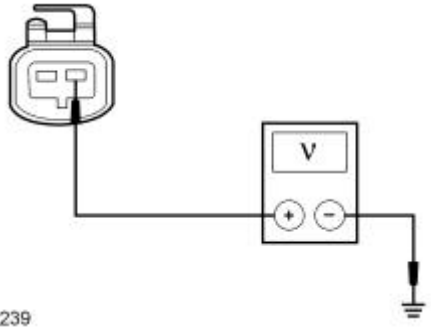
- Mode select switch (MSS)
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- 4WD control module
- Circuit CCF05 (BN/BU)
- Circuit CBB75A (YE/GY)

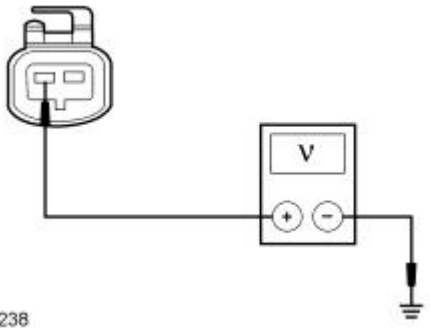
PINPOINT TEST A: THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY/MAKES

NOISE IN 4x2 MODE UNDER HEAVY THROTTLE

Test Step	Result / Action to Take
A1 CHECK FOR DTCs • Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Carry out the on-demand self test. • **Are DTCs C1979 or C1980 present?**	**Yes** If DTC C1979 is retrieved, GO to A13 . If DTC C1980 is retrieved, GO to A15 . **No** GO to A2 .
A2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS • Select 4x2 mode then select 4x4 mode while at rest. Drive the vehicle. • Select 4x2 mode then select 4x4 mode while driving the vehicle at low speed. • Select 4x2 mode then select 4x4 mode while driving the vehicle at high speed. • **Is the axle system fully functional at rest, but there is a grinding noise during engagement, especially at high speed?**	**Yes** If the concern is excessive front axle noise during 4x4 mode engagement (especially at high speeds), INSTALL the S-spring in the front differential. REFER to Section 205-03 . **No** GO to A3 .
A3 CHECK THE TRANSFER CASE SHIFT TO 4x2 MODE • Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Select 4x2 mode. • **Does the message center still indicate 4x4 auto mode or 4x4 mode?**	**Yes** GO to A4 . **No** Go To Pinpoint Test B .
A4 CHECK THE IWE DISENGAGEMENT • Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to Section 100-02 . • **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine and allow to idle. • Select 4x2 mode. • Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft. • Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft. • **Did either front halfshaft rotate?**	**Yes** GO to A10 . **No** GO to A5 .
A5 CHECK THE TRANSFER CASE SHIFT INTO 4x4 MODE • Select 4x4 mode. • **Does the instrument cluster indicator lamp indicate that the MSS is in 4x4 mode?**	**Yes** GO to A6 . **No** Go To Pinpoint Test C .
A6 CHECK THE IWE ENGAGEMENT • Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to Section 100-02 . • **NOTE:** The engine must be idling during the following	**Yes** CHECK that all driveline fasteners are present and tightened to specification.

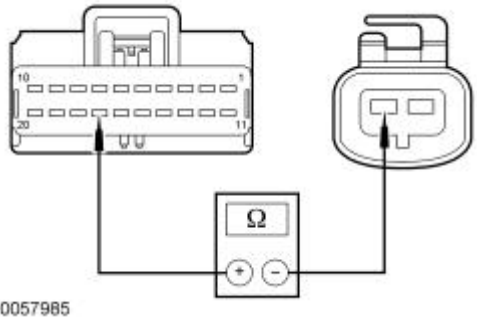
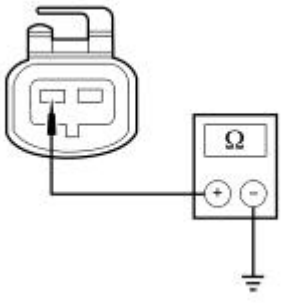
steps to supply vacuum to the IWE solenoid. • Start the engine and allow to idle. • Select 4x4 mode. • Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft. • Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft. • **Did both front halfshafts rotate?**	REFER to Section 205-00 for further diagnosis of the front axle. **No** GO to A7 .
A7 CHECK THE IWE SOLENOID OUTPUT IN 4x4 MODE	
• **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Disconnect the output vacuum line at the IWE solenoid. • Select 4x4 mode. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** Key in OFF position. GO to A24 . **No** GO to A8 .
A8 CHECK THE IWE SOLENOID OUTPUT IN 4x4 WITH THE SCAN TOOL	
• Key in OFF position. • Connect the diagnostic tool. • **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Disconnect: Active Commands. • Using the scan tool, command the IWE solenoid to engage the IWEs (solenoid OFF). • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** END active command. GO to A18 . **No** GO to A9 .
A9 CHECK THE IWE SOLENOID	
• Disconnect: IWE Solenoid C1157. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** END active command. GO to A17 . **No** END active command. INSTALL a new IWE solenoid. REPEAT the self-test.
A10 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 4x2 MODE	
• **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Disconnect the output vacuum line at the IWE solenoid. • Select 4x2 mode. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**Yes** GO to A19 . **No** GO to A11 .
A11 CHECK THE IWE SOLENOID INPUT VACUUM	
• Measure the vacuum at the input port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**Yes** GO to A12 . **No** REPAIR the vacuum leak. CLEAR the DTCs. REPEAT the

	self test.
A12 CHECK THE IWE SOLENOID OUTPUT IN 4x2 MODE WITH THE SCAN TOOL	
• Key in OFF position. • Connect the diagnostic tool. • **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Enter the following diagnostic mode on the scan tool: Active Command. • Using the scan tool, command the IWE solenoid to disengage the IWEs (IWE solenoid ON). • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**Yes** END active command. GO to A18 . **No** END active command. GO to A13 .
A13 CHECK CIRCUIT CBB75A (YE/GY) FOR VOLTAGE	
• Key in OFF position. • Disconnect: IWE Solenoid C1157. • Measure the voltage between IWE solenoid C1157-1, circuit CBB75A (YE/GY) and ground.  A0069239 • **Is the voltage greater than 9 volts?**	**Yes** GO to A14 . **No** CHECK CJB fuse 75 (5A) for an open. CLEAR the DTCs. REPEAT the self-test.
A14 CHECK THE IWE SOLENOID OPERATION	
• Connect: IWE Solenoid C1157. • **NOTE:** The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage. • Start the engine. • Connect a 10 amp fused jumper wire between IWE solenoid C1157-1, circuit CCF05 (BN/BU), component side and ground. • Measure the vacuum at the IWE solenoid output vacuum port. • **Is the IWE solenoid output port vacuum greater than 254 mm (10 in) Hg?**	**Yes** DISCONNECT the fused jumper. GO to A15 . **No** INSTALL a new IWE solenoid. CLEAR the DTCs. REPEAT the self-test.
A15 CHECK CIRCUIT CCF05 (BN/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: IWE Solenoid C1157. • Disconnect: 4WD Control Module C281a. • Key in ON position. • Measure the voltage between IWE solenoid C1157-2, circuit CCF05 (BN/BU), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to A16 .



A0069238

- **Is voltage present?**

A16 CHECK CIRCUIT CCF05 (BN/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between IWE solenoid C1157-2 harness side and 4WD control module C281a-17 harness side, circuit CCF05 (BN/BU).  N0057985 • **Is the resistance less than 5 ohms?**	**Yes** GO to A17 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A17 CHECK CIRCUIT CCF05 (BN/BU) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between IWE solenoid C1157-2, circuit CCF05 (BN/BU), harness side and ground.  A0079780 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A18 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A18 CHECK THE 4WD CONTROL MODULE	

• Disconnect all 4WD control module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all 4WD control module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have

	been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
A19 CHECK THE IWE VACUUM SYSTEM • Key in OFF position. • Disconnect both vacuum lines from the IWE solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** GO to A20 . **No** CONNECT the vacuum lines to the IWE solenoid. GO to A23 .
A20 CHECK THE RH IWE LEAK RATE • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Disconnect the vacuum line from the larger port on the RH IWE. • Apply 508 mm (20 in) Hg of vacuum to the RH IWE port and observe vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL a new IWE. REFER to Section 204-00 . GO to A19 . **No** GO to A21 .
A21 CHECK THE LH IWE LEAK RATE • Disconnect the vacuum line from the larger port at the LH IWE. • Apply 205 mm (20 in) Hg of vacuum to the LH IWE port and observe vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL a new IWE. REFER to Section 204-00 . GO to A19 . **No** GO to A22 .
A22 CHECK THE IWE VACUUM SUPPLY TUBE • Disconnect both vacuum lines from the IWE solenoid. • Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE vacuum circuit and observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL new vacuum lines as necessary. GO to A19 . **No** GO to A23 .
A23 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 4x2 MODE • Connect a hand-held vacuum gauge to the LH IWE vacuum supply tube. • **NOTE:** The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage. • Start the engine. • Select 4x2 mode while observing the vacuum gauge. • Repeat these steps for the RH IWE. • **Are the vacuum readings greater than 254 mm (10 in) Hg?**	**Yes** GO to A26 . **No** INSTALL new vacuum lines as necessary. GO to A19 .
A24 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION • Disconnect both vacuum lines from the IWE solenoid. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Disconnect the vacuum line at the LH IWE. • Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line. • **Did the vacuum pump draw a vacuum on the LH IWE vacuum line?**	**Yes** INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the vacuum line to the LH IWE. GO to A25 .

A25 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION	
• Disconnect the larger vacuum line at the RH IWE. • Connect a vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line. • **Did the vacuum pump draw a vacuum on the RH IWE vacuum line?**	**Yes** INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the vacuum line to the RH IWE. GO to A26 .
A26 CHECK THE LH IWE OPERATION	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to section Section 100-02 . • Connect a vacuum pump to the larger IWE vacuum port. • Observe the LH halfshaft while rotating the LH front tire. Apply and release vacuum to manually engage and disengage the LH IWE. • **Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**	**Yes** GO to A27 . **No** INSTALL a new LH IWE. CLEAR the DTCs. REPEAT the self-test.
A27 CHECK THE RH IWE OPERATION	
• Connect a vacuum pump to the larger RH IWE vacuum port. • Observe the RH halfshaft while rotating the RH front tire. Apply and release vacuum to manually engage and disengage the LH IWE. • **Did the RH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**	**Yes** CLEAR the DTC(s). REPEAT the self-test. Go To Pinpoint Test H . **No** INSTALL a new RH IWE. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Vehicle Does Not Shift Between Two Wheel Drive (2WD) and Four Wheel Drive (4WD) Modes Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The mode select switch (MSS) communicates the operator's choice to the four wheel drive (4WD) control module. The 4WD control module then controls the transfer case clutch, transfer case motor and integrated wheel ends (IWEs) as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary inputs and outputs of the 4WD control module, components of the transfer case, IWE components and halfshafts. Check all circuits for opens and shorts to power or ground.

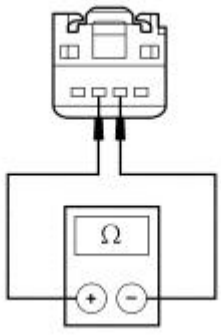
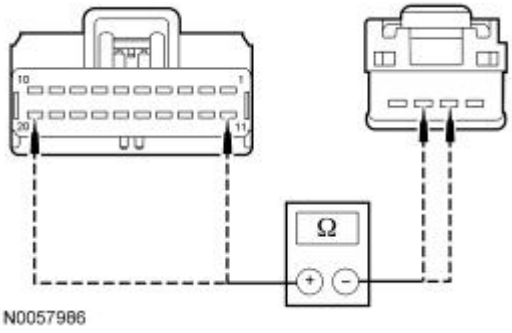
Possible Causes

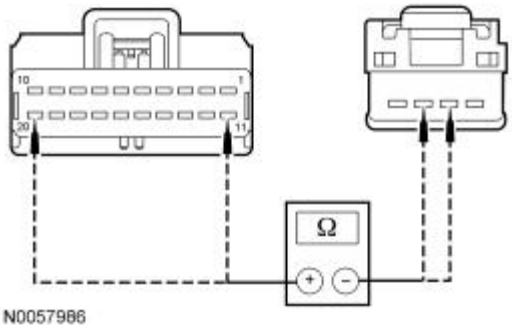
- 4WD indicator
- Ignition switch and/or circuity
- Transfer case clutch
- Transfer case
- Circuit CCF03 (GY/BN)
- Powertrain control module (PCM)
- Instrument cluster (IC)
- 4WD control module
- Controller area network (CAN) communication network

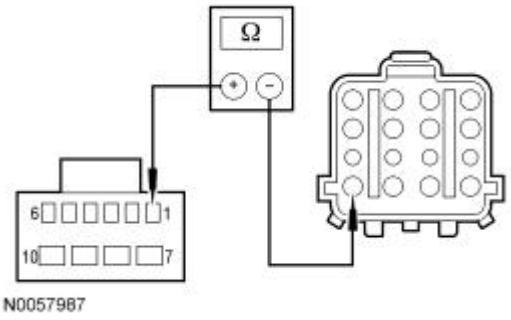
PINPOINT TEST B: THE VEHICLE DOES NOT SHIFT BETWEEN TWO WHEEL DRIVE (2WD) AND

FOUR WHEEL DRIVE (4WD) MODES CORRECTLY

Test Step	Result / Action to Take
B1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs) • Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module DTC Chart for diagnosis. **No** GO to B2 .
B2 CHECK THE 4x4 MODE INDICATOR • Select 4x4 mode and observe the instrument cluster. • **Does the instrument cluster indicator lamp indicate 4x4 mode?**	**Yes** GO to B8 . **No** GO to B3 .
B3 CHECK THE IGNITION SWITCH STATUS PID • Key in ON position. • Monitor the ignition switch status PID. • **Do the ignition switch PIDs match the ignition switch positions?**	**Yes** GO to B4 . **No** CHECK the ignition switch and the CAN communication network for faults. REFER to Section 413-00 and Section 418-00 . After the fault is repaired, CLEAR the DTC. REPEAT the self-test.
B4 CHECK THE MODE SELECT SWITCH (MSS) POSITION PID • Monitor each MSS PID while cycling through each MSS position. • **Does each MSS PID agree with each switch position?**	**Yes** GO to B7 . **No** GO to B5 .
B5 CHECK THE MSS RESISTANCE VALUES • Key in OFF position. • Disconnect: MSS C284. • Measure the resistance between MSS C284, terminals 2 and 3, while rotating the switch through all positions. Refer to the following chart. **Mode Select Switch (MSS) Position** / **Resistance** 4x2 / 39 ohms 4x4 AUTO / 237 ohms 4x4 / 536 ohms	**Yes** GO to B6 . **No** INSTALL a new MSS. CLEAR the DTCs. REPEAT the self-test.

 A0049121 • **Are the resistance values within specification?**	
B6 CHECK CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN • Measure the resistance between MSS C284-2, harness side and 4WD control module C281a-11, harness side, circuit CCF13 (WH/BU).  N0057986 • Measure the resistance between MSS C284-3, harness side and 4WD control module C281a-20, harness side, circuit RCF13 (WH/BN). • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
B7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the clutch duty cycle PID read 0% at closed throttle?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation.
B8 CHECK FOR 4x4 MODE WIND-UP • Switch 4x4 mode. • Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to B13 . **No** GO to B9 .
B9 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID AT WIDE OPEN THROTTLE (WOT) • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID at wide open throttle (WOT), engine off, key on. • **Does the clutch duty cycle PID read 98% at WOT?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No**

	GO to B10 .
B10 CHECK THE ACCELERATOR PEDAL POSITION OUTPUT PID • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move the accelerator pedal from closed throttle to WOT and observe the output PID. • **Does the throttle output PID vary between 0% at closed throttle and 100% at WOT?**	**Yes** GO to B11 . **No** Diagnose the powertrain control module (PCM). REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual and the CAN communication network, REFER to Section 418-00 .
B11 CHECK FOR TRANSFER CASE CLUTCH ENGAGEMENT WITH ACTIVE COMMANDS • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Using the active commands, engage the transfer case clutch to 100% while monitoring the transfer case clutch duty cycle PWM PID. • **Does the clutch duty cycle PID read 100%?**	**Yes** CHECK transfer case. REFER to Section 308-07B . **No** GO to B12 .
B12 CHECK CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN • Measure the resistance between MSS B284-2, harness side and 4WD control module C281a-11, harness side, circuit CCF13 (WH/BU).  N0057986 • Measure the resistance between MSS B284-3, harness side and 4WD control module C281a-20, harness side, circuit RCF13 (WH/BN). • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
B13 CHECK 4WD INDICATOR IN 4x4 AUTO MODE • Select 4x4 AUTO mode and observe the instrument cluster. • **Does the instrument cluster indicator lamp indicate 4x4 AUTO mode?**	**Yes** GO to B14 . **No** Go To Pinpoint Test C .
B14 CHECK FOR WIND-UP IN 4x4 AUTO MODE • Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to B15 . **No** The system is operating correctly.
B15 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID • Enter the following diagnostic mode on the diagnostic	**Yes**

tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID at closed throttle, engine off, key on. • **Does the PID indicate 2 to 4% clutch application at closed throttle?**	GO to B16 . **No** GO to B18 .
B16 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)	
• Use the scan tool active commands to energize the transfer case clutch to 4%. • Back-probe transfer case C350-16 circuit CCF03 (GY/BN), harness side. • Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter. • **Is the voltage approximately 0.2 to 0.4 volt?**	**Yes** END the active command. CHECK the transfer case. REFER to Section 308-07B . **No** GO to B17 .
B17 CHECK CIRCUITS CCF03 (GY/BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Transfer Case C350. • Disconnect: 4WD Control Module C281b. • Measure the resistance between 4WD control module C281b-1, harness side and transfer case C350-16, harness side circuit CCF03 (GY/BN).  N0057987 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL as new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B18 CHECK THE WHEEL SPEED PIDs	
• While driving the vehicle at 30 km/h (18 mph), monitor the wheel speed PIDs. • Compare the speedometer reading to the wheel speed PIDs. • **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to B19 . **No** CHECK the anti-lock brake system (ABS). REFER to Section 206-09 .
B19 CHECK THE THROTTLE POSITION OUTPUT PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move the accelerator pedal from closed throttle to WOT and observe the throttle position output PID. • **Does the throttle output PID vary between 0% at closed throttle and 100% at WOT?**	**Yes** INSTALL as new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** DIAGNOSE the powertrain control module (PCM). REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual and the CAN communication network, REFER to Section 418-00 .

Pinpoint Test C: Four Wheel Drive (4WD) Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

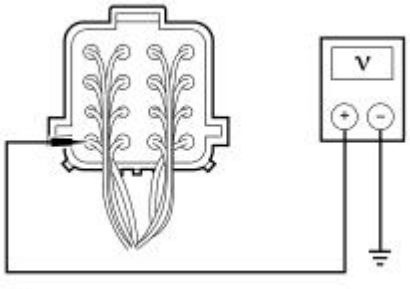
When the operator selects a transfer case mode from 4x2 mode, the 4 wheel drive (4WD) control module engages a clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a mechanical engagement of the transfer case. The 4WD control module also removes the ground path from the integrated wheel end (IWE) solenoid, which removes vacuum from the IWEs, allowing them to engage the front axle shaft. Systematically check the necessary inputs and outputs at the 4WD control module, internal components of the transfer case, IWE components and drive axles.

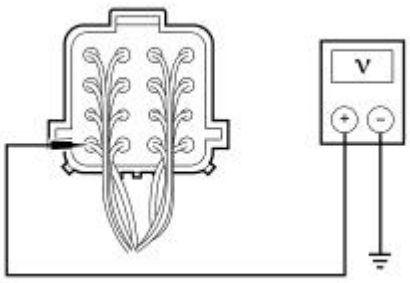
Possible Causes

- Transfer case clutch coil
- Transfer case
- 4WD control module
- Front axle assembly
- Circuit CCF03 (GY/BN)
- Circuit 92 (LB/YE)

PINPOINT TEST C: FOUR WHEEL DRIVE (4WD) DOES NOT ENGAGE AT SPEED CORRECTLY

Test Step	Result / Action to Take
C1 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the 4WD control module self-test. • **Are any DTCs retrieved?**	**Yes** If DTC P1825, GO to C11 . If DTC P1826, GO to C13 . If DTC P1824 and/or P1827, GO to C10 . For all other DTCs, GO to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart. **No** GO to C2 .
C2 CHECK 4x4 MODE ENGAGEMENT AT REST	
• Switch the mode select switch (MSS) from 4x2 mode to 4x4 mode. • While on the road, drive the vehicle in turns and check for wind-up. • **Does 4x4 mode engage at rest correctly?**	**Yes** GO to C3 . **No** Go To Pinpoint Test I .
C3 CHECK 4x2 MODE TO 4x4 MODE SHIFT AT SPEED	
• Switch the MSS to 4x2 mode. • Key in ON position. • Drive the vehicle and carry out a 4x2 mode to 4x4 mode shift while driving approximately at 16 km/h (10 mph). • Stop the vehicle, shift to 4x2 mode , drive the vehicle and carry out a 4x2 mode to 4x4 mode shift while driving at approximately 64 km/h (40 mph). • **Does 4x4 mode engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?**	**Yes** Go To Pinpoint Test H . **No** GO to C4 .
C4 CHECK THE TRANSFER CASE CLUTCH COIL LOCKUP	
• Connect the diagnostic tool. • Key in ON position.	**Yes** GO to C5 .

• Switch the MSS to 4x4 AUTO mode. • Using the scan tool, command the transfer case clutch to 98%. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate when the rear driveshaft is rotated?**	**No** GO to C8 .
C5 CHECK THE TRANSFER CASE CLUTCH COIL RELEASE	
• Using the scan tool, command the transfer case clutch to 0%. • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate when the rear driveshaft is rotated?**	**Yes** GO to C14 . **No** GO to C6 .
C6 CHECK THE TRANSFER CASE SYNCHRONIZATION (ON A HOIST)	
• Start the engine, shift the MSS to 4x2 mode. • Place the transmission in DRIVE and increase speed to between 16 km/h (10 mph) and 24 km/h (15 mph). • While observing the front driveshaft, switch the MSS to 4x4 mode. • **Did the front driveshaft start to spin?**	**Yes** GO to C7 . **No** GO to C14 .
C7 CHECK THE TRANSFER CASE DISENGAGEMENT	
• Switch the MSS to 4x2 mode. • Rotate the rear driveshaft while observing the front driveshaft. • **Did the front driveshaft rotate?**	**Yes** GO to C14 . **No** Go To Pinpoint Test H .
C8 CHECK CIRCUIT CCF03 (GY/BN) FOR VOLTAGE	
• Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).  N0037381 • While active commanding 98%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and the transfer case housing. • **Is the voltage greater than 9 volts?**	**Yes** END the active command. INSTALL a new transfer case synchronization clutch. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C9 .
C9 CHECK THE TRANSFER CASE-TO-CHASSIS GROUND	
• Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).	**Yes** END the active command. REPAIR the transfer case ground connection between the transfer case and the chassis. CLEAR the DTCs. REPEAT the self-test.



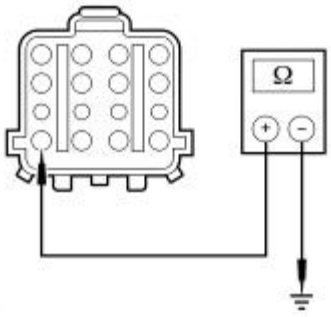
N0037381

- While still in active command 98%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and chassis ground.
- **Is the voltage greater than 9 volts?**

No
END the active command. GO to C10 .

C10 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO GROUND

- Disconnect: Transfer Case C350.
- Disconnect: 4WD Control Module C281b.
- Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN) and ground.



N0057998

- **Is the resistance greater than 10,000 ohms?**

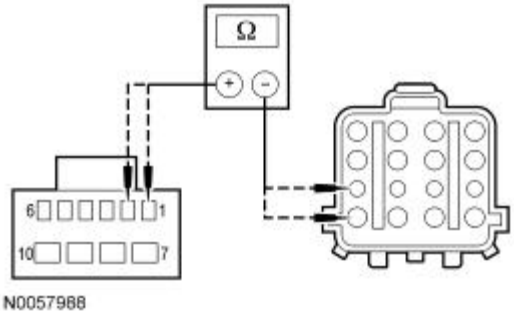
Yes
GO to C11 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C11 CHECK CIRCUITS CCF03 (GY/BN) AND CCF04 (VT/OG) FOR AN OPEN

- Key in OFF position.
- Measure the resistance of the following circuits between 4WD control module C281b, harness side and transfer case C350, harness side:

Circuit	C281b	C350
CCF03 (GY/BN)	1	16
CCF04 (VT/OG)	2	12

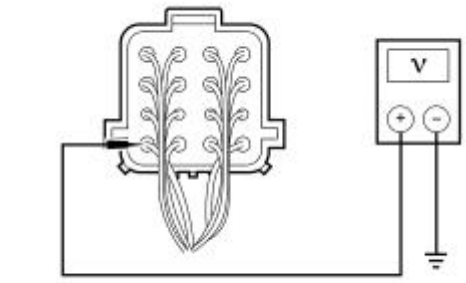
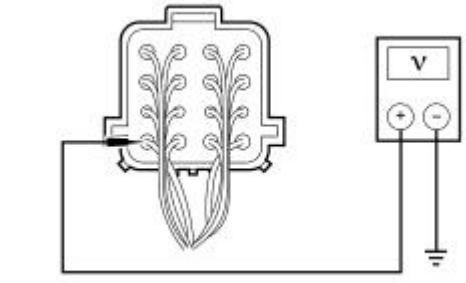


N0057988

- **Are the resistances less than 5 ohms?**

Yes
GO to C12 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C12 CHECK CIRCUIT CCF03 (GY/BN) FOR VOLTAGE	
• Connect: Transfer Case C350. • Connect: 4WD Control Module C281b. • Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).  N0037381 • While in active command greater than 10%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground. • **Is voltage present?**	**Yes** END active command. GO to C13 . **No** END active command. INSTALL a new transfer case synchronization clutch. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test.
C13 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO POWER	
• Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).  N0037381 • While in active command 0%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground. • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C14 .
C14 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION	

• Disconnect the 4WD control module connectors C281a and C281b.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect the 4WD control module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Four Wheel Drive (4WD) System Jumps Out Of Gear

Normal Operation

Once the 4 wheel drive (4WD) system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected position systematically check the 4WD system components.

Possible Causes

- Integrated wheel end (IWE) vent line(s)
- Mode select switch (MSS)
- Transfer case

PINPOINT TEST D: THE FOUR WHEEL DRIVE (4WD) SYSTEM JUMPS OUT OF GEAR

Test Step	Result / Action to Take
D1 CHECK FOR OBSTRUCTED IWE VENT LINES • With the vehicle in NEUTRAL, position in on a hoist. Refer to Section 100-02 . • **NOTE:** The integrated wheel end (IWE) vent port is the smaller of the 2 vacuum ports. • Disconnect the LH IWE line from the vent port. • Attach a vacuum pump to the IWE vent line. • Attempt to draw and hold a vacuum. Repeat Steps 1, 2 and 3 for the RH side of the vehicle. • **Can a vacuum be held on either IWE vent line?**	**Yes** INSTALL new IWE vent lines as necessary. **No** GO to D2 .
D2 VERIFY THE CONCERN • Drive the vehicle and attempt to duplicate the concern. • **Is the concern an uncommanded range shift (in or out of low range)?**	**Yes** GO to D5 . **No** GO to D3 .
D3 CHECK THE MODE SELECT SWITCH (MSS) POSITION PIDS • Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Drive the vehicle. • Dynamically monitor the MSS PID while driving the vehicle in each shift position. • **Does the MSS PID always agree with the switch position?**	**Yes** GO to D4 . **No** Go To Pinpoint Test C .
D4 CHECK FOR DTCs • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** Go To Pinpoint Test H .
D5 CHECK THE 4WD INDICATORS	

• Stop the vehicle. • Transmission in NEUTRAL. • Depress the brake pedal. • Observe the 4WD indicators in the instrument cluster while cycling through each MSS position. • **Do the 4WD indicators match MSS switch positions?**	**Yes** GO to D3 . **No** GO to D6 .
D6 CHECK FOR DTCs	
• Transmission in PARK. • Release the brake pedal. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** CHECK the transfer case fluid level. REFER to Section 308-07B . If the fluid level is okay, CHECK for internal transfer case faults. REFER to Section 308-07B .

Pinpoint Test E: Straightline Driveline Wind-up

Normal Operation

In order for the 4 wheel drive (4WD) system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST E: STRAIGHTLINE DRIVELINE WIND-UP

NOTE: 4x4 mode is not intended for driving on hard/dry surfaces; using 4x4 mode while driving on these surfaces may produce noise like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
E1 VERIFY THE CONCERN	
• Drive the vehicle and switch from 4x4 AUTO mode to 4x4 mode. There should be minimal wind-up in 4x4 mode during straight line maneuvers (wind-up in turns is normal; 4x4 mode is not intended for driving on hard/dry surfaces). • **Is excessive wind-up present?**	**Yes** GO to E2 . **No** RETURN the vehicle to the customer. ADVISE about correct 4WD system operation and normal vehicle behavior.
E2 CHECK FOR MATCHING WHEEL AND TIRE SIZES	
• Check the wheel and tire sizes. • **Do the 4 wheel and tire sizes match?**	**Yes** GO to E3 . **No** ADVISE the customer that 4WD systems

	require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
E3 CHECK TIRE WEAR	
• Check each of the 4 tires for wear. • **Are the 4 tires worn evenly?**	**Yes** GO to E4 . **No** ADVISE the customer that AWD systems require 4 matched, correctly inflated, correctly rotated tires to operate correctly.
E4 CHECK TIRE INFLATION PRESSURE	
• Check the inflation pressure in each tire. Refer to vehicle certification label. • **Are the tire inflation pressures correct?**	**Yes** GO to E5 . **No** ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that AWD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
E5 CHECK THE FRONT AND REAR AXLE RATIOS	
• Check that front and rear axle ratios match. Refer to Section 205-00 . • **Do the front and rear axle ratios match?**	**Yes** RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior. **No** CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to Section 205-02 and Section 205-03 .

Pinpoint Test F: Four Wheel Drive (4WD) System Functional Test

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the 4 wheel drive (4WD) system is in 4x4 mode, all 4 wheels rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4WD system to operate correctly, each wheel/tire assembly must have matching sizes, and the front and rear axle ratios must match.

Possible Causes

- 4x4 indicator
- 4WD control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST F: FOUR WHEEL DRIVE (4WD) SYSTEM FUNCTIONAL TEST

NOTE: 4x4 mode is not intended for driving on hard/dry surfaces; using 4x4 mode while driving on these

surfaces may produce noise like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
F1 CHECK 4x4 AUTO MODE OPERATION • Transmission in NEUTRAL. • Select 4x4 AUTO mode. • **Do the 4WD indicators turn off?**	**Yes** GO to F4 . **No** GO to F2 .
F2 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs) • Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to F3 .
F3 CHECK FOR WIND-UP IN 4x2 MODE • Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test B . **No** Go To Pinpoint Test C .
F4 CHECK FOR WIND-UP IN 4x2 MODE • Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** REPAIR the transfer case. REFER to Section 308-07B . **No** GO to F5 .
F5 CHECK 4x4 AUTO MODE OPERATION • Select 4x4 AUTO mode. • **Does the 4x4 AUTO indicator illuminate correctly?**	**Yes** GO to F8 . **No** GO to F6 .
F6 CHECK FOR DTCs • Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to F7 .
F7 CHECK FOR WIND-UP IN 4x4 AUTO MODE • Drive the vehicle on a dry, hard surface, executing turns while applying the throttle. • **Is wind-up present?**	**Yes** GO to F8 . **No** GO to F9 .
F8 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID • Enter the following diagnostic mode on the	**Yes**

diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the PID indicate 2 to 10% clutch application at closed throttle?**	GO to F9 . **No** GO to F10 .
F9 CHECK FOR WIND-UP IN 4x4 AUTO MODE WITH 100% CLUTCH	
• Using the scan tool, command the clutch duty cycle to 100%. • Drive the vehicle on a dry, hard surface, executing turns. • **Is wind-up present?**	**Yes** GO to F10 . **No** CHECK the transfer case. REFER to Section 308-07B .
F10 CHECK SHAFT SPEED PIDs	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case front and rear shaft speeds. • Drive the vehicle 30 km/h (18 mph). • Record and compare the front wheel speed and the rear wheel speed. • **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**	**Yes** GO to F11 . **No** CHECK the anti-lock brake system (ABS) . REFER to Section 206-09 and VERIFY that the 4 road tire sizes match.
F11 CHECK THE THROTTLE POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the throttle position PID from the 4WD control module. • Ignition ON, engine OFF. • Slowly move throttle from closed throttle to WOT and observe the 4WD control module throttle sensor PID. • **Does the PID value vary between 0% at closed throttle and 100% at WOT?**	**Yes** GO to F12 . **No** CHECK the throttle position sensor and/or powertrain control module (PCM). REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
F12 CHECK 4x4 MODE OPERATION	
• Select 4x4 mode. • **Does the 4x4 mode indicator illuminate correctly?**	**Yes** GO to F15 . **No** GO to F13 .
F13 CHECK FOR DTCs	
• Transmission in PARK. • Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs retreived?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to F14 .
F14 CHECK FOR WIND-UP IN 4x4 MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test C . **No**

	Go To Pinpoint Test B .
F15 CHECK FOR STRAIGHTLINE WIND-UP IN 4x4 MODE	
• Drive the vehicle on a dry, hard surface. • **Is straightline wind-up present?**	**Yes** Go To Pinpoint Test E . **No** GO to F16 .
F16 CHECK FOR 4x4 MODE WIND-UP IN TURNS	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** GO to F17 . **No** Go To Pinpoint Test B .
F17 CHECK 4x4 MODE TO 4X2 MODE SHIFT	
• With the vehicle at rest, brake applied and transmission in NEUTRAL, switch the mode select switch (MSS) from 4x4 mode to 4x2 mode. • **Do the 4WD indicators turn off?**	**Yes** GO to F20 . **No** GO to F18 .
F18 CHECK FOR DTCs	
• Transmission in PARK. • Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to F19 .
F19 CHECK FOR WIND-UP IN 4x2 MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test B . **No** Go To Pinpoint Test C .
F20 CHECK FOR TRANSFER CASE DISENGAGEMENT	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate?**	**Yes** CHECK the transfer case. REFER to Section 308-07B . **No** GO to F21 .
F21 CHECK FOR LH AND RH IWE DISENGAGEMENT	
• **NOTE:** The engine must be at idle during the following steps. • Start the engine and allow it to idle. • Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and universal joint. • Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and universal joint.	**Yes** Go To Pinpoint Test D . **No** GO to F22 .

• **Did either front axle shaft and universal joint rotate?**	
F22 CHECK FOR IWE VACUUM LEAKS	
• Key in OFF position. • Disconnect both vacuum lines from the IWE solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** CHECK the IWE and related components for leaks. Go To Pinpoint Test D . **No** GO to F23 .
F23 CHECK 4x2 MODE TO 4x4 MODE SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)	
• Select 4x2 mode. • Drive the vehicle on the road and shift from 4x2 mode to 4x4 mode while driving above 32 km/h (20 mph). • **Does the transfer case shift to 4x4 mode satisfactorily?**	**Yes** The 4WD system is functioning correctly. **No** Go To Pinpoint Test E .

Pinpoint Test G: The Four Wheel Drive (4WD) Indicators Do Not Operate Correctly/Do Not Operate

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The 4 wheel drive (4WD) system status is transmitted to the instrument cluster from the 4WD control module through the controller area network (CAN) to the powertrain malfunction indicator. A steady indicator displays if the vehicle is in 4x4 AUTO or 4x4 (HIGH) mode, according to the driver selection. A 4WD system fault condition will illuminate the powertrain malfunction indicator. The powertrain malfunction indicator includes other general powertrain system failures. For information about CAN, refer to Section 418-00 .

Possible Causes

- Instrument cluster (IC)
- 4WD system fault
- CAN circuits
- 4WD control module

PINPOINT TEST G: THE FOUR WHEEL DRIVE (4WD) INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

Test Step	Result / Action to Take
G1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to G2 .

G2 CHECK FOR INCORRECT 4WD INDICATOR ILLUMINATION	
• Select 4x2 mode. • Observe the instrument cluster. • **Do any 4WD indicators illuminate?**	**Yes** GO to G3 . **No** GO to G4 .
G3 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the clutch duty cycle PID read 0% at closed throttle?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test B .
G4 CHECK THE 4x4 AUTO INDICATOR	
• Select 4x4 AUTO mode with the engine running and the vehicle at rest. • Observe the instrument cluster. • **Does the 4x4 AUTO indicator illuminate?**	**Yes** GO to G6 . **No** GO to G5 .
G5 CHECK THE 4x4 MODE INDICATOR	
• Select 4x4 HIGH mode with the engine running and the vehicle at rest. • Observe the instrument cluster. • **Does the 4x4 AUTO indicator illuminate?**	**Yes** GO to G8 . **No** GO to G7 .
G6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID. • **Does the clutch duty cycle PID read 2% at closed throttle and the transfer case shift motor position PID indicate 4x4 AUTO?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test B .
G7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID. • **Does the clutch duty cycle PID read 2% at closed throttle and the transfer case shift motor position PID indicate 4x4 AUTO?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test A .
G8 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID.	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No**

• **Does the clutch duty cycle PID read 12% at closed throttle and the transfer case shift motor position PID indicate 4x4 mode?**	Go To Pinpoint Test B .

Pinpoint Test H: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Normal Operation

When the vehicle is operating in 4x4 AUTO mode, all 4 wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4 wheel drive (4WD) system to operate correctly, each wheel/tire assembly must have matching sizes and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST H: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: 4x4 mode is not intended for driving on hard/dry surfaces; using 4x4 mode while driving on these surfaces may produce noise like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
H1 VERIFY THE CONCERN	
• Test drive the vehicle on a straight stretch of road in 4x4 AUTO mode. • Drive the vehicle through turns and parking lot maneuvers. • **Does the vehicle bind, pulsate or shudder?**	**Yes** If the problem occurs in 4x4 AUTO mode, GO to H2 ; in 4x4 mode, binding is a normal condition. **No** Go To Pinpoint Test E .
H2 CHECK THE 4x4 INDICATOR	
• Review the test drive notes. • **Did the 4x4 indicator or the powertrain malfunction indicator illuminate?**	**Yes** If the powertrain malfunction indicator is illuminated, GO to H4 . If the 4x4 indicator stayed illuminated, GO to H3 . **No** GO to H5 .
H3 VERIFY THE FAULT	
• Review the test drive notes. • **Was 4x4 mode selected when the indicators were illuminated?**	**Yes** The system is functioning correctly. **No** The fault may have been caused by an intermittent, uncommanded or autolock shift. TEST the system for normal operation. Go To Pinpoint Test E .
H4 CHECK FOR DIAGNOSTIC TROUBLE	

CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to H5 .
H5 VERIFY THE CONCERN	
• Test drive the vehicle on a straight stretch of road and in turns, and shift the transfer case through each mode. Record any fault conditions. • **Is the concern present?**	**Yes** **Vehicles with limited slip rear differential:** The condition may be normal and no repair action is necessary. CHECK the rear axle to verify. REFER to Section 205-02 . **Vehicles without limited slip rear differential:** INSPECT the driveline components for damage or wear. REFER to Inspection and Verification in this section. **No** GO to H6 .
H6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Clear the DTCs. • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID at closed throttle, engine OFF, ignition ON. • **Is the clutch duty cycle greater than 10%?**	**Yes** GO to H7 . **No** CHECK the transfer case. REFER to Section 308-07B .
H7 CHECK THE SHAFT SPEED PIDs	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • While driving the vehicle at 30 km/h (18 mph), monitor the shaft speed PIDs. • Compare the speedometer reading to the shaft speed PIDs. • **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to H8 . **No** VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the anti-lock brake system (ABS) for faults. REFER to Section 206-09 .
H8 CHECK THE THROTTLE POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move throttle from closed throttle to wide open throttle (WOT) and observe the throttle position PID. • **Does the value vary between 0% at closed throttle and 100% at WOT?**	**Yes** GO to H9 . **No** CHECK the throttle position sensor and/or PCM for faults. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
H9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 .	**Yes** INSTALL a new 4WD control module. REFER to

• Rotate the front driveshaft by hand. • **Does the front driveshaft rotate freely (does it require less than 45 Nm [33 lb-ft] to rotate)?**	Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation. **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.

Four Wheel Drive (4WD) Systems — 2-Speed Torque-On-Demand

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Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST1177-A	88 Digital Multimeter or equivalent 105-R0053
ST2574-A	Flex Probe Kit 105-R025B

Principles of Operation

The Expedition is equipped with an automatic electronic-shift system that allows the operator to choose between 2 wheel drive (2WD) and 3 different 4 wheel drive (4WD) modes. The operator can switch between two-wheel drive (2H) mode and 4x4 AUTO (4A) mode or 4x4 (4H) mode at any speed below 88 kph (55 mph). The operator can switch between 4x4 AUTO (4A) mode and 4x4 (4H) mode at any speed. To engage or disengage 4L mode, the vehicle speed must be less than 3 km/h (2 mph), the brake pedal must be pressed and the transmission must be in NEUTRAL.

Wheel slip is sensed by monitoring the average front and rear wheel speeds. Based on steering wheel angle (SWA), accelerator pedal position and wheel slip, a pulse width modulated (PWM) signal is transmitted to the transfer case as torque is required.

The 4WD control module will provide the anti-lock brake system (ABS) with current clutch duty cycle and whether or not ABS may command the clutch duty cycle.

The brake subsystem sends the following information signals to the 4WD system:

- Occurrences of brake events and failures. Refer to Section 206-09 .

- Steering wheel angle status. Refer to Section 206-09 .
- Wheel speeds. Refer to Section 206-09 .

A concern with any of the above listed brake system signals will affect operation of the 4WD system.

The accelerator pedal position output signal is provided to the 4WD control module from the powertrain control module (PCM). This signal is used by the 4WD control module in controlling the transfer case clutch.

The shift motor sense plate, an integral part of the shift motor assembly, informs the 4WD control module of the transfer case position.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (2H, 4A and 4H) and LOW range (4L mode) positions.

The 4WD control module sends a duty cycle command to the clutch coil which activates the clutch within the transfer case.

The 4WD control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4WD control module activates the transfer case clutch a minimum duty cycle (percentage of time the clutch is turned on), which allows for the slight difference between the front and rear driveshafts which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4WD control module will increase the duty cycle in order to prevent or control slip:

- Slip is detected
- Heavy acceleration (accelerator pedal position)
- Straight-ahead steering wheel angle (SWA)

Feature inputs:

- Mode select switch (MSS)
- Accelerator pedal position (from the PCM)
- Steering wheel angle (from the anti-lock brake system [ABS] module)
- Transmission range (TR) position (from the transmission control module [TCM])
- Transmission output torque (from the PCM)
- Wheel speed signal (transmitted from the ABS module)
- Accelerator pedal position (from the PCM)
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature outputs:

- PWM signal to the transfer case clutch
- 4WD message center indicators
- Transfer case shift motor outputs

Shifts between 4A and 4H modes can be made at any speed. Listed below are the inputs and outputs needed by the 4WD control module to execute a change between any of these modes.

Feature inputs:

- Wheel speed signal
- Accelerator pedal position (from the PCM)
- MSS

Feature outputs:

- Transfer case shift motor outputs
- PWM signal to the transfer case clutch
- 4WD message center indicators

When shifting into or out of 4L mode, the 4WD control module requires that the vehicle speed is less than 3 km/h (2 mph) and the transmission is in NEUTRAL.

Feature inputs:

- Accelerator pedal position (from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to the transfer case clutch

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
● Halfshafts ● Integrated wheel ends (IWEs) ● Shift motor ● Driveshaft and universal joints ● Vacuum leaks ● Fluid leaks ● Matching tire sizes ● Transfer case	● Power distribution box (PDB) fuses: ■ 35 (20A) ■ 43 (20A) ■ 75 (5A) ● Smart junction box (SJB) mini fuse 35 (10A) ● Wiring harness ● Mode select switch (MSS) ● Synchronization clutch ● Connector(s) ● IWE vacuum solenoid ● Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. **NOTE:** Before carrying out the self-test, make sure that:
   - ignition is in RUN.
   - 4A mode is selected (or the last mode selected before starting the self-test).

   If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the DTCs and carry out the self-test diagnostics for the 4WD control module.

9. If the DTCs retrieved are related to the concern, go to the Four Wheel Drive (4WD) Control Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B1317	Battery Voltage High	Four Wheel Drive (4WD) Control Module	CHECK the battery and charging system for faults. REFER to Section 414-00 . CLEAR the DTC. REPEAT the self-test.
B1318	Battery Voltage Low	4WD Control Module	CHECK the battery and charging system for faults. REFER to Section 414-00 . CLEAR the DTC. REPEAT the self-test.
B1342	ECU is Defective	4WD Control Module	CLEAR the DTC. REPEAT the self-test. If DTC B1342 is retrieved, INSTALL a 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test.
C1979	IWE Solenoid Circuit Failure	4WD Control Module	Go To Pinpoint Test J .
C1980	IWE Solenoid Circuit Short to Battery	4WD Control Module	Go To Pinpoint Test J .
P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	4WD Control Module	Go To Pinpoint Test J .
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test J .
P1824	Transmission 4-Wheel Drive Clutch Relay Circuit Failure	4WD Control Module	Go To Pinpoint Test L .

P1825	Transmission 4-Wheel Drive Clutch Relay Open Circuit	4WD Control Module	Go To Pinpoint Test L .
P1826	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4WD Control Module	Go To Pinpoint Test L .
P1827	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test L .
P1849	Transmission Transfer Case Contact Plate A Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test K .
P1853	Transmission Transfer Case Contact Plate B Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test K .
P1857	Transmission Transfer Case Contact Plate C Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test K .
P1861	Transmission Transfer Case Contact Plate D Short Circuit to Ground	4WD Control Module	Go To Pinpoint Test K .
P1867	Transmission Transfer Case Contact Plate General Circuit Failure	4WD Control Module	Go To Pinpoint Test K .
P1891	Transmission Transfer Case Contact Plate Ground Return Open Circuit	4WD Control Module	Go To Pinpoint Test K .
P183B	4-Wheel Drive Clutch Coil Return Circuit Open	4WD Control Module	Go To Pinpoint Test L .
U0100	Lost Communication with PCM	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U0101	Lost Communication with Transaxle Control Module	Transmission Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U0121	Lost Communication with ABS Module	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U2023	External Node Fault	4WD Control Module	DIAGNOSE the module communication network. REFER to Section 418-00 .
U2050	Application Not Programmed	4WD Control Module	Method 3 programming fault. REFER to Section 418-00 for 4WD control module (PCM) programming information.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the four wheel drive (4WD) control module	• Scan tool • Data link connector (DLC) • Four wheel	• REFER to Section 418-00 .

	drive (4WD) control module • Circuitry	
• The 4WD indicators do not operate correctly/do not operate	• Instrument cluster • 4WD system fault • Controller area network (CAN) communication network • 4WD control module • Ignition switch and/or circuitry	• Go To Pinpoint Test P .
• The vehicle does not shift between two wheel drive (2WD) and 4WD modes correctly	• Mode select switch (MSS) • Transfer case • Transfer case clutch • Integrated wheel ends (IWEs) • 4WD control module • Circuitry	• Go To Pinpoint Test J .
• The vehicle does not shift between AWD mode and 4H mode correctly	• MSS • Transfer case • Circuitry • 4WD control module	• Go To Pinpoint Test L .
• Vehicle has no torque or inadequate torque at rear wheels in AWD mode	• Transfer case • Circuitry • 4WD control module	• Go To Pinpoint Test O .
• The vehicle does not shift between 4H and 4L modes correctly	• Transfer case • MSS • 4WD control module • Transmission drag torque	• Go To Pinpoint Test K .
• Four wheel drive (4WD) does not engage at speed correctly	• Transfer case clutch coil • 4WD control module • IWEs	• Go To Pinpoint Test L .
• The front axle does not engage/disengage correctly/makes noise in 2H under heavy throttle	• MSS • IWEs • IWE solenoid • Vacuum leaks • 4WD control module • Front halfshaft • Vacuum check valve(s)	• Go To Pinpoint Test I .
• The four wheel drive (4WD) system jumps out of gear	• Transfer case • IWE vent • MSS	• Go To Pinpoint Test M .
• Straightline driveline	• Tire inflation	• Go To Pinpoint Test N .

wind-up	pressure • Tire and wheel size • Tire wear • Axle ratio	
• Grinding noise during four wheel drive (4WD) system engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed	• INSTALL the S-spring in the front differential. REFER to Section 205-03 for S-spring installation.
• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct.
	• Tire tread wear	• CHECK tire tread wear to see if there is more than 0.15 mm (0.06 in) difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again.
	• Internal components	• OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission. REFER to Section 307-01B . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to Section 308-07B . CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary.
	• Fluid level	• FILL with automatic transmission fluid. REFER to Section 308-07B .
• Unable to duplicate customer concern	• 4WD system and/or related components	• CARRY OUT the torque-on demand Functional Test. Go To Pinpoint Test O .
• Vehicle binds in a turn/resists turning/pulsates in a straightline in 4WD mode	• Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Accelerator pedal position failure • Transfer case clutch • Circuitry • 4WD control module	• Go To Pinpoint Test Q .

Pinpoint Tests

Pinpoint Test I: The Front Axle Does Not Engage/Disengage Correctly/Makes Noise in 2H Mode Under Heavy Throttle

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

In 2H mode, the 4 wheel drive (4WD) control module supplies a ground path to the integrated wheel end (IWE) solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In 4A, 4H and 4L modes, the 4WD control module does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the 4WD control module, internal components of the transfer case, mode select switch (MSS), IWE components and drive axles.

Possible Causes

- MSS
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- 4WD control module
- Circuit CCF05 (BN/BU)
- Circuit CBB75A (YE/GY)
- Battery junction box (BJB) fuse 75 (5A)

PINPOINT TEST I: THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY/MAKES NOISE IN 2H MODE UNDER HEAVY THROTTLE

Test Step	Result / Action to Take
I1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Carry out the on-demand self-test. • **Are DTCs C1979 or C1980 present?**	**Yes** If DTC C1979 is retrieved, GO to I13 . If DTC C1980 is retrieved, GO to I15 . **No** GO to I2 .
I2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS	
• Turn the MSS from 2H mode to 4H mode at rest. Drive the vehicle. • Turn the MSS from 2H mode to 4H mode while driving the vehicle at low speed. • Turn the MSS from 2H mode to 4H mode while driving the vehicle at high speed. • **Is the axle system fully functional at rest, but there is a grinding noise during engagement, especially at high**	**Yes** If the concern is excessive front axle noise during 4WD mode engagement (especially at high speeds), INSTALL the S-spring in the front differential. REFER to

speed?

Section 205-03 .

No
GO to I3 .

I3 CHECK THE TRANSFER CASE SHIFT TO 2H

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- **NOTE:** If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.
- Monitor the 4WD control module PID for the contact plate position while switching the MSS to 2H.

Mode Select Switch (MSS) Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/AWD/4H Mode	CLOSED	OPEN	CLOSED	CLOSED
4L Mode	OPEN	CLOSED	OPEN	CLOSED

- **Does the 4WD control module PID and instrument cluster indicator lamp indicate that vehicle shifted into 2H?**

Yes
GO to I4 .

No
Go To Pinpoint Test J .

I4 CHECK THE IWE DISENGAGEMENT

- Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to Section 100-02 .
- **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid.
- Start the engine and allow to idle.
- Switch the MSS to 2H.
- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft.
- **Did either front halfshaft rotate?**

Yes
GO to I10 .

No
GO to I5 .

I5 CHECK THE TRANSFER CASE SHIFT INTO 4H

- **NOTE:** If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.
- Monitor the 4WD control module PID for the contact plate position while switching the MSS to 4H.

Mode Select Switch (MSS) Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/AWD/4H Mode	CLOSED	OPEN	CLOSED	CLOSED
4L Mode	OPEN	CLOSED	OPEN	CLOSED

- **Does the 4WD control module PID and instrument cluster indicator lamp indicate that the MSS in 4H?**

Yes
GO to I6 .

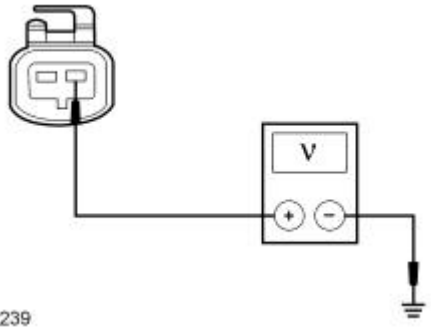
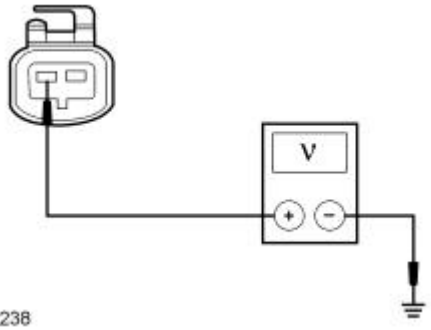
No
Go To Pinpoint Test C .

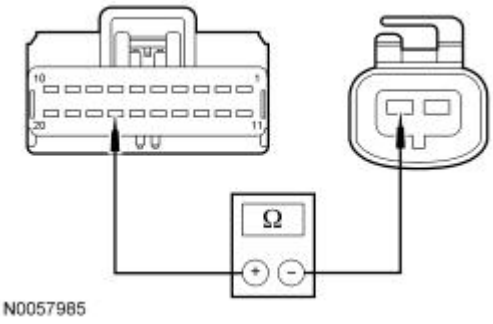
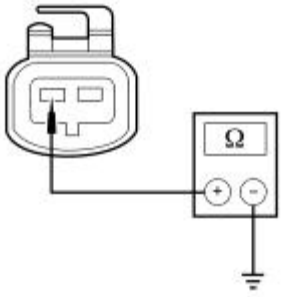
I6 CHECK THE IWE ENGAGEMENT

- Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to Section 100-02 .
- **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid.
- Start the engine and allow to idle.
- Switch the MSS to 4H.

Yes
CHECK that all driveline fasteners are present and tightened to specification. REFER to Section 205-00 for further diagnosis of the

• Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft. • Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft. • **Did both front halfshafts rotate?**	front axle. **No** GO to I7 .
I7 CHECK THE IWE SOLENOID OUTPUT IN 4H	
• **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Disconnect the output vacuum line at the IWE solenoid. • Switch the MSS to 4H. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** Key in OFF position. GO to I24 . **No** GO to I8 .
I8 CHECK THE IWE SOLENOID OUTPUT IN 4H WITH THE SCAN TOOL	
• Key in OFF position. • Connect the diagnostic tool. • **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Enter the following diagnostic mode on the scan tool: Active Commands. • Using the scan tool, command the IWE solenoid to engage the IWEs (solenoid OFF). • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** END active command. GO to I18 . **No** GO to I9 .
I9 CHECK THE IWE SOLENOID	
• Disconnect: IWE Solenoid C1157. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum less than 25 mm (1 in) Hg?**	**Yes** END active command. GO to I17 . **No** END active command. INSTALL a new IWE solenoid. REPEAT the self-test.
I10 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H MODE	
• **NOTE:** The engine must be idling during the following steps to supply vacuum to the IWE solenoid. • Start the engine. • Disconnect the output vacuum line at the IWE solenoid. • Switch the MSS to 2H mode. • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**Yes** GO to I19 . **No** GO to I11 .
I11 CHECK THE IWE SOLENOID INPUT VACUUM	
• Measure the vacuum at the input port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**Yes** GO to I12 . **No** REPAIR the vacuum leak. CLEAR the DTCs. REPEAT the self-test.
I12 CHECK THE IWE SOLENOID OUTPUT IN 2H MODE WITH THE SCAN TOOL	
• Key in OFF position. • Connect the diagnostic tool. • **NOTE:** The engine must be idling during the following steps to	**Yes** END active command. GO to I18 .

supply vacuum to the IWE solenoid. • Start the engine. • Enter the following diagnostic mode on the scan tool: Active Commands. • Using the scan tool, command the IWE solenoid to disengage the IWEs (IWE solenoid ON). • Measure the vacuum at the output port of the IWE solenoid. • **Is the vacuum greater than 254 mm (10 in) Hg?**	**No** END active command. GO to I13 .
I13 CHECK CIRCUIT CBB75A (YE/GY) FOR VOLTAGE	
• Key in OFF position. • Disconnect: IWE Solenoid C1157. • Measure the voltage between IWE solenoid C1157-1, circuit CBB75A (YE/GY) and ground.  A0069239 • **Is the voltage greater than 9 volts?**	**Yes** GO to I14 . **No** CHECK CJB fuse 75 (5A) for an open. REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self-test.
I14 CHECK THE IWE SOLENOID OPERATION	
• Connect: IWE Solenoid C1157. • **NOTE:** The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage. • Start the engine. • Connect a 10 amp fused jumper wire between IWE solenoid C1157-1, circuit CCF05 (BN/BU), component side and ground. • Measure the vacuum at the IWE solenoid output vacuum port. • **Is the IWE solenoid output port vacuum greater than 254 mm (10 in) Hg?**	**Yes** DISCONNECT the fused jumper. GO to I15 . **No** INSTALL a new IWE solenoid. CLEAR the DTCs. REPEAT the self-test.
I15 CHECK CIRCUIT CCF05 (BN/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: IWE Solenoid C1157. • Disconnect: 4WD Control Module C281a. • Key in ON position. • Measure the voltage between IWE solenoid C1157-2, circuit CCF05 (BN/BU), harness side and ground.  A0069238 • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to I16 .
I16 CHECK CIRCUIT CCF05 (BN/BU) FOR AN OPEN	
• Key in OFF position.	**Yes**

• Measure the resistance between IWE solenoid C1157-2 harness side and 4WD control module C281a-17 harness side, circuit CCF05 (BN/BU).  • **Is the resistance less than 5 ohms?**	GO to I17 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
I17 CHECK CIRCUIT CCF05 (BN/BU) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: 4WD Control Module C281a. • Measure the resistance between IWE solenoid C1157-2, circuit CCF05 (BN/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I18 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
I18 CHECK THE 4WD control module	

• Disconnect all 4WD control module connectors C281a and C281b.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect the 4WD control module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

I19 CHECK THE IWE VACUUM SYSTEM	
• Key in OFF position. • Disconnect both vacuum lines from the IWE solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** GO to I20 . **No** CONNECT the vacuum lines to the IWE solenoid. GO to I23 .

I20 CHECK THE RH IWE LEAK RATE	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Disconnect the vacuum line from the larger port on the RH IWE. • Apply 508 mm (20 in) Hg of vacuum to the RH IWE port and observe vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL a new IWE. GO to I19 . **No** GO to I21 .
I21 CHECK THE LH IWE LEAK RATE	
• Disconnect the vacuum line from the larger port at the LH IWE. • Apply 205 mm (20 in) Hg of vacuum to the LH IWE port and observe vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL a new IWE. GO to I19 . **No** GO to I22 .
I22 CHECK THE IWE VACUUM SUPPLY TUBE	
• Disconnect both vacuum lines from the IWE solenoid. • Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE vacuum circuit and observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** INSTALL new vacuum lines as necessary. GO to I19 . **No** GO to I23 .
I23 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H	
• Connect a hand-held vacuum gauge to the LH IWE vacuum supply tube. • **NOTE:** The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage. • Start the engine. • Switch the MSS to 2H while observing the vacuum gauge. • Repeat these steps for the RH IWE. • **Are the vacuum readings greater than 254 mm (10 in) Hg?**	**Yes** GO to I26 . **No** INSTALL new vacuum lines as necessary. GO to I19 .
I24 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION	
• Disconnect both vacuum lines from the IWE solenoid. • Raise and support the vehicle on a hoist. Refer to Section 100-02 . • Disconnect the vacuum line at the LH IWE. • Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line. • **Did the vacuum pump draw a vacuum on the LH IWE vacuum line?**	**Yes** INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the vacuum line to the LH IWE. GO to I25 .
I25 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION	
• Disconnect the larger vacuum line at the RH IWE. • Connect a vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line. • **Did the vacuum pump draw a vacuum on the RH IWE vacuum line?**	**Yes** INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self-test. **No** CONNECT the vacuum line to the RH IWE. GO to I26 .
I26 CHECK THE LH IWE OPERATION	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 .	**Yes** GO to I27 .

• Connect a vacuum pump to the larger IWE vacuum port. • Observe the LH halfshaft while rotating the LH front tire. Apply and release vacuum to manually engage and disengage the LH IWE. • **Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**	**No** INSTALL a new LH IWE. CLEAR the DTCs. REPEAT the self-test.
I27 CHECK THE RH IWE OPERATION	
• Connect a vacuum pump to the larger RH IWE vacuum port. • Observe the RH halfshaft while rotating the RH front tire. Apply and release vacuum to manually engage and disengage the LH IWE. • **Did the RH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**	**Yes** CLEAR the DTC(s). REPEAT the self-test. Go To Pinpoint Test N . **No** INSTALL a new RH IWE. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Vehicle Does Not Shift Between Two Wheel Drive (2WD) and Four Wheel Drive (4WD) Modes Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

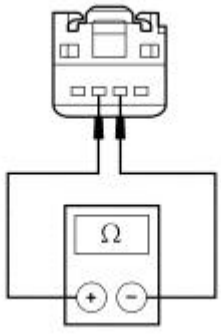
In 2H mode, the 4 wheel drive (4WD) control module supplies a ground path to the integrated wheel end (IWE) solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In 4A, 4H and 4L modes, the 4WD control module does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the 4WD control module, internal components of the transfer case, mode select switch (MSS), IWE components and drive axles.

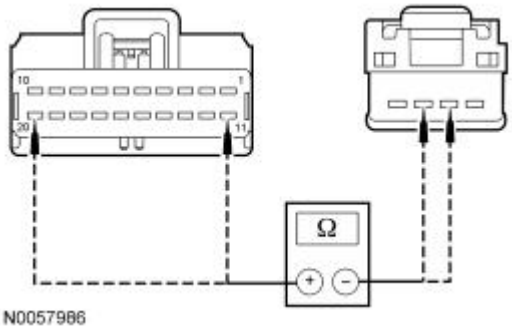
Possible Causes

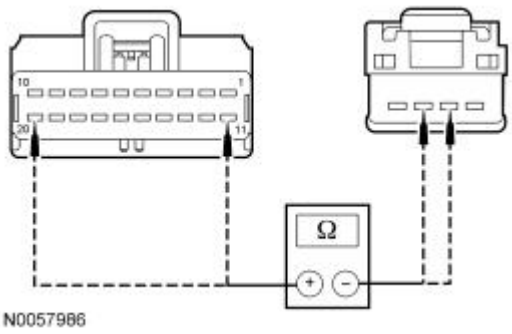
- MSS
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- 4WD control module
- Circuit CCF05 (BN/BU)
- Circuit CBB75A (YE/GY)
- Smart junction box (SJB) mini-fuse 35 (10A)

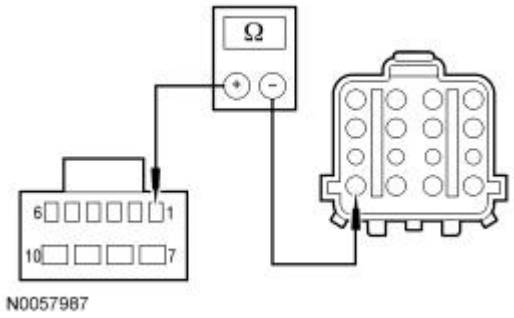
PINPOINT TEST J: THE VEHICLE DOES NOT SHIFT BETWEEN TWO WHEEL DRIVE (2WD) AND FOUR WHEEL DRIVE (4WD) MODES CORRECTLY

Test Step	Result / Action to Take
J1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the 4WD control module on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis.

	No GO to J2 .
J2 CHECK THE 4H INDICATOR • Select 4H mode and observe the instrument cluster. • **Does the instrument cluster indicator lamp indicate 4H mode?**	**Yes** GO to J8 . **No** GO to J3 .
J3 CHECK THE IGNITION SWITCH STATUS PID • Key in ON position. • Monitor the ignition switch status PID. • **Do the ignition switch PIDs match the ignition switch positions?**	**Yes** GO to J4 . **No** CHECK the ignition switch and the controller area network (CAN) communication network for faults. REFER to Section 413-00 . After the fault is repaired, CLEAR the DTC. REPEAT the self-test.
J4 CHECK THE MSS POSITION PID • Monitor each MSS PID while cycling through each MSS position. • **Does each MSS PID agree with each switch position?**	**Yes** GO to J7 . **No** GO to J5 .
J5 CHECK THE MSS RESISTANCE VALUES • Key in OFF position. • Disconnect: MSS C284. • Measure the resistance between MSS C284, terminals 2 and 3, while rotating the switch through all positions. Refer to the following chart. **Mode Select Switch (MSS) Position** / **Resistance** 2H — 619 ohms 4A — 270 ohms 4H — 130 ohms  A0049121 • **Are the resistance values within specification?**	**Yes** GO to J6 . **No** INSTALL a new MSS. CLEAR the DTCs. REPEAT the self-test.
J6 CHECK CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN • Measure the resistance between MSS C284-2, harness side and 4WD control module C281a-11, harness side, circuit RCF13 (WH/BN).	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this

 • Measure the resistance between MSS C284-3, harness side and 4WD control module C281a-20, harness side, circuit CCF13 (WH/BU). • **Is the resistance less than 5 ohms?**	section. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
J7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the clutch duty cycle PID read 0% at closed throttle?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation.
J8 CHECK FOR WIND-UP IN 4H MODE	
• Switch the MSS to 4H mode. • Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to J13 . **No** GO to J9 .
J9 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID AT WIDE OPEN THROTTLE (WOT)	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID at wide open throttle (WOT), engine OFF, key ON. • **Does the clutch duty cycle PID read 98% at WOT?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** GO to J10 .
J10 CHECK THE ACCELERATOR PEDAL POSITION OUTPUT PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move the accelerator pedal from closed throttle to WOT and observe the output PID. • **Does the output PID vary between 0% at closed throttle and 100%t at WOT?**	**Yes** GO to J11 . **No** Diagnose the powertrain control module (PCM), REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual and the CAN communication network, REFER to Section 418-00 .
J11 CHECK FOR TRANSFER CASE CLUTCH ENGAGEMENT WITH ACTIVE COMMANDS	
• Enter the following diagnostic mode on the diagnostic	**Yes** CHECK the transfer case. REFER

tool: PID/DATA Monitor and Record. • Using the active commands, engage the transfer case clutch to 100% while monitoring the transfer case clutch duty cycle PWM PID. • **Does the clutch duty cycle PID read 100%?**	to Section 308-07B . **No** GO to J12 .
J12 CHECK CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN	
• Measure the resistance between MSS C284-2, harness side and 4WD control module C281a-11, harness side, circuit RCF13 (WH/BN).  • Measure the resistance between MSS C284-3, harness side and 4WD control module C281a-20, harness side, circuit CCF13 (WH/BU). • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
J13 CHECK THE INSTRUMENT CLUSTER INDICATOR IN AWD MODE	
• Select AWD mode and observe the instrument cluster. • **Does the instrument cluster indicator lamp indicate AWD mode?**	**Yes** GO to J14 . **No** Go To Pinpoint Test C .
J14 CHECK FOR WIND-UP IN AWD MODE	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to J15 . **No** The system is operating correctly.
J15 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID at closed throttle, engine OFF, key ON. • **Does the PID indicate 2 to 4% clutch application at closed throttle?**	**Yes** GO to J16 . **No** GO to J18 .
J16 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)	
• Use the scan tool active commands to energize the transfer case clutch to 4%. • Back-probe transfer case C350-16 circuit CCF03 (GY/BN), harness side. • Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter. • **Is the voltage approximately 0.2 to 0.4 volt?**	**Yes** END the active command. CHECK the transfer case. REFER to Section 308-07B . **No** GO to J17 .
J17 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	

• Key in OFF position. • Disconnect: Transfer Case C350. • Disconnect: 4WD Control Module C281b. • Measure the resistance between 4WD control module C281b-1, harness side and transfer case C350-16, harness side circuit CCF03 (GY/BN).  N0057987 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J18 CHECK THE WHEEL SPEED PIDs	
• While driving the vehicle at 30 km/h (18 mph), monitor the wheel speed PIDs. • Compare the speedometer reading to the wheel speed PIDs. • **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to J19. **No** CHECK the anti-lock brake system (ABS). REFER to Section 206-09.
J19 CHECK THE THROTTLE POSITION OUTPUT PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move the accelerator pedal from closed throttle to WOT and observe the throttle position output PID. • **Does the throttle output PID vary between 0% at closed throttle and 100% at WOT?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** Diagnose the powertrain control module (PCM), REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual and the CAN communication network, REFER to Section 418-00.

Pinpoint Test K: The Vehicle Does Not Shift Between 4H and 4L Modes Correctly

Refer to Wiring Diagrams Cell 34, Four-Wheel Drive System for schematic and connector information.

Normal Operation

With the key in the ON position, the four wheel drive (4WD) control module receives the operator's choice of 4WD selection from the mode select switch (MSS). The 4WD control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4WD control module.

Possible Causes

- MSS
- 4WD control module
- Circuitry
- Anti-lock brake system (ABS) module

- Controller area network (CAN)
- Transfer case shift motor
- Transfer case

PINPOINT TEST K: THE VEHICLE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>K1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)</td><td></td></tr>
<tr><td>• Key in ON position.
• Connect the diagnostic tool.
• Carry out the on-demand self test.
• Are DTCs retrieved?</td><td>Yes
If DTC C1729, GO to K23 . If DTCs P1812, P1815, P1867 or P1891, GO to K24 .

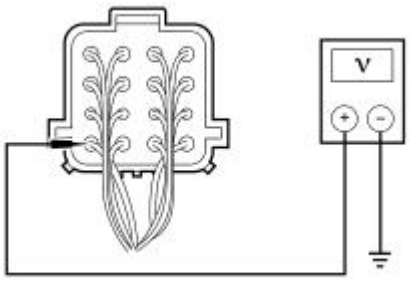
No
GO to K2 .</td></tr>
<tr><td>K2 CHECK THE MESSAGE CENTER</td><td></td></tr>
<tr><td>• If the MSS is not in 4L mode: Switch the MSS to 4L mode.
  ▪ Press the brake pedal.
  ▪ Vehicle at rest.
  ▪ Transmission in NEUTRAL .
• Monitor the message center.
• If the MSS is in 4L mode: Switch the MSS to 4H mode.
• Monitor the message center.
• Does the message center read SHIFT IN PROGRESS?</td><td>Yes
GO to K3 .

No
GO to K4 .</td></tr>
<tr><td>K3 CHECK THE 4H/4L INDICATOR</td><td></td></tr>
<tr><td>• Observe the instrument cluster.
• Is the correct 4WD indicator illuminated (4H or 4L) for the MSS mode selected in step K2?</td><td>Yes
GO to K5 .

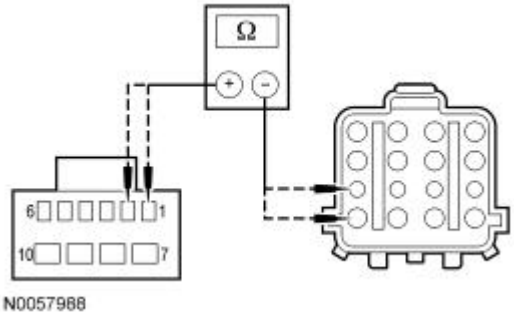
No
GO to K4 .</td></tr>
<tr><td>K4 CHECK THE CONTACT PLATE ENCODER PIDs IN THE SELECTED MODE</td><td></td></tr>
<tr><td>• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
• Monitor the contact plate position PIDs. Refer to the following chart:
<table><tr><th>Contact Plate Position PID</th><th>MSS PID 4A/4H MODE</th><th>MSS PID 4L MODE</th></tr><tr><td>PLATE_A</td><td>CLOSED</td><td>OPEN</td></tr><tr><td>PLATE_B</td><td>OPEN</td><td>CLOSED</td></tr><tr><td>PLATE_C</td><td>CLOSED</td><td>OPEN</td></tr><tr><td>PLATE_D</td><td>CLOSED</td><td>CLOSED</td></tr></table>• Do the contact plate position PIDs indicate that the transfer case shift motor is in the selected mode from step K2?</td><td>Yes
CHECK the instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.

No
GO to K24 .</td></tr>
<tr><td>K5 CHECK FOR DRIVELINE WIND-UP</td><td></td></tr>
<tr><td>• Drive the vehicle on a dry, hard surface in turns while applying the throttle.
• Is wind-up present in turns?</td><td>Yes
GO to K6 .

No</td></tr>
</table>

	GO to K10 .
K6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID at wide open throttle (WOT), with the transfer case in 4L mode, engine OFF, key ON. • **Does the clutch duty cycle PID indicate 98% clutch application at WOT?**	**Yes** GO to K7 . **No** GO to K8 .
K7 CHECK FOR VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)	
• Carefully back-probe the transfer case connector C350-16, circuit CCF03 (GY/BN).  N0037381 • Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter. • Use the scan tool active commands to cycle the transfer case clutch to 98%. • **Is the voltage greater than 9 volts?**	**Yes** END the active command. Go To Pinpoint Test O . **No** END the active command. GO to K9 .
K8 CHECK THE THROTTLE POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the throttle position PID from the 4WD control module. • Key ON, engine OFF. • Slowly move throttle from closed throttle to WOT and observe the 4WD control module throttle sensor PID. • **Does the PID value vary between 0% at closed throttle and 100% at WOT?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** CHECK the throttle position sensor and/or the powertrain control module (PCM). REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
K9 CHECK CIRCUITS CCF03 (GY/BN) AND CCF04 (VT/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Transfer Case C350. • Disconnect: 4WD Control Module C281b. • Measure the resistance of the following circuits between 4WD control module C281b, harness side and transfer case C350, harness side: 	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal

Circuit	C281b	C350
CCF03 (GY/BN)	1	16
CCF04 (VT/OG)	2	12



- **Are the resistances less than 5 ohms?**

operation.

No
REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test.

K10 CHECK FOR PRESENCE OR ABSENCE OF TRANSFER CASE GEAR REDUCTION

- While driving the vehicle, monitor the engine rpm and vehicle speed.
- **Does the engine rpm and vehicle speed indicate that the vehicle is in the designated mode (4H or 4L mode)?**

Yes
The system is functioning correctly.

No
GO to K11 .

K11 CHECK THE CONTACT PLATE ENCODER PIDs IN 4H OR 4L MODE

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- With the MSS in the designated mode (4H or 4L mode), monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4A/4H MODE	MSS PID 4L MODE
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Do the contact plate position PIDs indicate that the transfer case shift motor is in 4H or 4L mode?**

Yes
GO to K12 .

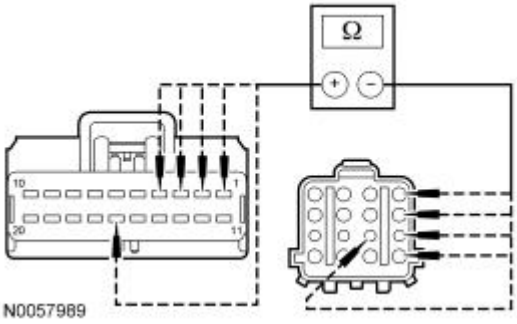
No
GO to K13 .

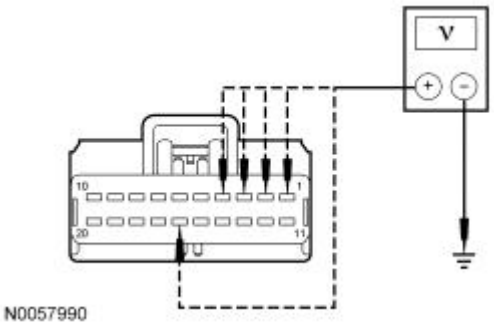
K12 CHECK THE TRANSFER CASE SHIFT MOTOR

- Remove the transfer case shift motor from the transfer case.
- Rotate the shift cam through all positions.
- **Does the transfer case shift cam rotate with difficulty (is the force required to rotate the cam greater than 45 Nm [33 lb-ft])?**

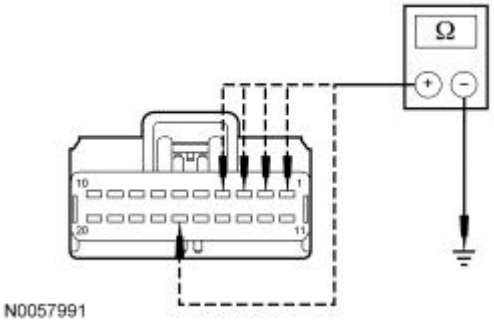
Yes
REPAIR the transfer case. REFER to Section 308-07B . CLEAR the DTC(s). REPEAT the self-test.

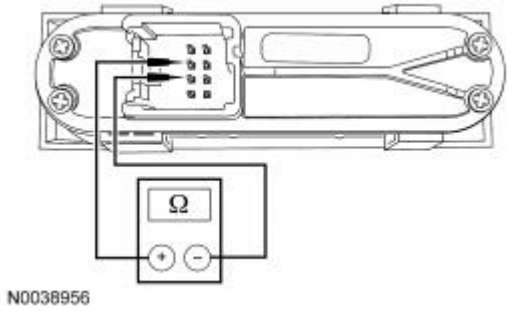
No
INSTALL a new transfer case shift motor. CLEAR the DTC(s). REPEAT the self-test.

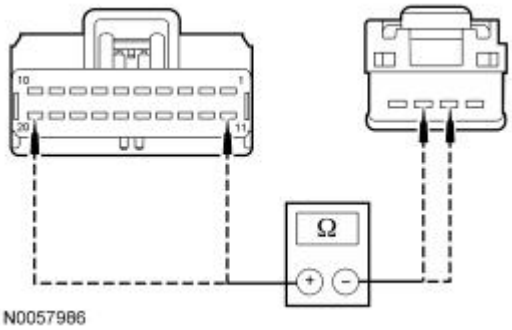
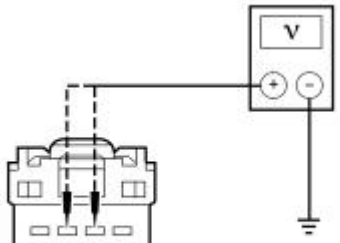
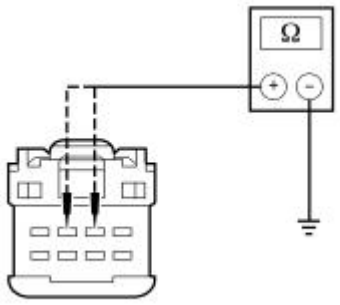
K13 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Transfer Case C350. • Disconnect: 4WD Control Module C281a. • Measure the resistance of the following circuits between 4WD control module C281a, harness side and transfer case C350, harness side: **Circuit** / **C281a** / **C350** RCF09 (BN/WH) / 16 / 10 CCF17 (WH/OG) / 4 / 13 CCF16 (VT/GN) / 3 / 9 CCF15 (BN/YE) / 2 / 1 CCF14 (GN/OG) / 1 / 5  • **Are the resistances less than 5 ohms?**	**Yes** GO to K14 . **No** REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test.
K14 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between the following circuits at the 4WD control module C281a, harness side and ground: **Circuit** / **C281a** RCF09 (BN/WH) / 16 CCF17 (WH/OG) / 4 CCF16 (VT/GN) / 3 CCF15 (BN/YE) / 2 CCF14 (GN/OG) / 1	**Yes** REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test. **No** GO to K15 .

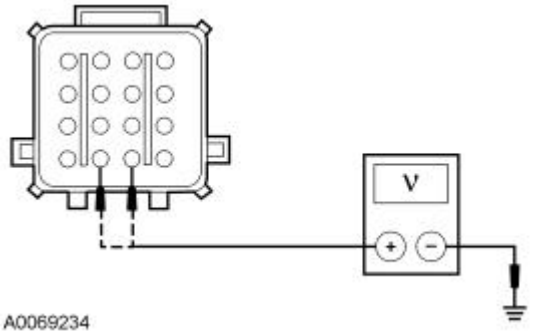
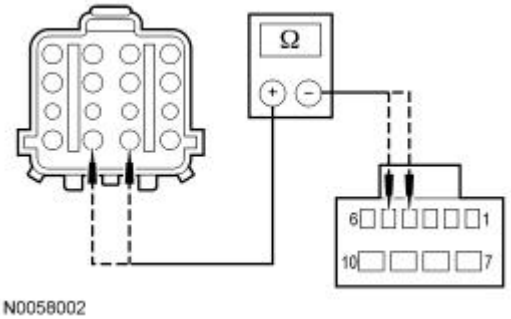
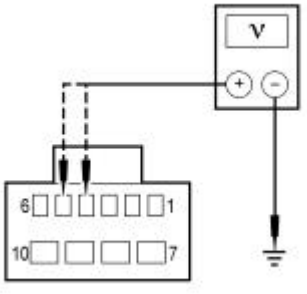


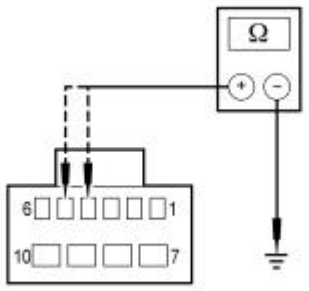
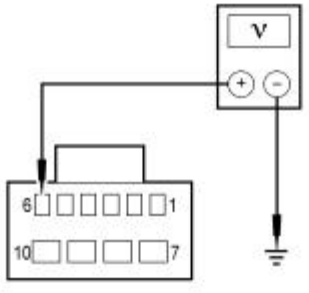
- **Is voltage present?**

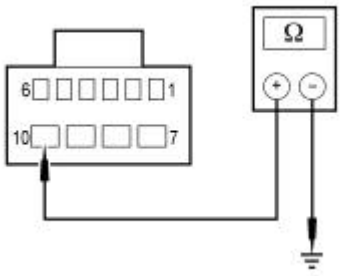
K15 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the following circuits at 4WD control module C281a, harness side and ground: **Circuit** / **C281a** RCF09 (BN/WH) / 16 CCF17 (WH/OG) / 4 CCF16 (VT/GN) / 3 CCF15 (BN/YE) / 2 CCF14 (GN/OG) / 1  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to K16 . **No** REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test.
K16 CHECK THE TRANSMISSION RANGE (TR) AND WHEEL SPEED PIDS DURING THE 4H/4L MODE SHIFT	
• Connect: 4WD Control Module C281a. • Connect: 4WD Control Module C281b. • Connect: Transfer Case C350. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • A. Monitor the 4WD control module transmission range (TR) sensor status PID while shifting the transmission to NEUTRAL. • B. Monitor the ABS wheel speed PID. • **A. Does the 4WD control module TR sensor PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?** **B. Does the ABS wheel speed PID indicate 0 km/h (0 mph)?**	**Yes** If all 3 PIDs are accurate, GO to K17 . **No** **A.** REFER to Section 307-01B for further diagnosis of the TR sensor and the CAN communication network. **B.** REFER to Section 206-09 for further diagnosis of the ABS system and the CAN

	communication network.
K17 CHECK THE IGNITION STATUS PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Key in ON position. • Monitor the ignition status PID. • **Does the ignition switch position correspond with the ignition status PID?**	**Yes** GO to K18 . **No** CHECK the ignition switch circuit(s) and CAN communication network. REFER to Section 418-00 .
K18 CHECK THE MODE SELECT SWITCH (MSS) POSITION PIDS	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Drive the vehicle. • Dynamically monitor the MSS PID while driving the vehicle in each shift position. • **Does the MSS PID always agree with the switch position?**	**Yes** GO to K13 . **No** GO to K19 .
K19 CHECK THE MSS	
• Key in OFF position. • Disconnect: MSS C284. • Measure the resistance between MSS C284-2, component side and C284-3, component side. Refer to the following chart: **MSS Position** / **Resistance (± 1%)** 4A — 270 ohms 4H — 130 ohms 4L — 62 ohms 2H — 619 ohms  N0038956 • **Are the resistances within the specified values?**	**Yes** GO to K20 . **No** INSTALL a new MSS. CLEAR the DTC(s). REPEAT the self-test.
K20 CHECK THE MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN	
• Measure the resistance between MSS C284-2 and 4WD control module C281a-11, circuit CCF13 (WH/BU); measure the resistance between MSS C284-3 and 4WD control module C281a-20, circuit RCF13 (WH/BN).	**Yes** GO to K21 . **No** REPAIR the circuit(s). CLEAR the DTC(s). REPEAT the self-test.

 N0057986 • **Are the resistances less than 5 ohms?**	
K21 CHECK THE MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between MSS C284-2, circuit CCF13 (WH/BU) and ground; measure the voltage between MSS C284-3, circuit RCF13 (WH/BN) and ground.  N0037380 • **Is voltage present?**	**Yes** REPAIR the circuit(s). CLEAR the DTC(s). REPEAT the self-test. **No** GO to K22 .
K22 CHECK THE MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND	
• Measure the resistance between MSS C284-2, circuit CCF13 (WH/BU) and ground; measure the resistance between MSS C284-3, circuit RCF13 (WH/BN) and ground.  N0037379 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** REPAIR the circuit(s). CLEAR the DTC(s). REPEAT the self-test.
K23 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR POWER DURING ACTIVE COMMANDS	
• Connect: 4WD Control Module C281a. • Enter the following diagnostic mode on the diagnostic tool: Access Active Commands. • Enter the clockwise transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-15, circuit CCF07 (GN/RD) harness side and ground. Enter the counterclockwise transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-14, circuit CCF08 (GY/OG) harness side	**Yes** CHECK the transfer case. REFER to Section 308-07B and REPAIR the transfer case as necessary. REPEAT the self-test. Go To Pinpoint Test O .

and ground.  A0069234 • **Are the voltages 10 volts or greater while the corresponding active commands are on?**	**No** GO to K24 .
K24 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR AN OPEN	
• Measure the resistance between transfer case C350-14, circuit and 4WD control module C281b-4, harness side, circuit CCF08 (GY/OG).  N0058002 • Measure the resistance between transfer case C350-15, circuit and 4WD control module C281b-5, harness side, circuit CCF07 (BN/GN). • **Are the resistances less than 5 ohms?**	**Yes** GO to K25 . **No** REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test. Go To Pinpoint Test O .
K25 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between 4WD control module C281b-4, circuit CCF08 (GY/OG), harness side and ground.  N0057993 • Measure the voltage between 4WD control module C281b-5, circuit CCF07 (BN/GN), harness side and ground. • **Is voltage present?**	**Yes** GO to K26 . **No** REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test. Go To Pinpoint Test O .
K26 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO GROUND	
• Measure the resistance between 4WD control module C281b-4, circuit CCF08 (GY/OG) harness side and ground.	**Yes** GO to K27 . **No**

 N0057994 • Measure the resistance between 4WD control module C281b-5, circuit CCF07 (BN/GN) harness side and ground. • **Are the resistances greater than 10,000 ohms?**	REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test. Go To Pinpoint Test O .
K27 CHECK THE HOT AT ALL TIMES-2 (HAT2) BJB FUSE 43 (20A)	
• Check battery junction box (BJB) fuse 43 (20A). • **Is the fuse OK?**	**Yes** GO to K28 . **No** REPAIR the circuit. REPEAT the self-test.
K28 CHECK FOR BATTERY VOLTAGE FROM THE FUSE CAVITY	
• Measure the voltage between PDB input side fuse cavity 43 and ground. • **Is the voltage greater than 9 volts?**	**Yes** GO to K29 . **No** REPAIR or INSTALL new components as necessary. REPEAT the self-test.
K29 CHECK FOR HAT VOLTAGE INPUT TO THE 4WD CONTROL MODULE	
• Disconnect: 4WD Control Module C281b. • Measure the voltage between 4WD control module C281b-6, circuit SBB34 (BU/RD) harness side and ground.  N0057995 • **Is the voltage greater than 9 volts?**	**Yes** GO to K30 . **No** REPAIR the affected circuit(s). REPEAT the self-test.
K30 CHECK THE GROUND CIRCUIT FOR AN OPEN	
• Key in OFF position. • Measure the resistance between 4WD control module C281b-10 circuit GD123 (BK/GY), harness side and ground.	**Yes** GO to K31 . **No** REPAIR the circuit. REPEAT the self-test.

 N0057996 • **Is the resistance less than 5 ohms?**	
K31 CHECK THE 4WD CONTROL MODULE CONNECTOR	
• Check 4WD control module connectors C281a and C281b for corrosion and bent or broken pins. • Connect: C281a. • Connect: C281b. • Test the 4WD system operation. • Carry out the 4WD control module on-demand self test. • **Is the concern still present?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. Go To Pinpoint Test O . **No** Go To Pinpoint Test O .

Pinpoint Test L: Four Wheel Drive (4WD) Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the four wheel drive (4WD) control module engages a clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a mechanical engagement of the transfer case. The 4WD control module also removes the ground path from the integrate wheel end (IWE) solenoid, which removes vacuum from the IWEs, allowing them to engage the front axle shaft. Systematically check the necessary inputs and outputs at the 4WD control module, internal components of the transfer case, IWE components and drive axles.

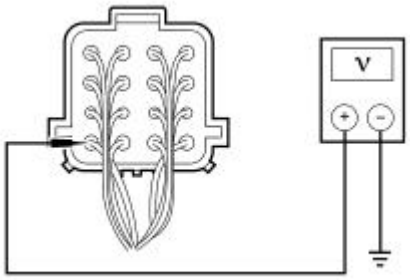
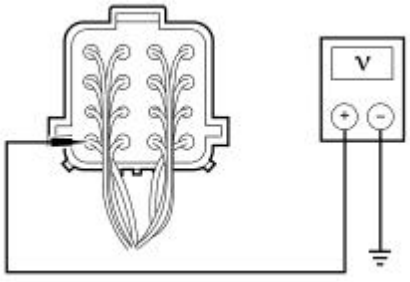
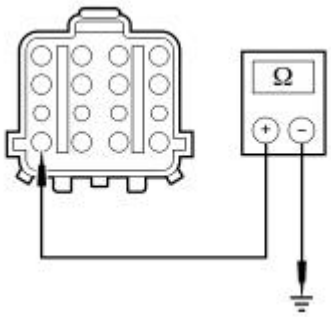
Possible Causes

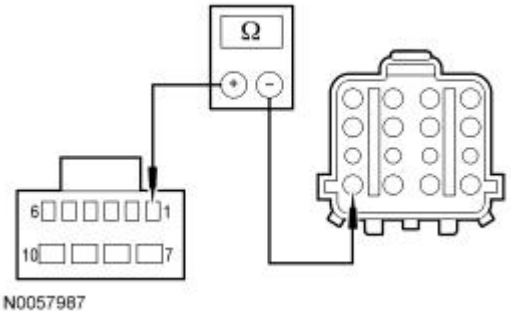
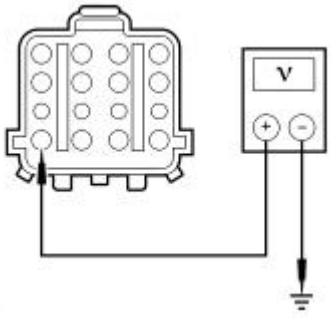
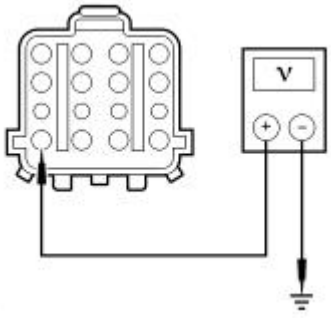
- Transfer case clutch coil
- Transfer case
- 4WD control module
- Front axle assembly
- Circuit CCF03 (GY/BN)
- Circuit 92 (LB/YE)

PINPOINT TEST L: 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

Test Step	Result / Action to Take
L1 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the 4WD control module self-test. • **Are any DTCs retrieved?**	**Yes** If DTC P1824, DTC P1827 or DTC P183B, GO to L10 . If DTC P1825, GO to L11 . If DTC P1826

	GO to L13 . For all other DTCs, GO to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart. **No** GO to L2 .
L2 CHECK 4H ENGAGEMENT AT REST	
• Switch the MSS from 2H mode to 4H mode. • While on the road, drive the vehicle in turns and check for wind-up. • **Does 4H mode engage at rest correctly?**	**Yes** GO to L3 . **No** Go To Pinpoint Test I .
L3 CHECK 2H MODE TO 4H MODE SHIFT AT SPEED	
• Switch the mode select switch (MSS) to 2H mode. • Key in ON position. • Drive the vehicle and carry out a 2H mode to 4H mode shift while driving approximately at 16 km/h (10 mph). • Stop the vehicle, shift to 2H mode , drive the vehicle and carry out a 2H mode to 4H mode shift while driving at approximately 64 km/h (40 mph). • **Does 4H mode engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?**	**Yes** Go To Pinpoint Test H . **No** GO to L4 .
L4 CHECK THE TRANSFER CASE CLUTCH COIL LOCKUP	
• Connect the diagnostic tool. • Key in ON position. • Switch the MSS to AWD mode. • Using the scan tool, command the transfer case clutch to 98%. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate when the rear driveshaft is rotated?**	**Yes** GO to L5 . **No** GO to L8 .
L5 CHECK THE TRANSFER CASE CLUTCH COIL RELEASE	
• Using the scan tool, command the transfer case clutch to 0%. • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate when the rear driveshaft is rotated?**	**Yes** GO to L14 . **No** GO to L6 .
L6 CHECK THE TRANSFER CASE SYNCHRONIZATION (ON A HOIST)	
• Start the engine, shift the MSS to 2H mode. • Place the transmission in DRIVE and increase speed to between 16 km/h (10 mph) and 24 km/h (15 mph). • While observing the front driveshaft, switch the MSS to 4H mode. • **Did the front driveshaft start to spin?**	**Yes** GO to L7 . **No** GO to L14 .
L7 CHECK THE TRANSFER CASE DISENGAGEMENT	
• Switch the MSS to 2H mode. • Rotate the rear driveshaft while observing the front driveshaft. • **Did the front driveshaft rotate?**	**Yes** GO to L14 . **No**

	Go To Pinpoint Test H .
L8 CHECK CIRCUIT CCF03 (GY/BN) FOR VOLTAGE • Disconnect: Transfer Case C350. • Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).  N0037381 • While active commanding 98%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and the transfer case housing. • **Is the voltage greater than 9 volts?**	**Yes** END the active command. INSTALL a new transfer case synchronization clutch. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test. **No** GO to L9 .
L9 CHECK THE TRANSFER CASE CHASSIS GROUND • Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).  N0037381 • While active commanding 98%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and chassis ground. • **Is the voltage greater than 9 volts?**	**Yes** END the active command. REPAIR the transfer case ground connection between the transfer case and the chassis. CLEAR the DTCs. REPEAT the self-test. **No** END the active command. GO to L10 .
L10 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO GROUND • Disconnect: 4WD Control Module C281b. • Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN) and ground.  N0057992 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
L11 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN • Measure the resistance between transfer case C350-16,	**Yes**

circuit CCF03 (GY/BN), harness side and the 4WD control module C281b-1, circuit CCF03 (GY/BN), harness side.  N0057987 • **Is the resistance less than 5 ohms?**	GO to L12 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
L12 CHECK CIRCUIT CCF03 (GY/BN) FOR VOLTAGE	
• Active command the transfer case clutch greater than 10% and measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.  N0058003 • **Is voltage present?**	**Yes** END active command. GO to L13 . **No** END active command. INSTALL a new transfer case synchronization clutch. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test.
L13 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO VOLTAGE	
• While in active command 0%, measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.  N0058003 • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to L14 .
L14 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION	

• Disconnect all 4WD control module connectors C281a and C281b.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect the 4WD control module connectors and make sure they are seated correctly.
	Yes
	INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. REPEAT the self-test.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: The Four Wheel Drive (4WD) System Jumps Out of Gear

Normal Operation

When the 4 wheel drive (4WD) system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected mode, systematically check the 4WD system components.

Possible Causes

- Integrated wheel end (IWE) vent line(s)
- Mode select switch (MSS)
- Transfer case

PINPOINT TEST M: THE FOUR WHEEL DRIVE (4WD) SYSTEM JUMPS OUT OF GEAR

Test Step	Result / Action to Take
M1 CHECK FOR OBSTRUCTED IWE VENT LINES	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • **NOTE:** The IWE vent port is the smaller of the 2 vacuum ports. • Disconnect the LH IWE line from the vent port. • Attach a vacuum pump to the IWE vent line. • Attempt to draw and hold a vacuum. Repeat Steps 1, 2 and 3 for the RH side of the vehicle. • **Can a vacuum be held on either IWE vent line?**	**Yes** INSTALL new IWE vent lines as necessary. **No** GO to M2 .
M2 VERIFY THE CONCERN	
• Drive the vehicle and attempt to duplicate the concern. • **Is the concern an uncommanded range shift (in or out of 4L mode)?**	**Yes** GO to M5 . **No** GO to M3 .
M3 CHECK THE MSS POSITION PIDS	
• Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Drive the vehicle. • Dynamically monitor the MSS PID while driving the vehicle in each shift position. • **Does the MSS PID always agree**	**Yes** GO to M4 . **No** Go To Pinpoint Test B .

with the switch position?	
M4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart. **No** Go To Pinpoint Test H .
M5 CHECK THE 4WD INDICATORS	
• Stop the vehicle. • Transmission in NEUTRAL. • Depress the brake pedal. • Observe the 4WD indicators in the instrument cluster while cycling through each MSS position. • **Do the 4WD indicators match MSS switch positions?**	**Yes** GO to M3 . **No** GO to M6 .
M6 CHECK FOR DTCs	
• Transmission in PARK. • Release the brake pedal. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart. **No** CHECK the transfer case fluid level. REFER to Section 308-07B . If the fluid level is OK, CHECK for internal transfer case faults. REFER to Section 308-07B .

Pinpoint Test N: Straightline Driveline Wind-up

Normal Operation

In order for the 4 wheel drive (4WD) system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST N: STRAIGHTLINE DRIVELINE WIND-UP

NOTE: Four high/low mode (4H/4L mode) is not intended for driving on hard/dry surfaces; using 4H/4L mode while driving on these surfaces may produce noises like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
N1 VERIFY THE CONCERN	
• Drive the vehicle and shift from 2H mode to 4H mode. There should be minimal wind-up in 4H mode during straightline maneuvers,	**Yes** GO to N2 .

(wind-up in turns is normal; 4H/4L is not intended for driving on hard/dry surfaces). • **Is excessive wind-up present?**	**No** RETURN the vehicle to the customer. ADVISE about correct 4WD system operation and normal vehicle behavior.
N2 CHECK FOR MATCHING WHEEL AND TIRE SIZES	
• Check the wheel and tire sizes. • **Do the 4 wheel and tire sizes match?**	**Yes** GO to N3 . **No** ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
N3 CHECK TIRE WEAR	
• Check each of the 4 tires for wear. • **Are the 4 tires worn evenly?**	**Yes** GO to N4 . **No** ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly rotated tires to operate correctly.
N4 CHECK TIRE INFLATION PRESSURE	
• Check the inflation pressure in each tire. Refer to vehicle certification label. • **Are the tire inflation pressures correct?**	**Yes** GO to N5 . **No** ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
N5 CHECK THE FRONT AND REAR AXLE RATIOS	
• Check that front and rear axle ratios match. Refer to Section 205-03 . • **Do the front and rear axle ratios match?**	**Yes** RETURN the vehicle to the customer and ADVISE about correct 4WD system usage and normal vehicle behavior. **No** CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to Section 205-00 .

Pinpoint Test O: Torque On-Demand Functional Test

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When operating in 4 wheel drive (4WD), the transfer case and both integrated wheel ends (IWEs) are locked. When in 4L mode, the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2H mode, the transfer case and both IWEs are unlocked.

Possible Causes

- Transfer case and related components

- IWE and related components
- Wheel/tire assemblies

PINPOINT TEST O: TORQUE ON-DEMAND FUNCTIONAL TEST

NOTE: Four high/low mode (4H/4L mode) is not intended for driving on hard/dry surfaces; using 4H/4L mode while driving on these surfaces may produce noises like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
O1 CHECK FOR 4WD INDICATOR PROVE OUT	
• Key in OFF position. • Key in ON position. • **Do the 4WD indicators illuminate at prove out?**	**Yes** GO to O2 . **No** CHECK the instrument cluster for faults. REFER to Section 413-01 .
O2 CHECK 2H MODE OPERATION	
• Stop the vehicle. • Transmission in NEUTRAL. • Depress the brake pedal. • Switch the mode select switch (MSS) to 2H mode. • **Do the 4WD indicators turn off?**	**Yes** GO to O5 . **No** GO to O3 .
O3 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Transmission in PARK. • Release the brake pedal. • Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to O4 .
O4 CHECK FOR WIND-UP IN 2H MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test D . **No** Go To Pinpoint Test I .
O5 CHECK FOR WIND-UP IN 2H MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** REPAIR the transfer case. REFER to Section 308-07B . **No** GO to O6 .
O6 CHECK AWD MODE OPERATION	
• Switch the MSS to AWD mode. • **Are the 4WD indicators off?**	**Yes** GO to O9 . **No** GO to O7 .
O7 CHECK FOR DTCs	

• Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to O8 .
O8 CHECK FOR WIND-UP IN AWD MODE	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to O9 . **No** GO to O10 .
O9 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the PID indicate 2 to 4% clutch application at closed throttle?**	**Yes** GO to O10 . **No** GO to O11 .
O10 CHECK FOR WIND-UP IN AWD WITH 100% CLUTCH	
• Using the scan tool, command the clutch duty cycle to 100%. • Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to O11 . **No** CHECK the transfer case. REFER to Section 308-07B .
O11 CHECK SHAFT SPEED PIDs	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case front and rear shaft speeds. • Drive the vehicle 30 km/h (18 mph). • Record and compare the front wheel speed and rear wheel speed. • **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**	**Yes** GO to O12 . **No** CHECK anti-lock brake system (ABS). REFER to Section 206-09 and VERIFY the 4 road tire sizes match.
O12 CHECK THE THROTTLE POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the throttle position PID from the 4WD control module. • Key ON, engine OFF. • Slowly move throttle from closed throttle to WOT and observe the 4WD control module throttle sensor PID. • **Does the PID value vary between 0% at closed throttle and 100% at WOT?**	**Yes** GO to O13 . **No** CHECK the throttle position sensor and/or the powertrain control module (PCM). REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
O13 CHECK 4H MODE OPERATION	
• Switch the MSS to 4H mode. • **Does the 4H indicator illuminate correctly?**	**Yes** GO to O16 . **No** GO to O14 .

O14 CHECK FOR DTCs	
• Transmission in PARK. • Release the brake pedal. • Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to O15 .
O15 CHECK FOR WIND-UP IN 4H MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test I . **No** Go To Pinpoint Test C .
O16 CHECK FOR WIND-UP IN 4H MODE	
• Drive the vehicle on a dry, hard surface. • **Is straightline wind-up present?**	**Yes** Go To Pinpoint Test G . **No** GO to O17 .
O17 CHECK WIND-UP IN TURNS IN 4H MODE	
• Drive the vehicle in 4H mode while turning. • **Is wind-up present in turns?**	**Yes** GO to O18 . **No** Go To Pinpoint Test I .
O18 CHECK 4L MODE OPERATION	
• Bring the vehicle to a stop with the brake applied, transmission in NEUTRAL, switch the MSS to 4L mode. • **Does the 4WD low indicator illuminate correctly?**	**Yes** GO to O21 . **No** GO to O19 .
O19 CHECK FOR DTCs	
• Transmission in PARK. • Release the brake pedal. • Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to O20 .
O20 CHECK FOR WIND-UP IN 4L MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test I . **No** Go To Pinpoint Test D .
O21 CHECK FOR WIND-UP IN TURNS IN 4L MODE	
• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present and 4L mode functioning?**	**Yes** GO to O22 . **No** CHECK for 4WD control module DTCs. REFER to the Inspection and Verification procedure in this section. If no DTCs are present, Go To Pinpoint Test D .

O22 CHECK 4L MODE TO 2H MODE SHIFT • With the vehicle at a stop, brake applied and transmission in NEUTRAL, switch the MSS from 4L mode to 2H mode. • **Does the 4WD indicator turn OFF?**	**Yes** GO to O25 . **No** GO to O23 .
O23 CHECK FOR DTCs • Transmission in PARK. • Release the brake pedal. • Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to O24 .
O24 CHECK FOR WIND-UP IN 2H MODE • Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** Go To Pinpoint Test D . **No** Go To Pinpoint Test I .
O25 CHECK FOR TRANSFER CASE DISENGAGEMENT • With the vehicle in NEUTRAL, position it on a hoist. Refer to section Section 100-02 . • Rotate the rear driveshaft while observing the front driveshaft. • **Does the front driveshaft rotate?**	**Yes** REFER to Section 308-07B . **No** GO to O26 .
O26 CHECK FOR LH AND RH IWE DISENGAGEMENT **NOTE:** The engine must be at idle during the following steps to supply vacuum for IWE engagement/disengagement. • Start the engine and allow to idle. • Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft and universal joint. • Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft and universal joint. • **Does the LH or RH front halfshaft rotate?**	**Yes** Go To Pinpoint Test B . **No** GO to O27 .
O27 CHECK FOR IWE VACUUM LEAKS • Key in OFF position. • Disconnect both vacuum lines from the IWE solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**	**Yes** CHECK the IWE and related components for leaks. Go To Pinpoint Test B . **No** GO to O28 .
O28 CHECK 2H MODE TO 4H MODE SHIFT AT SPEED ABOVE 32 KM/H (20 MPH) • Switch the MSS to 2H mode. • Drive the vehicle on the road and shift from 2H mode to 4H mode while driving above 32 km/h (20 mph). • **Does the transfer case shift to 4H mode satisfactorily?**	**Yes** The 4WD system is functioning correctly. **No** Go To Pinpoint Test E .

Pinpoint Test P: The 4WD Indicators Do Not Operate Correctly/Do Not Operate

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The 4 wheel drive (4WD) system status is transmitted to the instrument cluster from the 4WD control module through the controller area network (CAN) to the powertrain malfunction indicator. A steady indicator displays if the vehicle is in 4x4 auto (4A), 4x4 high (4H) or 4x4 low (4L) (no indicator is provided for 2WD [2H] mode), according to the driver selection. A system fault condition will illuminate the powertrain malfunction indicator. The powertrain malfunction indicator includes other general powertrain system failures. For information about CAN, refer to Section 418-00 .

Possible Causes

- Instrument cluster (IC)
- 4WD system fault
- CAN circuits
- 4WD control module

PINPOINT TEST P: THE 4WD INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

Test Step	Result / Action to Take
P1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCs)	
• Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to P2 .
P2 CHECK FOR INCORRECT 4WD INDICATOR ILLUMINATION	
• Switch the mode select switch (MSS) to 2H mode. • Observe the instrument cluster. • **Do any 4WD indicators illuminate?**	**Yes** GO to P3 . **No** GO to P4 .
P3 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID. • **Does the clutch duty cycle PID read 0% at closed throttle?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test B .
P4 CHECK THE AWD MODE INDICATOR	
• Switch the MSS to 4A mode with the engine running and the vehicle at rest: • Observe the instrument cluster. • **Does the 4WD mode indicator illuminate?**	**Yes** GO to P6 . **No** GO to P5 .

P5 CHECK THE 4H MODE INDICATOR	
• Switch the MSS to 4H mode with the engine running and the vehicle at rest: • Observe the instrument cluster. • **Does the 4WD mode indicator illuminate?**	**Yes** GO to P8 . **No** GO to P7 .
P6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID. • **Does the clutch duty cycle PID read 2% at closed throttle and the transfer case shift motor position PID indicate AWD?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test B .
P7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID. • **Does the clutch duty cycle PID read 2% at closed throttle and the transfer case shift motor position PID indicate AWD mode?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test A .
P8 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE AND TRANSFER CASE SHIFT MOTOR POSITION PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle PWM PID and the transfer case shift motor position PID. • **Does the clutch duty cycle PID read 12% at closed throttle and the transfer case shift motor position PID indicate 4H mode?**	**Yes** CHECK the instrument cluster. REFER to Section 413-01 . **No** Go To Pinpoint Test B .

Pinpoint Test Q: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straightline in 4WD Mode

Normal Operation

When the vehicle is operating in 4WD (4H/4L modes), all 4 wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4 wheel drive (4WD) system to function correctly, each tire must be in good condition and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST Q: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHTLINE IN 4WD MODE

NOTE: Four high/low mode (4H/4L mode) is not intended for driving on hard/dry surfaces; using 4H/4L mode while driving on these surfaces may produce noises like intermittent clunking, but will not damage driveline components.

Test Step	Result / Action to Take
Q1 VERIFY THE CONCERN • Test drive the vehicle on a straight stretch of road in AWD mode. • Drive the vehicle through turns and parking lot maneuvers. • **Does the vehicle bind, pulsate or shudder?**	**Yes** If the problem occurs in 4A mode, GO to Q2 ; If 4H mode or 4L mode, binding is a normal condition. **No** Go To Pinpoint Test N .
Q2 CHECK THE 4WD INDICATORS • Review the test drive notes. • **Did any of the instrument cluster 4WD indicators illuminate or flash?**	**Yes** If the 4H mode indicator or 4L mode indicator illuminated, GO to Q4 . If the 4H mode or 4L mode indicators stayed illuminated, GO to Q3 . **No** GO to Q5 .
Q3 VERIFY THE FAULT • Review the test drive notes. • **Was 4H mode or 4L mode selected when the 4WD indicators were illuminated?**	**Yes** The system is functioning correctly. **No** The fault may have been caused by an intermittent, uncommanded or autolock shift. TEST the system for normal operation. Go To Pinpoint Test N .
Q4 CHECK FOR DTCs • Connect the diagnostic tool. • Carry out the on-demand self test. • **Are DTCs retrieved?**	**Yes** REFER to the Four Wheel Drive (4WD) Control Module Diagnostic Trouble Code (DTC) Chart for diagnosis. **No** GO to Q5 .
Q5 VERIFY THE CONCERN • Disconnect: Transfer Case C350. • Test drive the vehicle on a straight stretch of road and in turns, and shift the transfer case through each mode. Record any fault conditions. • **Is the concern present?**	**Yes** **Vehicles with limited slip rear differential:** The condition may be normal and no repair action is necessary. CHECK the rear axle to verify. REFER to Section 205-00 . **Vehicles without limited slip rear differential:** INSPECT the driveline components for damage or wear. REFER to Inspection and Verification. **No** GO to Q6 .
Q6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID • Connect: Transfer Case C350. • CLEAR the DTCs. • Enter the following diagnostic mode on the diagnostic tool:	**Yes** GO to Q7 . **No**

PID/DATA Monitor and Record. • Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID at closed throttle, engine OFF, key ON. • **Is the clutch duty cycle greater than 10%?**	CHECK the transfer case. REFER to Section 308-07B .
Q7 CHECK THE 4WD SHAFT SPEED PIDs	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • While driving the vehicle at 30 km/h (18 mph), monitor the shaft speed PIDs. • Compare the speedometer reading to the wheel speed PIDs. • **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to Q8 . **No** VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the anti-lock brake system (ABS) system for faults. REFER to Section 206-09 .
Q8 CHECK THE ACCELERATOR PEDAL POSITION OUTPUT PID	
• Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record. • Slowly move accelerator pedal from closed throttle to WOT and observe the output PID. • **Does the value vary between 0% at closed throttle and 100% at WOT?**	**Yes** GO to Q9 . **No** Diagnose the powertrain control module (PCM). REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Q9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the front driveshaft by hand. • **Does the front driveshaft rotate freely (does it require less than 45 Nm [33 lb-ft] to rotate)?**	**Yes** INSTALL a new 4WD control module. REFER to Four Wheel Drive (4WD) Control Module in this section. TEST the system for normal operation. **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.

Four Wheel Drive (4WD) Control Module

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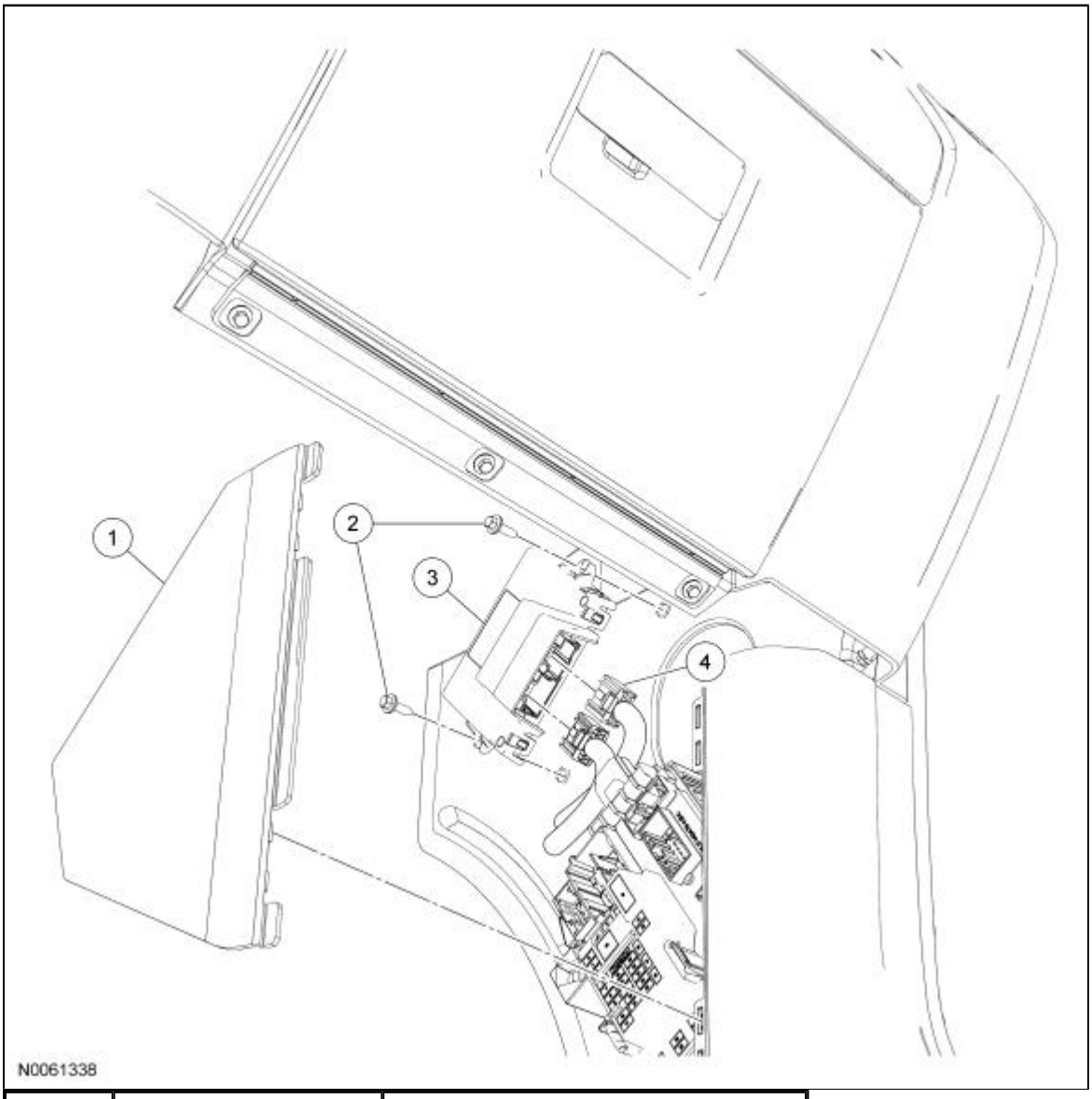
Removal and Installation



Item	Part Number	Description
1	020A78	Cowl side panel cover
2	W705314	Screws
3	—	Connectors
4	7E453	4WD control module

1. Remove the RH-side cowl side panel cover to gain access.
2. Remove the 2 screws.
3. Disconnect the electrical connectors.

4. Remove the 4WD control module.
5. To install, reverse the removal procedure.

Printable View (79 KB)

General Specifications

Item	Specification
Fluid	
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON®
Transfer case fluid capacity	1.5-1.7 (3.1-3.6 pt)
Thread Sealant with PTFE TA-24	WSK-M2G30-A2
Ultra Silicone Sealant TA-29	ESL-M4G273-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Coil nuts	10	—	89
Crossmember mount bolt (Navigator)	40	30	—
Drain plug	15	11	—
Fill plug	15	11	—
Shift motor bolts	10	—	89
Transfer case bolts	24	18	—
Transfer case-to-transmission bolts (Navigator)	41	30	—
Transmission-to-transfer case bolts	47	35	—

Transfer Case

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Features and Operation

Expedition

The automatic four wheel drive (A4WD) transfer case uses an electronic shift four wheel drive (4WD) system that allows the operator to choose between 4 different operational modes. The operator can switch between 2H, all wheel drive (AWD) and 4H modes at any speed. However, to engage or disengage 4L mode, the 4WD control module requires that the vehicle speed is less than 5 km/h (3 mph), the brake is applied and the transmission is in NEUTRAL.

In AWD mode, the 4WD control module varies the torque split between front and rear drivelines by controlling the transfer case clutch. Under most conditions, the 4WD control module activates the transfer case clutch at a minimum duty cycle (percentage of time the clutch is turned on) which allows for a slight speed difference between the front and rear drivelines which normally occurs when negotiating a corner on dry pavement. When the rear wheels are overpowered, the 4WD control module detects this slip condition and the duty cycle to the transfer case clutch is increased until the speed difference between front and rear drivelines is reduced. In this manner, the 4WD control module can redirect engine torque to the front wheels when the rear wheels lose traction yet still allow operation in the AWD mode on dry pavement.

Navigator

The A4WD transfer case uses an electronic shift 4WD system that allows the operator to choose between 3 different operational modes. The operator can switch between 4x2, 4x4 AUTO and 4x4 modes at any speed. 4L mode is not available.

In 4x4 AUTO mode, the 4WD control module varies the torque split between front and rear drivelines by controlling the transfer case clutch. Under most conditions, the 4WD control module activates the transfer case clutch at a minimum duty cycle (percentage of time the clutch is turned on) which allows for a slight speed difference between the front and rear drivelines which normally occurs when negotiating a corner on dry pavement. When the rear wheels are overpowered, the 4WD control module detects this slip condition and the duty cycle to the transfer case clutch is increased until the speed difference between front and rear drivelines is reduced. In this manner, the 4WD control module can redirect engine torque to the front wheels when the rear wheels lose traction yet still allow operation in the AWD mode on dry pavement.

Expedition and Navigator

When the anti-lock brake (ABS) system is active, the 4WD control module will default to a minimum duty cycle for the transfer case clutch.

Feature inputs:

- Mode select switch (MSS)
- ABS active input (battery voltage when ABS is active, grounded when inactive)
- Contact plate position inputs A, B, C, D grounded when closed, open circuit when open

Feature outputs:

- Solid state clutch relay (pulse width modulated signal: grounded when relay is on, battery potential when relay is off)

Transfer Case

Printable View (62 KB)

Refer to Section 308-07A .

Transfer Case Draining and Filling

Printable View (92 KB)

Special Tool(s)

ST2323-A	Oil Suction Gun 303-D104 (D94T-9000-A)

Material

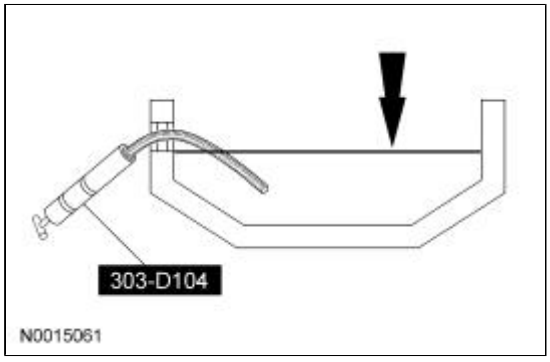
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

1. Remove the drain plug and drain the fluid. Clean the drain plug and the drain plug area. Apply thread sealant to the drain plug threads. Reinstall the drain plug.
   - To install, tighten to 15 Nm (11 lb-ft).

2. Clean the area around the fill plug. Remove the fill plug.

3. **CAUTION: Incorrect fluid fill can result in transfer case failure.**

   Using the special tool, fill the transfer case to specification.
   - The fluid must be just below the fill plug hole. Fill the case until the fluid slowly flows over the fill plug threads. Clean the fluid from the fill plug area.



4. Apply thread sealant to the fill plug threads, then install the fill plug.
   - Tighten to 15 Nm (11 lb-ft).

Transfer Case Rear Output Shaft Seal

Printable View (108 KB)

Special Tool(s)

ST2261-A	Installer, Input Shaft Oil Seal 308-249 (T96T-7127-A)

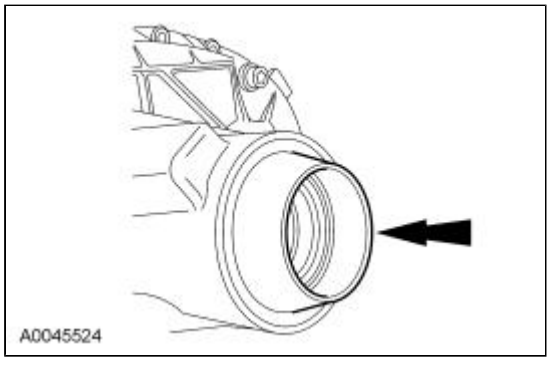
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** Index-mark the rear driveshaft yoke and pinion flange to maintain initial driveshaft balance during installation.

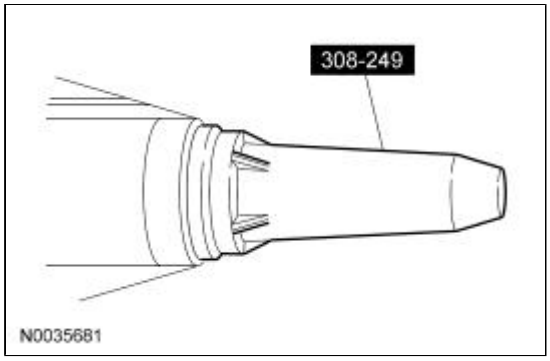
   Remove the rear driveshaft. For additional information, refer to Section 205-01 .

3. Using a suitable tool, remove the oil seal.



Installation

1. To install, reverse the removal procedure.
   - Using the special tool, install the oil seal.



Transfer Case

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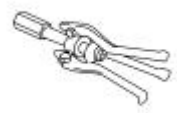
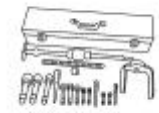
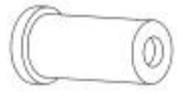
Special Tool(s)

 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
ST1255-A	Handle 205-D055 (D81L-4000-A) or equivalent
 ST1144-A	Universal Puller Set 303-DS005 (D80L-100-A)
 ST1788-A	Installer, Mainshaft Bearing 308-060 (T77J-7025-K)
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2239-A	Installer, Output Shaft Front Bearing 308-410
	Installer, Front Axle Oil Seal 205-350 (T95T-3010-A)

ST1786-A	
ST2305-A	Installer, Input Shaft Oil Seal 308-186 (T90T-7127-B)
ST2261-A	Installer, Input Shaft Oil Seal 308-249 (T96T-7127-A)
ST1466-A	Installer, Valve Stem Oil Seal 303-367 (T90P-6510-AH)

Material

Item	Specification
Ultra Silicone Sealant TA-29	ESL-M4G273-A
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Disassembly

1. **WARNING: Make sure protective eyewear is in place.**

   WARNING: Use a petroleum-based solvent to clean the transfer case. Refer to the solvent manufacturer's safety precautions to prevent personal injury or transfer case damage.

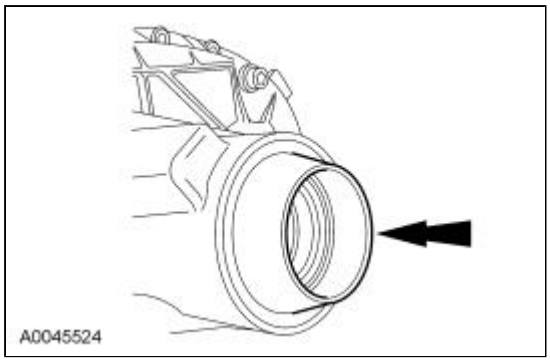
   CAUTION: Seal all openings before cleaning the transfer case exterior. This will prevent entry of dirt and water, which can cause damage to internal components.

   Clean the transfer case exterior with solvent and dry with compressed air.

2. Using special tool 307-003, secure the transfer case to a work bench. Rotate the transfer case so that the output shaft is pointing upward.

3. Drain the fluid from the transfer case, if not done previously.

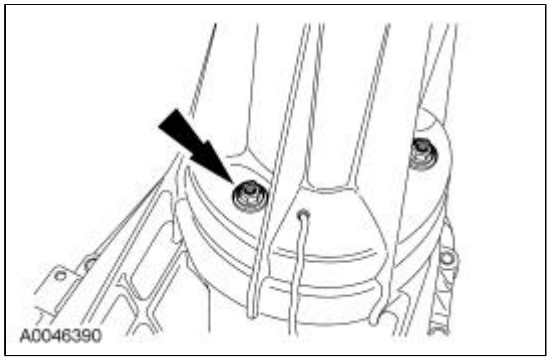
4. Using a suitable tool, remove and discard the oil seal.



5. Remove the coil wire pin from the electrical connector.
    - Remove the wire connector spacer.
    - Remove the coil wire pin (tan wire).
        - Use an electrical connector pin extractor tool.

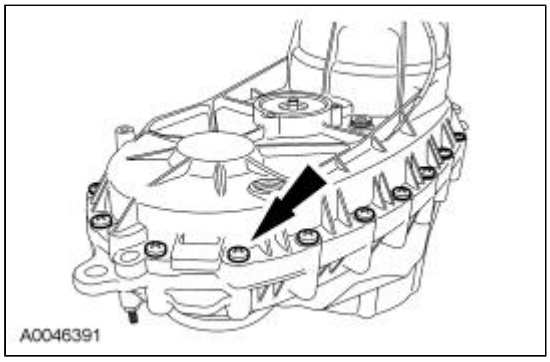
6. Remove the bolts and transfer case shift motor.

7. Remove the 3 coil nuts and washers.

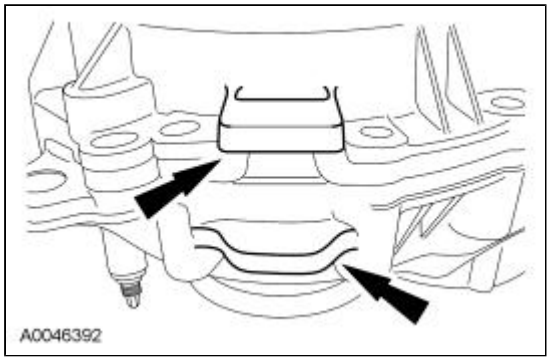


8. **NOTE:** It is normal to find metal shavings after removing the self-tapping transfer case bolts.

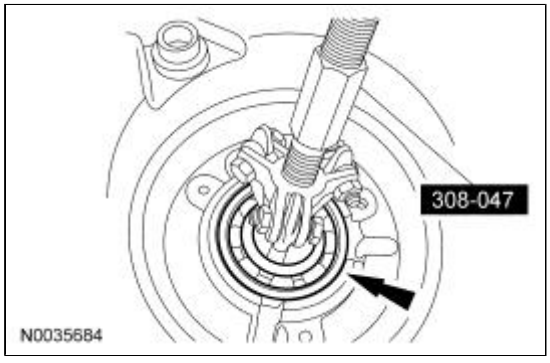
    Remove the 20 bolts.



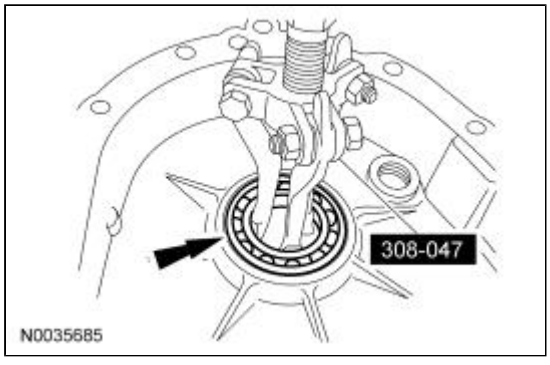
9. Separate the transfer case halves.
    - Use the pry bosses to separate the case halves.



10. Using the special tool, remove the rear output shaft support bearing.



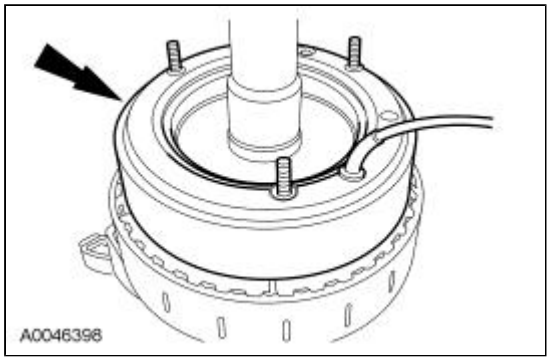
11. Using the special tool, remove the front output shaft rear bearing.



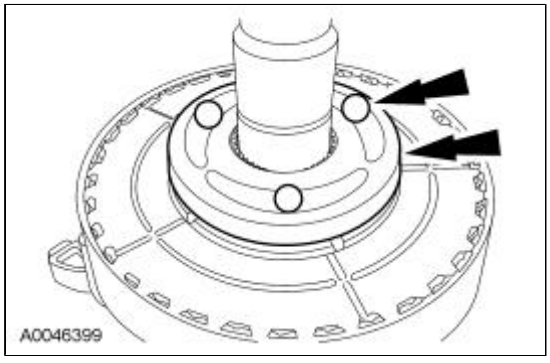
12. Remove the snap ring.
    - Inspect the snap ring for wear or damage. Install a new snap ring as necessary.

13. Remove the caged thrust bearing assembly.
    - Inspect the bearing for wear or damage. Install a new bearing as necessary.

14. Remove the cam/coil housing.

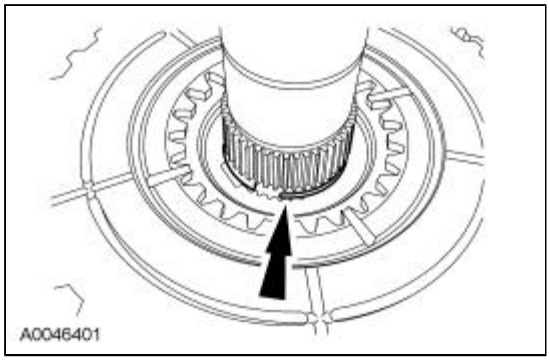


15. Remove the steel balls and the cam.



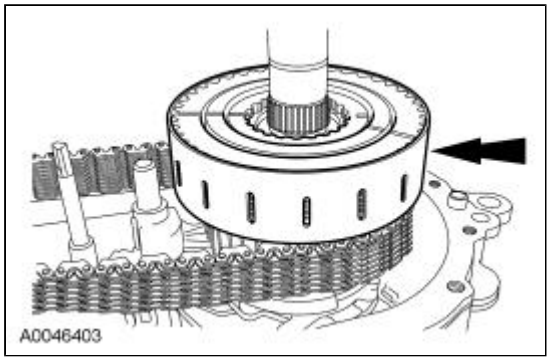
16. Remove the wave spring.

17. Remove and discard the snap ring.

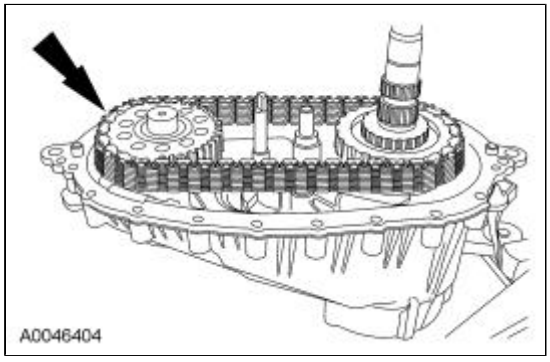


18. **CAUTION: When removing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack upon removal. Set the clutch pack assembly on the bench in the same position as located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem can occur.**

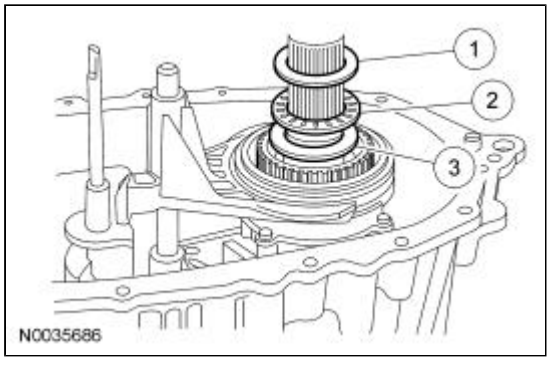
    Remove the clutch pack assembly.



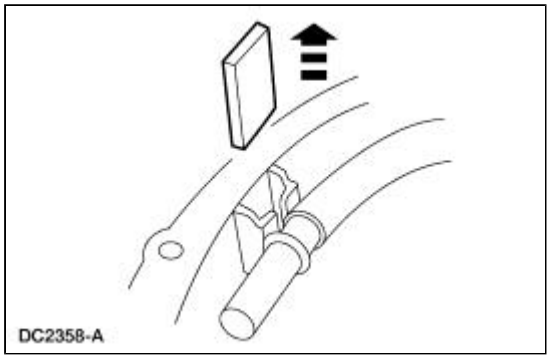
19. Remove the drive chain and the sprockets as an assembly.
    - Inspect the drive chain for wear or damage. Inspect the sprockets for broken or cracked teeth. Install new components as necessary.



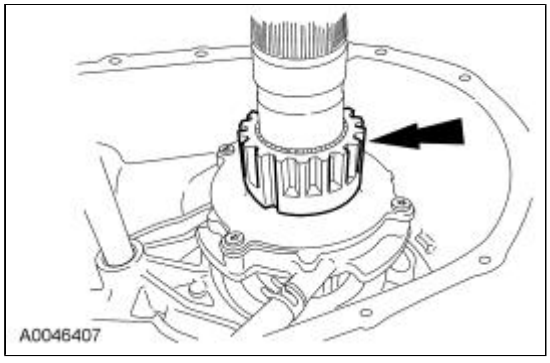
20. Remove the thrust bearing assembly.
    1. Remove the thrust washer.
        - The upper thrust washer may be attached to the sprocket.
    2. Remove the thrust bearing.
    3. Remove the thrust washer.
    - Inspect the washers and bearing for wear or damage. Install new components as necessary.



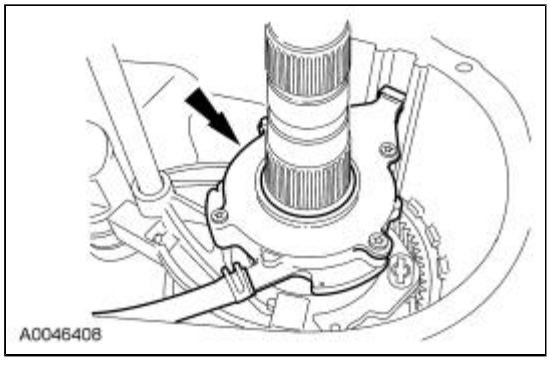
21. Remove and clean the oil pan magnet.



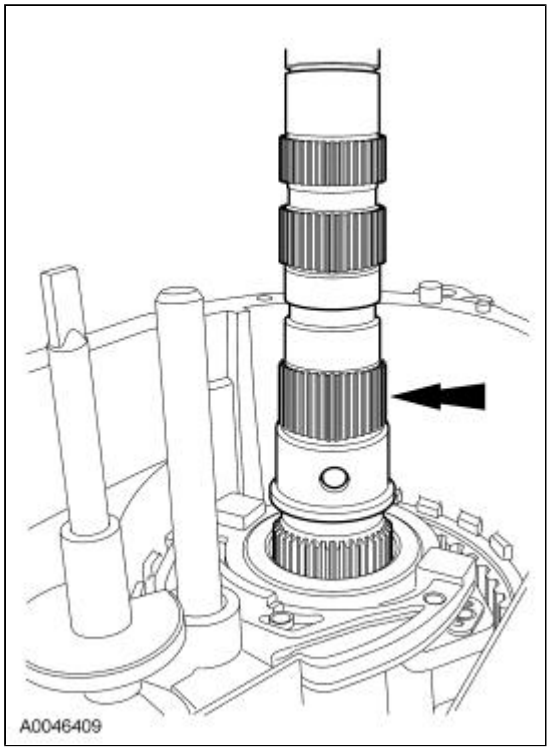
22. Remove the output shaft sprocket.



23. Remove the oil pump assembly.



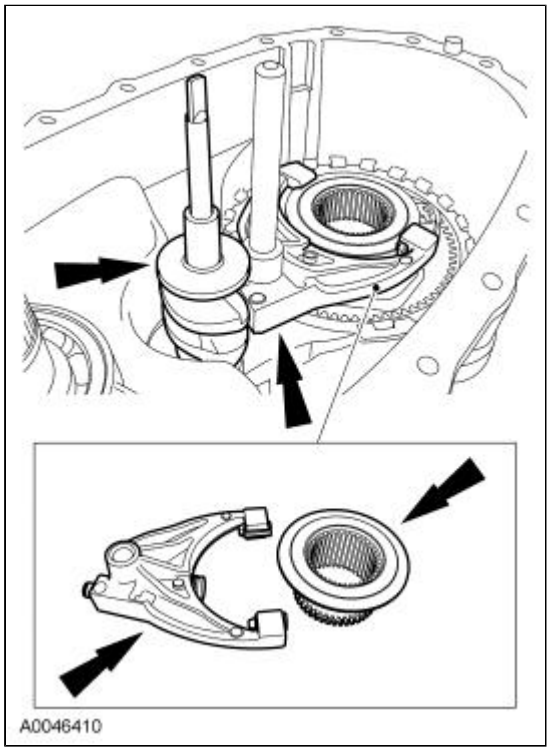
24. Remove the output shaft.



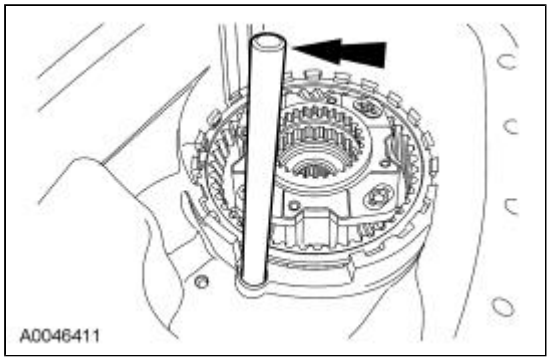
25. **WARNING: Do not disassemble the shift cam assembly.**

Remove the reduction shift fork, the reduction hub and the shift cam as an assembly.

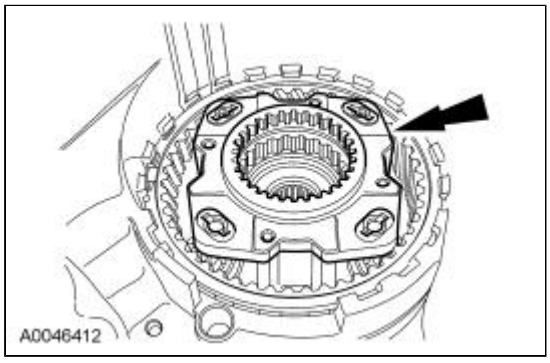
- Separate and inspect the reduction hub and the reduction shift fork for wear or damage.



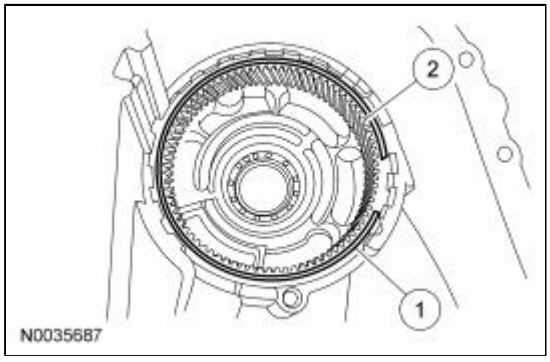
26. Remove the shift fork shaft.



27. Remove the front planet.
    - Using a drift and a hammer, remove the front planet needle bearing, if necessary.



28. Remove the ring gear.
    1. Remove the snap ring.
        - Inspect the snap ring for wear or damage. Install a new snap ring as necessary.
    2. Remove the ring gear.

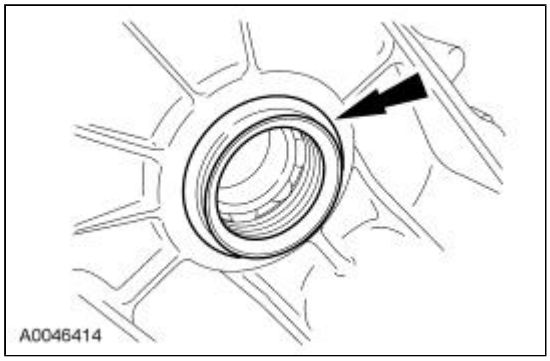


29. **CAUTION: Do not let the front output shaft fall when removing the snap ring.**

    Remove the snap ring and the front output shaft.
    - Inspect the snap ring for wear or damage. Install a new snap ring as necessary.

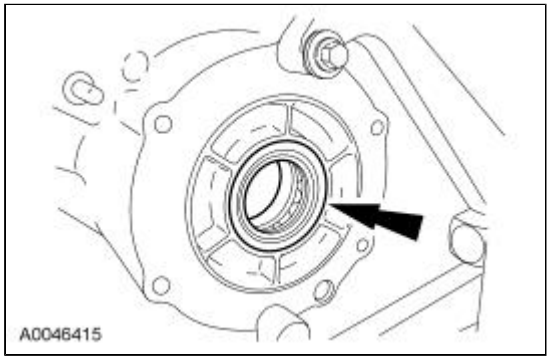
30. **NOTE:** Carefully remove the seal, do not damage the seal bore.

    Remove and discard the front output shaft oil seal.

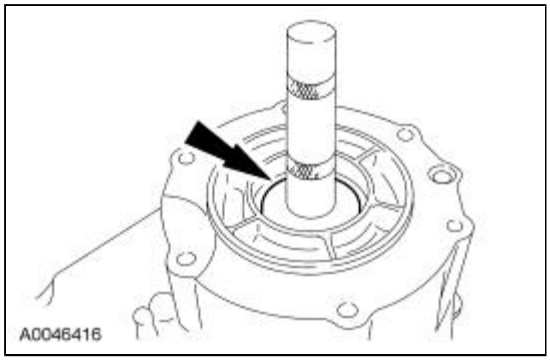


31. **NOTE:** Carefully remove the seal, do not damage the seal bore.

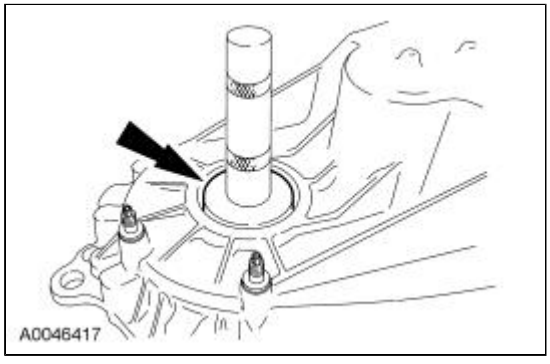
    Remove and discard the front input shaft oil seal.



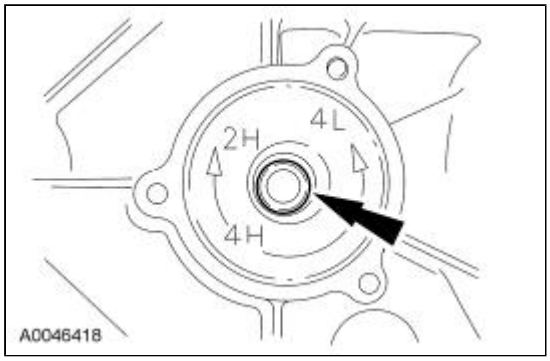
32. Using a suitable driver, remove the front planet support bearing.



33. Using a suitable driver, remove the front output shaft support bearing.



34. Using a suitable tool, remove and discard the shifter shaft seal.

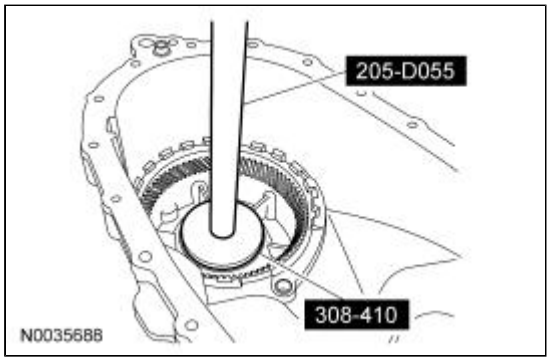


Assembly

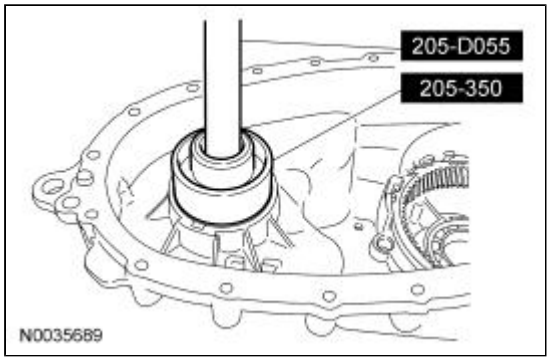
1. Lubricate all internal components with the recommended transfer case lubricant during reassembly.

2. Clean the mating surfaces of the cases.

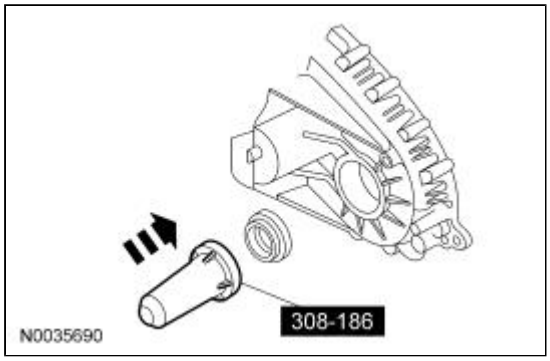
3. Using a suitable press and the special tools, install the front planet support bearing.



4. Using a suitable press and the special tools, install the front output shaft support bearing.

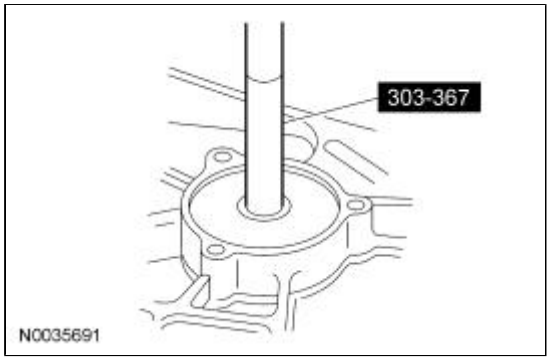


5. Using the special tool, install a new oil seal.



6. **CAUTION: Be careful not to crush the seal.**

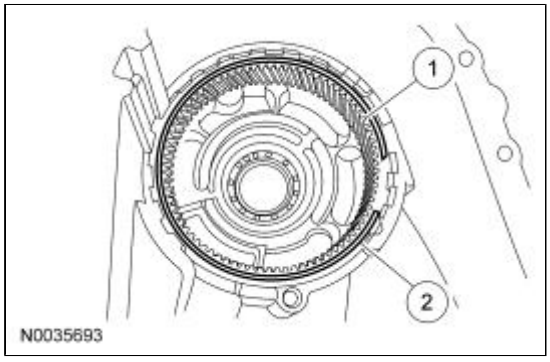
   Using the special tool, install a new shifter shaft seal.



7. Install the case to the transmission holding fixture. Secure the case to the work bench.

8. Using special tool 308-249, install a new oil seal.

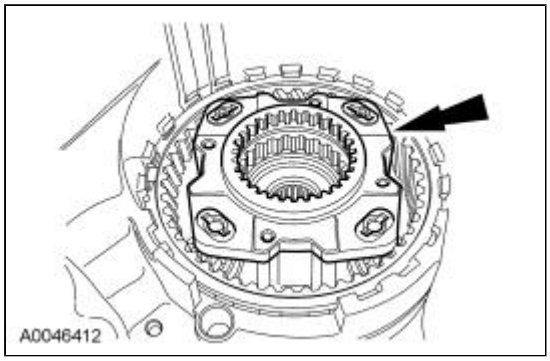
9. Install the ring gear.
   1. Position the ring gear in the case.
   2. Install the snap ring.



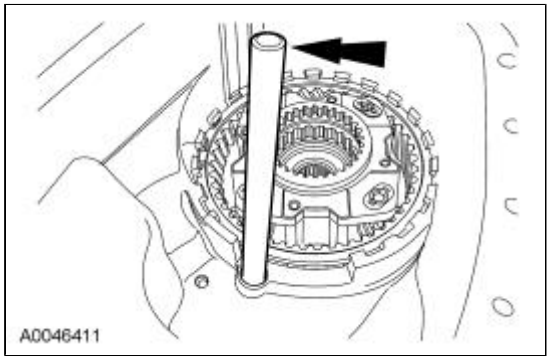
10. Install the front output shaft and the snap ring.

11. **NOTE:** If removed, using a suitable press and the special tool 308-085, install the needle bearing into the front planet. Be careful not to crush the bearing cage.

    Install the front planet.

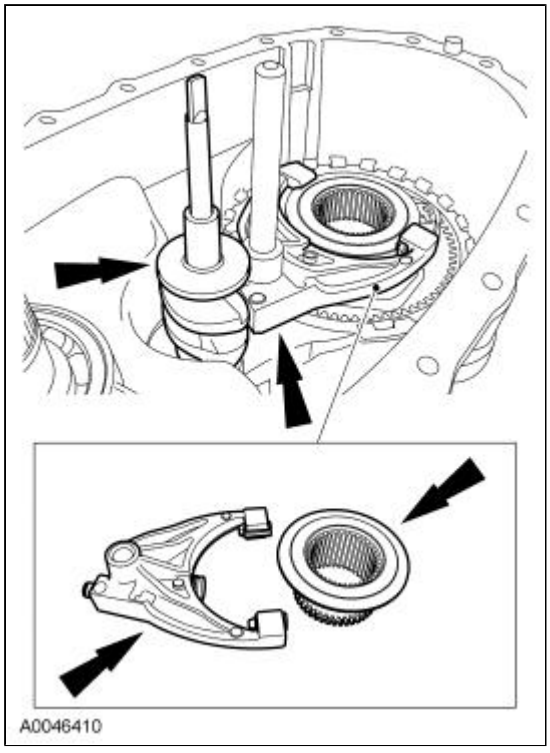


12. Install the shift fork shaft.

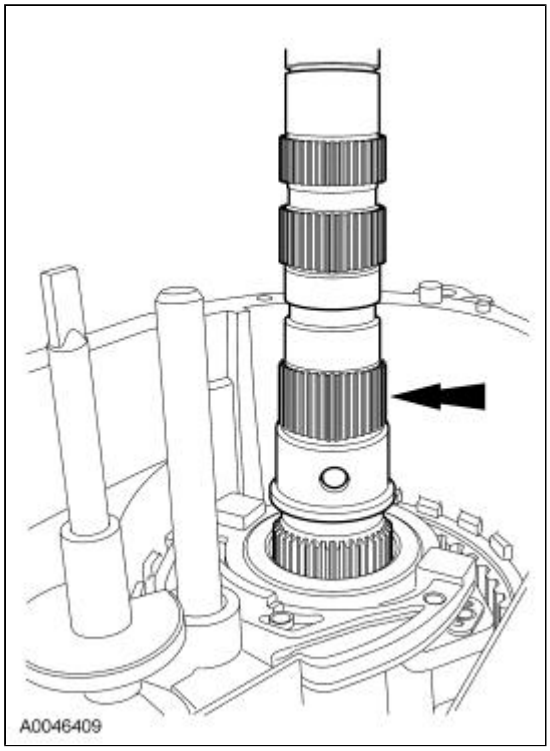


13. **NOTE:** Assemble the reduction hub and the reduction shift fork.

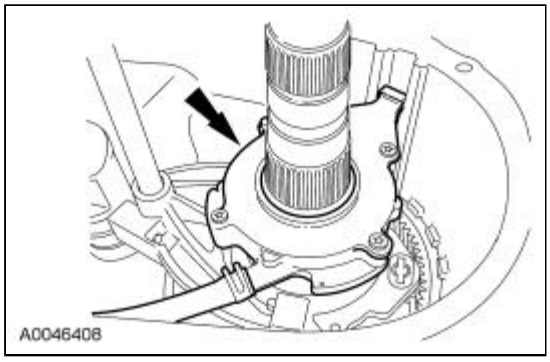
    Install the reduction shift fork, the reduction hub and the shift cam as an assembly.



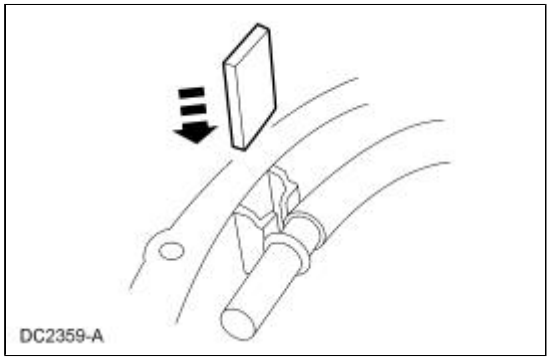
14. Install the output shaft.



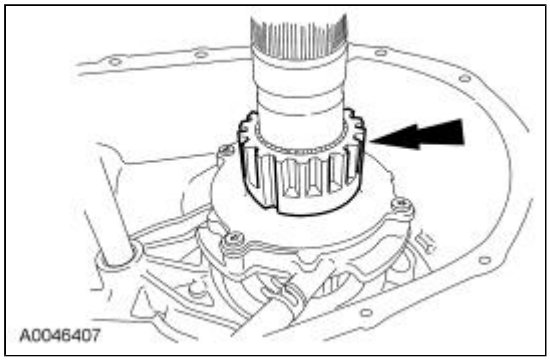
15. Install the oil pump assembly.
    - Make sure the oil pump finger is in the slot in the case.



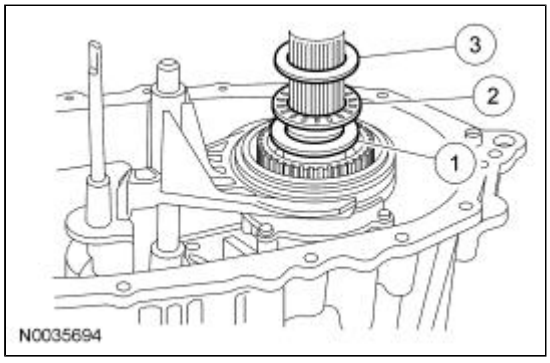
16. Install the oil pan magnet into its slot in the case.



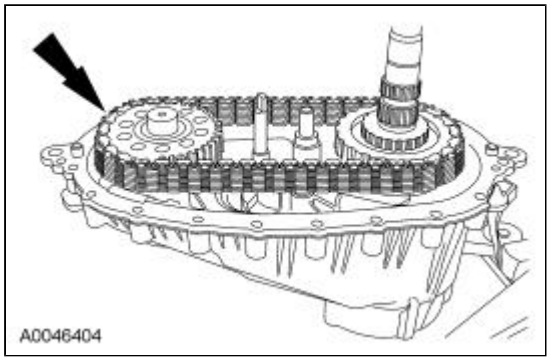
17. Install the output shaft sprocket.



18. Install the 3-piece thrust bearing assembly.
    1. Install the thrust washer.
    2. Install the thrust bearing.
    3. Install the thrust washer.

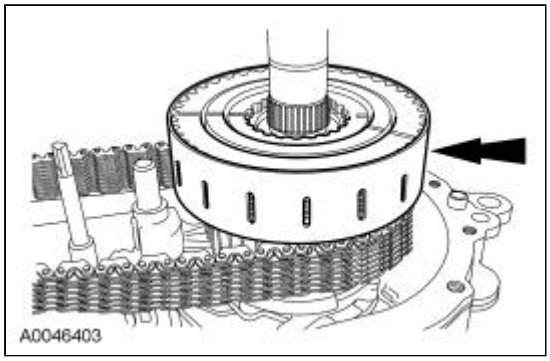


19. Install the drive chain and the sprockets as an assembly.

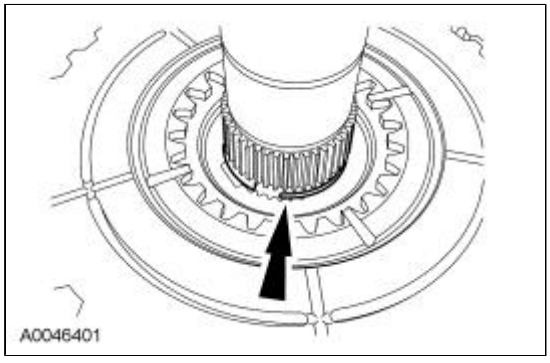


20. **CAUTION: When installing the clutch assembly, do not separate the clutch pack assembly. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem can occur.**

    Install the clutch pack assembly.

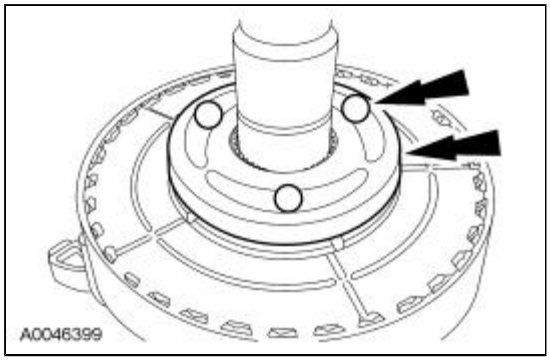


21. Install a new snap ring.

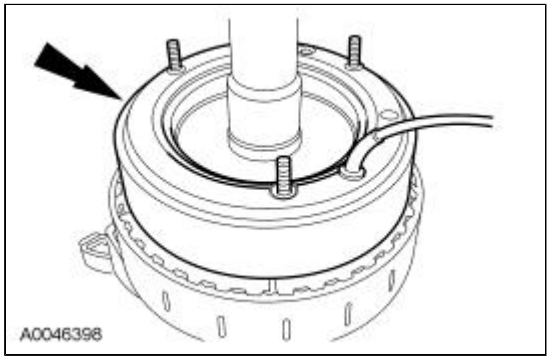


22. Install the wave spring.

23. Install the cam and the steel balls.



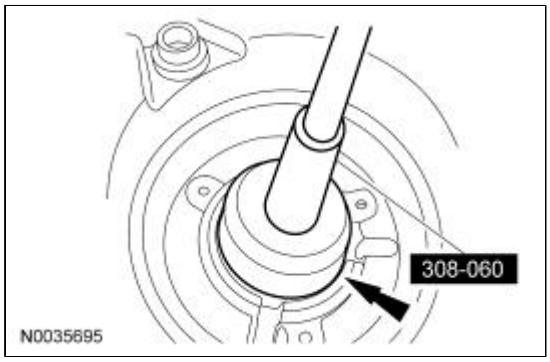
24. Install the cam/coil housing.



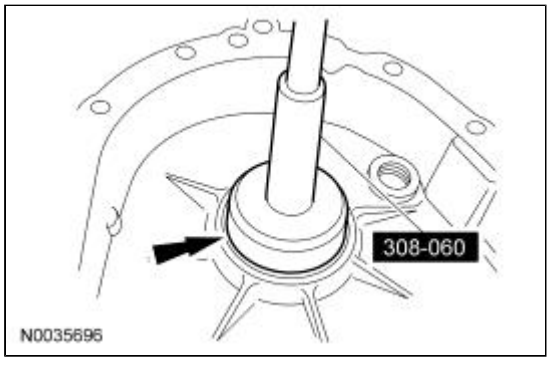
25. Install the thrust bearing assembly.

26. Install the snap ring.

27. Using a suitable press and the special tool, install the rear output shaft support bearing.

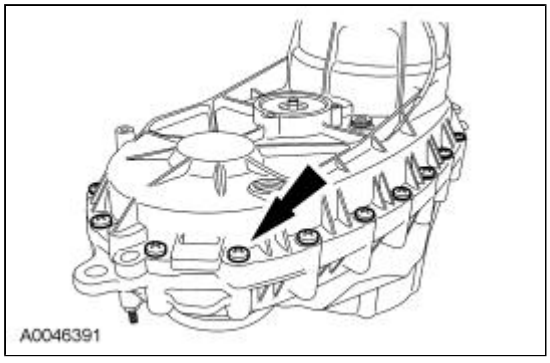


28. Using a suitable press and the special tool, install the front output shaft rear bearing.



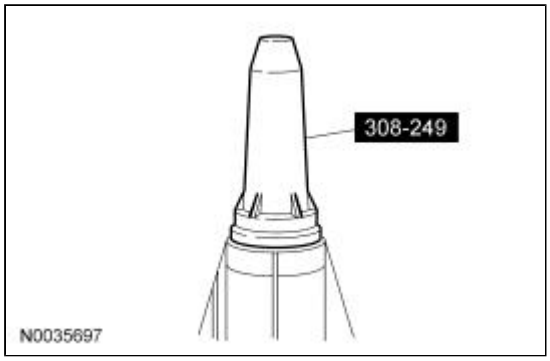
29. **CAUTION: Applying too much silicone sealant can plug the fluid filter and cause transfer case failure.**

    Apply a bead of silicone sealant to the transfer case mating surfaces, then position the 2 transfer case halves together. Tighten the transfer case bolts evenly in a star pattern.
    - Position the coil studs through the case holes, make sure the shift cam shaft is aligned with its case bore, and the lockup shift fork spring is in position.
    - Tighten to 24 Nm (18 lb-ft).



30. Install the 3 coil washers and nuts.
    - Tighten to 10 Nm (89 lb-in).

31. Using the special tool, install the oil seal.



32. Install the transfer case shift motor.
    - Tighten the shift motor bolts to 10 Nm (89 lb-in).

33. Install the coil wire pin in the electrical connector.
    - Remove the wire connector spacer.
    - Install the coil wire pin. Reinstall the wire connector spacer.

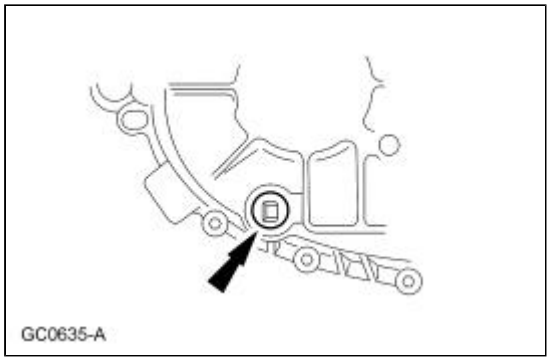
34. Remove the transfer case from the special tool.

Transfer Case — Navigator

Printable View (252 KB)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the fluid if the transfer case is to be disassembled.
   - Install the drain plug when finished draining.



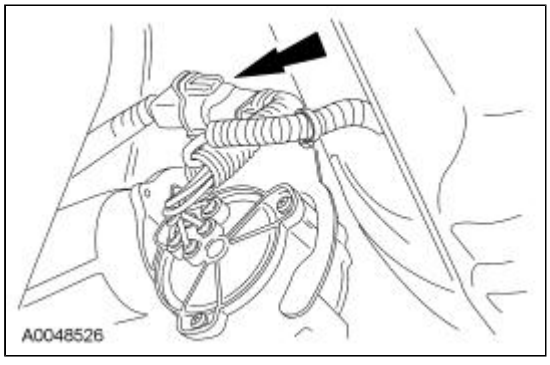
3. **NOTE:** Index-mark the driveshaft to maintain initial driveshaft balance during installation.

   Remove the front driveshaft. For additional information, refer to Section 205-01 .

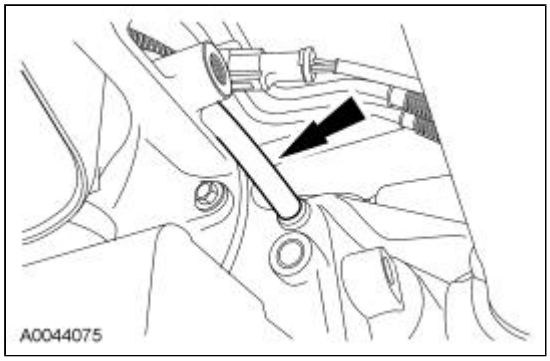
4. **NOTE:** Index-mark the driveshaft to maintain initial driveshaft balance during installation.

   Remove the rear driveshaft. For additional information, refer to Section 205-01 .

5. Disconnect the electrical connector.

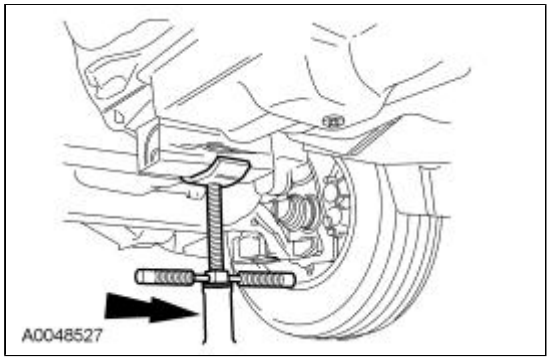


6. Disconnect the vent hose.



7. **CAUTION: Never support the transmission from the bottom of the transmission pan.**

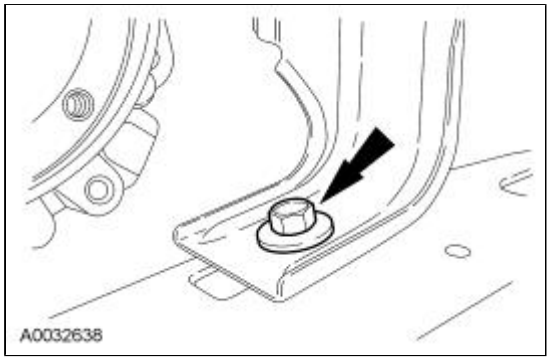
   Using a suitable jack stand, support the transmission.



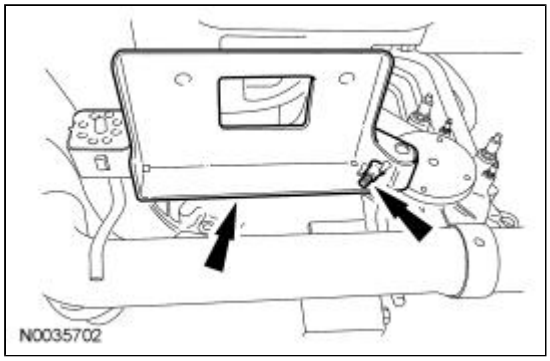
8. **CAUTION: Secure the transfer case to the jack with a safety strap.**

   Using a suitable transmission jack, support the transfer case.

9. Remove the 2 exhaust heat shield-to-crossmember bolts.

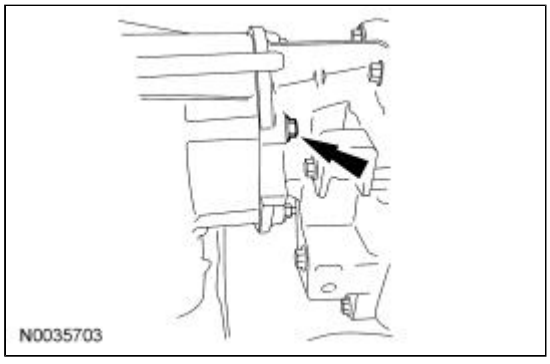


10. Remove the bolt and the exhaust hanger bracket.
    - To install, tighten to 40 Nm (30 lb-ft).



11. **NOTE:** Position a suitable drain pan below the transmission extension housing.

    Remove the 6 transfer case-to-transmission extension housing bolts.
    - To install, tighten to 41 Nm (30 lb-ft).

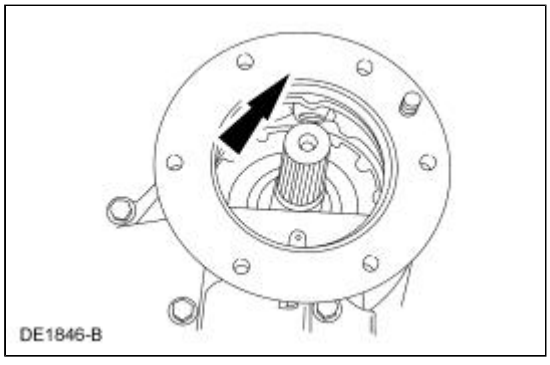


12. **NOTE:** Watch for obstructions.

    Separate the transfer case from the transmission extension housing, move the transfer case rearward off the output shaft, then lower the transfer case from the vehicle.

13. **CAUTION: Carefully clean the gasket surfaces. Nicks and gouges cause fluid leaks.**

    Remove the transfer case-to-transmission gasket and clean the mating surfaces.

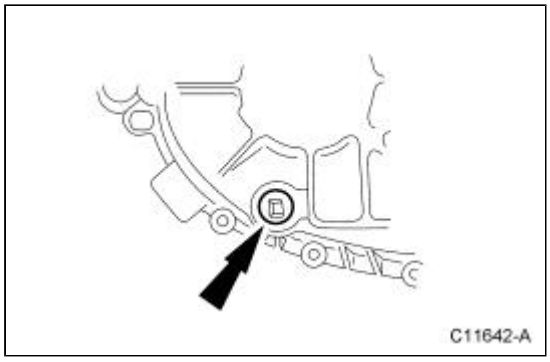


Transfer Case — Expedition

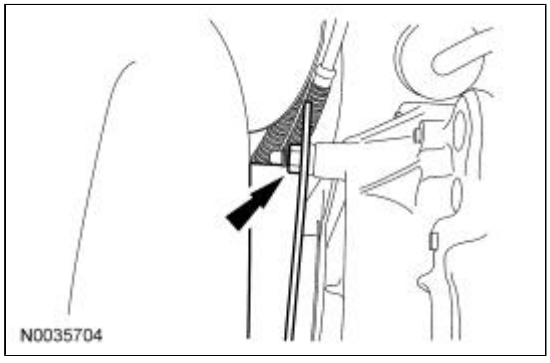
Printable View (230 KB)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the fluid if the transfer case is to be disassembled.
   - Install the drain plug when finished draining.



3. Remove the 2 nuts and the front driveshaft shield.
   - To install, tighten to 18 Nm (13 lb-ft).



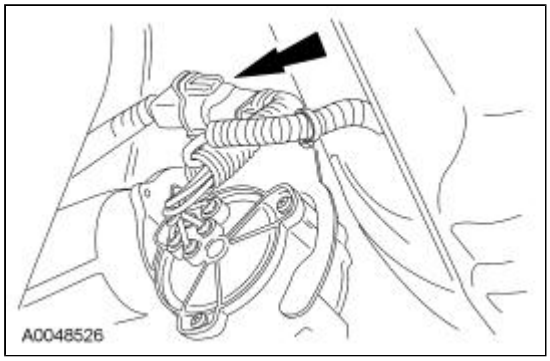
4. **NOTE:** Index-mark the driveshaft to maintain initial driveshaft balance during installation.

   Remove the front driveshaft. For additional information, refer to Section 205-01 .

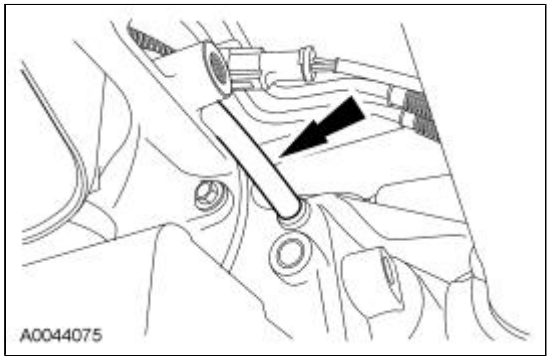
5. **NOTE:** Index-mark the driveshaft to maintain initial driveshaft balance during installation.

   Remove the rear driveshaft. For additional information, refer to Section 205-01 .

6. Disconnect the electrical connector.

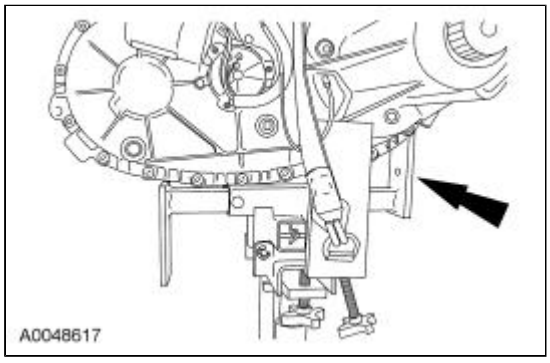


7. Disconnect the vent hose.



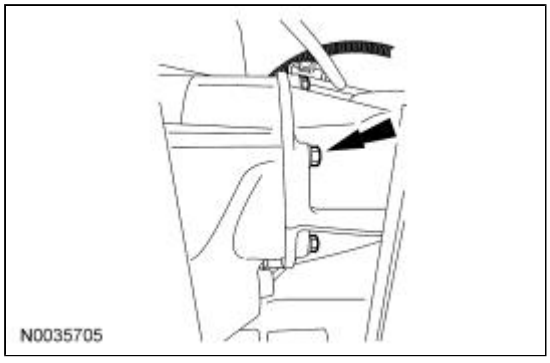
8. **CAUTION: Secure the transfer case to the jack with a safety strap.**

   Using a suitable transmission jack, support the transfer case.



9. **NOTE:** Position a suitable drain pan below the transmission extension housing.

   Remove the 6 transfer case-to-transmission extension housing bolts.
   - To install, tighten to 47 Nm (35 lb-ft).

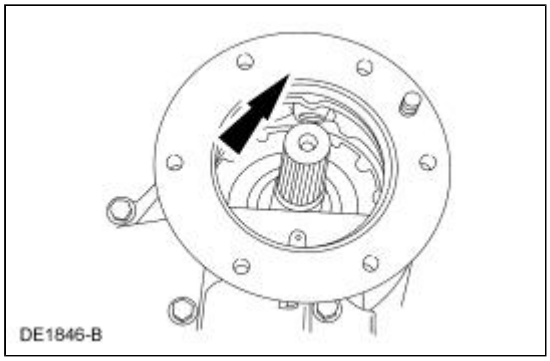


10. **NOTE:** Watch for obstructions.

    Separate the transfer case from the transmission extension housing, move the transfer case rearward off the output shaft, then lower the transfer case from the vehicle.

11. **CAUTION: Carefully clean the gasket surfaces. Nicks and gouges cause fluid leaks.**

    Remove the transfer case-to-transmission gasket and clean the mating surfaces.

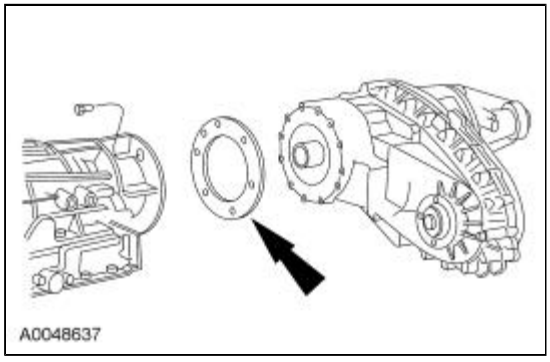


Transfer Case

Printable View (105 KB)

NOTE: Installation is for both Navigator and Expedition.

1. To install, reverse the removal procedure.
   - Install a new transfer case-to-transmission gasket.
   - Fill the transfer case. For additional information, refer to Transfer Case Draining and Filling in the General Procedures portion of this section when refilling the transfer case. Refer to Specifications in this section for the correct type and quantity of fluid.
   - Tighten the transfer case-to-transmission bolts evenly in a star pattern.
   - Adjust the transmission selector lever cable. For additional information, refer to Section 307-05 .



Printable View (65 KB)

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust and transmission mounting bracket cap bolt	35	26	—
Exhaust and transmission mounting bracket-to-transmission bolts	90	66	—
Exhaust dual Y-pipe catalytic converter-to-exhaust manifold nuts	40	30	—
Exhaust hanger and transmission mounting bracket-to-crossmember nuts	103	76	—
Heat shield bolt	20	15	—
Heated oxygen and catalyst monitor sensors	40	30	—
Isolator and bracket assembly-to-frame bolts	25	18	—
RH catalytic converter-to-LH catalytic converter clamp nut	55	41	—
RH catalytic converter-to-muffler assembly bolts	48	35	—
Tail pipe-to-chrome tip clamp nut	48	35	—
Tail pipe-to-muffler assembly clamp nut	48	35	—
Transfer case skid plate bolts	25	18	—
Transmission crossmember bolts	90	66	—
Worm gear clamp	7	—	62

Exhaust System

Printable View (84 KB)

Exhaust System

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converter and a muffler assembly. Rubber exhaust hanger insulators attach the exhaust system to the mounting hooks.

Catalytic Converter

The catalytic converter plays a major role in the emission control system. The catalytic converter operates as a gas reactor. Its catalytic function is to speed the heat-producing chemical reaction of components in the exhaust gases in order to reduce air pollutants. The catalyst material inside the catalytic converter consists of a ceramic substrate.

The catalytic converter is designed to provide a long life. No maintenance is necessary for the catalytic converter.

Sound Insulators and Shields

Sound insulators and shields attached to the underbody protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator or shield is damaged or shows evidence of deterioration, a new sound insulator or shield should be installed. The sound insulators and shields for the muffler, exhaust downpipe, inlet pipe and catalytic converter pipe are installed separately.

Precautions

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to repair any part of the exhaust system until it has cooled. Use special care when working around the catalytic converter. The catalytic converter heats to a high temperature after only a short period of engine operation. Failure to follow these instructions may result in personal injury.

WARNING: Exhaust gases contain carbon monoxide which can be harmful to health and are potentially lethal. Exhaust system leaks should be repaired immediately. Never operate the engine in enclosed areas. Failure to follow these instructions may result in personal injury.

CAUTION: Do not use leaded fuel in a vehicle equipped with catalytic converter.

CAUTION: In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless.

CAUTION: The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.

CAUTION: Extremely high temperatures of 1,100°C (2,012°F) or above due to misfiring or

over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss or other unusual operating conditions, such as engine overheating and backfiring

CAUTION: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

Apply anti-seize lubricant to the threads of the heated oxygen sensors (HO2S) and catalyst monitor sensor before installation.

Exhaust System

Printable View (89 KB)

Principles of Operation

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters and a muffler assembly. The catalytic converters also play a major role in reducing air pollutants.

Inspection and Verification

1. Verify the concern by running the engine (with the vehicle on the ground) or road testing the vehicle to duplicate the condition.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.
3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Cracked exhaust manifold • Dirty engine air cleaner • Loose or damaged heat shields

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.
5. If the fault is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Rattle, squeaks or buzz type noise — from the bottom of vehicle	• Loose or damaged heat shield	• INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system

		components. If any heat shields are loose, INSTALL worm gear clamp 7L5Z-5A231-AA and TIGHTEN to 7 Nm (62 lb-in). If the heat shields are missing, INSTALL new heat shields or exhaust system components as necessary. If a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary.
	• Loose or damaged exhaust isolators	• CHECK exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	• Damaged exhaust isolator hanger bracket	• INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN bolts to specification or INSTALL new components as necessary.
	• Loose or damaged catalytic converter or muffler	• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	• Exhaust grounded to chassis	• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.
• Drone or clunk type noise — from bottom of vehicle	• Loose or damaged exhaust isolators	• INSPECT exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	• Exhaust grounded to chassis	• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.
• Whistles, boom, hum or ticking type noise — noise tends to change as	• Punctures in the muffler • Broken, loose or missing exhaust manifold fasteners	• REPAIR as necessary.

engine warms. Noises are often accompanied by exhaust fumes	or gaskets • Loose heated oxygen or catalyst monitor sensor	
	• Exhaust system leak	• INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which would indicate exhaust leakage at that point. To magnify a small leak, have an assistant hold a rag over the tailpipe outlet, while listening for a leak. REPAIR or INSTALL new components as necessary.
	• Catalytic converter	• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly tap on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	• Exhaust muffler/resonator drain hole enlarged due to corrosion	• **NOTE:** Check with vehicle on the ground, not on a hoist. CONFIRM drain holes are noise source. INSTALL new components as necessary.
• Hissing or rushing noise — high frequency sound. Vehicle performance is unaffected	• Exhaust system. Exhaust flow through pipes	• CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly tap on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
• Pinging noise — occurs when exhaust system is hot, engine turned OFF	• Catalytic converter/exhaust system	• Cool down pinging is the exhaust system expanding and contracting during heating and cooling. Condition is normal.
• Vibration — occurs at idle and at low speeds. Also	• Loose or damage exhaust isolator	• INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.

accompanied by clunk or buzz type noise	• Loose or damaged exhaust isolator hanger brackets	• INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.
	• Exhaust system grounded to chassis	• CARRY OUT the Exhaust System Alignment in this section.
• Vehicle has low or no power — vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to test for restricted exhaust.
	• Restricted exhaust (possible frozen condensate in muffler)	• CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST vehicle for normal operation. If concern is still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
• Burning smell — usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	• INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.
• Odor — described as a sulfur or rotten egg smell	• Catalytic converter	• At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE customer, no repair required.
	• Rich fuel conditions • Misfire conditions • Excessive sulfur content in fuel	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
• Visible rust on surface of exhaust pipes	• Catalytic converter/exhaust system	• Surface rust is a characteristic of materials used on exhaust system. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, condition is normal.

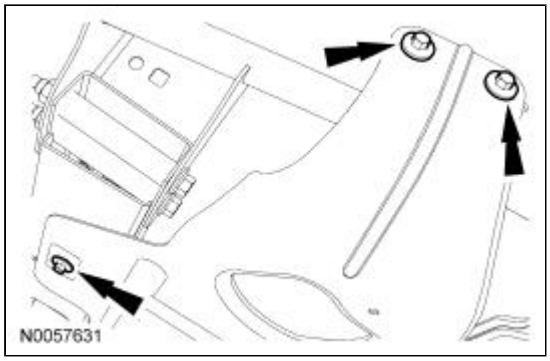
Exhaust System Alignment

Printable View (258 KB)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** LH side shown, RH side similar.

   If equipped, remove the transfer case skid plate.



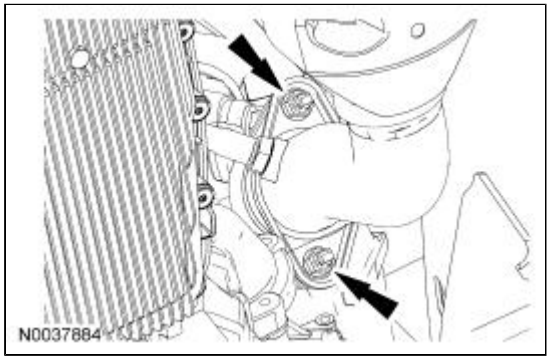
3. Loosen all exhaust component fasteners from the exhaust manifolds to the muffler inlet pipe except the RH catalytic converter-to-LH catalytic converter clamp.

4. Verify that the RH catalytic converter-to-LH catalytic converter and tailpipe clamps are secure and pipes are fully inserted.

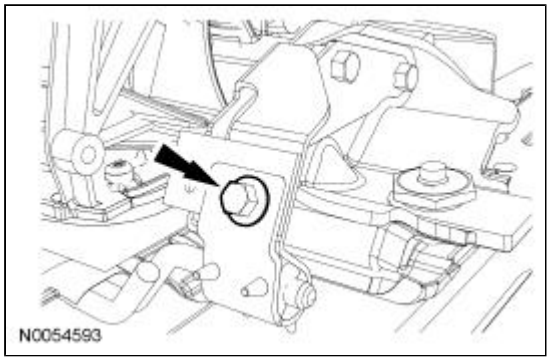
5. **NOTE:** Make sure the exhaust isolators are not torn, damaged or binding.

   Beginning at the front of the vehicle, align the exhaust system to establish the maximum clearance to surrounding components. Make sure that all slip fit pipes are pushed all the way into the preceding pipe and the notches are correctly lined up with the tabs.

6. Tighten the RH catalytic converter-to-exhaust manifold nuts in the following sequence:
   1. Tighten the RH upper catalytic converter-to-exhaust manifold nut.
      - Tighten to 40 Nm (30 lb-ft).
   2. Tighten the RH lower catalytic converter-to-exhaust manifold nut.
      - Tighten to 40 Nm (30 lb-ft).



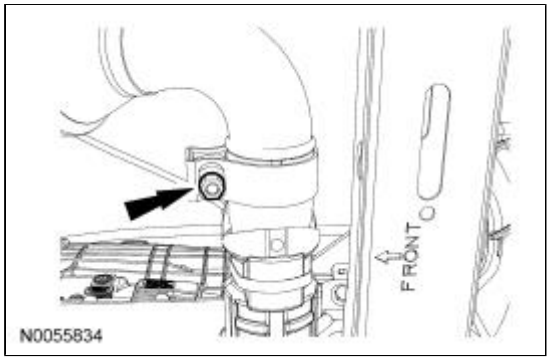
7. Tighten the exhaust and transmission mounting bracket cap bolt.
   - Tighten to 35 Nm (26 lb-ft).



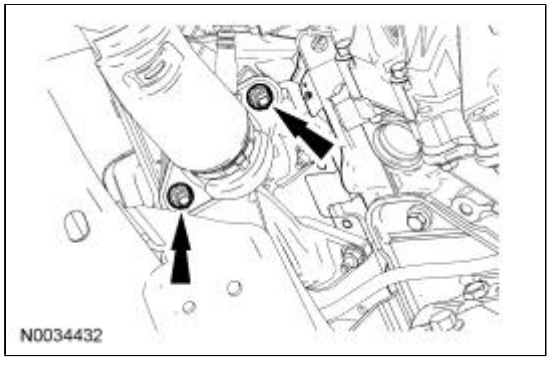
8. **NOTE:** A new RH catalytic converter-to-LH catalytic converter clamp must be installed whenever the clamp is loosened.

   NOTE: Make sure the new RH catalytic converter-to-LH catalytic converter clamp is positioned with the clamp bolt facing the front of the vehicle.

   If loosened, tighten the RH catalytic converter-to-LH catalytic converter clamp.
   - Tighten to 55 Nm (41 lb-ft).



9. Tighten the LH catalytic converter-to-exhaust manifold nuts in the following sequence:
   1. Snug the LH inner catalytic converter-to-exhaust manifold nut.
   2. Tighten the LH outer catalytic converter-to-exhaust manifold nut.
      - Tighten to 40 Nm (30 lb-ft).
   3. Tighten the LH inner catalytic converter-to-exhaust manifold nut.
      - Tighten to 40 Nm (30 lb-ft).

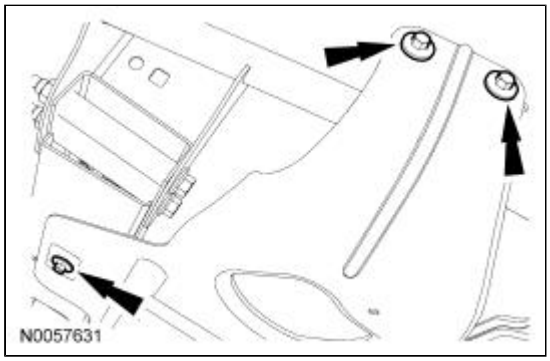


10. Tighten the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts in the following sequence:
    1. Snug the outer exhaust Y-pipe dual catalytic converter-to-muffler assembly bolt.
    2. Tighten the inner exhaust Y-pipe dual catalytic converter-to-muffler assembly bolt.
       - Tighten to 48 Nm (35 lb-ft).
    3. Tighten the outer exhaust Y-pipe dual catalytic converter-to-muffler assembly bolt.
       - Tighten to 48 Nm (35 lb-ft).

11. Start the engine and check the exhaust system for leaks.

12. **NOTE:** LH side shown, RH side similar.

    If equipped, install the transfer case skid plate.
    - Tighten to 25 Nm (18 lb-ft).



Exhaust System — Exploded View

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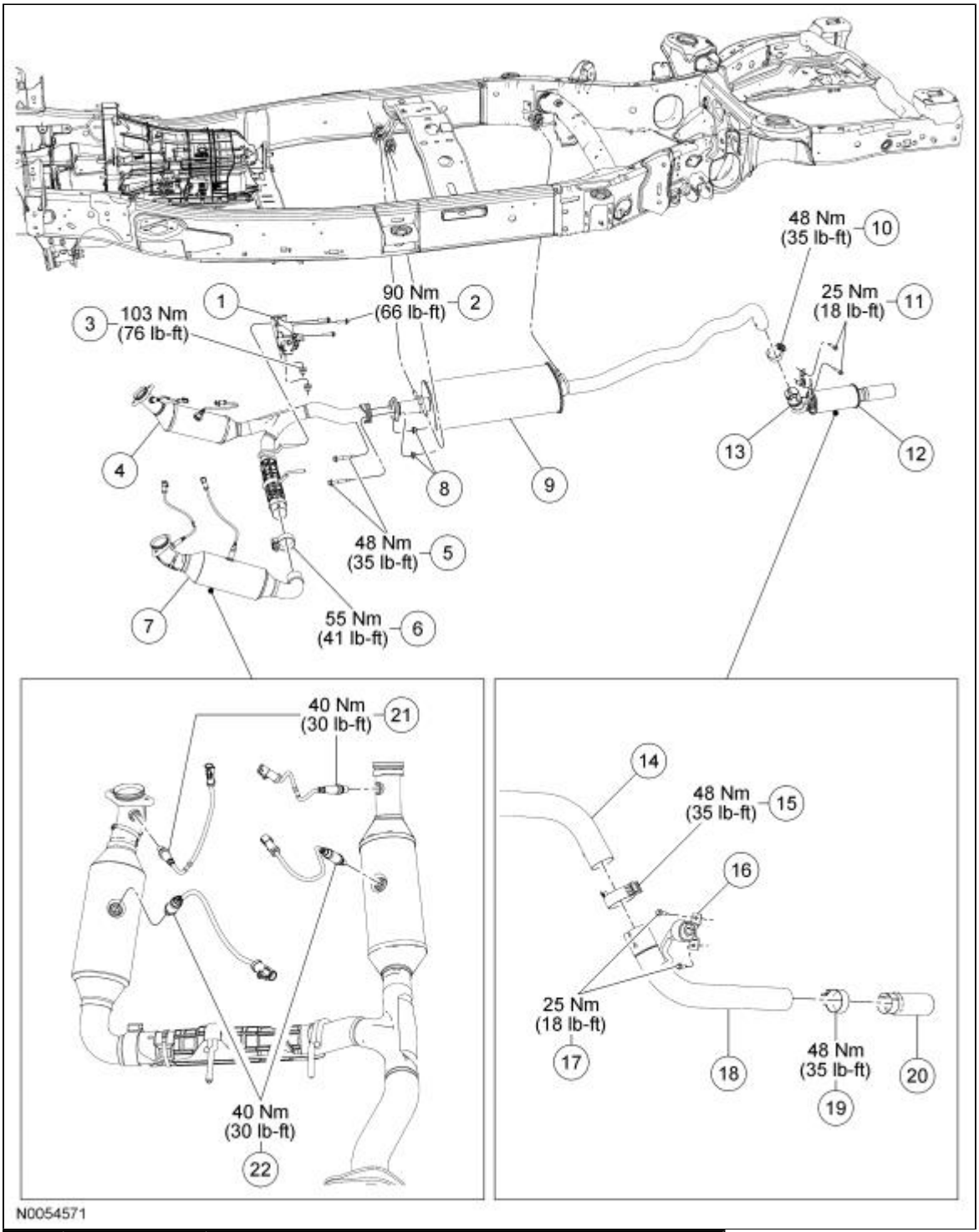
Expedition and Navigator

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.

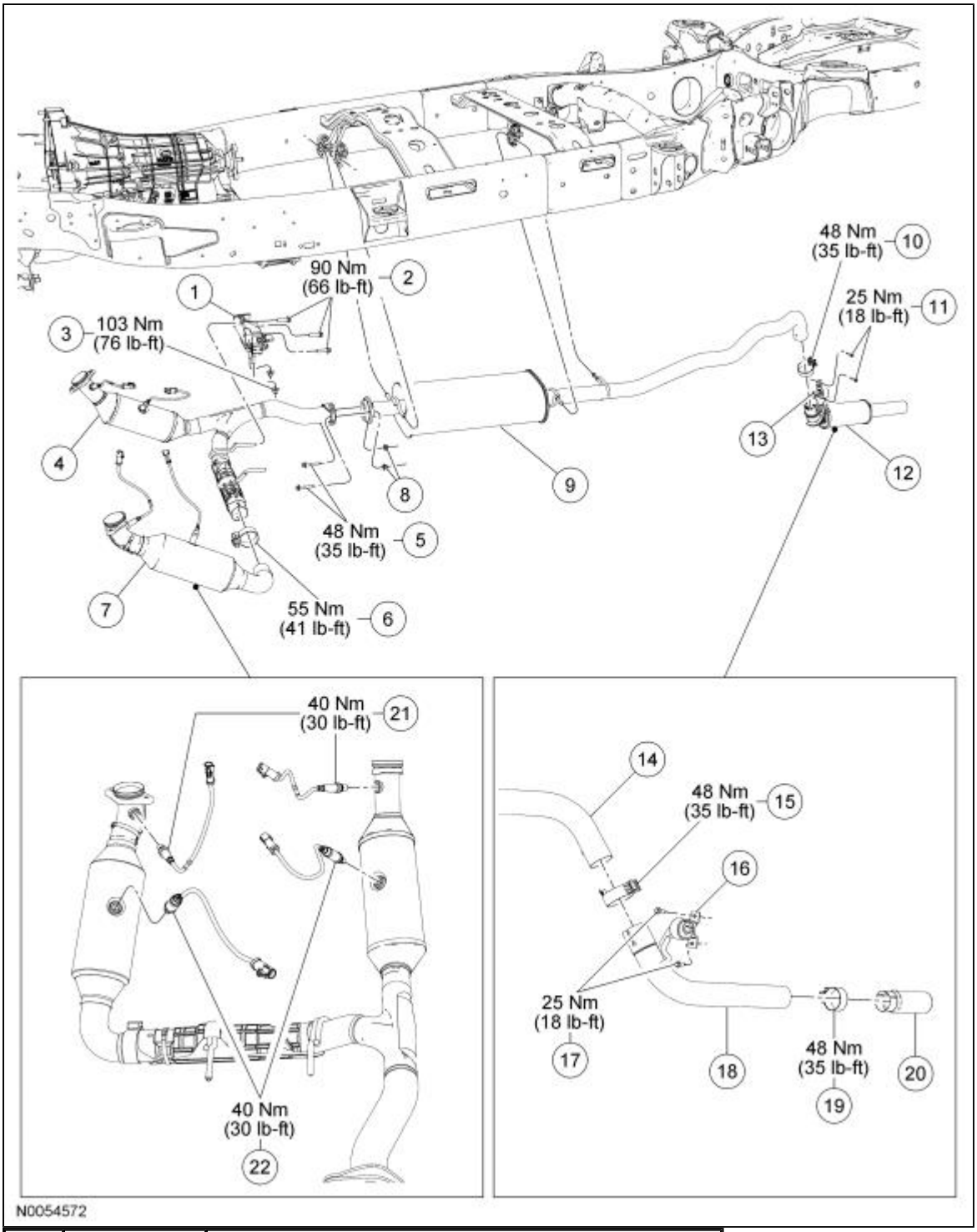


Item	Part Number	Description

1	5E269	Exhaust and transmission mounting bracket
2	—	Exhaust and transmission mount bolts
3	5A262	Exhaust and transmission mount to crossmember nuts
4	5E212	RH catalytic converter
5	—	RH catalytic converter-to-muffler assembly bolts
6	5221	RH catalytic converter-to-LH catalytic converter clamp
7	5E212	LH catalytic converter
8	—	RH catalytic converter-to-muffler assembly flag nuts
9	5230	Muffler assembly
10	—	Muffler assembly to resonator clamp
11	—	Isolator and bracket assembly bolts
12	5201	Resonator
13	—	Isolator and bracket assembly
14	—	Muffler assembly
15	—	Muffler assembly to tailpipe clamp
16	—	Isolator and bracket assembly
17	—	Isolator and bracket assembly bolts
18	5202	Tailpipe
19	—	Tailpipe chrome tip clamp
20	—	Tailpipe chrome tip
21	9F472	Heated oxygen sensors
22	9G444	Catalyst monitor sensors

Expedition EL and Navigator L

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	5E269	Exhaust and transmission mounting bracket
2	—	Exhaust and transmission mount bolts
3	5A262	Exhaust and transmission mount to crossmember nuts
4	5E212	RH catalytic converter
5	—	RH catalytic converter-to-muffler assembly bolts
6	5221	RH catalytic converter-to-LH catalytic converter clamp

7	5E212	LH catalytic converter
8	—	RH catalytic converter-to-muffler assembly flag nuts
9	5230	Muffler assembly
10	—	Muffler assembly to resonator clamp
11	—	Isolator and bracket assembly bolts
12	5201	Resonator
13	—	Isolator and bracket assembly
14	—	Muffler assembly
15	—	Muffler assembly to tailpipe clamp
16	—	Isolator and bracket assembly
17	—	Isolator and bracket assembly bolts
18	5202	Tailpipe
19	—	Tailpipe chrome tip clamp
20	—	Tailpipe chrome tip
21	9F472	Heated oxygen sensors
22	9G444	Catalyst monitor sensors

1. For additional information, refer to the procedures in this section.

Exhaust Y-Pipe — Dual Catalytic Converter

Printable View (420 KB)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A

Removal

CAUTION: Do not use oil or grease-based lubricants on isolators as they deteriorate the rubber.

NOTE: The exhaust Y-pipe dual catalytic converter is a 2-piece assembly. The RH and LH converters can be serviced separately as needed.

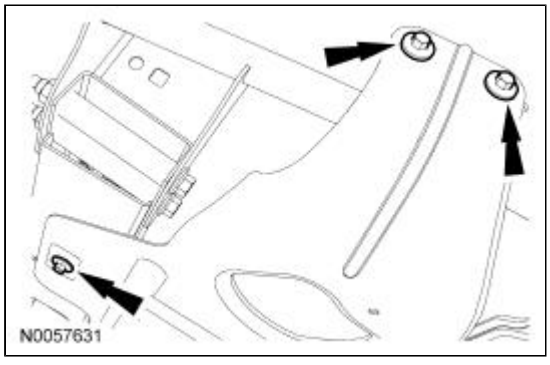
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Four wheel drive (4WD) vehicles

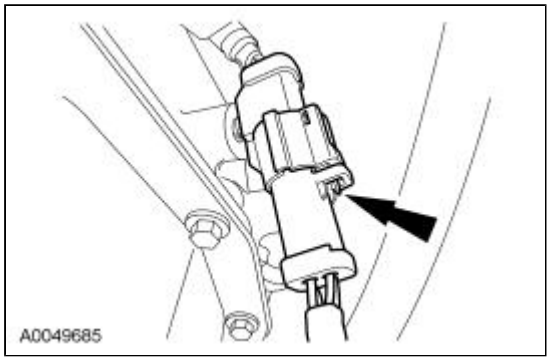
2. **NOTE:** LH side shown, RH side similar.

   If equipped, remove the transfer case skid plate.



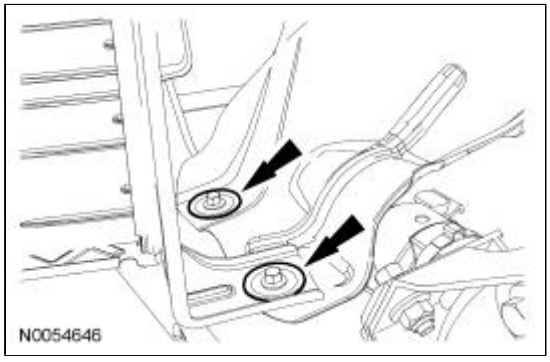
All vehicles

3. Disconnect the heated oxygen and catalyst monitor sensors electrical connectors.

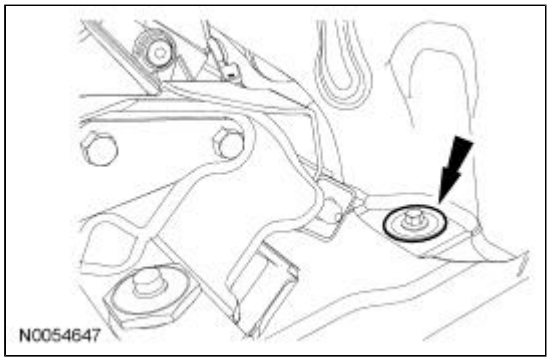


4. Using a suitable jack, support the transmission.

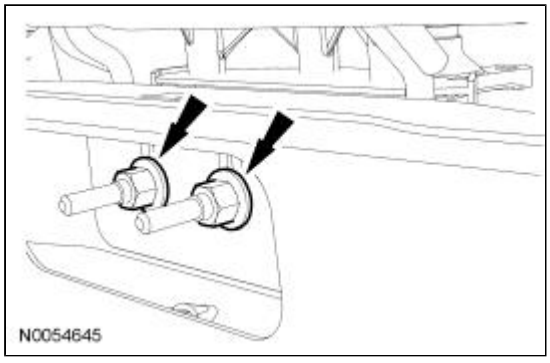
5. Remove the LH heat shield bolt and LH heat shield and evaporative emissions (EVAP) canister assembly bolt.



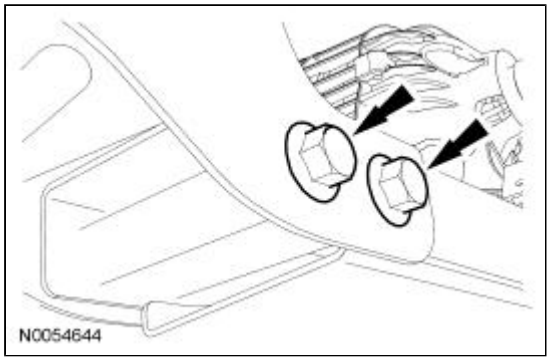
6. Remove the RH heat shield bolt.



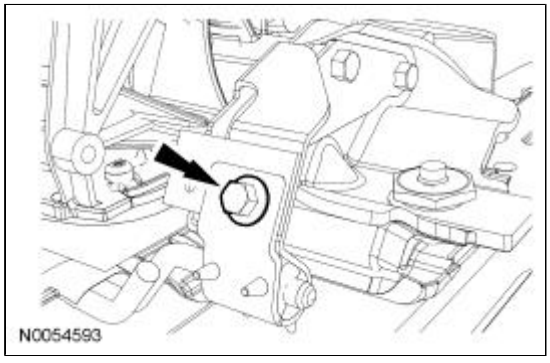
7. Remove the transmission mount nuts.



8. Remove the 4 crossmember bolts and the crossmember.

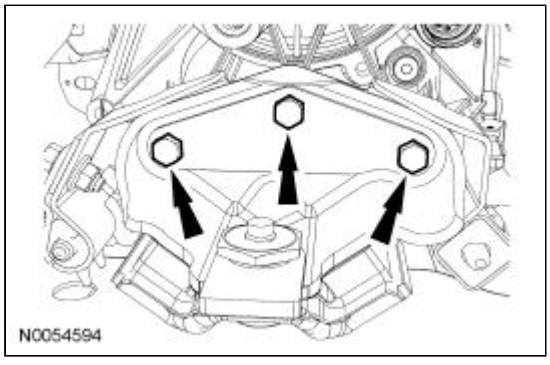


9. Loosen the exhaust and transmission mounting bracket cap bolt.



Rear wheel drive (RWD) vehicles

10. Remove the 3 bolts and then slide off the exhaust and transmission mounting bracket from the exhaust Y-pipe dual catalytic converter.

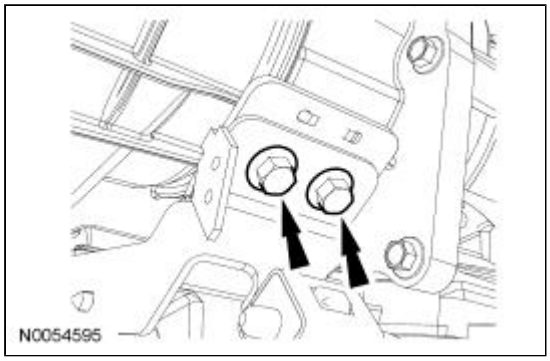


4WD vehicles

11. **NOTE:** On 4WD vehicles, the exhaust and transmission mounting bracket will not slide off the exhaust Y-pipe dual catalytic converter until the exhaust Y-pipe dual catalytic converter is removed from the vehicle.

    NOTE: RH side shown, LH side similar.

    Remove the 4 bolts from the exhaust and transmission mounting bracket.

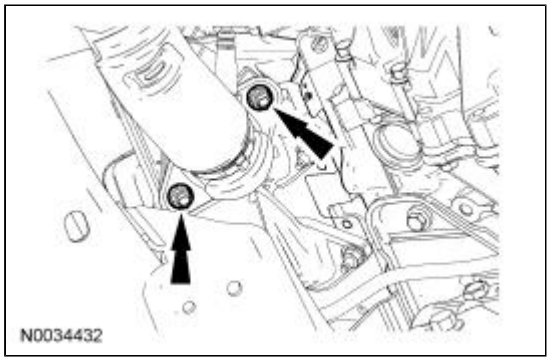


All vehicles

12. Remove the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts.

13. **NOTE:** LH catalytic converter-to-exhaust manifold nuts shown, RH similar.

    Remove and discard the exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.



14. **NOTE:** Use caution removing the exhaust Y-pipe dual catalytic converter. Make sure not to damage the manifold outlet flare, the converter inlet flare or the studs.

    Remove the exhaust Y-pipe dual catalytic converter from the vehicle.

4WD vehicles

15. If necessary, remove the exhaust and transmission mounting bracket from the exhaust Y-pipe dual catalytic converter.

All vehicles

16. **NOTE:** A new RH catalytic converter-to-LH catalytic converter clamp must be installed whenever the clamp is loosened.

    If necessary, loosen the RH catalytic converter-to-LH catalytic converter clamp.

17. If necessary, separate the RH catalytic converter from the LH catalytic converter.

18. If the RH catalytic converter-to-LH catalytic converter clamp is loosened, grind the spot weld and remove the RH catalytic converter-to-LH catalytic converter clamp. Clean the uneven surface area.

Installation

All vehicles

CAUTION: Do not tighten the fasteners until all components are assembled and aligned, making sure to tighten all fasteners beginning at the front of the vehicle. For additional information, refer to Exhaust System Alignment in this section.

NOTE: Clean the mating surfaces of the exhaust manifold outlet flare and the exhaust Y-pipe dual catalytic converter inlet flares.

Also clean the mating surfaces of the exhaust Y-pipe dual catalytic converter-to-muffler assembly.

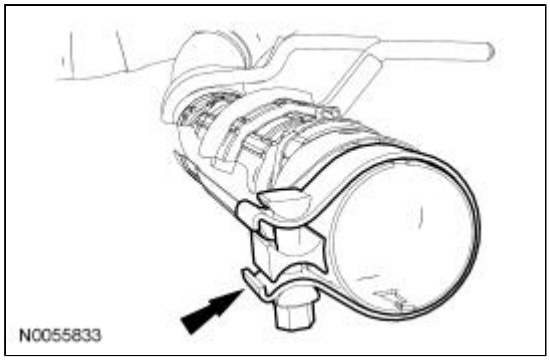
Make sure not to damage the exhaust manifold outlet flares, the exhaust Y-pipe-dual catalytic converter inlet flares or the studs.

NOTE: Always install new fasteners and RH catalytic converter-to-LH catalytic converter clamp.

1. **NOTE:** Make sure to apply anti-seize lubricant to the threads of the sensors before installation.

   If removed, install the heated oxygen and the catalyst monitor sensors.
   - Tighten to 40 Nm (30 lb-ft).

2. If necessary, position a new RH catalytic converter-to-LH catalytic converter clamp with the clamp bolt facing the front of the vehicle.



3. If separated, install RH catalytic converter to the LH catalytic converter.

4WD vehicles

4. If removed, install the exhaust and transmission mounting bracket to the exhaust Y-pipe dual catalytic converter.

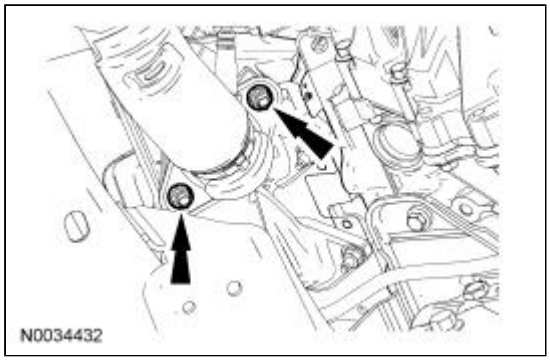
All vehicles

5. **NOTE:** Use caution installing the Y-pipe dual catalytic converter. Make sure not to damage the manifold outlet flare, the converter inlet flare or the studs.

   Position the exhaust Y-pipe dual catalytic converter into the vehicle.

6. **NOTE:** LH catalytic converter-to-exhaust manifold nuts shown, RH similar.

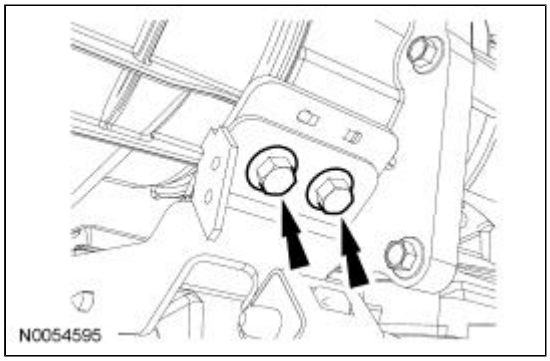
   Loosely install the exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.



4WD vehicles

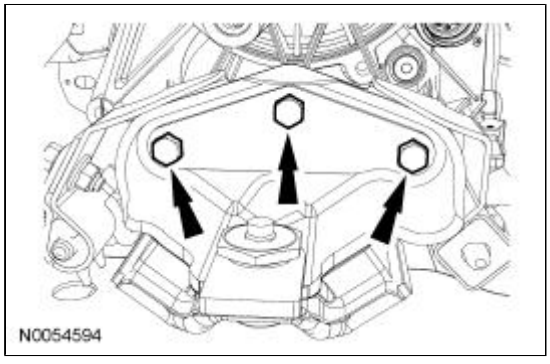
7. **NOTE:** RH side shown, LH side similar.

   Install the 4 exhaust and transmission mounting bracket-to-transmission bolts.
   - Tighten to 90 Nm (66 lb-ft).



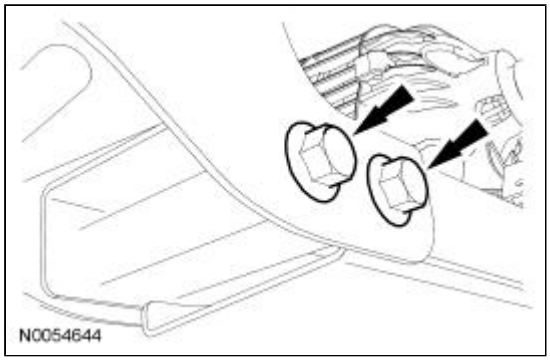
RWD vehicles

8. Slide on the exhaust and transmission mounting bracket to the exhaust Y-pipe dual catalytic converter and install the 3 exhaust and transmission mounting bracket-to-transmission bolts.
   - Tighten to 90 Nm (66 lb-ft).

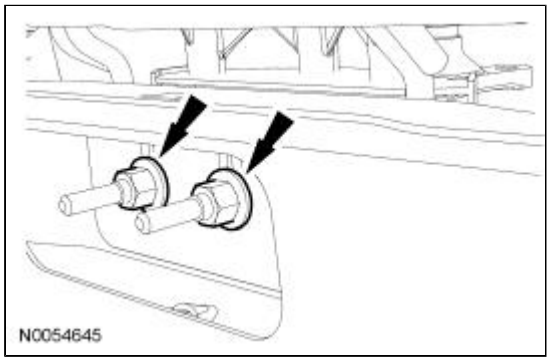


All vehicles

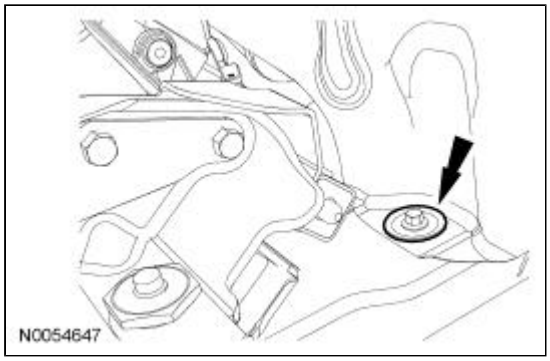
9. Install the 4 crossmember bolts and the crossmember.
   - Tighten to 90 Nm (66 lb-ft).



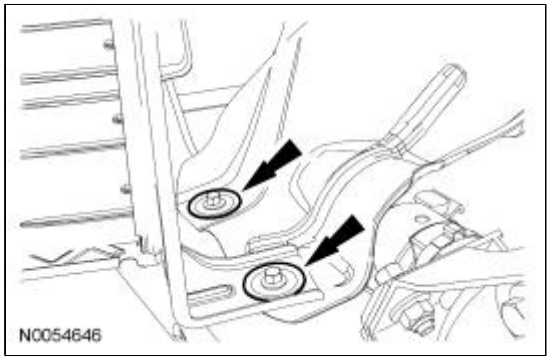
10. Install the exhaust and transmission mounting bracket nuts.
    - Tighten to 103 Nm (76 lb-ft)



11. Install the RH heat shield bolt.
    - Tighten to 20 Nm (15 lb-ft).

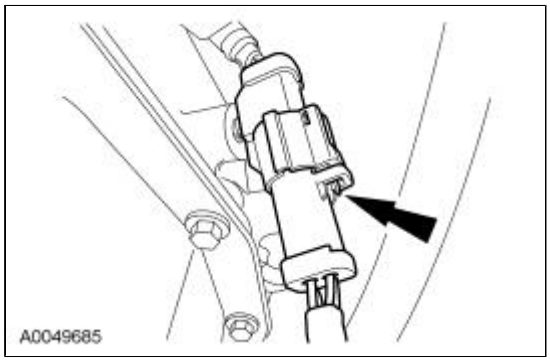


12. Install the LH heat shield bolt and LH heat shield and evaporative emissions (EVAP) canister assembly bolt.
    - Tighten to 20 Nm (15 lb-ft).



13. Loosely install the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts.

14. Connect the heated oxygen and catalyst monitor sensor electrical connectors.

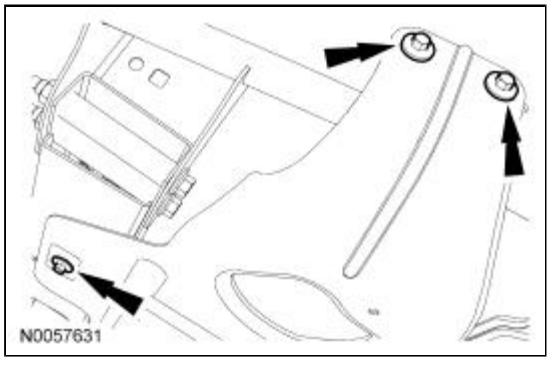


15. Align the exhaust system. For additional information, refer to Exhaust System Alignment in this section.

4WD vehicles

16. **NOTE:** LH side shown, RH side similar.

    If equipped, install the transfer case skid plate.
    - Tighten to 25 Nm (18 lb-ft).



Muffler and Tailpipe

Printable View (153 KB)

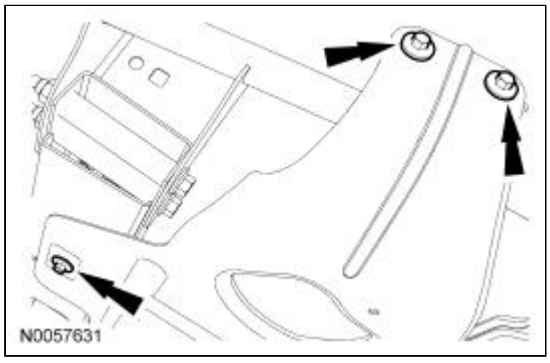
Removal

CAUTION: Do not use oil or grease-based lubricants on isolators as they deteriorate the rubber.

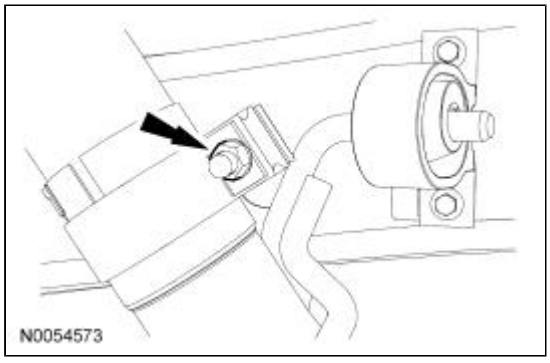
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** LH side shown, RH side similar.

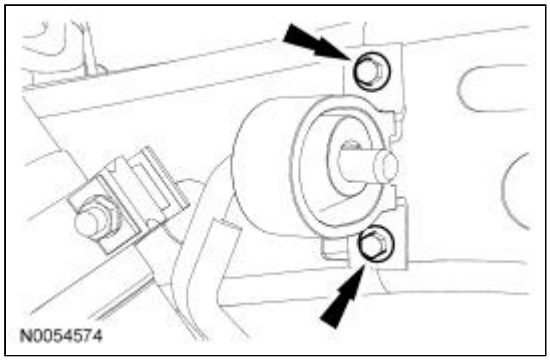
   If equipped, remove the transfer case skid plate.



3. Loosen the tailpipe or resonator-to-muffler assembly clamp.



4. Remove the isolator and bracket assembly bolts and remove:
   - the tailpipe for Expedition models.
   - the resonator for Navigator models.



5. Using a suitable jack stand, support the muffler.

6. Remove and discard the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts and flag nuts.

7. **CAUTION: Make sure not to make contact with the axle boots while routing the muffler assembly outlet over the rear axle or damage to the boots may result.**

   Detach the isolators from the muffler assembly and remove from the vehicle

Installation

1. **NOTE:** Clean the mating surfaces of the exhaust Y-pipe dual catalytic converter-to-muffler assembly.

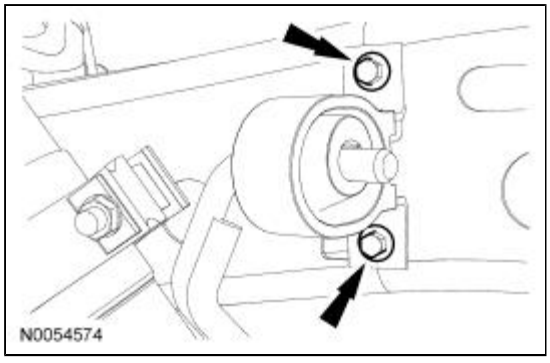
   NOTE: Check the exhaust hanger isolators for wear or damage, install new isolators, if necessary.

   Install the muffler assembly into the vehicle and attach the isolators.

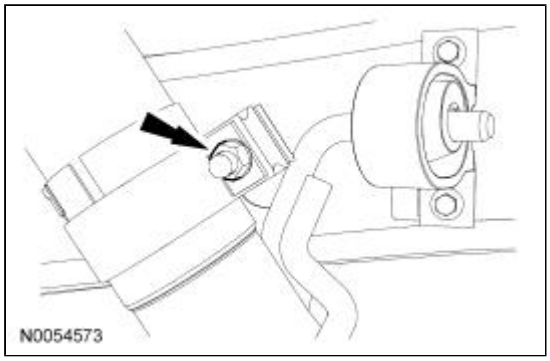
2. **NOTE:** Always install new fasteners.

   Loosely install the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts and flag nuts.

3. Install the tailpipe for Expedition models or the resonator for Navigator models and install the isolator and bracket assembly bolts.
   - Tighten to 25 Nm (18 lb-ft).



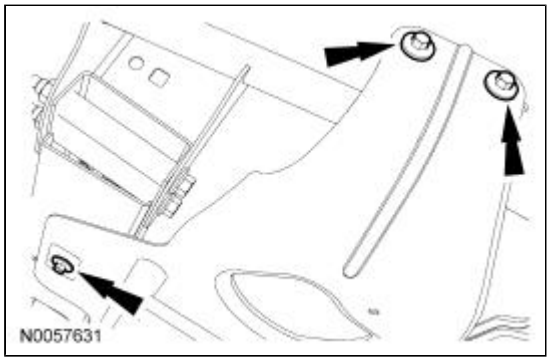
4. Tighten the tailpipe or resonator-to-muffler assembly clamp.
   - Tighten to 48 Nm (35 lb-ft).



5. Align the exhaust system. For additional information, refer to Exhaust System Alignment in this section.

6. **NOTE:** LH side shown, RH side similar.

   If equipped, install the transfer case skid plate.
   - Tighten to 25 Nm (18 lb-ft).



Printable View (78 KB)

General Specifications

Item	Specification
Fuel tank capacity (Expedition and Navigator)	106L (28.0 gal)
Fuel tank capacity (Expedition EL and Navigator L)	127L (33.5 gal)
Fuel Pressure	
Key on, engine off	240-310 kPa (35-45 psi)
Engine running	193-310 kPa (28-45 psi)
Lubricants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Fuel System

Printable View (62 KB)

The vehicle:

- is equipped with a multi-port fuel injection system.
- has separately controlled fuel injectors mounted to the intake manifold for each cylinder.
- has fuel injectors that are supplied with pressurized fuel from the fuel pump through the fuel rail.
- uses a mechanical returnless fuel system (MRFS).

Fuel System

Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Fuel System Pressure Release

Printable View (152 KB)

Special Tool(s)

ST1371-A	Fuel Pressure Gauge 310-012 (T80L-9974-B)

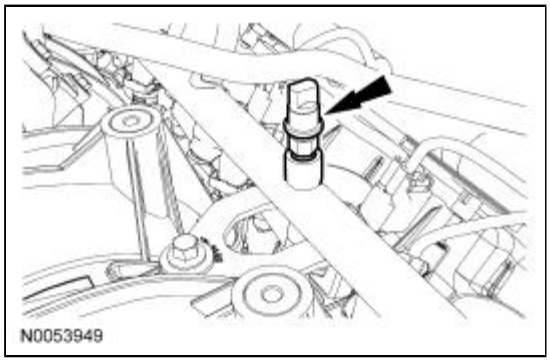
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing a fire hazard. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

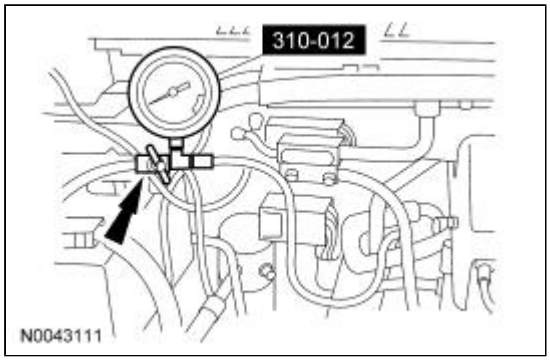
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Remove the Schrader valve cap and attach the pressure gauge.



3. **NOTE:** Open manual valve slowly to relieve the system pressure. This may drain fuel from the fuel system. Place fuel in a suitable container.

   Open the manual valve on the pressure gauge and relieve the fuel pressure.


310-012
N0043111

Fuel Tank Draining

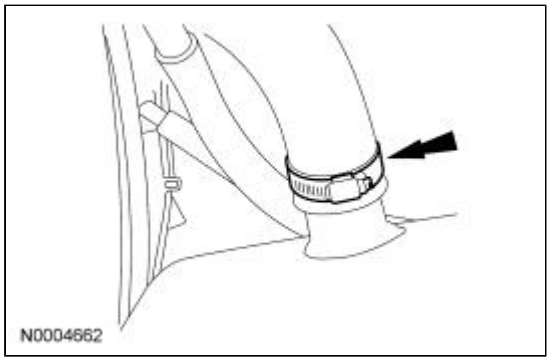
Printable View (115 KB)

Special Tool(s)

ST1114-A	Hand Operated Fuel Storage Tank 164-R3201 or equivalent

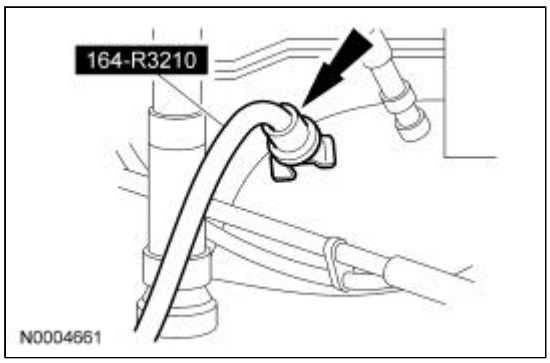
WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

1. If equipped, turn the air suspension switch OFF.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.
4. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
5. Disconnect the fuel tank filler pipe from the fuel tank.



6. **NOTE:** Follow the operating instructions of the equipment manufacturer.

   Using the special tool, pump the fuel from the fuel tank opening into the fuel storage tank.


164-R3210
N0004661

Spring Lock Couplings

Printable View (240 KB)

Special Tool(s)

ST1147-A	Disconnect Tool, Spring Lock Coupling (1/2 inch) 310-D005 (D87L-9280-B) or equivalent
ST1399-A	Disconnect Tool, Spring Lock Coupling 310-S039 (T90T-9550-S)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect

WARNING: Do not smoke, carry lighted tobacco or have open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard. Failure to follow these instructions may result in personal injury.

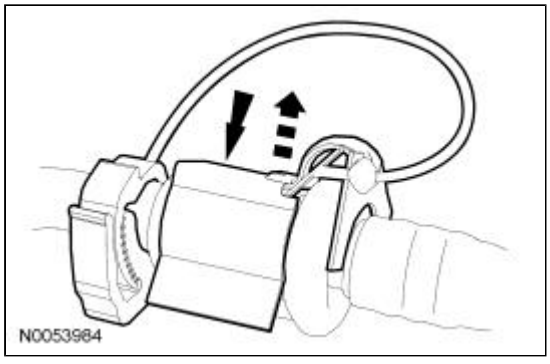
CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air

to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

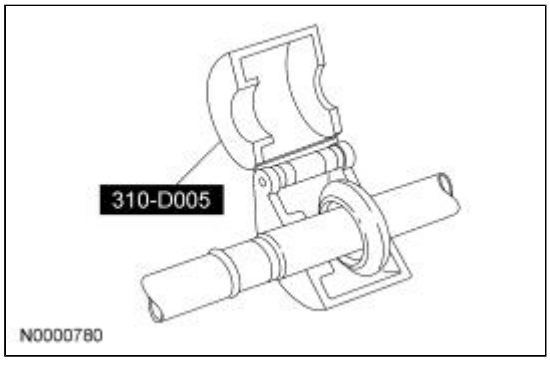
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

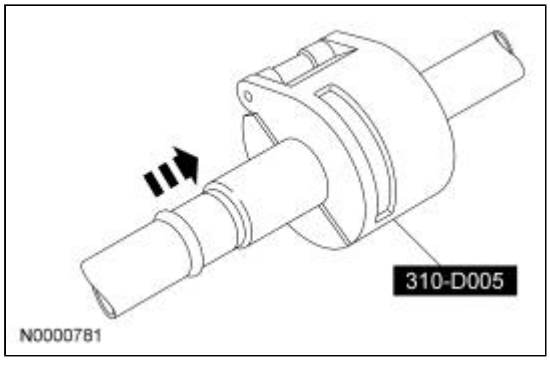
2. Remove the fuel tube safety clip.



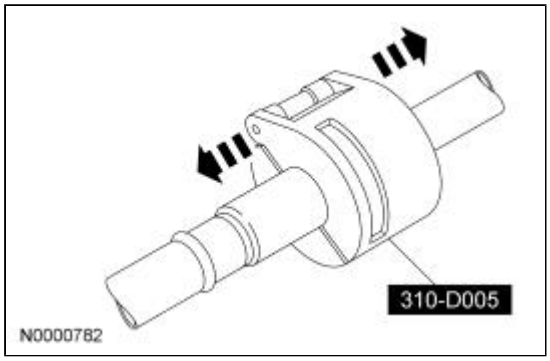
3. Install the special tool.



4. Close and push the special tool into the open side of the cage.



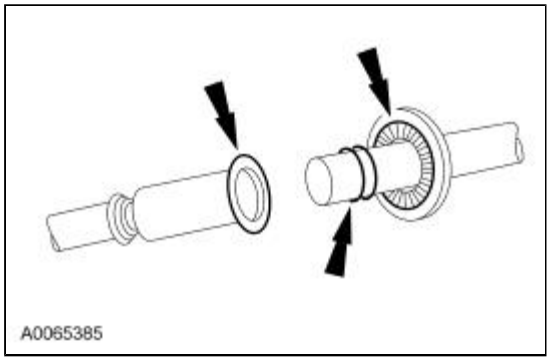
5. Separate the spring lock coupling.



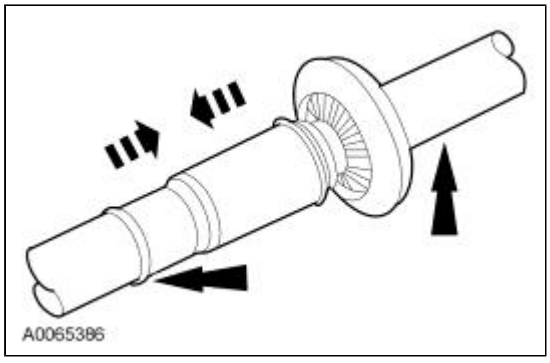
Connect

CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

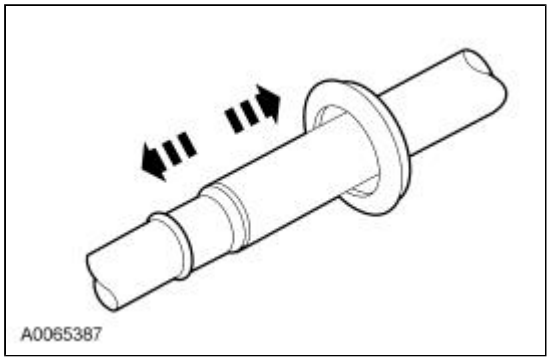
1. Inspect and clean both spring lock coupling ends. Install new O-ring seals and garter springs if necessary.
    - Lubricate the O-ring seals with clean engine oil.



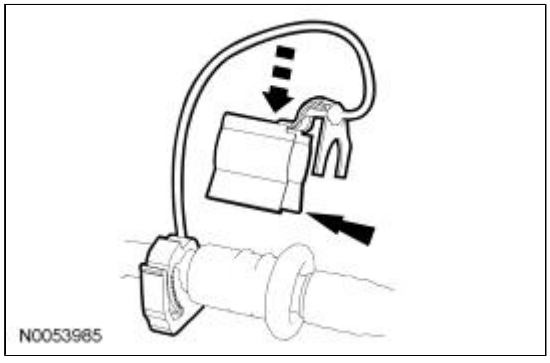
2. Fit the male fitting into the female end and push until the garter spring snaps over the flared end of the female end.



3. Make sure the spring lock coupling is engaged by pulling on the lines.



4. Install the fuel tube safety clip.



Disconnect — Type II

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, which can cause a fire hazard. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

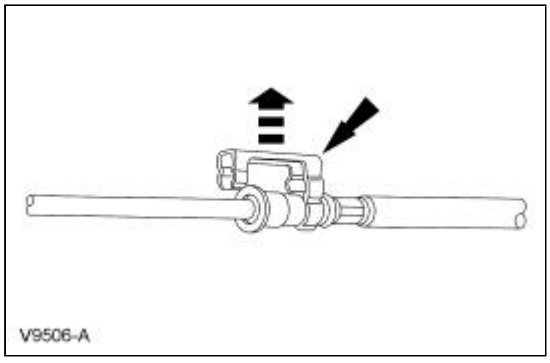
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always cap off any open orifices or tubes.

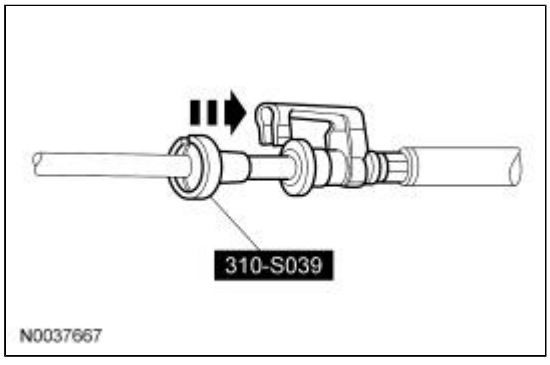
CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

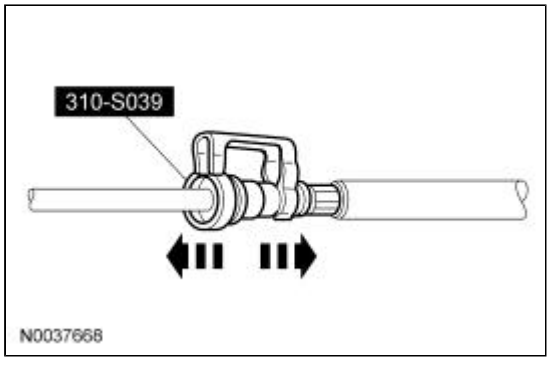
2. Disconnect the safety clip from the male hose.



3. Install the special tool and press it into the spring lock coupling.



4. Separate the spring lock coupling.



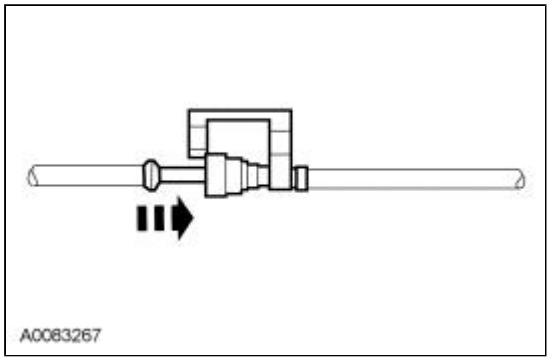
Connect — Type II

1. Inspect and clean both spring lock coupling ends.

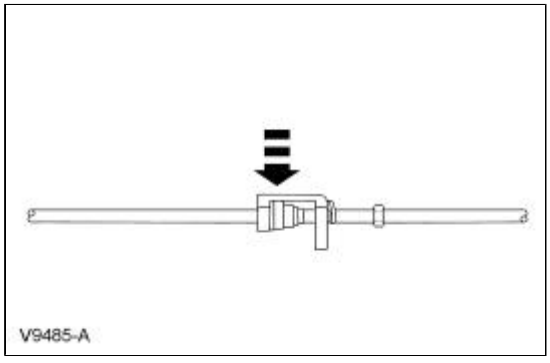
2. **CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.**

   NOTE: Lubricate the tube end with clean engine oil to ease assembly.

   Align the fuel tubes spring lock coupling and push together until a click is heard.



3. Pull on the spring lock coupling to make sure it is fully engaged, then install the safety clip.



Quick Connect Coupling

Printable View (221 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect — Type I

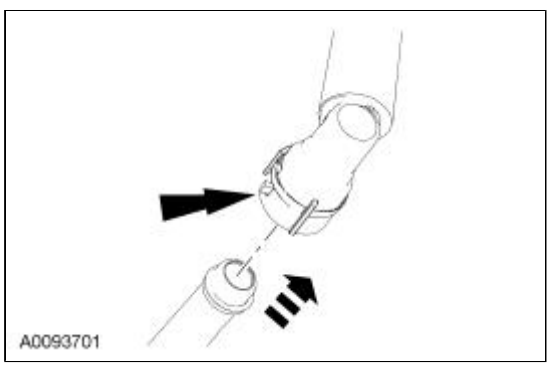
WARNING: Do not smoke, carry lighted tobacco or have open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

1. Disconnect the quick connect coupling.
   - Push the connector toward the tube to release pressure.
   - Push the release tab clockwise.
   - Disconnect the quick connect coupling.

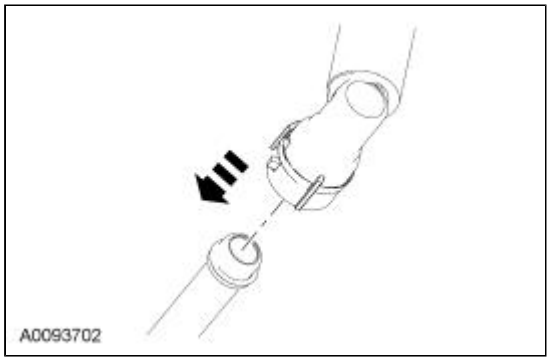


Connect — Type I

CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

1. **NOTE:** Apply clean engine oil to the end of the tube or fitting before connecting.

   Connect the quick connect coupling.



Disconnect — Type II

WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

WARNING: Do not smoke, carry lighted tobacco or have open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard. Failure to follow these instructions may result in personal injury.

CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), a new tube assembly must be installed. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

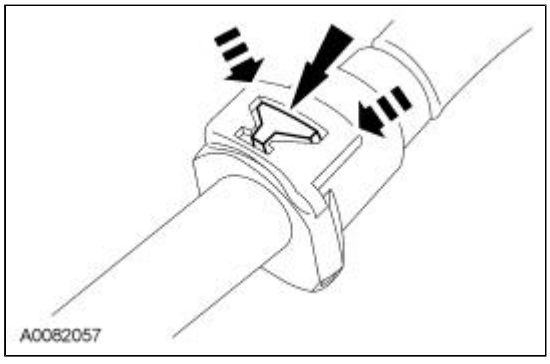
CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

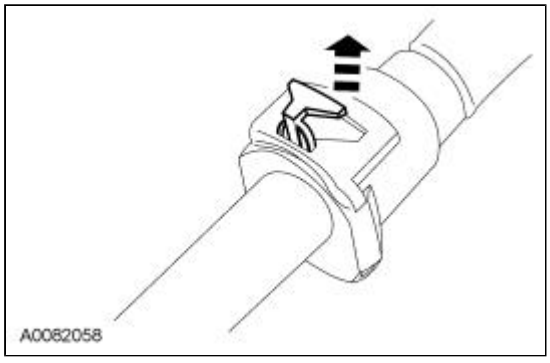
CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information refer to Fuel System Pressure Release in this section.

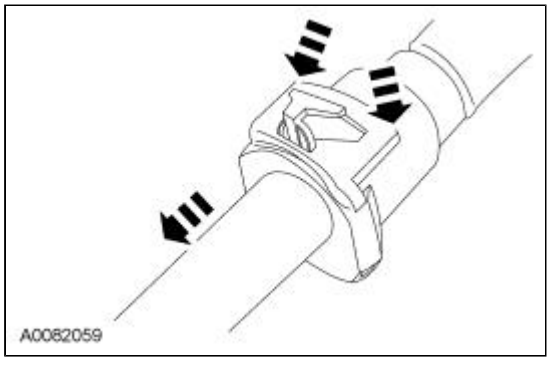
2. Press the tab corners to release the locking tab.



3. Pull the locking tab to the release position.



4. Disconnect the quick connect coupling.
   - Push the fitting toward the tube to release pressure.
   - Press the tab corners to release the fitting.
   - Disconnect the quick connect fitting.

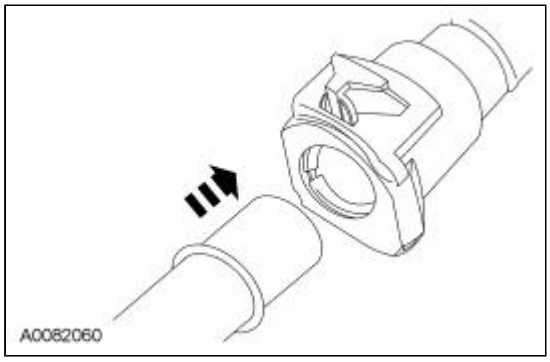


Connect — Type II

CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

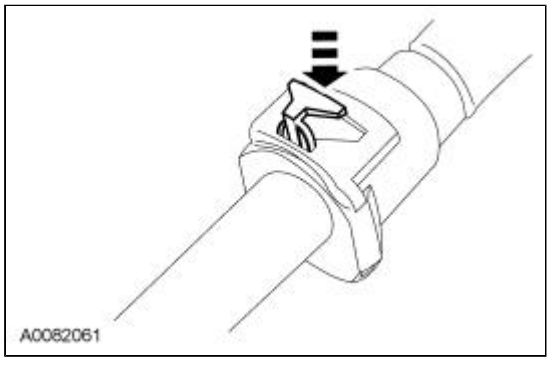
1. **NOTE:** Apply clean engine oil to the end of the tube or fitting before connecting.

   Connect the tube into the quick connect coupling.



2. **CAUTION: Make sure the quick connect fitting clicks into place when installing the tube. To make sure that the quick connect fitting is fully seated, pull on the fitting.**

   Press the locking tab down into the locked position.



Disconnect — Type III

WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

WARNING: Do not smoke or carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as a cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is

not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), a new tube assembly must be installed. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

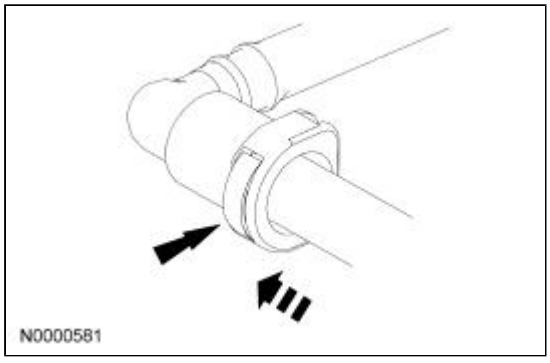
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is, therefore, essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Disconnect the fuel tube quick connect coupling.
   - Press the fuel tube quick connect coupling button and pull the fuel tube to disconnect.

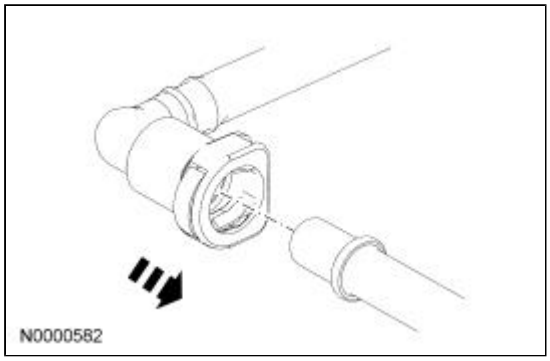


Connect — Type III

1. **CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.**

   NOTE: Apply clean engine oil to O-ring seals.

   Install the quick connect coupling onto the tube until it is fully seated.



Disconnect — Type IV

WARNING: The evaporative emissions system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

WARNING: Do not smoke, or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), a new tube assembly must be installed. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

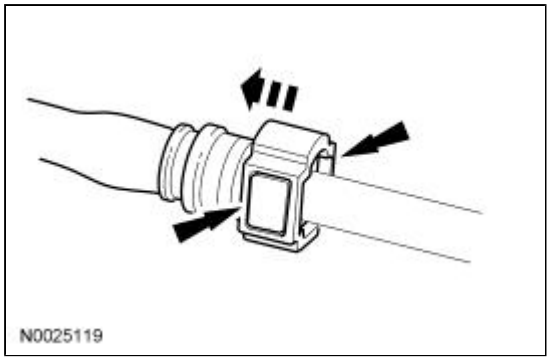
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Disconnect the fuel tube quick connect coupling.
   - Press the 2 fuel tube quick connect coupling buttons and pull the fuel tube to disconnect.

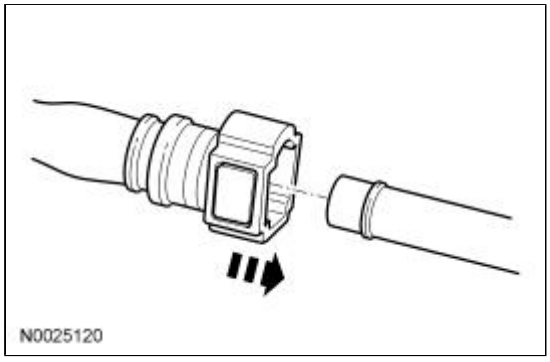


Connect — Type IV

1. **CAUTION: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.**

   NOTE: Apply clean engine oil to O-ring seals.

   Install the quick connect coupling onto the tube until it is fully seated.



Vapor Tube Fittings

Printable View (97 KB)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect

WARNING: The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or fuel liquid is present in the area. Failure to follow these instructions may result in personal injury.

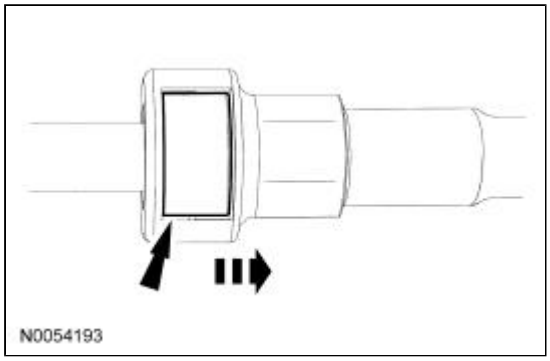
WARNING: Do not smoke, carry lighted tobacco or have open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the vapor tube fitting.
   - Push the connector toward the tube or fitting to release pressure.
   - Press the quick connect fitting button and pull the fuel tube to disconnect.

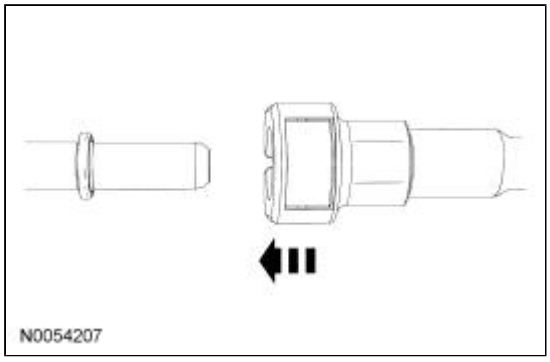


Connect

CAUTION: Make sure the quick connect fitting clicks into place when installing the tube. To make sure that the quick connect fitting is fully seated, pull on the tube.

1. **NOTE:** Apply clean engine oil to the end of the tube or fitting before connecting.

   Connect the vapor tube fitting.



Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel tank support strap bolts	40	30	—
Fuel tank filler pipe-to-frame bolts	15	11	—
Inertia fuel shutoff (IFS) switch bolts	10	—	89
Skid plate nuts	20	15	—
Sway bar bracket nuts	48	35	—

Fuel Tank and Lines

Printable View (63 KB)

The fuel system consists of:

- the fuel tank assembly.
- the fuel tank filler pipe, which contains a restrictor plate to permit only unleaded fuel to be pumped into the fuel tank.
- a 1/4 turn type fuel tank filler cap.
- a fuel filter to protect the fuel injectors located on the fuel tank assembly.
- fuel tube.
- fuel rail pressure and temperature sensor, located on the fuel rail.
- a fuel pump containing:
  - the electric fuel pump, which provides pressurized fuel to the engine.
  - the fuel level sensor.
  - an inlet filter.
  - a check valve which maintains system pressure after the pump is shut off.
  - a pressure relief valve for overpressure protection in the event of restricted flow.

The fuel pump is controlled by the powertrain control module (PCM). Electrical power to the pump is provided through the inertia fuel shutoff (IFS) switch.

Fuel Tank and Lines

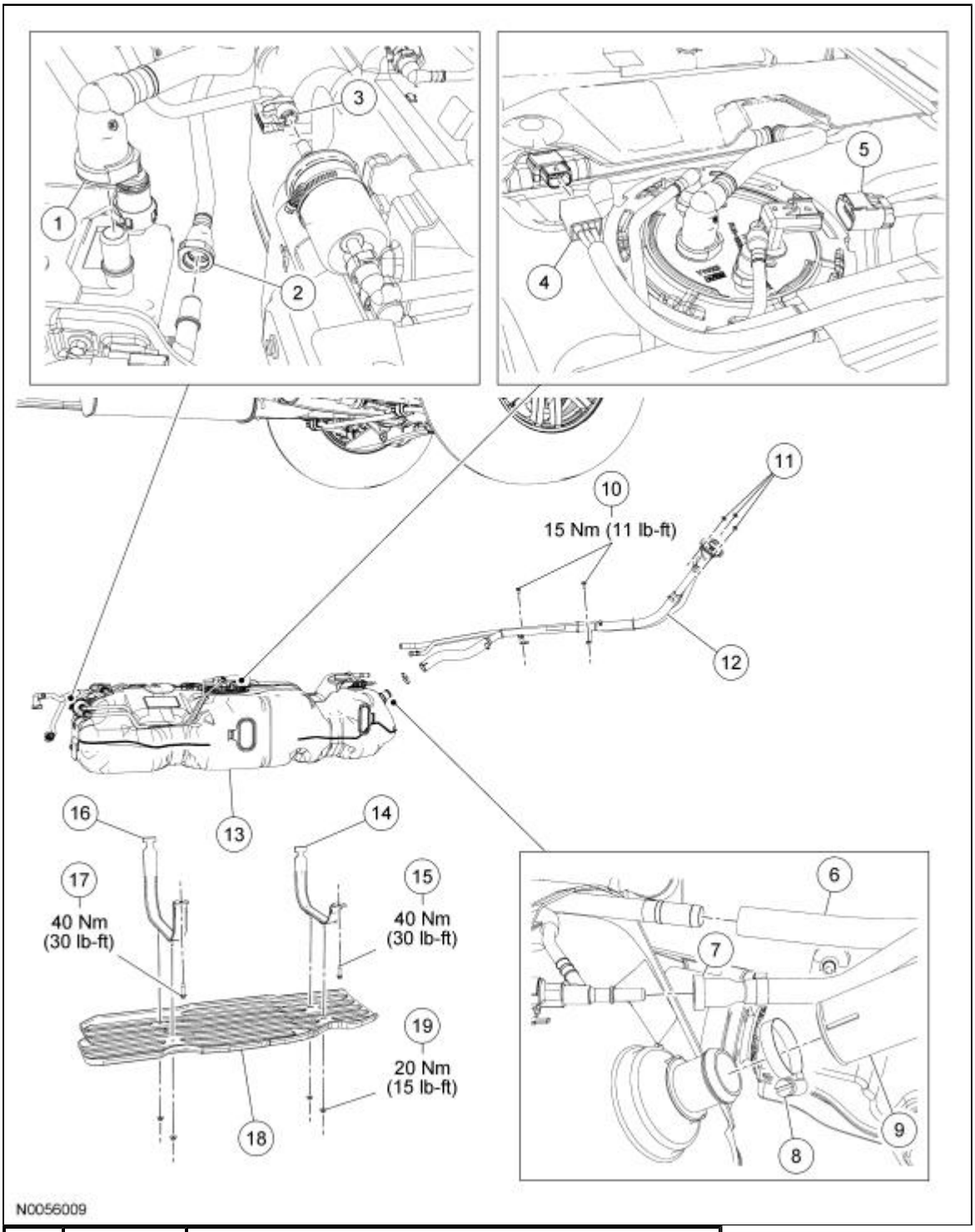
Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Fuel Tank and Filler Pipe — Exploded View

Printable View (499 KB)

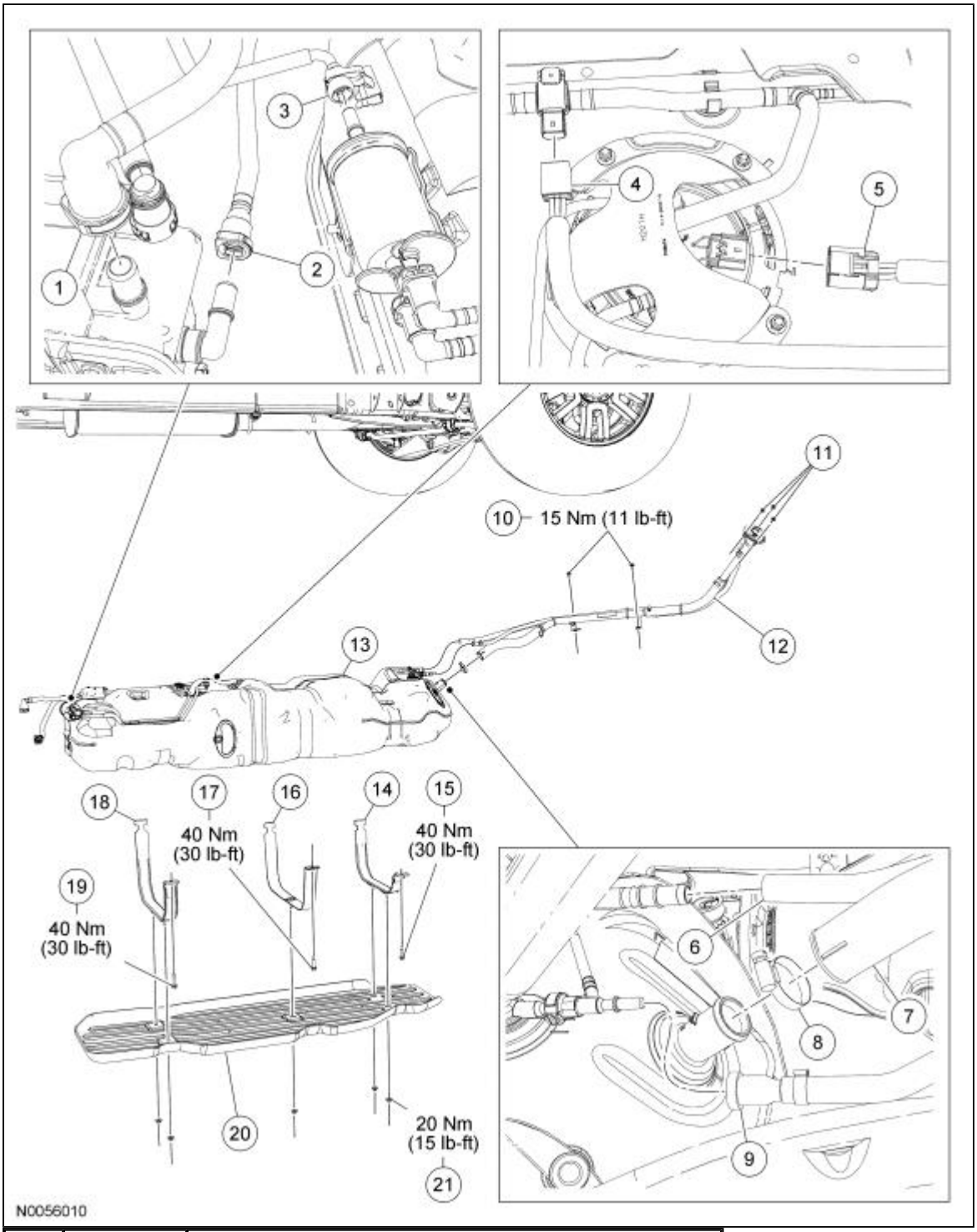
106L (28 Gal) Fuel Tank



Item	Part Number	Description
1	—	Fuel tank pressure sensor and vapor tube assembly-

		to-evaporative emissions (EVAP) canister quick connect coupling
2	—	EVAP canister fresh air tube-to-dust separator quick connect coupling
3	—	Fuel filter outlet tube-to-fuel tube spring lock coupling (part of 9J280)
4	—	Fuel pressure sensor electrical connector (part of 14405)
5	—	Fuel pump module electrical connector (part of 14405)
6	—	Fuel tank filler pipe vapor tube-to-EVAP canister fresh air tube
7	—	Fuel tank filler pipe vent tube-to-fuel tank pressure sensor and vapor tube assembly quick connect coupling
8	W525937	Fuel tank filler pipe hose-to-fuel tank clamp
9	9047	Fuel tank filler pipe hose
10	W704901	Fuel tank filler pipe bracket-to-frame bolts (2 required)
11	N807605	Fuel tank filler pipe-to-body screws
12	9034	Fuel tank filler pipe
13	9010	Fuel tank assembly
14	9057	Rear fuel tank support strap
15	W506435	Rear fuel tank support strap bolt
16	9054	Front fuel tank support strap
17	W506435	Front fuel tank support strap bolt
18	9A147	Fuel tank skid plate
19	W705047	Fuel tank skid plate nut (4 required)

127L (33.5 Gal) Fuel Tank



Item	Part Number	Description
1	—	Fuel tank pressure sensor and vapor tube assembly-to-evaporative emissions (EVAP) canister quick connect coupling
2	—	EVAP canister fresh air tube-to-dust separator quick connect coupling
3	—	Fuel filter outlet tube-to-fuel tube spring lock coupling (part of 9J280)
4	—	Fuel pressure sensor electrical connector (part of 14405)
5	—	Fuel pump module electrical connector (part of

		14405)
6	—	Fuel tank filler pipe vapor tube-to-EVAP canister fresh air tube
7	9047	Fuel tank filler pipe hose
8	W525937	Fuel tank filler pipe hose-to-fuel tank clamp
9	—	Fuel tank filler pipe vent tube-to-fuel tank pressure sensor and vapor tube assembly quick connect coupling
10	W704901	Fuel tank filler pipe bracket-to-frame bolts (2 required)
11	N807605	Fuel tank filler pipe-to-body screws
12	9034	Fuel tank filler pipe
13	9010	Fuel tank assembly
14	9057	Rear fuel tank support strap
15	W506435	Rear fuel tank support strap bolt
16	9092	Center fuel tank support strap
17	W506435	Center fuel tank support strap bolt
18	9054	Front fuel tank support strap
19	W506435	Front fuel tank support strap bolt
20	9A147	Fuel tank skid plate
21	W705047	Fuel tank skid plate nut (5 required)

1. For additional information, refer to the procedures in this section.

Fuel Tank

Printable View (106 KB)

Removal and Installation

All fuel tanks

WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel tubes or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel which can cause a fire hazard. Failure to follow these instructions may result in personal injury.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the fuel system pressure. For additional information, refer to Section 310-00 .

3. Drain the fuel tank. For additional information, refer to Section 310-00 .

106L (28 gal) fuel tank

4. If equipped, remove the 4 nuts and the fuel tank skid plate.
   - To install, tighten to 20 Nm (15 lb-ft).

127L (33.5 gal) fuel tank

5. If equipped, remove the 5 nuts and the fuel tank skid plate.
   - To install, tighten to 20 Nm (15 lb-ft).

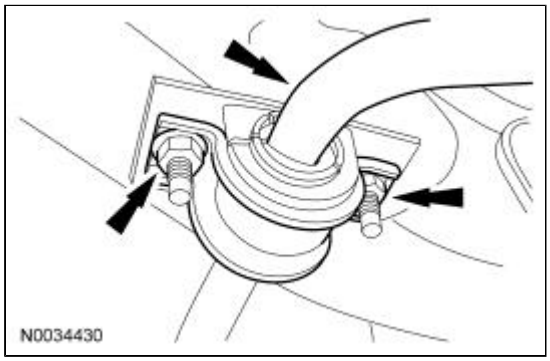
All fuel tanks

6. Disconnect the fuel tank filler pipe vapor tube from the evaporative emissions (EVAP) canister fresh air tube, and the fuel tank filler pipe vent tube-to-fuel tank pressure sensor and vapor tube assembly quick connect coupling in the rear of the fuel tank. For additional information, refer to Section 310-00 .

7. Disconnect the fuel filter outlet tube-to-fuel tube spring lock coupling, EVAP canister fresh air tube-to-dust separator quick connect coupling and the fuel tank pressure sensor and vapor tube assembly-to-EVAP canister quick connect coupling in the front of the fuel tank. For additional

information, refer to Section 310-00 .

8. Remove the sway bar bracket nuts and let the sway bar hang down.
    - To install, tighten to 48 Nm (35 lb-ft).



9. **CAUTION: Do not support the fuel tank directly beneath the fuel pump mounting area. Damage to the fuel pump assembly can occur.**

    Position a suitable jack under the fuel tank.

127L (33.5 gal) fuel tank

10. Remove the center fuel tank support strap bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

All fuel tanks

11. Remove the 2 bolts from the front and rear fuel tank support straps.
    - To install, tighten to 40 Nm (30 lb-ft).

12. Remove the front fuel tank support strap.

127L (33.5 gal) fuel tanks

13. **NOTE:** To assist in removing the center fuel tank support strap, you may have to push up slightly on the front of the tank to get the center fuel tank support strap to clear the fuel tank.

    Lower the fuel tank slightly and rotate the center fuel tank support strap aside.

All fuel tanks

14. Rotate the rear fuel tank support strap aside.

15. Lower the fuel tank slightly. Disconnect the fuel pump module and fuel tank pressure sensor electrical connectors.

16. Remove the fuel tank from the vehicle.

127L (33.5 gal) fuel tanks

17. If installing a new center fuel tank support strap, remove the center fuel tank support strap from the vehicle.

All fuel tanks

18. If installing a new rear fuel tank support strap, remove the rear fuel tank support strap from the vehicle.

19. To install, reverse the removal procedure.

Fuel Tank Filler Pipe

Printable View (110 KB)

Removal and Installation

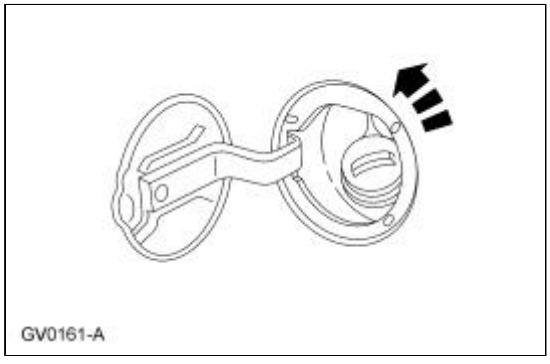
WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel tubes or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel which can cause a fire hazard. Failure to follow these instructions may result in personal injury.

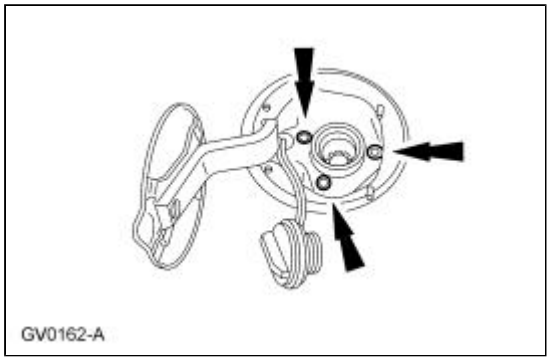
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the fuel tank filler cap.



4. Remove the 3 fuel tank filler pipe-to-body screws.



5. Disconnect the fuel tank filler pipe vent tube-to-fuel tank pressure sensor and vapor tube assembly quick connect coupling.

6. Disconnect the fuel tank filler pipe vapor tube from the evaporative emissions (EVAP) canister fresh air tube.

7. Loosen the hose clamp and disconnect the fuel tank filler pipe hose-to-fuel tank.

8. Remove the 2 fuel tank filler pipe support brackets-to-frame bolts.
    - To install, tighten to 15 Nm (11 lb-ft).

9. Remove the fuel tank filler pipe assembly.

10. To install, reverse the removal procedure.

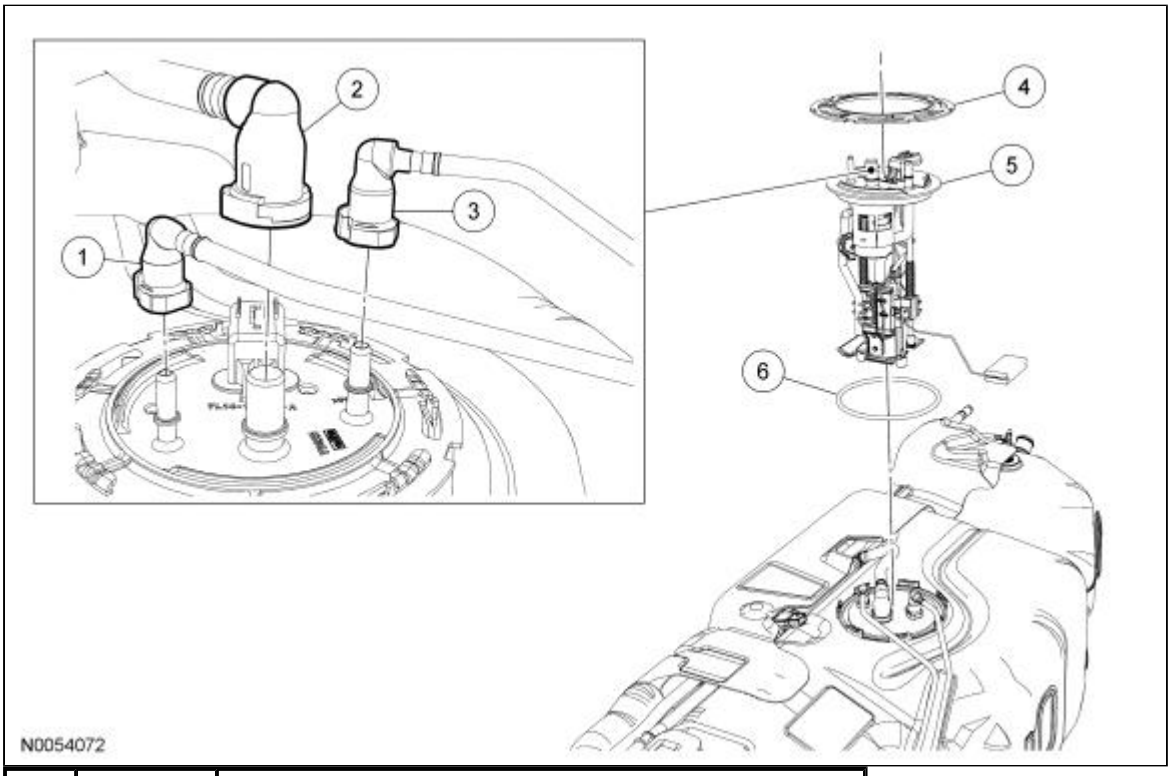
Fuel Pump Module

Printable View (240 KB)

Special Tool(s)

ST2803-A	Wrench, Fuel Tank Sender Unit 310-123

NOTE: 106L (28 gal) fuel tank shown, 127L (33.5 gal) fuel tank similar.



Item	Part Number	Description
1	—	Return fuel tube-to-fuel pump module quick connect coupling (part of 9J337)
2	—	Fuel tank pressure sensor and vapor tube assembly-to-fuel pump module quick connect coupling (part of 9G271)
3	—	Supply fuel tube-to-fuel pump module quick connect coupling (part of 9J337)
4	9C385	Fuel pump module locking ring
5	9H307	Fuel pump module
6	9276	Fuel pump module O-ring seal

Removal and Installation

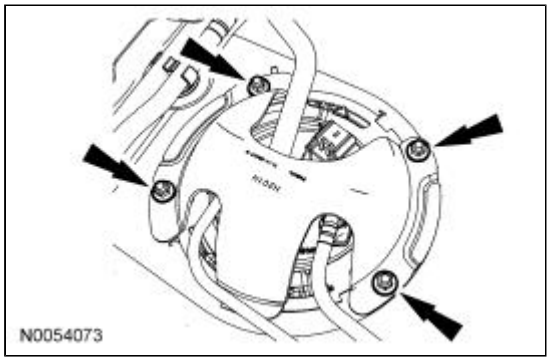
WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

All fuel tanks

1. Remove the fuel tank. For additional information, refer to Fuel Tank in this section.

127L (33.5 gal) fuel tank

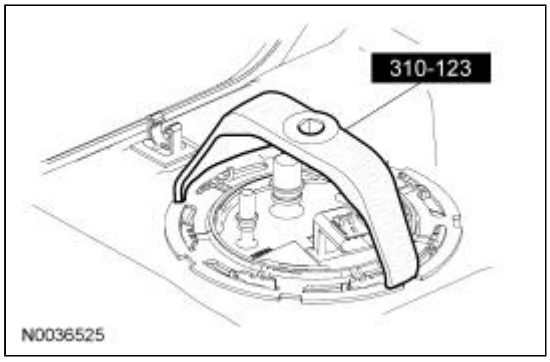
2. Remove the nuts and the fuel pump module cover.



All fuel tanks

3. Disconnect the return fuel tube-to-fuel pump module quick connect coupling, the fuel tank pressure sensor and vapor tube assembly-to-fuel pump module quick connect coupling and the supply fuel tube-to-fuel pump module quick connect coupling.

4. Using the special tool, remove the fuel pump lock ring.



5. **CAUTION: Note the location of the fuel pump alignment tabs.**

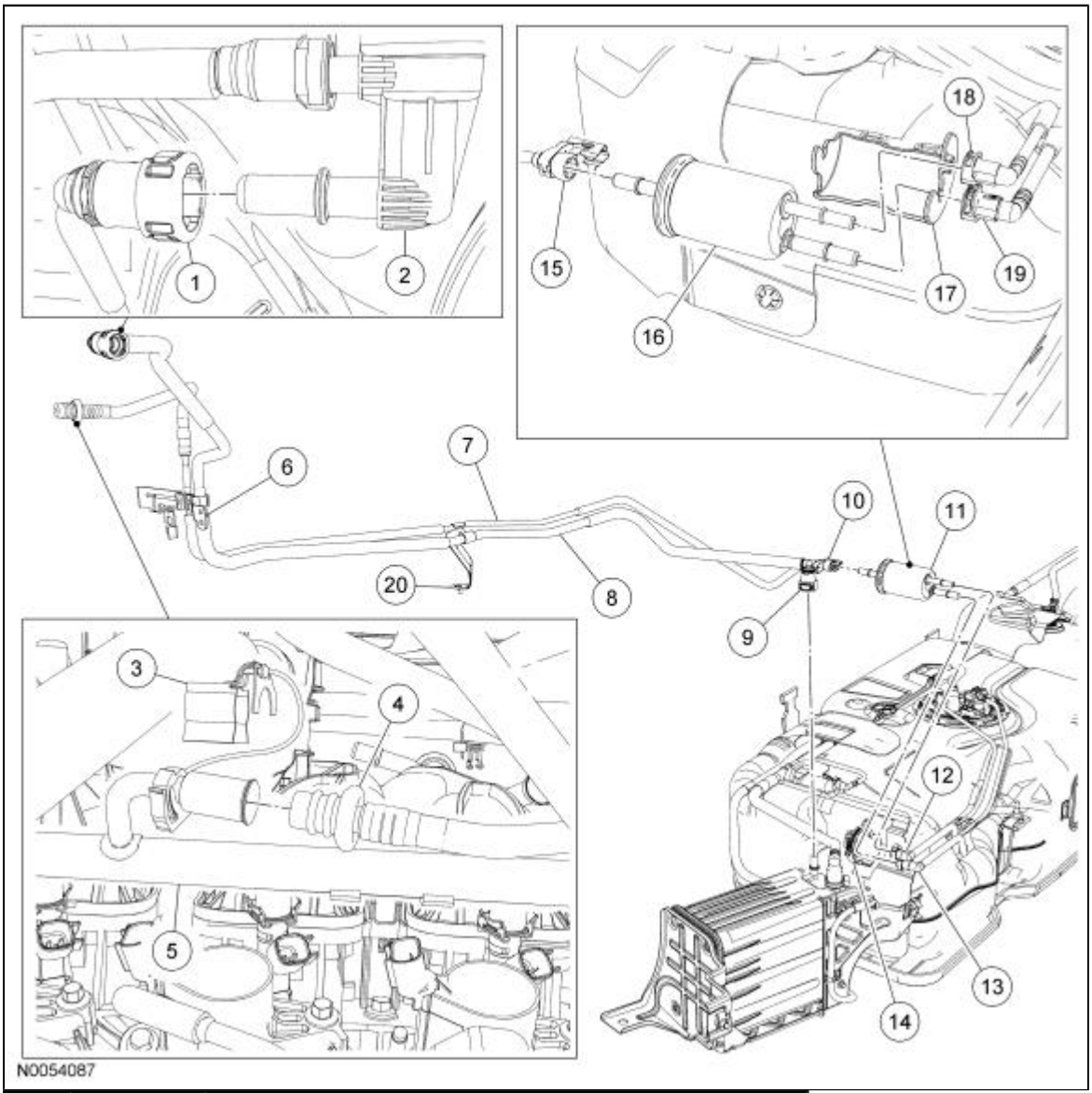
   CAUTION: Carefully remove the fuel pump assembly to avoid damaging the fuel level sensor.

   Remove the fuel pump module assembly.
   - Remove and discard the O-ring seal.

6. To install, reverse the removal procedure.

Fuel Lines and Fuel Filter — Exploded View

Printable View (277 KB)



Item	Part Number	Description
1	—	Evaporative emissions (EVAP) canister-to-EVAP purge valve quick release coupling (part of 9D676)
2	9G641	EVAP purge valve
3	—	Fuel tube spring lock coupling safety clip
4	—	Fuel tube spring lock coupling (part of 9J280)
5	—	Fuel Rail
6	—	Fuel tube and vapor tube bracket to transmission bellhousing
7	9J280	Fuel filter-to-fuel rail fuel tube
8	—	EVAP canister-to-EVAP purge valve vapor tube

9	—	EVAP purge valve-to-EVAP canister quick connect coupling (part of 9D676)
10	—	Fuel filter outlet tube-to-fuel tube spring lock coupling (part of 9J280)
11	9155	Fuel filter
12	—	Fuel return tube-to-fuel filter inlet tube quick connect coupling (part of 9J337)
13	—	Fuel supply tube-to-fuel filter inlet tube quick connect coupling (part of 9J337)
14	—	Fuel filter clamp, 106L (28 gal) fuel tank
15	—	Fuel filter outlet tube-to-fuel tube spring lock coupling (part of 9J280)
16	9155	Fuel filter
17	9A335	Fuel filter support bracket, 127L (33.5 gal) fuel tank
18	—	Fuel return tube-to-fuel filter inlet tube quick connect coupling (part of 9J280)
19	—	Fuel supply tube-to-fuel filter inlet tube quick connect coupling (part of 9J337)
20	—	Fuel tube and vapor tube bracket to transmission housing

1. For additional information, refer to the procedures in this section.

Fuel Lines

Printable View (81 KB)

Removal and Installation

WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel tubes or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel which can cause a fire hazard. Failure to follow these instructions may result in personal injury.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Release the fuel system pressure. For additional information, refer to Section 310-00 .
3. Disconnect the fuel tube-to-fuel rail spring lock coupling. For additional information, refer to Section 310-00 .
4. Disconnect the evaporative emissions (EVAP) canister-to-EVAP canister purge valve vapor tube quick connect coupling. For additional information, refer to Section 310-00 .
5. Remove the transmission. For additional information, refer to Section 307-01A or Section 307-01B .
6. Disconnect the fuel tube-to-fuel filter outlet tube spring lock coupling. For additional information, refer to Section 310-00 .
7. Disconnect the EVAP canister purge valve vapor tube-to-EVAP canister quick connect coupling.
8. To install, reverse the removal procedure.

Fuel Filter

Printable View (81 KB)

Removal and Installation

All fuel tanks

WARNING: Do not smoke, carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel tubes or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel which can cause a fire hazard. Failure to follow these instructions may result in personal injury.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Release the fuel system pressure. For additional information, refer to Section 310-00 .
3. Disconnect the fuel filter outlet tube spring lock coupling. For additional information, refer to Section 310-00 .
4. Disconnect the return fuel tube-to-fuel filter inlet tube quick connect coupling and supply fuel tube-to-fuel filter inlet tube quick connect coupling. For additional information, refer to Section 310-00 .

106L (28 gal) fuel tank

5. Loosen the worm gear clamp and remove the fuel filter.

127L (33.5 gal) fuel tank

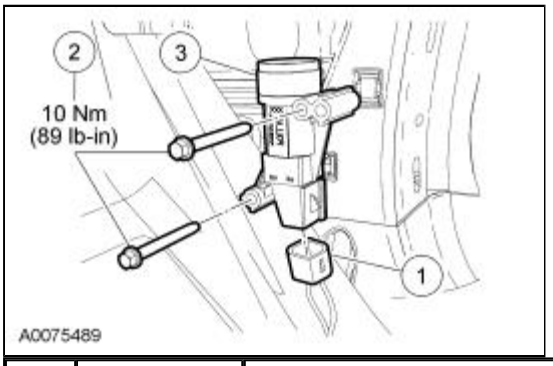
6. Remove the fuel filter from the fuel filter bracket.

All fuel tanks

7. To install, reverse the removal procedure.

Inertia Fuel Shutoff (IFS) Switch

Printable View (92 KB)



Item	Part Number	Description
1	—	Inertia fuel shutoff (IFS) switch electrical connector (part of 14405)
2	W5041483	IFS bolts (2 required)
3	9341	IFS switch

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the LH rear interior quarter trim panel. For additional information, refer to Section 501-05 .
3. Disconnect the inertia fuel shutoff (IFS) switch electrical connector.
4. Remove the 2 bolts and the IFS switch.
   - To install, tighten to 10 Nm (89 lb-in).
5. To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-ft
Fixed accelerator pedal bolts	25	18
Adjustable accelerator pedal bolts	12	9

Acceleration Control

Printable View (63 KB)

The throttle is controlled by an accelerator pedal position sensor on the accelerator pedal assembly. The accelerator pedal should travel smoothly from the idle position to the wide open throttle position. Hesitation or binding should not be experienced at any portion of the accelerator pedal travel. Surrounding components such as wiring, sound insulator and floor carpet must not contact or interfere with the accelerator pedal.

Some vehicles are equipped with adjustable pedals. This allows both the accelerator and brake pedals to be adjusted simultaneously forward or rearward. A rocker switch on the instrument panel provides adjustment on the pedal's assembly when it is activated. On vehicles with the memory seat option, the pedal's position can be controlled by the memory selection, as well as the rocker switch. The adjustable accelerator pedal can be serviced separately from the adjuster. The components in the acceleration control system are not adjustable and new components must be installed if damaged or worn.

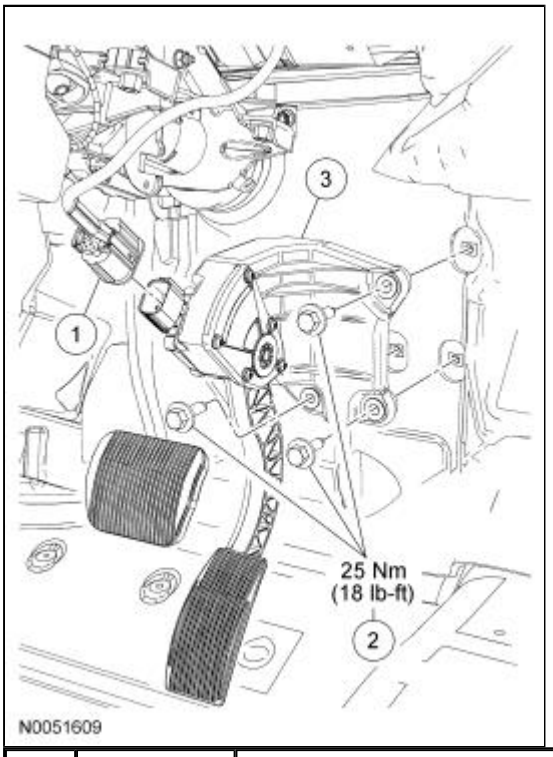
Acceleration Control

Printable View (62 KB)

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Accelerator Pedal — Fixed

Printable View (154 KB)



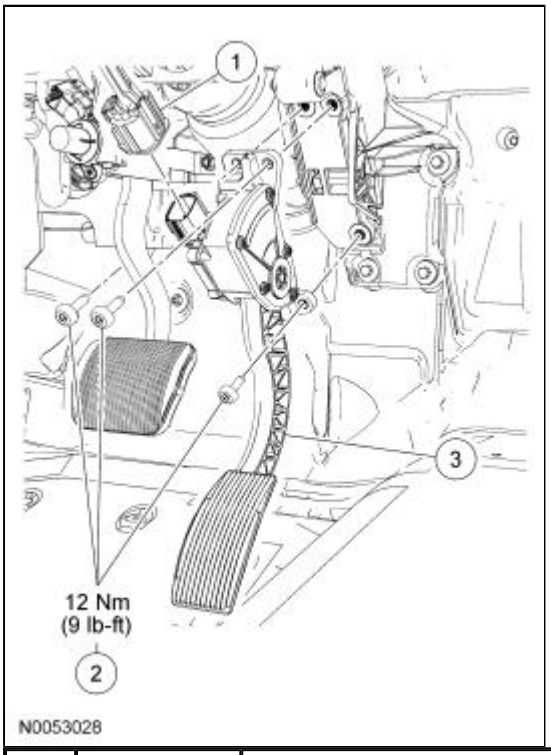
Item	Part Number	Description
1	—	Accelerator pedal position sensor electrical connector (part of 12A581)
2	N806738	Accelerator pedal assembly bolts (3 required)
3	9F836	Accelerator pedal assembly

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the accelerator pedal position sensor electrical connector.
3. Remove the 3 bolts and the accelerator pedal assembly.
   - To install, tighten to 25 Nm (18 lb-ft).
4. To install, reverse the removal procedure.

Accelerator Pedal — Adjustable

Printable View (157 KB)



Item	Part Number	Description
1	—	Accelerator pedal position sensor electrical connector (12A581)
2	W500014	Accelerator pedal assembly bolts (3 required)
3	9F836	Accelerator pedal assembly

Removal and Installation

CAUTION: The brake pedal and the accelerator pedal must be in the same position when installing a new cable or a new pedal. The pedals must be in the all the way forward or the all the way rearward position.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the accelerator pedal position sensor electrical connector.
3. Remove the 3 bolts and the accelerator pedal assembly.
   - To install, tighten to 12 Nm (9 lb-ft).
4. To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Speed control switch screws	7	62

Speed Control

Printable View (62 KB)

The vehicle speed control system consists of the following components:

- Speed control switches
- Speed control deactivator switch (part of the stoplamp switch)
- Stoplamp switch
- Speed control indicator
- Powertrain control module (PCM)
- Electronic controlled throttle body (ECT)
- Clockspring

Speed Control

Printable View (220 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025C or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The speed control system is controlled by the powertrain control module (PCM). The speed control system is designed to maintain a selected vehicle speed between 48 and 200 km/h (30 and 124 mph). The speed control system is controlled by the steering wheel mounted switch(es) (ON, OFF, SET+ [ACCEL], SET- [COAST], RESUME), the stoplamp switch and the speed control deactivator switch (part of the stoplamp switch). The steering wheel mounted switch(es) are hardwired to the PCM through the clockspring.

The speed control functions include:

- Turning on the speed control system
- Setting and maintaining the desired vehicle speed
- Accelerating the vehicle speed
- Decelerating the vehicle speed
- Turning the vehicle speed control system off
- Canceling the speed control

Pressing and releasing the ON switch turns the speed control system on. Pressing and releasing the SET+ or SET- switch while the vehicle is traveling at the desired speed activates the speed control system.

Tapping the SET+ or the SET- switch while in the set mode respectively, increases or decreases the maintained vehicle speed by 1.6 km/h (1 mph) per tap. If the respective button is pressed and held, the vehicle speed continues to accelerate or decelerate until the button is released.

Pressing and releasing the OFF switch, or switching the ignition switch to the OFF position, turns the

speed control system off. Applying the brake pedal puts the speed control system into the STANDBY mode. Pressing the RESUME button, when the speed control system is in the STANDBY mode causes the vehicle to accelerate to the last set speed. Resume does not function if the OFF button is pressed, the ignition switch is in the OFF position, or if the current vehicle speed is below the minimum operational speed.

The clockspring provides the electrical interface between the steering column wiring and the speed control switches in the steering wheel.

The speed control deactivator switch (part of the stoplamp switch) is provided as an additional safety feature. When the brake pedal is applied, the speed control deactivator switch opens and removes the voltage signal from the PCM input circuit, deactivating the speed control system.

Whenever the speed control system is engaged and active, a speed control icon on the instrument cluster is illuminated.

The inputs to the PCM are:

- Transmission output shaft speed (OSS) sensor
- Digital transmission range (TR) sensor
- Speed control switch(es)
- Stoplamp switch
- Speed control deactivator switch (part of stoplamp switch)
- Accelerator pedal position (APP) sensor

The outputs of the PCM for the speed control system are:

- Speed control indicator lamp
- Throttle command

The speed control system throttle position is completely controlled by the PCM through the electronically controlled throttle body. Speed control electronics are contained entirely within the PCM.

When the speed control system is active, the PCM corrects for deviations in the actual vehicle speed by proportionally moving the throttle plate. The PCM modulates the throttle to minimize error between the actual vehicle speed and the desired speed.

The PCM strategy uses the throttle control for smooth accelerations.

The PCM sends a message over the controller area network (CAN) to the instrument cluster whenever the speed control telltale should be turned on or off.

In the event of an off command or a deactivation request from any source, the speed control system carries out a deactivation and immediately returns the throttle to the idle position.

The speed control system provides self-diagnostics. Speed control is disabled anytime an error is detected in the system. No cluster telltale or message center messages are displayed when faults occur. DTCs are logged by the PCM.

An electronically controlled throttle system fault also causes the speed control system to be disabled and the malfunction indicator lamp (MIL) illuminates, or a message center message is displayed.

Additionally, the following conditions cause the speed control system to deactivate:

- Transmission gear selector in a position other than D or OD.
- Speed control set speed is over-ridden with the accelerator pedal for a period longer than 5 minutes.

- Vehicle speed loss from set speed of greater than 16 km/h (10 mph) occurs.
- Vehicle speed falls below the minimum allowable limit of 48 km/h (30 mph).
- Speed control is pressed or stuck longer than 2 minutes.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Throttle body	• Battery junction box (BJB) fuse 74 (20A) • Circuitry • Stoplamp switch • Speed control deactivator switch (integral to the stoplamp switch) • Powertrain control module (PCM) • Speed control switches

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Verify the speedometer operates correctly without speed control by test driving the vehicle. If the speedometer does not operate correctly, refer to Section 413-01 .

5. Verify the parking brake warning indicator operates correctly. If the parking brake warning indicator does not operate correctly, refer to Section 413-01 .

6. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

7. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

8. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

9. Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

10. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.

11. If the DTCs retrieved are related to the concern, go to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

12. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Chart

DTCs	Description	Action
P0500	Vehicle Speed Sensor	REFER to Section 307-01A or Section 307-01B .
P0579	Cruise Control Multi-function Input A Circuit Range/Performance	Go To Pinpoint Test C .
P0581	Cruise Control Multi-function Circuit High	Go To Pinpoint Test C .
P1572	Brake Pedal Switch Circuit	Go To Pinpoint Test B .
P1703	Brake Switch Out of Self Test Range	Go To Pinpoint Test B .
All other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The speed control is inoperative	• Stoplamp switch • Speed control switch • Digital transmission range (TR) sensor • Vehicle speed signal • Powertrain control module (PCM)	• Go To Pinpoint Test A .
• The speed control indicator lamp is always on	• Circuitry • Instrument cluster • PCM	• REFER to Section 413-01 .

Pinpoint Tests

Pinpoint Test A: The Speed Control Is Inoperative

Normal Operation

The powertrain control module (PCM) sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring. When the brake pedal is applied, voltage is routed to the PCM to deactivate the speed control, if engaged.

The speed control deactivator switch interrupts circuit CES09 (VT/OG), removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

Possible Causes

- Stoplamp switch
- Speed control switch
- Digital transmission range (TR) sensor
- Vehicle speed signal
- PCM

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

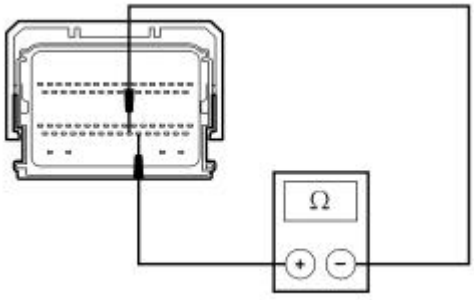
<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>A1 RETRIEVE THE RECORDED PCM DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS</td><td rowspan="2">Yes
REFER to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Chart in this section.

No
GO to A2 .</td></tr>
<tr><td>• Check for recorded PCM DTCs from the continuous and on-demand self-tests.
• Are any DTCs recorded?</td></tr>
<tr><td>A2 CHECK THE STOPLAMP SWITCH</td><td rowspan="2">Yes
GO to A3 .

No
Go To Pinpoint Test B .</td></tr>
<tr><td>• Key in ON position.
• Enter the following diagnostic mode on the diagnostic tool: PCM Stoplamp Switch PID BOO.
• Monitor the PCM BOO PID.
• Apply and release the brake pedal.
• Does the PID value agree with the brake pedal position?</td></tr>
<tr><td>A3 CHECK THE SPEED CONTROL SWITCH</td><td rowspan="2">Yes
GO to A4 .

No
Go To Pinpoint Test C .</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: PCM C175b.
• Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side while pressing the speed control buttons as follows:

<table>
<tr><th>Speed Control Switch</th><th>Resistance Value</th></tr>
<tr><td>OFF</td><td>Less than 5 ohms</td></tr>
<tr><td>SET -</td><td>285 - 315 ohms</td></tr>
<tr><td>SET +</td><td>570 - 630 ohms</td></tr>
<tr><td>RESUME</td><td>1,055 - 1,165 ohms</td></tr>
<tr><td>ON</td><td>2,004 - 2,216 ohms</td></tr>
<tr><td>No switch pressed</td><td>4,094 - 4,526 ohms</td></tr>
</table>
</td></tr>
</table>

 N0002245 • **Are the speed control switch resistance values OK?**	
A4 CHECK THE DIGITAL TR SENSOR	
• Connect: PCM C175b. • Apply the parking brake. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: TCM Digital TR Sensor PID. • Monitor the TCM TR PID. • Select DRIVE. • **Does the PID value agree with the transmission range selector lever position?**	**Yes** GO to A5 . **No** REFER to Section 307-01A or Section 307-01B to continue diagnosis of the digital TR sensor.
A5 CHECK THE DIGITAL TR SENSOR FOR CORRECT ALIGNMENT	
• Check the digital TR sensor alignment. REFER to Section 307-01A or Section 307-01B . • **Is the digital TR sensor aligned correctly?**	**Yes** GO to A6 . **No** ADJUST the digital TR sensor. REFER to Section 307-01A or Section 307-01B . TEST the system for normal operation.
A6 CHECK THE VEHICLE SPEED	
NOTE: This step may require an assistant. • Enter the following diagnostic mode on the diagnostic tool: Anti-lock Brake System (ABS) Wheel Speed PID. • Monitor and record the ABS LF_WSPD PID while driving the vehicle at 48 km/h (30 mph) as indicated on the speedometer. • Enter the following diagnostic mode on the diagnostic tool: PCM Vehicle Speed PID. • Monitor and record the PCM VSS PID while driving the vehicle at 48 km/h (30 mph). • **Does the speed indicated by the ABS LF_WSPD PID match the PCM VSS PID?**	**Yes** GO to A7 . **No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the output shaft speed (OSS) sensor signal.
A7 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P1703 or DTC P1572 — Brake On/Off Circuit Failure

Refer to Wiring Diagrams Cell 31 , Speed Control for schematic and connector information.

Normal Operation

When the brake pedal is applied, voltage is routed through circuit CLS17 (YE/GY) to the powertrain control module (PCM) to deactivate the speed control, if engaged.

The speed control deactivator switch interrupts circuit CES09 (VT/OG), removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

DTC P1572 — sets when the PCM does not sense the proper sequence of the brake pedal input signal from both the stoplamp and deactivator switches when the brake pedal is pressed and released.

DTC P1703 — sets when there is an open or short in the deactivator switch circuits or when there is an open or short in the stoplamp circuits.

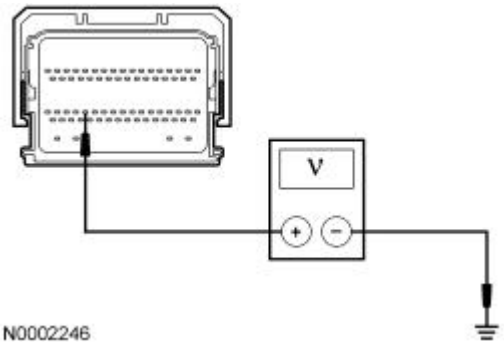
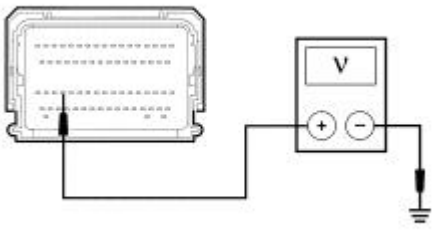
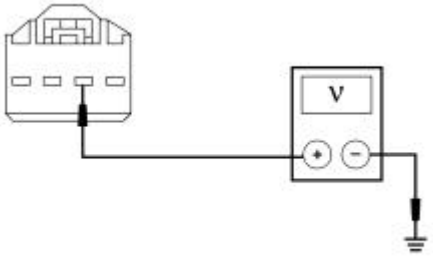
Possible Causes

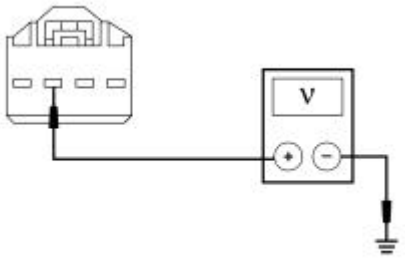
- Fuse
- Circuit CBB74 (VT/BN) open
- Circuit CES09 (VT/OG) open or short to voltage
- Circuit CLS17 (YE/GY) open
- PCM
- Speed control deactivator switch (integral to the stoplamp switch)

PINPOINT TEST B: DTC P1703 OR DTC P1572 — BRAKE ON/OFF CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

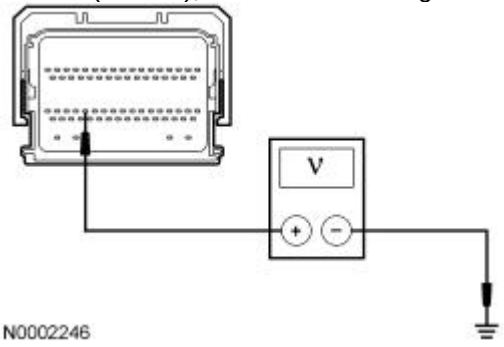
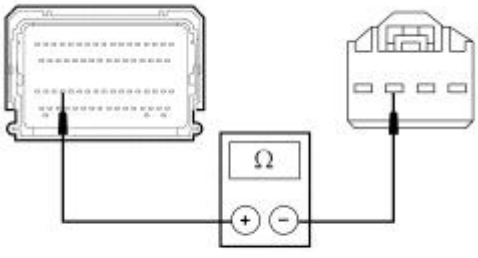
Test Step	Result / Action to Take
B1 CHECK THE OPERATION OF THE STOPLAMPS	
• Key in ON position. • Operate the stoplamps. • **Do the stoplamps operate correctly?**	**Yes** GO to B2 . **No** REFER to Section 417-01 .
B2 CHECK CIRCUIT CLS17 (YE/GY) FOR VOLTAGE	
• Key in OFF position. • Disconnect: PCM C175b. • Key in ON position. • Apply the brake pedal. • Measure the voltage between the PCM C175b-46, circuit CLS17 (YE/GY), harness side and ground.	**Yes** GO to B3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0002246 • **Is the voltage greater than 10 volts with the brake pedal applied?**	
B3 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION	
• While firmly applying and releasing the brake pedal, measure the voltage between the PCM C175b-47, circuit CES09 (VT/OG), harness side and ground.  N0038828 • **Is the voltage greater than 10 volts with the brake pedal released and 0 volts with the brake pedal firmly applied?**	**Yes** GO to B8 . **No** GO to B4 .
B4 CHECK CIRCUIT CBB74 (VT/BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Stoplamp Switch C278. • Key in ON position. • Measure the voltage between the stoplamp switch C278-2, circuit CBB74 (VT/BN), harness side and ground.  N0038829 • **Is the voltage greater than 10 volts?**	**Yes** GO to B5 . **No** VERIFY the battery junction box (BJB) fuse 74 (20A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK CIRCUIT CES09 (VT/OG) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Connect: PCM C175b. • Key in ON position. • Measure the voltage between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side and ground.	**Yes** GO to B6 . **No** GO to B7 .



N0038830

- **Is any voltage present?**

B6 CHECK THE PCM FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: PCM C175b. • Key in ON position. • Measure the voltage between the PCM C175b-47, circuit CES09 (VT/OG), harness side and ground.  N0002246 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .
B7 CHECK CIRCUIT CES09 (VT/OG) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side and the PCM C175b-47, circuit CES09 (VT/OG), harness side.  N0038831 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new stoplamp switch. REFER to Section 417-01 . CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .
B8 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR

	the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC P0579 or DTC P0581 — Speed Control Switch Circuit Failure

Refer to Wiring Diagrams Cell 31 , Speed Control for schematic and connector information.

Normal Operation

The powertrain control module (PCM) sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring.

DTC P0579 — may set when the speed control switch circuits are open, shorted to voltage or shorted to ground.

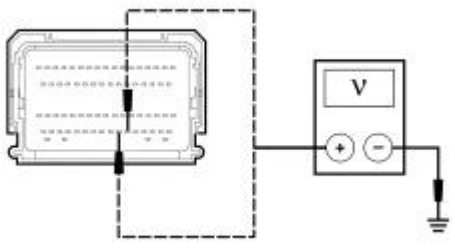
DTC P0581 — sets when the speed control switch circuits are open or shorted to voltage.

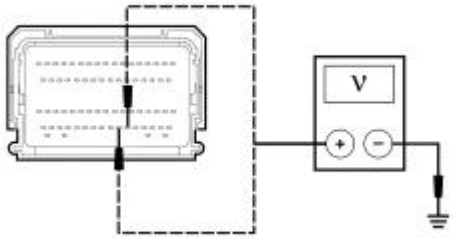
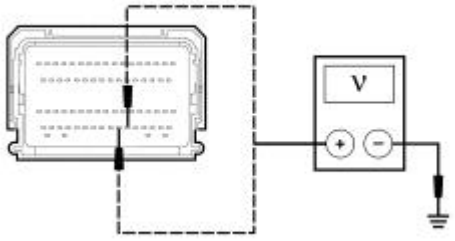
Possible Causes

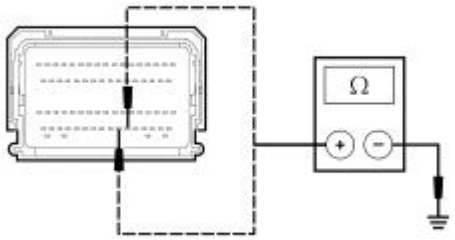
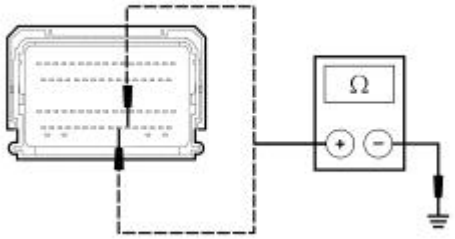
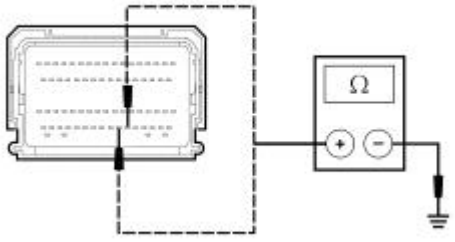
- Circuit RES08 (GN/BN) open, short to voltage or ground
- Circuit VES10 (WH) open, short to voltage or ground
- Clockspring
- Speed control switch
- PCM

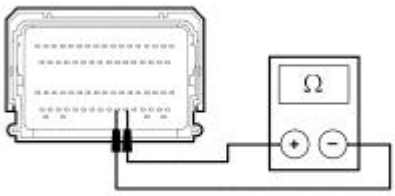
PINPOINT TEST C: DTC P0579 OR DTC P0581 — SPEED CONTROL SWITCH CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: PCM C175b. • Key in ON position. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.  N0038832 • **Is any voltage present?**	**Yes** TURN the parking lamps off. GO to C2 . **No** TURN the parking lamps off. GO to C4 .

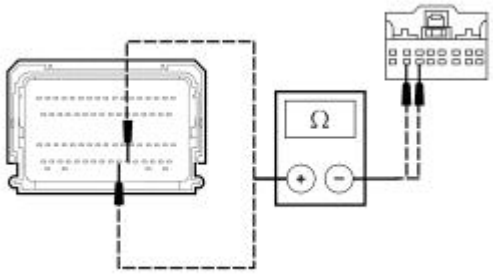
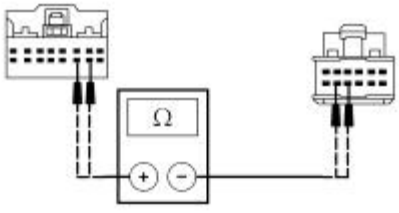
C2 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Clockspring C218. • Key in ON position. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.  N0038832 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** TURN the parking lamps off. GO to C3 .
C3 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Connect: Clockspring C218. • Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • **WARNING: Make sure there is no one inside the vehicle and that there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal injury.** • Connect the battery. • Key in ON position. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.  N0038832 • **Is any voltage present?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C4 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.	**Yes** GO to C7 . **No** GO to C5 .

 N0038833 • **Are the resistances greater than 10,000 ohms?**	
C5 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.  N0038833 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C6 .
C6 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO GROUND	
• Disconnect: Clockspring C218. • Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.  N0038833 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C7 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR AN OPEN	
• Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side.	**Yes** GO to C10 . **No** GO to C8 .



N0038826

- **Is the resistance between 4,279 and 4,363 ohms?**

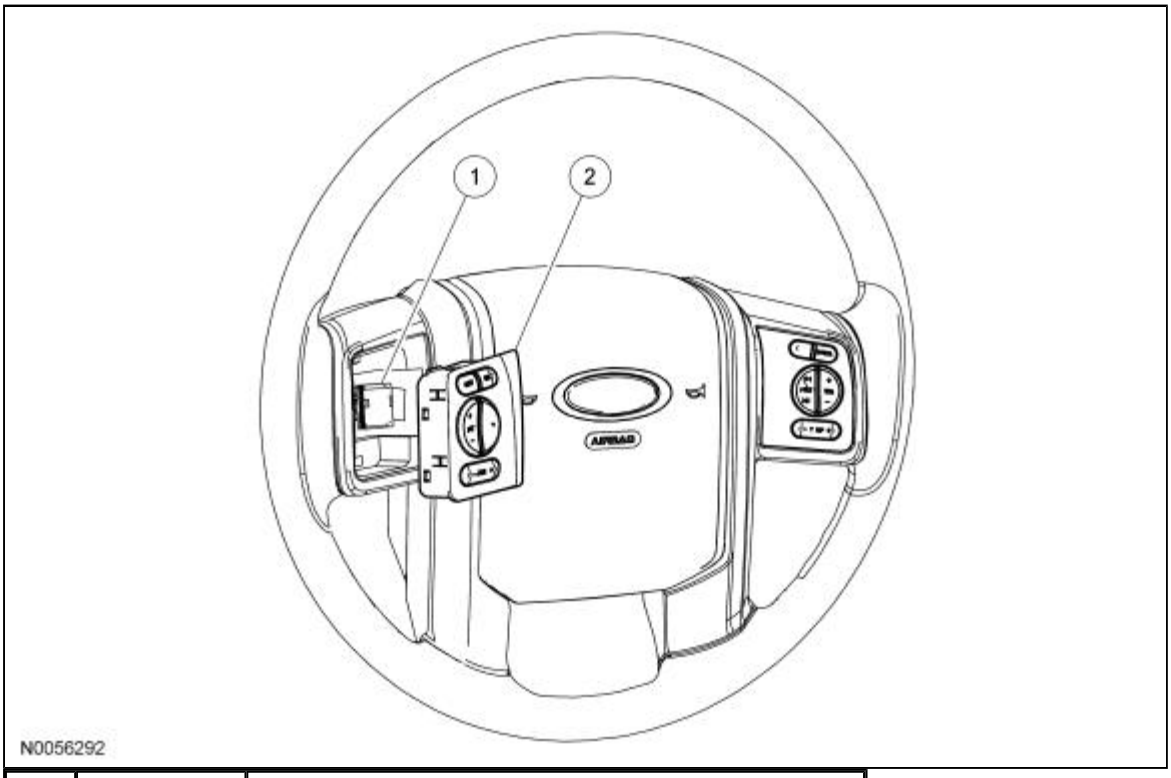
C8 CHECK CIRCUITS VES10 (GN/BK) AND RES08 (GN/BN) FOR AN OPEN	
• Disconnect: Clockspring C218. • Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the clockspring C218-15, circuit VES10 (WH), harness side; and between the PCM C175b-57, RES08 (GN/BN), harness side and the clockspring C218-14, circuit RES08 (GN/BN), harness side.  N0038834 • **Are the resistances less than 5 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK THE CLOCKSPRING	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • Measure the resistance between the upper clockspring connector pin 15, component side and the clockspring C218 pin 8, component side; and between the upper clockspring connector pin 14, component side and the clockspring C218 pin 9, component side.  N0038835 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation. **No** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C10 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins	**Yes** INSTALL a new PCM. REFER to Section 303-14 .

• Connect all the PCM connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Speed Control Switch

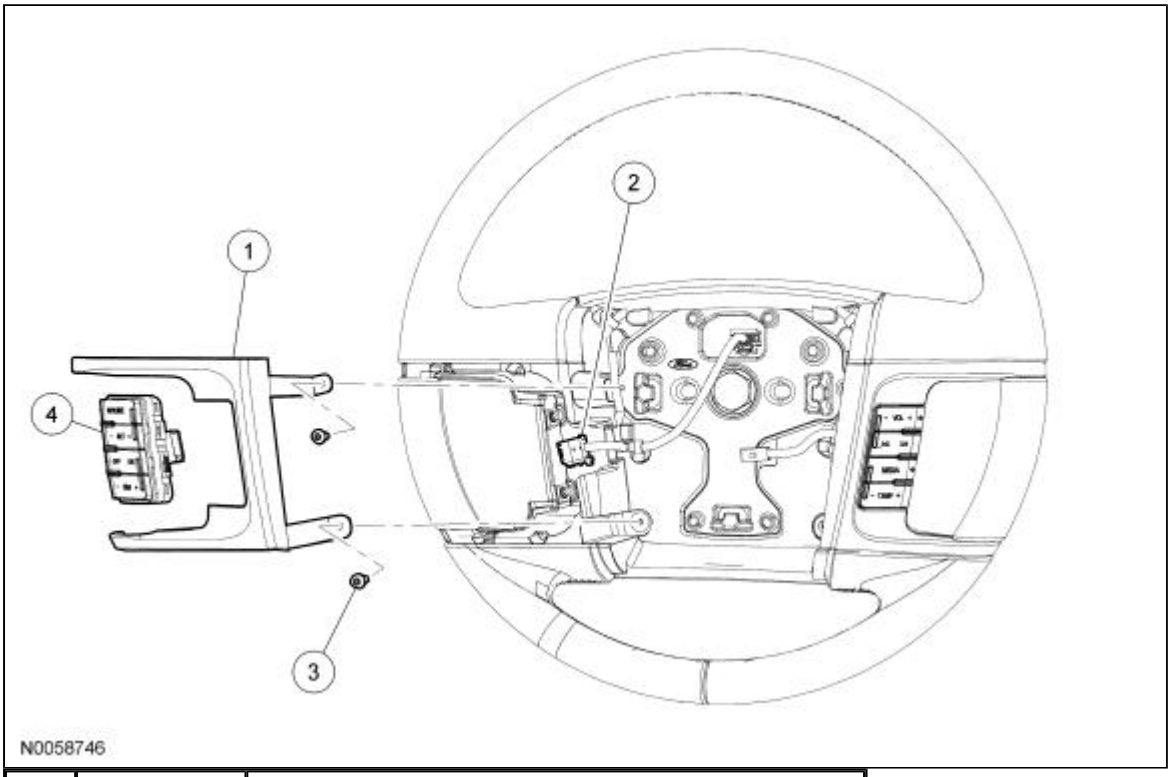
Printable View (211 KB)

Expedition



Item	Part Number	Description
1	—	Speed control switch electrical connector (part of 3600)
2	9E740	Speed control switch

Navigator



Item	Part Number	Description
1	—	Steering wheel controls bezel (part of 3600)
2	—	Speed control switch electrical connector (part of 3600)
3	—	Steering wheel controls bezel screws (2 required)
4	9E740	Speed control switch

Removal and Installation

Expedition

NOTE: It is not necessary to remove the driver air bag module during this procedure.

NOTE: Be careful not to allow the speed control switch electrical connector to fall back into the steering wheel.

1. Remove the speed control switch by pulling the switch toward the rear of the vehicle.
    - Disconnect the electrical connector.

Navigator

2. Remove the driver air bag module. For additional information, refer to Section 501-20B .

3. Remove the 2 screws and the steering wheel controls bezel.

4. Remove the speed control switch by pulling the switch toward the rear of the vehicle.
    - Disconnect the electrical connector.

All vehicles

5. To install, reverse the removal procedure.

Printable View (81 KB)

General Specifications

Item	Specification
A/C Compressor	
Type	FS20
Displacement	213 cc (13 cu in)
A/C Pressure Relief Valve [a]	
Open pressures	3,792-4,137 kPa (550-600 psi)
Magnetic Clutch	
Air gap clearance	0.35-0.65 mm (0.014-0.026 in)
Evaporator Discharge Air Temperature Sensor	
On temperatures	2.2-3.3°C (36-38°F)
Off temperatures	2.2-3.3°C (36-38°F)
Refrigerant Lubricant and Capacity	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B
Capacity without auxiliary climate control	266 ml (9 oz)
Capacity with auxiliary climate control	414 ml (14 oz)
Refrigerant and Capacity	
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A
Capacity without auxiliary climate control	1.13 kg (40 oz)
Capacity with auxiliary climate control	1.64 kg (58 oz)
Refrigerant System Cleaner	
A/C Systems Flushing YN-23	—
Refrigerant System Coating	
A/C Cooling Coil Coating YN-29	—
Refrigerant System Dye	
R-134a Leak Detection Dye 164-R6060 or 164-R6081	—

[a] Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve, low charge protection and pressure cutoff switch locations.

Torque Specifications

Description	Nm	lb-in
Peanut fitting	15	133

Climate Control System

Printable View (242 KB)

Climate Control System

WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

WARNING: R-134a is classified as a safe refrigerant, but misuse can make it dangerous. The following precautions must be observed.

- **Always wear safety goggles when repairing an air conditioning system.**
- **Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13° F) under atmospheric pressure and it will freeze skin tissue.**
- **Never allow refrigerant R-134a gas to escape in quantity in an occupied space. R-134a is non-toxic, but it will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but when it is exposed to high temperatures, such as a torch flame, it decomposes. During decomposition it releases irritating and toxic gases (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.**
- **Do not allow any portion of the charged air conditioning system to become too hot. The pressure in an air conditioning system rises as the temperature rises and temperatures of approximately 85°C (185°F) can be dangerous.**
- **Allow the engine to cool sufficiently prior to carrying out maintenance or serious burns and injury can occur.**

WARNING: It is dangerous to charge the system with the engine running at the high side service port.

CAUTION: To avoid damaging the vehicle or A/C components, the following precautions must be observed.

- **The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.**
- **Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These two types of refrigerant must never be mixed. Doing so can damage the A/C system.**
- **Charge the A/C system with R-134a refrigerant gas while the engine is running only at the low-pressure side to prevent refrigerant slugging from damaging the A/C compressor.**
- **Use only R-134a refrigerant. Due to environmental concerns, when the A/C system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal, State/Provincial and/or local laws REQUIRE that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as ASE, MACS, HRAI, etc. Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the A/C system.**
- **Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other**

purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.

- **A number of manufacturers are producing refrigerant products that are described as direct substitutes for refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled refrigerant R-134a.**

CAUTION: To avoid contamination of the A/C system, the following precautions must be observed.

- **Never open or loosen a connection before recovering the refrigerant.**
- **When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.**
- **Evacuate a system that has been opened to install a new component or one that has discharged through leakage before charging.**
- **Seal open fittings with a cap or plug immediately after disconnecting a component from the system.**
- **Clean the outside of the fittings thoroughly before disconnecting a component from the system.**
- **Do not remove the sealing caps from a new component until ready to install.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use and install the cap immediately after using. Store the oil in a clean, moisture-free container.**
- **Install a new O-ring seal before connecting an open fitting. Coat the fitting and O-ring seal with mineral oil before connecting.**
- **When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.**
- **Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.**
- **Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.**

The electronic manual temperature control (EMTC) system heats or cools the vehicle depending on the EMTC control panel selection.

- The EMTC control panel selections determine heating or cooling, air distribution and enables blower motor operation.
- The temperature control setting determines the air temperature.
- The blower motor switch varies the blower motor speed.
- During A/C operation the system also reduces the relative humidity of the air.
- The driver side and passenger side temperature settings can be individually controlled. (Dual-zone EMTC only.)

The dual-zone electronic automatic temperature control (EATC) system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.
- The temperature control setting determines the air temperature.
- The blower motor control override buttons vary the blower motor speed.
- The driver side and passenger side temperature settings can be individually controlled.

Principles of Operation

There are 4 main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporization
- Relative humidity
- Effects of pressure

Heat Transfer

If 2 substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature. The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable you feel. Removing the moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

Compressor Anti-Slugging Strategy

Liquid refrigerant may accumulate in the A/C compressor under certain conditions. To alleviate damage to the A/C compressor, compressor anti-slugging strategy (CASS) is utilized.

CASS is initiated only under specific conditions:

- Ignition is off for more than 8 hours
- Ambient temperature is above -4°C (25°F)
- Battery voltage is above 8.5 volts during engine cranking

When these conditions are present, the powertrain control module (PCM) will activate the A/C control relay prior to cranking of the engine. The A/C control relay engages the A/C compressor for approximately 4-15 A/C compressor revolutions or a maximum of 2 seconds (depending upon vehicle application), allowing the liquid refrigerant to be pushed from the A/C compressor. CASS is initiated by the PCM regardless of the EMTC or the EATC system settings.

The Refrigerant Cycle

During stabilized conditions (air conditioning system shutdown), the refrigerant pressures are equal throughout the system. When the A/C compressor is in operation it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The

now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser and enters the inlet side of the A/C receiver/drier. The receiver/drier is designed to remove moisture from the refrigerant.

The outlet of the receiver/drier is connected to the thermostatic expansion valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high and low pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

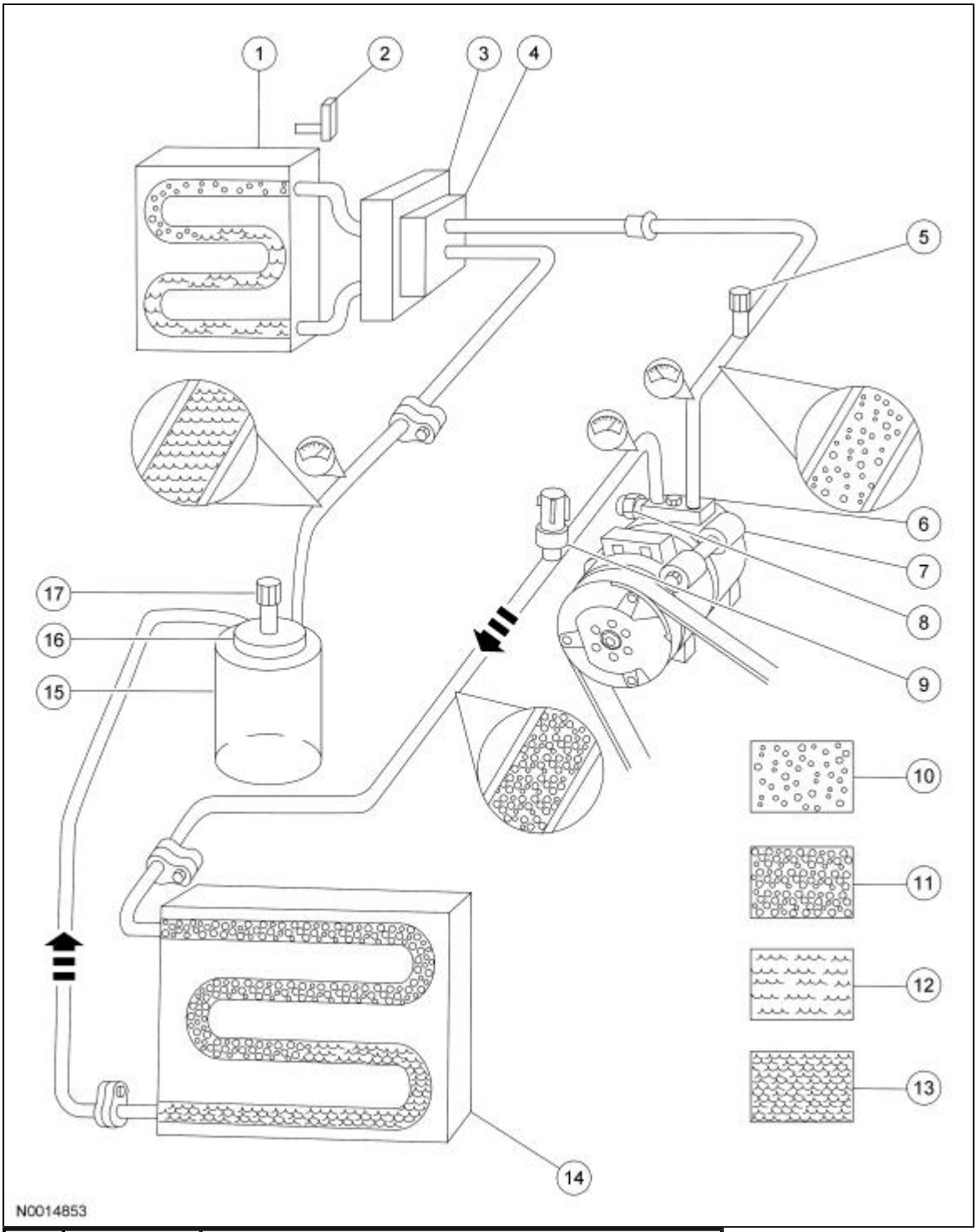
A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle powertrain control module (PCM).

The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

Thermostatic Expansion Valve Type Refrigerant System



Item	Part Number	Description
1	19860	A/C evaporator core
2	19C734	A/C evaporator core outlet temperature thermistor
3	19849	Thermostatic expansion valve
4	19835	Manifold and tube assembly — thermostatic expansion valve
5	19D701	A/C charge valve port (low side)
6	19D734	Manifold and tube assembly — A/C compressor
7	19703	A/C compressor

8	19D644	A/C pressure relief valve
9	19D594	A/C pressure transducer
10	—	Low pressure vapor
11	—	High pressure vapor
12	—	Low pressure liquid
13	—	High pressure liquid
14	19712	A/C condenser core
15	19959	A/C receiver/drier
16	19835	Manifold and tube assembly — receiver/drier
17	19D701	A/C charge valve port (high side)

Climate Control System Operation

Electronic Manual Temperature Control System

The electronic manual temperature control (EMTC) system operation is determined by the settings on the climate control assembly. The EMTC system is composed of the EMTC module, blower motor resistor, mode door actuator, air inlet door actuator and temperature blend door actuator to control the various functions.

The blower motor switch:

- sets the blower motor speed.
- directs the blower motor path to ground through the blower motor resistor to allow blower motor operation in LO, MED LO and MED HI.
- directs the blower motor path directly to ground, bypassing the blower motor resistor, to allow blower motor operation in HI.

The A/C request switch:

- can command the A/C compressor ON when the function selector switch is in PANEL, FLOOR/PANEL, FLOOR/DEFROST and FLOOR when the A/C request switch is pressed. Indicator illuminates when A/C request switch is toggled ON.
- is inoperative in MAX A/C, OFF and DEFROST.
- indicator illuminates when the function selector switch is in MAX A/C and cannot be toggled.
- indicator does not illuminate in OFF and cannot be toggled.
- indicator does not illuminate in DEFROST but can be toggled ON or OFF. The A/C compressor will operate regardless of indicator status if the outside air temperature is above 6°C (43°F).
- is serviced only with the climate control assembly.

The function selector switch:

- selects airflow direction.
- is serviced only with the climate control assembly.

The air recirculation button:

- selects either recirculated or outside air source.
- recirculates air in any mode except DEFROST, if requested.
- is disabled in MAX A/C or OFF mode where recirculated air only is used.
- is disabled in DEFROST mode where outside air only is used.

- is serviced only with the climate control assembly.

The auxiliary climate controls:

- select the auxiliary blower motor speed.
- select the auxiliary airflow mode/temperature.

The EMTC module also includes:

- a rear window defrost button, refer to Section 501-11 .
- heated/cooled seat controls, refer to Section 501-10 .

Electronic Automatic Temperature Control System

The electronic automatic temperature control (EATC) system operation is determined by the settings on the EATC module. The EATC system automatically maintains a selected temperature for vehicle interior comfort. The EATC system is composed of the EATC module, blower motor speed control, mode door actuator, air inlet door actuator, temperature blend door actuator, in-vehicle temperature sensor and solar radiation sensor to control the various functions.

When the EATC module is set to AUTO:

- the air distribution direction, blower motor speed and A/C compressor operation are automatically controlled based on the temperature(s) selected.

The EATC module manual override settings:

- allow the air distribution direction to be manually selected.
- allow the blower motor speed to be manually selected.
- allow RECIRCULATION mode to be manually selected in all modes except DEFROST. The A/C request can be cancelled by pressing the A/C request switch, turning the indicator OFF.
- allow A/C compressor operation to be manually selected except in DEFROST.

The auxiliary climate controls:

- select the auxiliary blower motor speed.
- select the auxiliary airflow mode/temperature.

The EATC module also includes:

- a rear window DEFROST button, refer to Section 501-11 .
- heated/cooled seat controls, refer to Section 501-10 .

Auxiliary Climate Control System

An auxiliary climate control system is available as optional equipment. The auxiliary climate control system operation is determined by the settings on the front or rear auxiliary climate control assembly. The auxiliary climate control assemblies include a blower motor switch and temperature control/air distribution mode knob, neither of which can be individually serviced.

Auxiliary blower motor operation is enabled when the EMTC or EATC is in any mode except OFF. The auxiliary system air can be cooled below interior air temperature only when A/C compressor operation has been requested by the settings of the climate control assembly of the base (front) system. The auxiliary system air can be heated at any time.

The front auxiliary climate controls:

- are built into the dual-zone EMTC or EATC module. The blower motor speed can be set to OFF, LO, MED LO, MED HI or HI by pressing the auxiliary blower FAN button either right (higher) or left (lower). The temperature/airflow mode can be adjusted by pressing the rear button either right (warm/floor) or left (cool/panel). If the front (main) driver side temperature is set to full COOL or full HEAT, the auxiliary temperature will be set to the same as the driver and cannot be changed. When the front auxiliary REAR button is depressed, all control of the auxiliary climate control system functions are then transferred to the rear auxiliary climate control assembly and the auxiliary temperature can be fully independently controlled.

The rear auxiliary climate control assembly:

- blower motor switch controls the auxiliary blower motor speed only when the front auxiliary climate control assembly blower motor switch is set to REAR. The blower motor speed can be set to OFF, LO, MED LO, MED HI or HI.
- temperature/airflow mode control switch is a potentiometer that outputs a variable voltage to the auxiliary temperature blend door actuator and auxiliary mode door actuator to set the position of the auxiliary temperature blend and mode doors only when the front auxiliary climate control assembly blower motor switch is set to REAR. When A/C compressor operation has not been initiated (A/C compressor commanded on) by the EMTC or EATC module (as equipped), the auxiliary climate control system cannot cool the air below that of the interior air temperature.

System Airflow Description — EMTC

Max A/C

When MAX A/C is selected:

- the air inlet door actuator closes off outside air and admits only recirculated air.
- the recirc button is disabled and the indicator is illuminated.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is illuminated and will be disabled.
- the A/C compressor will operate if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air

inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

OFF

When OFF is selected:

- the recirc request button is disabled.
- the air inlet door actuator closes off outside air and admits only recirculated air.
- the A/C request button is disabled.
- the blower motor is OFF.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR/DEFROST

When the FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button will indicate the last status and the indicator can be toggled. To reduce fogging, the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the air inlet door actuator opens, admitting only outside air into the passenger compartment.

- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.
- the A/C request button will indicate the last status and the indicator can be toggled. To reduce fogging, the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

System Airflow Description — EATC

AUTO

When AUTO is selected:

- the temperature control setting is manually set to the desired setting.
- the air inlet door actuator is automatically controlled by the EATC module, based on the temperature setting.
- the mode door actuators are automatically controlled by the EATC module based on the temperature setting.
- the A/C compressor is automatically controlled by the EATC module based on the temperature setting. The A/C compressor will not operate if the outside temperature is below approximately 6° C (43°F).
- the A/C request button or the RECIRC request button, if pressed, will transfer the system to semi-auto operation.
- the blower motor is ON. The blower motor speed is automatically controlled by the EATC module based on the temperature setting, but can be manually overridden.

OFF

When OFF is selected:

- the RECIRC request button is disabled.
- the air inlet door actuator closes off outside air and admits only recirculated air.
- the floor/defrost/panel door actuator is in the DEFROST position.
- the A/C request button is disabled.
- the blower motor is OFF.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor will operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR/DEFROST

When the FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate automatically and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the recirc request button and indicator is disabled. Regardless of button and indicator status, the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.
- the A/C request button will indicate the last status and the indicator can be toggled. To reduce

fogging, the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).

- the blower motor is ON.

Climate Control System

Printable View (1967 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	FLUKE 77III Automotive Meter 105-R0056 or equivalent
ST1928-A	R-134a Manifold Gauge Set 176-R032A or equivalent
ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
ST1252-A	Set, A/C Fittings 412-DS028 (014-00333, D93L-19703B) or equivalent
ST2351-A	Refrigerant Leak Detector 216-00001 or equivalent
ST1474-A	Pressure Test Kit 014-R1072 or equivalent

Inspection and Verification

1. Verify the customer's concern by operating the climate control system to duplicate the condition.

2. Inspect to determine if one of the following mechanical or electrical concerns apply:

   Visual Inspection Chart

Mechanical	Electrical

• Loose, missing or damaged A/C compressor drive belt
• Loose or disconnected A/C clutch
• Broken or binding door/actuator
• Broken or leaking refrigerant lines
• Obstructed in-vehicle temperature sensor
• Disconnected in-vehicle temperature aspirator hose
	• Battery junction box (BJB) fuse:
	  ▪ 11 (30A)
	  ▪ 24 (40A)
	  ▪ 30 (10A)
	  ▪ 67 (10A)
	  ▪ 70 (20A)
	• Smart junction box (SJB) fuse:
	  ▪ 15 (10A)
	  ▪ 37 (10A)
	  ▪ 46 (7.5A)
	• Blower motor inoperative
	• A/C compressor inoperative
	• Circuitry open/shorted
	• Disconnected electrical connectors
	• Cooling fan inoperative

3. As pinpoint tests and measurements are being carried out, be sure to inspect for any disconnected, loose-fitting or incorrectly installed component, module and in-line electrical connectors and pins.

4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

6. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power to The Scan Tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM), electronic manual temperature control (EMTC) or electronic automatic temperature control (EATC) module.

8. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory diagnostic trouble codes (DTCs).

9. Clear the continuous DTCs and carry out the self-test diagnostics from the PCM, EMTC or EATC.

10. **NOTE:** Some PCM DTCs may inhibit air conditioning (A/C) operation. If any PCM DTCs are retrieved, diagnose those first. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

    If the EATC DTCs retrieved are related to the concern, go to the EATC Diagnostic Trouble Code (DTC) Chart. If the EMTC DTCs retrieved are related to the concern, go to the EMTC Diagnostic Trouble Code (DTC) Chart. If the PCM DTCs retrieved are related to the concern, go to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Electronic Automatic Temperature Control (EATC) Module — Diagnostic Methods

The EATC system must be diagnosed by first retrieving any DTCs, if present.

- An on-demand (hard fault) DTC indicates that the fault is currently present. An on-demand DTC suggests a wiring fault, disconnected connector or component failure.
- A continuous (intermittent) DTC alone (corresponding on-demand DTC is not present) indicates that the fault is an intermittent condition and may not be currently present. A continuous only DTC suggests a poor wiring connection, loose pin or terminal or intermittent component failure.

On-demand (hard fault) or continuous (intermittent fault) DTCs can be retrieved using a scan tool. If using a scan tool, refer to the scan tool operating manual.

On-demand DTCs can also be retrieved by carrying out the Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test. To retrieve and/or clear continuous DTCs, carry out the Electronic Automatic Temperature Control (EATC) Module — Retrieve Continuous DTCs procedure. Always carry out the Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test before retrieving continuous DTCs.

If no DTCs are present, GO to Symptom Chart for the appropriate diagnostic action.

Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test

The Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test will retrieve on-demand (hard fault) DTCs only, it will not retrieve continuous DTCs. Continuous DTCs can be cleared when exiting the Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test. Make sure to retrieve continuous DTCs by carrying out the Electronic Automatic Temperature Control (EATC) Module — Retrieve Continuous DTCs procedure before clearing any continuous DTCs.

- The Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test will not detect concerns associated with data link messages like engine coolant temperature or vehicle speed signals. A scan tool must be used to retrieve these concerns.
- The Electronic Automatic Temperature Control (EATC) Module On-Demand Self Test will detect concerns in the system control functions and will display on-demand (hard fault) DTCs for concerns that are present during the self-test. The vehicle interior temperature should be between 4°C-38°C (40°F-100°F) when carrying out the self-test. If the temperatures are not within the specified ranges, false DTCs may be displayed.
- The self-test can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when the self-test is activated.
- To enter the self-test, press the OFF and DEFROST buttons simultaneously and release, then press the AUTO button within 2 seconds. The display will show a flashing blower icon for 20 seconds, after which all vacuum fluorescent segments will be displayed if there are no on-demand DTCs present. If DTCs are present, the EATC module will display "00 00" and then on-demand DTCs. Record all DTCs displayed.
- If any DTCs appear during the self-test, carry out the diagnostic procedure. Refer to the

Electronic Automatic Temperature Control (EATC) Module Diagnostic Trouble Code Chart and follow the ACTION for each DTC given.

- If a condition exists, but no DTCs appear during the self-test, GO to Symptom Chart Condition: The EATC System Is Inoperative, Intermittent or Incorrect Operation.
- To exit the self-test and **retain** all DTCs, press any button **except** DEFROST. The EATC module will exit the self-test and retain all DTCs.
- To exit the self-test and **clear** all DTCs, press the DEFROST button. The EATC module will exit the self-test and all DTCs will be cleared.
- Always exit the self-test before powering the system down (system turned OFF). Once the self-test is exited, the ignition switch must remain ON for at least 30 seconds to allow the door actuators to automatically recalibrate.
- Continuous DTCs will be deleted after 80 ignition switch ON cycles after the intermittent fault occurs.

Electronic Automatic Temperature Control (EATC) Module — Retrieve Continuous DTCs

The EATC module will retrieve only continuous (intermittent) DTCs when carrying out this procedure.

- Retrieval of continuous DTCs can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when retrieving continuous DTCs.
- To retrieve continuous DTCs, press the OFF and DEFROST buttons simultaneously and release, then press the RECIRC button within 2 seconds. All vacuum fluorescent segments will be displayed if there are no continuous DTCs present. Continuous DTCs are indicated by the presence of the Celsius symbol (°C) on the EATC module display. Record all DTCs displayed.
- If any DTCs appear, carry out the diagnostic procedure. Refer to the Electronic Automatic Temperature Control (EATC) Module Diagnostic Trouble Code Chart and follow the ACTION for each DTC given.
- If a condition exists but no DTCs appear, GO to Symptom Chart Condition: The EATC System Is Inoperative, Intermittent or Incorrect Operation.
- To exit and **retain** all continuous DTCs, press any button **except** DEFROST. The EATC module will exit the retrieved continuous DTCs mode and retain all continuous DTCs.
- To exit and **clear** all continuous DTCs, press the DEFROST button. The EATC module will exit the retrieve continuous DTCs mode and all continuous DTCs will be cleared.
- Always exit the procedure before powering the system down (system turned OFF). Once the procedure is exited, the ignition switch must remain ON for at least 30 seconds to allow the door actuators to automatically recalibrate.
- Continuous DTCs will be deleted after 80 ignition switch ON cycles after the intermittent fault occurs.

Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process

The purpose of the cold boot process is to allow the EATC or EMTC module to reinitialize and calibrate the actuators. To carry out the cold boot process, follow the steps below.

1. Turn the ignition switch to the OFF position.
2. Disconnect the EATC or EMTC module electrical connectors.
3. Wait one minute.
4. Connect the EATC or EMTC module electrical connectors.
5. Turn the ignition switch to the ON position.
6. Select any position except OFF on the EATC or EMTC module.

The EATC or EMTC module will not initialize and calibrate the actuators. Calibration of the actuators will

take approximately 30 seconds.

Diagnostic Trouble Code Chart

Electronic Automatic Temperature Control (EATC) Module Diagnostic Trouble Code (DTC) Chart

NOTE: Some PCM DTCs may inhibit air conditioning (A/C) operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

DTC	Description	Action to Take
B1342	EMTC Module Faulted	INSTALL a new EMTC module. REFER to Section 412-01 .
B1676	Battery Voltage Out Of Range	Go To Pinpoint Test W .
B2266	(LH) Blend Door Failure or Short	Go To Pinpoint Test M .
B2826	Evaporator Temperature Sensor Circurt Failure	Go To Pinpoint Test E .
B2827	Evaporator Temperature Sensor Circuit Short to Ground	Go To Pinpoint Test E .
B2916	Auxiliary Blend Door Failure	Go To Pinpoint Test T .
B2917	Auxiliary Mode Door Failure	Go To Pinpoint Test U .
B2918	Auxiliary Temperature Input Circuit Open/Short to Ground	If the vehicle is not equipped with a center console and rear auxiliary climate controls, ignore the DTC and continue diagnostics. If the vehicle is equipped with a center console and rear auxiliary climate controls, Go To Pinpoint Test V .
B2919	Auxiliary Blower Motor Speed Input Circuit Open/Short to Ground	If the vehicle is not equipped with a center console and rear auxiliary climate controls, ignore the DTC and continue diagnostics. If the vehicle is equipped with a center console and rear auxiliary climate controls, Go To Pinpoint Test V .
U2050	No Application Present	INSTALL a new EMTC module. REFER to Section 412-01 .

Electronic Automatic Temperature Control (EATC) Module Diagnostic Trouble Code (DTC) Chart

NOTE: Some PCM DTCs may inhibit air conditioning (A/C) operation. If any PCM DTCs are retreived, diagnose those first. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

DTC	Description	Action to Take
B1200	Stuck Button	Button held too long may set DTC. ATTEMPT to clean buttons. If code returns, INSTALL a new EATC module. REFER to Section 412-01 .
B1251	In-Vehicle Temperature Sensor Open Circuit	Go To Pinpoint Test A .
B1253	In-Vehicle Temperature Sensor Circuit Short to Ground	Go To Pinpoint Test A .
B1255	Ambient Temperature Sensor	Go To Pinpoint Test B .

	Open Circuit	
B1257	Ambient Temperature Sensor Circuit Short to Ground	Go To Pinpoint Test B .
B2795	LH A/C Solar Radiation Sensor Circuit Short to Ground	Go To Pinpoint Test C .
B2796	LH A/C Solar Radiation Sensor Open Circuit	Go To Pinpoint Test C .
B2426	RH A/C Solar Radiation Sensor Open Circuit	Go To Pinpoint Test C .
B2427	RH A/C Solar Radiation Sensor Circuit Short to Ground	Go To Pinpoint Test C .
B2411	A/C Humidity Sensor Circuit Open	Go To Pinpoint Test D .
B2412	A/C Humidity Sensor Circuit Short to Ground	Go To Pinpoint Test D .
B2826	Evaporator Temperature Sensor Circuit Failure	Go To Pinpoint Test E .
B2827	Evaporator Temperature Sensor Circuit Short to Ground	Go To Pinpoint Test E .
B2268	Steering Wheel Control Switch Circuit Open	Go To Pinpoint Test F .
B2269	Steering Wheel Control Switch Circuit Short to Ground	Go To Pinpoint Test F .
B2266	LH Blend Door Failure or Short	Go To Pinpoint Test M .
B2267	RH Blend Door Failure or Short	Go To Pinpoint Test M .
B1003	Mode Door Short/Failure	Go To Pinpoint Test H .
B2916	Auxiliary Blend Door Failure	Go To Pinpoint Test T .
B2917	Auxiliary Mode Door Failure	Go To Pinpoint Test U .
B2918	Auxiliary Temperature Input Circuit Open/Short to Ground	If the vehicle is not equipped with a center console and rear auxiliary climate controls, ignore the DTC and continue diagnostics. If the vehicle is equipped with a center console and rear auxiliary climate controls, Go To Pinpoint Test V .
B2919	Auxiliary Blower Motor Speed Input Circuit Open/Short to Ground	If the vehicle is not equipped with a center console and rear auxiliary climate controls, ignore the DTC and continue diagnostics. If the vehicle is equipped with a center console and rear auxiliary climate controls, Go To Pinpoint Test V .
B1676	Battery Voltage Out of Range	Go To Pinpoint Test W .
B1342	EATC Module Faulted	INSTALL a new EATC module. REFER to Section 412-01 .
U2050	No Application Present	INSTALL a new EATC module. REFER to Section 412-01 .

Symptom Chart

SYMPTOM CHART

NOTE: Some PCM DTCs may inhibit air conditioning (A/C) operation. If any PCM DTCs are retrieved, diagnose those first. Refer to Powertrain Control/Emissions Diagnosis

(PC/ED) manual.

Condition	Possible Sources	Action
• The air inlet door is inoperative	• Circuitry open/shorted • Door actuator • Air inlet door binding or stuck • Electronic module temperature control (EMTC) module or electronic automatic temperature control (EATC) module	• Go To Pinpoint Test G .
• Incorrect/erratic direction of airflow from outlets	• Circuitry open/shorted • Door actuator • Mode door binding or stuck • EMTC module or EATC module	• Go To Pinpoint Test H .
• The EATC system is inoperative, intermittent or incorrect operation	• Fuse(s) • Circuitry open	• Go To Pinpoint Test I .
• Insufficient, erratic or no heat	• Low engine coolant level • Engine overheating • Plugged or partially plugged heater core • Temperature blend door is binding or stuck • Temperature blend door actuator • Heater hose is kinked or binding	• Go To Pinpoint Test J .
• The air conditioning (A/C) is inoperative/does not operate correctly	• Fuse(s) • Circuitry open • A/C system discharged/low charge • PCM • EATC module • EMTC module • A/C clutch relay • A/C compressor clutch air gap • A/C pressure transducer • Evaporator discharge temperature sensor • A/C clutch field coil • Battery junction	• Go To Pinpoint Test K .

	box (BJB)	
• The A/C is always on	• Circuitry shorted • PCM • EATC module • EMTC module • A/C clutch relay • A/C compressor clutch air gap • A/C pressure transducer • Evaporator discharge temperature sensor • A/C clutch field coil	• Go To Pinpoint Test L .
• Temperature control is inoperative/does not operate correctly	• Circuitry open/shorted • EMTC module • EATC module • Temperature blend door is binding or stuck • Temperature blend door actuator	• Go To Pinpoint Test M .
• The blower motor is inoperative — EMTC	• Fuse(s) • Circuitry open • A/C blower motor switch • Blower motor relay • A/C blower motor • EMTC module • BJB	• Go To Pinpoint Test N .
• The blower motor does not operate correctly — EMTC	• Circuitry open/shorted • A/C blower motor resistor • A/C blower motor switch	• Go To Pinpoint Test O .
• The blower motor is inoperative — EATC	• Fuse(s) • Circuitry short/open • Blower motor relay • A/C blower motor • EATC module • A/C blower motor speed control • BJB	• Go To Pinpoint Test P .
• The blower motor does not operate correctly — EATC	• Circuitry open/shorted • A/C blower motor speed control • EATC module	• Go To Pinpoint Test Q .
• The auxiliary blower motor is inoperative	• Fuse(s) • Circuitry open • Auxiliary blower motor relay 1 • Auxiliary blower motor resistor • Auxiliary blower motor	• Go To Pinpoint Test R .

	• EMTC module • EATC module	
• The auxiliary blower motor does not operate correctly	• Fuse(s) • Circuitry open/shorted • Auxiliary blower motor relay 1 • Auxiliary blower motor relay 2 • Auxiliary blower motor relay 3 • Auxiliary blower motor resistor • Rear auxiliary control • EMTC module • EATC module	• Go To Pinpoint Test S .
• The temperature control is inoperative/does not operate correctly using the front/rear auxiliary climate controls	• Circuitry open/shorted • Auxiliary blend door actuator • EMTC module • EATC module	• Go To Pinpoint Test T .
• The panel/floor control is inoperative/does not operate correctly using the front/rear auxiliary climate controls	• Circuitry open/shorted • Auxiliary mode door actuator • EMTC module • EATC module	• Go To Pinpoint Test U .
• The temperature, panel/floor and blower motor controls are inoperative/do not operate correctly using the front/rear auxiliary climate controls	• Circuitry open/shorted • Rear auxiliary control • EMTC module • EATC module	• Go To Pinpoint Test V .
• The dual temperature control is inoperative/does not operate correctly	• Temperature blend door/actuator broken/binding • EATC module • Low A/C refrigerant charge	• CHECK that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), REFER to Fluorescent Dye Leak Detection in this section. CHECK the temperature blend doors/actuators for a binding or broken condition. If no condition is found, INSTALL a new EMTC/EATC module.
• The temperature set point does not repeat after turning the ignition switch OFF	• Fuse • Circuitry short/open • EATC module	• VERIFY smart junction box (SJB) fuse 15 (10A) is OK. If OK, CHECK circuit SBP15 (WH/RD) for a short or open and repair as necessary. If OK, INSTALL a new EATC module.
• The temperature	• EATC module	• If the instrument cluster

display will not switch between Celsius and Fahrenheit	• Instrument cluster (IC) module	does not switch between English and Metric, refer to Section 413-00 and diagnose. • If only the EATC module does not switch between English and Metric, INSTALL a new EATC module.

Pinpoint Tests

Pinpoint Test A: DTC B1251 or DTC B1253 — In-Vehicle Temperature Sensor Open Circuit or Short to Ground

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

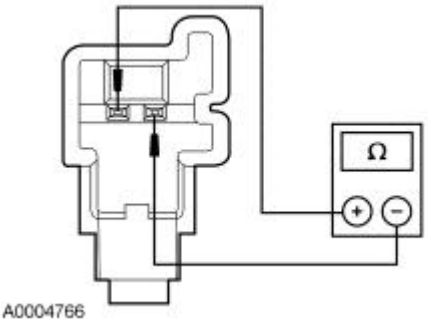
Under normal operation, the in-vehicle air temperature sensor receives a ground from the electronic automatic temperature control (EATC) module through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the in-vehicle air temperature sensor from the EATC module through circuit VH414 (GN/BU).

Possible Causes

- An open in circuit RH111 (GY/BU) or VH414 (GN/BU)
- A short to ground in circuit VH414 (GN/BU)
- A short together in circuit RH111 (GY/BU) and VH414 (GN/BU)
- In-vehicle air temperature sensor
- EATC module

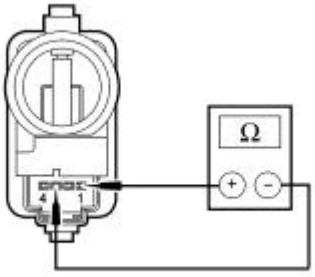
PINPOINT TEST A: DTC B1251 OR DTC B1253 — IN-VEHICLE TEMPERATURE SENSOR OPEN CIRCUIT OR SHORT TO GROUND

Test Step	Result / Action to Take
A1 CHECK THE SENSOR RESISTANCE	
• Key in OFF position. • Disconnect: In-Vehicle Temperature Sensor C233 (Expedition) or C2247 (Navigator). • **NOTE:** Expedition only. • Measure the resistance between in-vehicle temperature sensor C233 terminals.	**Yes** GO to A2 . **No** INSTALL a new in-vehicle temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



A0004766

- **NOTE:** Navigator only.
- Measure the resistance between in-vehicle temperature sensor C2247 terminals.

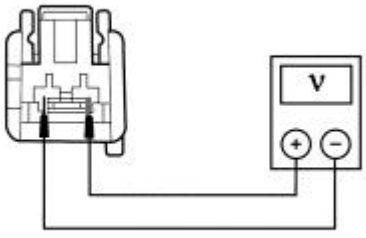


A0047071

- **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F), 37,000-58,000 ohms; 20-30°C (68-86°F), 24,000-37,000 ohms; 30-40°C (86-104°F), 16,000-24,000 ohms?**

A2 CHECK THE EATC SENSOR OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.
- **NOTE:** Expedition only.
- Measure the voltage between in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU) and C233-2, circuit RH111 (GY/BU).

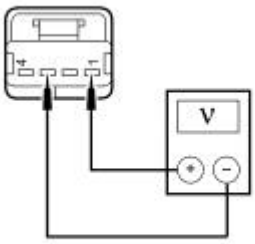


A0001977

- **NOTE:** Navigator only.
- Measure the voltage between in-vehicle temperature sensor C2247-1, circuit VH414 (GN/BU) and C2247-2, circuit RH111 (GY/BU).

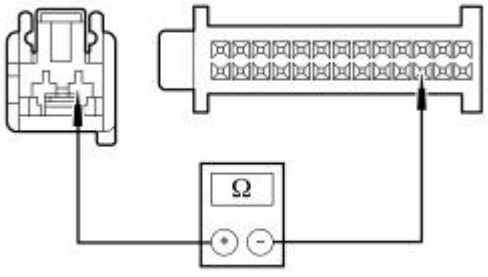
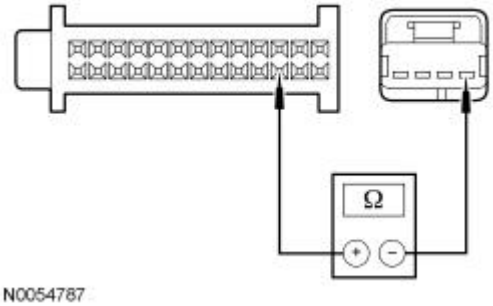
Yes
INSTALL a new in-vehicle sensor. If code returns, GO to A7 .

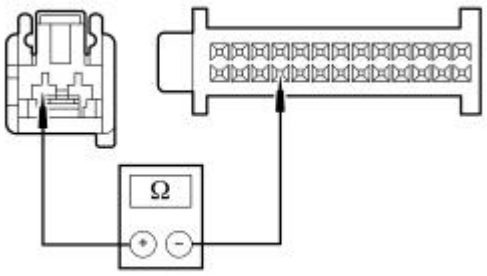
No
If diagnosing DTC B1251, GO to A3 . If diagnosing DTC B1253, GO to A5 .



A0047072

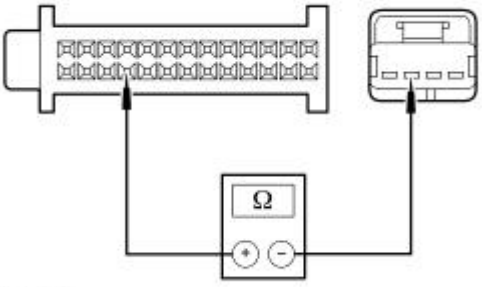
- **Is the voltage between 4.7 and 5.1 volts?**

A3 CHECK CIRCUIT VH414 (GN/BU) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a. • **NOTE:** Expedition only. • Measure the resistance between EATC module C228a-3, circuit VH414 (GN/BU) and in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU).  N0054649 • **NOTE:** Navigator only. • Measure the resistance between EATC module C228a-3, circuit VH414 (GN/BU) and in-vehicle temperature sensor C2247-1, circuit VH414 (GN/BU).  N0054787 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR circuit VH414 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A4 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• **NOTE:** Expedition only. • Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and in-vehicle temperature sensor C233-2, circuit RH111 (GY/BU).	**Yes** GO to A7 . **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



N0054650

- **NOTE:** Navigator only.
- Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and in-vehicle temperature sensor C2247-3, circuit RH111 (GY/BU).

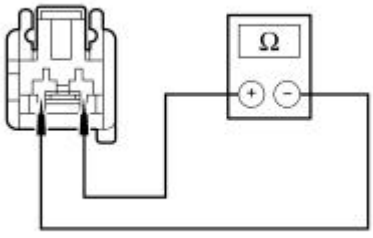


N0054788

- **Is the resistance less than 5 ohms?**

A5 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO CIRCUIT RH111 (GY/BU)

- Key in OFF position.
- Disconnect: EATC Module C228b.
- **NOTE:** Expedition only.
- Measure the resistance between in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU) and C233-2, circuit RH111 (GY/BU).

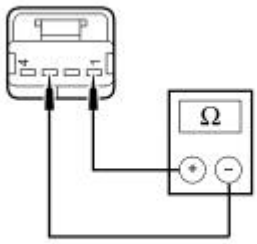
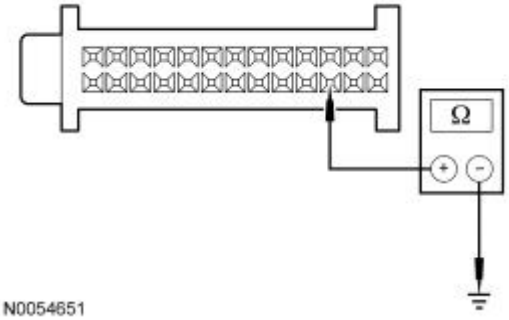


A0052122

- **NOTE:** Navigator only.
- Measure the resistance between in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU) and C2247-3, circuit RH111 (GY/BU).

Yes
GO to A6 .

No
REPAIR circuit VH414 (GN/BU) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 A0047075 • **Is the resistance greater than 10,000 ohms?**	
A6 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between EATC module C228a-3, circuit VH414 (GN/BU) and ground.  N0054651 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A7 . **No** REPAIR circuit VH414 (GN/BU) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A7 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test B: DTC B1255 or DTC B1257 — Ambient Temperature Sensor Open Circuit or Short to Ground

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

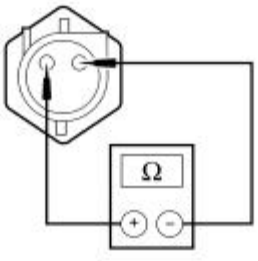
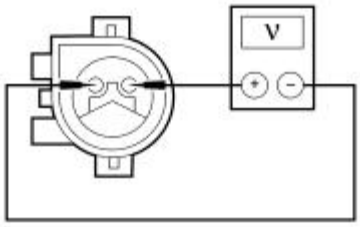
Normal Operation

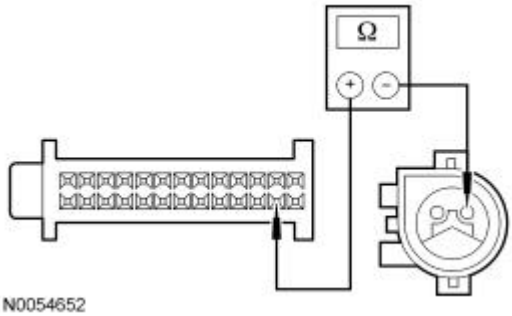
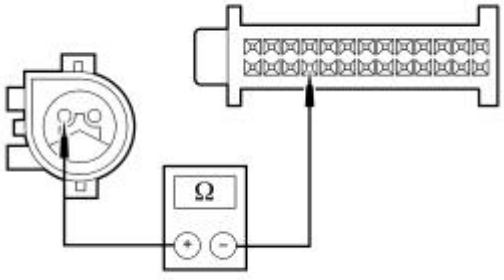
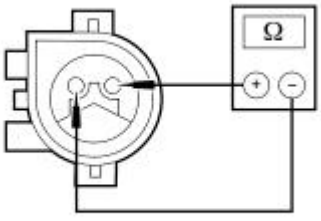
Under normal operation, the ambient air temperature sensor receives a ground from the electronic automatic temperature control (EATC) module through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the ambient air temperature sensor from the EATC module through circuit VH407 (YE/GN).

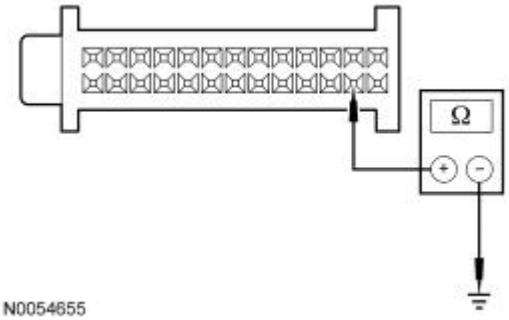
Possible Causes

- An open in circuit RH111 (GY/BU) or VH407 (YE/GN)
- A short to ground in circuit VH407 (YE/GN)
- A short together in circuit RH111 (GY/BU) and VH407 (YE/GN)
- Ambient air temperature sensor
- EATC module

PINPOINT TEST B: DTC B1255 OR DTC B1257 — AMBIENT TEMPERATURE SENSOR OPEN CIRCUIT OR SHORT TO GROUND

Test Step	Result / Action to Take
B1 CHECK THE SENSOR RESISTANCE	
• Key in OFF position. • Disconnect: Ambient Temperature Sensor C132. • Measure the resistance between the ambient temperature sensor C132 terminals.  A0013640 • **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F), 37,000-58,000 ohms; 20-30°C (68-86°F), 24,000-37,000 ohms; 30-40°C (86-104°F), 16,000-24,000 ohms?**	**Yes** GO to B2 . **No** INSTALL a new in-vehicle temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B2 CHECK THE EATC SENSOR OUTPUT VOLTAGE	
• Key in ON position. • Press the AUTO button. • Measure the voltage between ambient temperature sensor C132-2, circuit VH407 (YE/GN) and C132-1, circuit RH111 (GY/BU).  A0013641 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** INSTALL a new ambient temperature sensor. If code returns, GO to B7 . **No** If diagnosing DTC B1255, GO to B3 . If diagnosing DTC B1257, GO to B5 .
B3 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between EATC module C228a-2, circuit VH407 (YE/GN) and ambient temperature sensor C132-2, circuit VH407 (YE/GN).	**Yes** GO to B4 . **No** REPAIR circuit VH407

 N0054652 • **Is the resistance less than 5 ohms?**	(YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B4 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and ambient temperature sensor C132-1, circuit RH111 (GY/BU).  N0054653 • **Is the resistance less than 5 ohms?**	**Yes** GO to B7 . **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B5 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO CIRCUIT RH111 (GY/BU)	
• Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between ambient temperature sensor C132-2, circuit VH407 (YE/GN) and C132-1, circuit RH111 (GY/BU).  N0054654 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B6 . **No** REPAIR circuit VH407 (YE/GN) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B6 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO GROUND	
• Measure the resistance between EATC module C228a-2, circuit VH407 (YE/GN) and ground.	**Yes** GO to B7 . **No** REPAIR circuit VH407 (YE/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal

 • **Is the resistance greater than 10,000 ohms?**	operation.
B7 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test C: DTC B2796, DTC B2795, DTC B2426 or DTC B2427 — Solar Radiation Sensor Open Circuit or Short to Ground

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

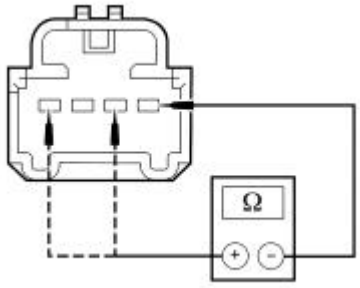
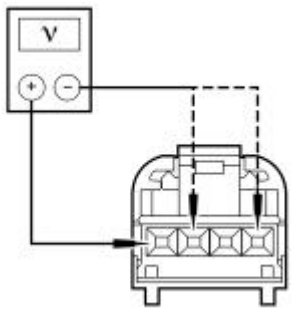
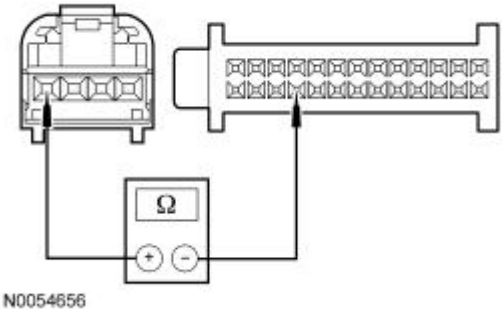
Under normal operation, the solar radiation sensor receives a ground through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the solar radiation sensor from the electronic automatic temperature control (EATC) module through circuit VH417 (YE/OG) (LH) and circuit VH416 (VT/GY) (RH).

Possible Causes

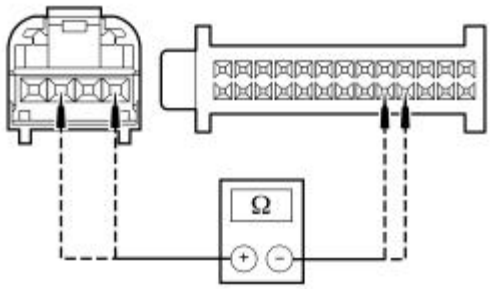
- An open in circuit RH111 (GY/BU), VH416 (VT/GY) or VH417 (YE/OG)
- A short to ground in circuit VH417 (YE/OG) or VH416 (VT/GY)
- A short together in circuit RH111 (GY/BU), VH416 (VT/GY) or VH417 (YE/OG)
- Solar radiation sensor
- EATC module

PINPOINT TEST C: DTC B2796, DTC B2795, DTC B2426 or DTC B2427 — SOLAR RADIATION SENSOR OPEN CIRCUIT OR SHORT TO GROUND

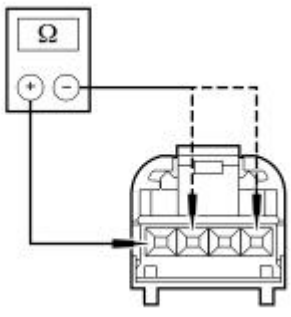
Test Step	Result / Action to Take
C1 CHECK THE SOLAR RADIATION SENSOR	

RESISTANCE	
• Key in OFF position. • Disconnect: Solar Radiation Sensor C286. • Measure the resistance between the solar radiation sensor terminals 4 and 1 and between 4 and 3, component side.  N0041877 • **Is continuity present and the resistance greater than 0 ohm?**	**Yes** GO to C2 . **No** INSTALL a new solar radiation sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C2 CHECK THE SOLAR RADIATION SENSOR REFERENCE VOLTAGE	
• Key in ON position. • Press the AUTO button. • Measure the voltage between solar radiation sensor C286-4, circuit RH111 (GY/BU) and solar radiation sensor: ▪ C286-3, circuit VH417 (YE/OG) ▪ C286-1, circuit VH416 (VT/GY)  N0041878 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** GO to C7 . **No** If diagnosing DTC B2796 or DTC B2426, GO to C3 . If diagnosing DTC B2795 or DTC B2427, GO to C5 .
C3 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between solar radiation sensor C286-4, circuit RH111 (GY/BU) and EATC module C228a-10, circuit RH111 (GY/BU).  N0054656 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C4 CHECK CIRCUIT VH417 (YE/OG) OR CIRCUIT VH416 (VT/GY) FOR AN OPEN	

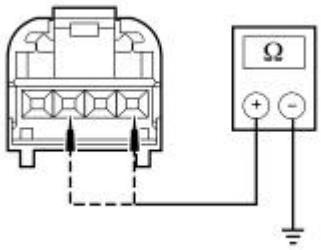
• Disconnect: EATC Module C228a.
• Measure the resistance between EATC module:.
  ▪ (for DTC 2796) C228a-5, circuit VH417 (YE/OG) and solar radiation sensor C286-3, circuit VH417 (YE/OG)
  ▪ (for DTC 2726) C228a-4, circuit VH416 (VT/GY) and solar radiation sensor C286-1, circuit VH416 (VT/GY)
 
 	
N0054657
• **Is the resistance less than 5 ohms?**
	Yes
	GO to C7 .
	
	No
	REPAIR circuit VH416 (VT/GY) or circuit VH417 (YE/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C5 CHECK CIRCUIT VH417 (YE/OG) OR CIRCUIT VH416 (VT/GY) FOR A SHORT TO CIRCUIT RH111 (GY/BU)	

• Key in OFF position.
• Disconnect: EATC Module C228a.
• Measure the resistance between solar radiation sensor C286-4, circuit RH111 (GY/BU) and solar radiation sensor:
  ▪ (for DTC 2795) C286-3, circuit VH417 (YE/OG)
  ▪ (for DTC 2427) C286-1, circuit VH416 (VT/GY)
 
 	
N0054658
• **Is the resistance less than 5 ohms?**
	Yes
	GO to C6 .
	
	No
	REPAIR circuits VH417 (YE/OG) and VH416 (VT/GY) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C6 CHECK CIRCUIT VH416 (VT/GY) AND VH417 (YE/OG) FOR A SHORT TO GROUND	

• Measure the resistance between ground and solar radiation sensor:
  ▪ (for DTC 2795) C286-3, circuit VH417 (YE/OG)
  ▪ (for DTC 2427) C286-1, circuit VH416 (VT/GY)
	Yes
	GO to C7 .
	
	No
	REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 N0041881 • **Is the resistance greater than 10,000 ohms?**	
C7 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR The DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: DTC B2411 or DTC B2412 — A/C Humidity Sensor Open Circuit or Short to Ground

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

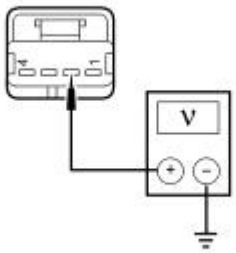
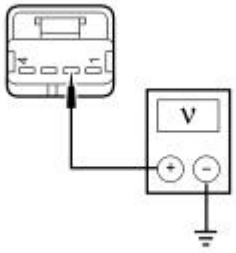
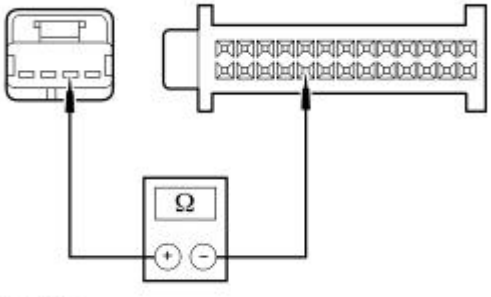
Under normal operation, the A/C humidity sensor is grounded through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the A/C humidity sensor from the electronic automatic temperature control (EATC) module through circuit VH413 (WH/BU). The EATC module receives the humidity value through circuit LH115 (WH).

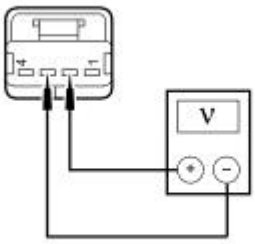
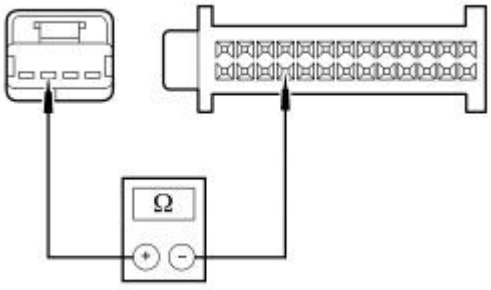
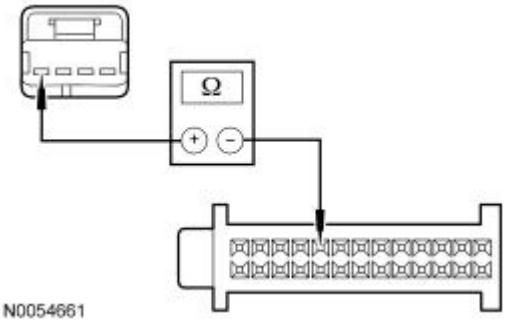
Possible causes

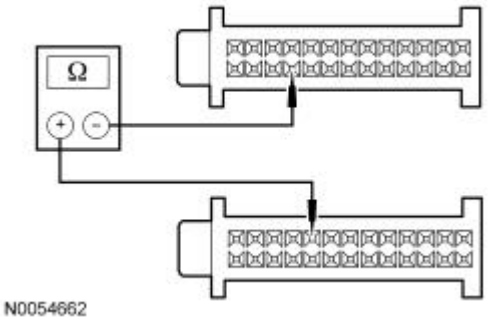
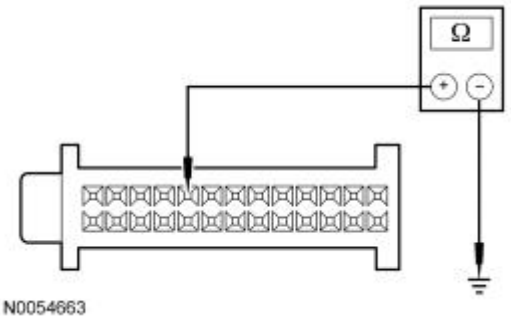
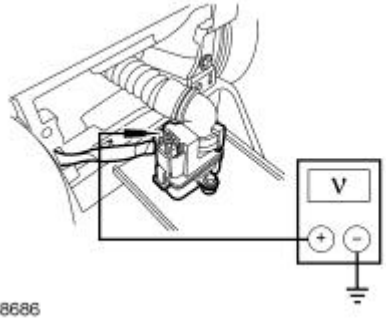
- An open in circuit RH111 (GY/BU), VH413 (WH/BU) or LH115 (WH)
- A short together in circuit RH111 (GY/BU) and LH115 (WH)
- A short to ground in circuit LH115 (WH)
- A short to voltage in circuit VH413 (WH/BU)
- A/C humidity sensor
- EATC module

PINPOINT TEST D: DTC B2411 OR DTC B2412 — A/C HUMIDITY SENSOR OPEN CIRCUIT, SHORT TO GROUND OR FAILURE

Test Step	Result / Action to Take
D1 CHECK THE A/C HUMIDITY SENSOR VOLTAGE INPUT	

• Key in OFF position. • Disconnect: A/C Humidity Sensor C2247. • Key in ON position. • Press the AUTO button on the EATC module. • Measure the voltage between A/C humidity sensor C2247-2, circuit VH413 (WH/BU) and ground.  A0047094 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** GO to D4 . **No** GO to D2 .
D2 CHECK CIRCUIT VH413 (WH/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: EATC Module C228b. • Key in ON position. • Measure the voltage between A/C humidity sensor C2247-2, circuit VH413 (WH/BU) and ground.  A0047094 • **Is voltage present?**	**Yes** REPAIR circuit VH413 (WH/BU) for a short to voltage. TEST the system for normal operation. **No** GO to D3 .
D3 CHECK CIRCUIT VH413 (WH/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between EATC module C228b-9, circuit VH413 (WH/BU) and A/C humidity sensor C2247-2, circuit VH413 (WH/BU).  N0054659 • **Is the resistance less than 5 ohms?**	**Yes** GO to D10 . **No** REPAIR circuit VH413 (WH/BU) for an open. TEST the system for normal operation.
D4 CHECK THE A/C HUMIDITY SENSOR GROUND	
• Measure the voltage between A/C humidity sensor C2247-2, circuit VH413 (WH/BU) and A/C humidity sensor C2247-3, circuit RH111 (GY/BU).	**Yes** GO to D6 .

 A0047096 • **Is the voltage between 4.7 and 5.1 volts?**	**No** GO to D5 .
D5 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and A/C humidity sensor C2247-3, circuit RH111 (GY/BU).  N0054660 • **Is the resistance less than 5 ohms?**	**Yes** GO to D10 . **No** REPAIR circuit RH111 (GY/BU) for an open. TEST the system for normal operation.
D6 CHECK CIRCUIT LH115 (WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228b. • Measure the resistance between EATC module C228b-22, circuit LH115 (WH) and A/C humidity sensor C2247-4, circuit LH115 (WH).  N0054661 • **Is the resistance less than 5 ohms?**	**Yes** GO to D7 . **No** REPAIR circuit LH115 (WH) for an open. TEST the system for normal operation.
D7 CHECK CIRCUIT LH115 (WH) FOR A SHORT TO CIRCUIT RH111 (GY/BU)	
• Disconnect: EATC Module C228a. • Measure the resistance between EATC module C228b-22, circuit LH115 (WH) and EATC module C228a-10, circuit RH111 (GY/BU).	**Yes** GO to D8 . **No** REPAIR circuit LH115 (WH) for a short to circuit RH111 (GY/BU). TEST the system for normal operation.

 N0054662 • **Is the resistance greater than 10,000 ohms?**	
D8 CHECK CIRCUIT LH115 (WH) FOR A SHORT TO GROUND	
• Measure the resistance between EATC module C228b-22, circuit LH115 (WH) ground.  N0054663 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D9 . **No** REPAIR circuit LH115 (WH) for a short ground. TEST the system for normal operation.
D9 CHECK THE A/C HUMIDITY SENSOR VOLTAGE OUTPUT	
• Key in ON position. • Measure the voltage between A/C humidity sensor C2247-4, circuit LH115 (WH) and ground by back-probing the sensor.  A0048686 • **Is the voltage between 0.3 and 4.3 volts?**	**Yes** GO to D10 . **No** INSTALL a new A/C humidity sensor. TEST the system for normal operation.
D10 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded

	connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: DTC B2826 or DTC B2827 — Evaporator Temperature Sensor Open Circuit or Short to Ground

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the evaporator discharge air temperature sensor receives a ground from the electronic automatic temperature control (EATC) module through circuit RH111 (GY/BU). A 5-volt reference voltage is supplied to the evaporator discharge air temperature sensor from the EATC module through circuit VH406 (VT/BN).

Possible Causes

- An open in circuit RH111 (GY/BU) or VH406 (VT/BN)
- A short to ground in circuit VH406 (VT/BN)
- An short together in circuit RH111 (GY/BU) and VH406 (VT/BN)
- Evaporator discharge air temperature sensor
- EATC module

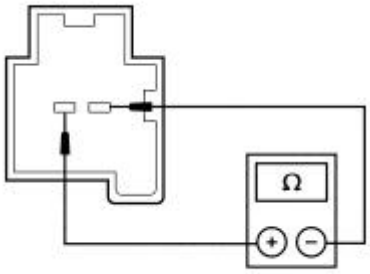
PINPOINT TEST E: DTC B2826 OR DTC B2827 — EVAPORATOR TEMPERATURE SENSOR OPEN CIRCUIT OR SHORT TO GROUND

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>E1 CHECK THE SENSOR RESISTANCE

• Key in OFF position.
• Disconnect: Evaporator Discharge Temperature Sensor C2323.
• Measure the resistance between the evaporator discharge temperature sensor C2323 terminals and compare to the table below.

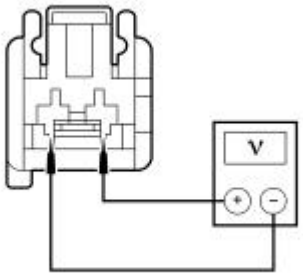
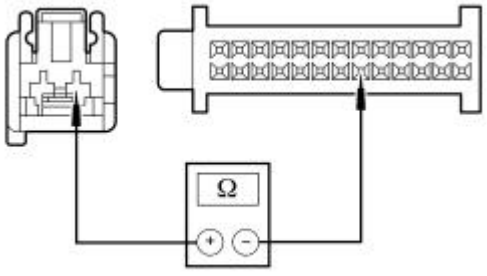
<table><tr><th>Ambient Temperature</th><th>Resistance</th></tr><tr><td>-40°C (-40°F)</td><td>832,591-1,017,523 ohms</td></tr><tr><td>-20°C (-4°F)</td><td>263,111-290,807 ohms</td></tr><tr><td>0°C (32°F)</td><td>91,058-100,644 ohms</td></tr><tr><td>20°C (68°F)</td><td>35,473-39,207 ohms</td></tr><tr><td>25°C (77°F)</td><td>28,500-31,500 ohms</td></tr><tr><td>40°C (104°F)</td><td>15,307-16,919 ohms</td></tr><tr><td>60°C (140°F)</td><td>7,171-7,925 ohms</td></tr><tr><td>100°C (212°F)</td><td>1,976-2,184 ohms</td></tr><tr><td>120°C (248°F)</td><td>1,131-1,251 ohms</td></tr></table></td><td>Yes
GO to E2 .

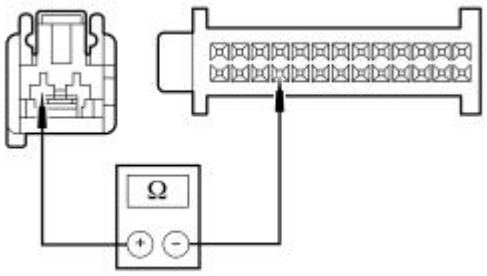
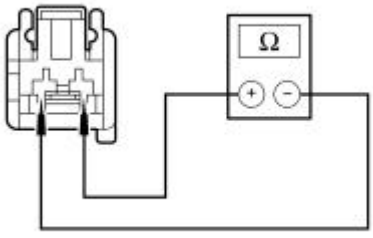
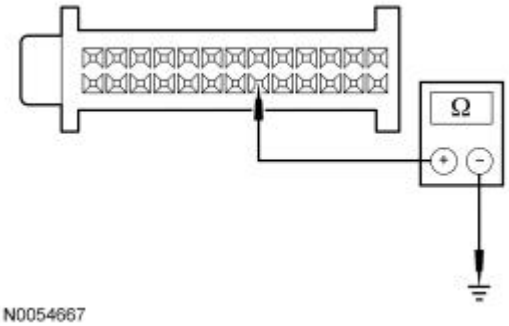
No
INSTALL a new in-vehicle temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.</td></tr>
</table>



A0004761

- **Is the resistance within the specified values for the temperatures?**

E2 CHECK THE EATC SENSOR OUTPUT VOLTAGE	
• Key in ON position. • Press the AUTO button. • Measure the voltage between evaporator discharge temperature sensor C2323-1, circuit VH406 (VT/BN) and C2323-2, circuit RH111 (GY/BU).  N0054664 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** INSTALL a new evaporator discharge sensor. If code returns, GO to E7 . **No** If diagnosing DTC B1946, GO to E3 . If diagnosing DTC B1947, GO to E5 .
E3 CHECK CIRCUIT VH406 (VT/BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a or EMTC Module C294a. • Measure the resistance between EMTC module C294a-6 or EATC module C228a-6, circuit VH406 (VT/BN) and evaporator discharge temperature sensor C2323-1, circuit VH406 (VT/BN).  N0054665 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR circuit VH406 (VT/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E4 CHECK CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• Measure the resistance between EMTC module C294a-10 or EATC module C228a-10, circuit RH111 (GY/BU) and evaporator discharge temperature sensor C2323-2, circuit RH111 (GY/BU).	**Yes** GO to E7 . **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR

 N0054666 • **Is the resistance less than 5 ohms?**	the DTCs. REPEAT the self-test. TEST the system for normal operation.
E5 CHECK CIRCUIT VH406 (VT/BN) FOR A SHORT TO CIRCUIT RH111 (GY/BU)	
• Key in OFF position. • Disconnect: EATC Module C228a or EMTC Module C294a. • Measure the resistance between evaporator discharge temperature sensor C2323-1, circuit VH406 (VT/BN) and C2323-2, circuit RH111 (GY/BU).  A0052122 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E6 . **No** REPAIR circuit VH406 (VT/BN) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E6 CHECK CIRCUIT VH406 (VT/BN) FOR A SHORT TO GROUND	
• Measure the resistance between EMTC module C294a-6 or EATC module C228a-6, circuit VH406 (VT/BN) and ground.  N0054667 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E7 . **No** REPAIR circuit VH406 (VT/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E7 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EMTC or EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The

	concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: DTC B2268 or DTC B2269 — The Steering Wheel Control Switches are Inoperative/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

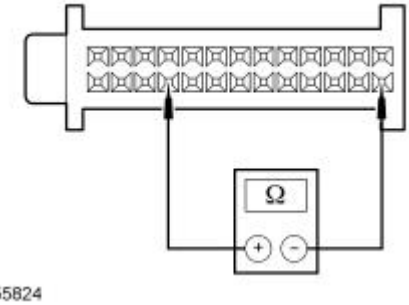
Under normal operation, the steering wheel control switches receive a ground from the electronic automatic temperature control (EATC) module through circuit RH111 (GY/BU). The EATC module senses the resistance (depending on what button is pressed) from the steering wheel control switches through circuit CH447 (YE/GY).

Possible Causes

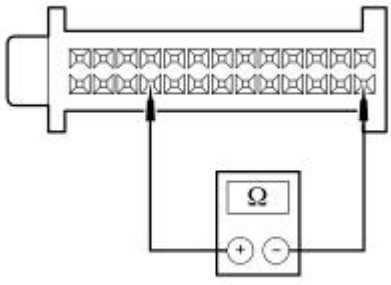
- An open in circuit RH111 (GY/BU) and CH447 (YE/GY)
- A short together in circuit RH111 (GY/BU) or CH447 (YE/GY)
- Steering wheel control switch
- EATC module

PINPOINT TEST F: DTC B2268 OR DTC B2269 — THE STEERING WHEEL CONTROL SWITCHES ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTE: Before carrying out the following test, verify that the vehicle is equipped with, and the module is configured for, redundant steering wheel controls.

Test Step	Result / Action to Take
F1 CHECK THE INPUT TO THE EATC MODULE • Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between EATC module C228a-1, circuit CH447 (YE/GY) and EATC module C228a-10, circuit RH111 (GY/BU).  N0055824 • **Is the resistance reading between 759 and 840 ohms?**	**Yes** GO to F2 . **No** If the resistance is greater than 840 ohms, GO to F5 . If the resistance is less than 759 ohms, GO to F7 .
F2 CHECK THE STEERING WHEEL CONTROL SWITCH OUTPUT	

- Measure the resistance between EATC module C228a-1, circuit CH447 (YE/GY) and EATC module C228a-10, circuit RH111 (GY/BU).



N0055824

- Press each steering wheel control switch and compare the resistance reading to the chart below.

Switch	Resistance (ohms)
None	759-840
TEMP +	101-113
TEMP -	350-388
FAN +	190-211
FAN -	48-54

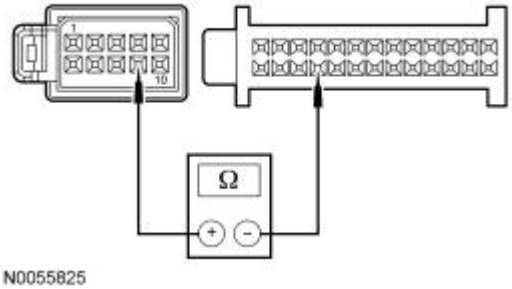
- **Are the resistance readings within the range?**

Yes
GO to F10 .

No
If the TEMP -/TEMP + is incorrect, GO to F3 . If the FAN -/FAN + is incorrect, INSTALL a new LH steering wheel control switch. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

F3 CHECK CIRCUIT RH111 (GY/BU) TO THE RH SWITCH FOR AN OPEN

- **NOTE:** For Navigator only.
- Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and RH steering wheel control switch connector pin 9.

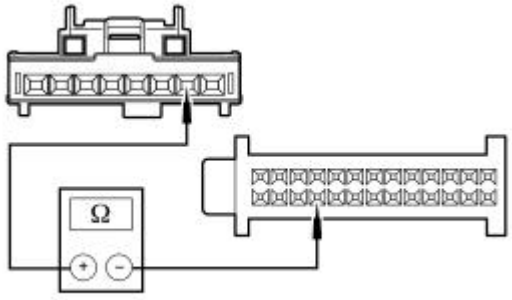


N0055825

- **NOTE:** For Expedition only.
- Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and RH steering wheel control switch connector pin 2.

Yes
GO to F4 .

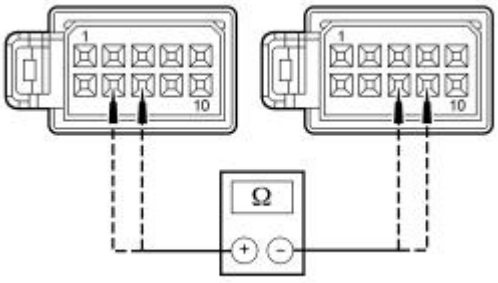
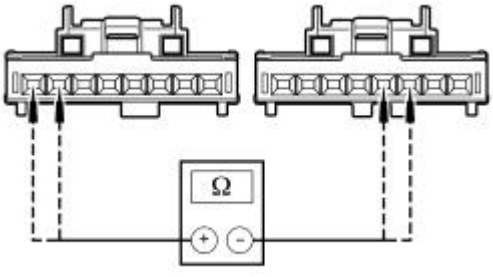
No
REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



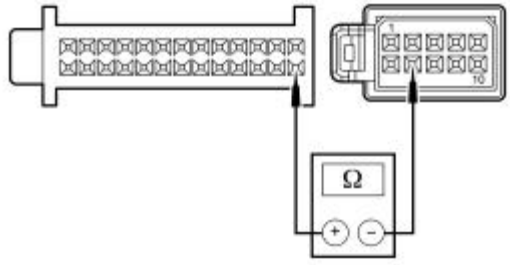
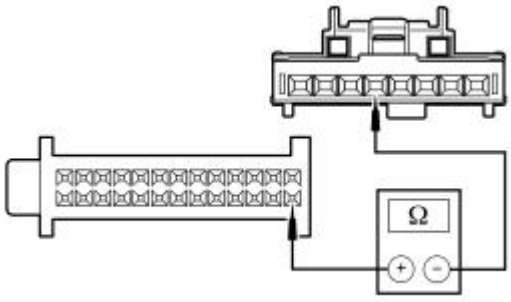
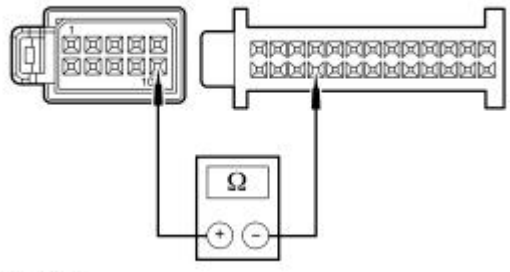
N0061812

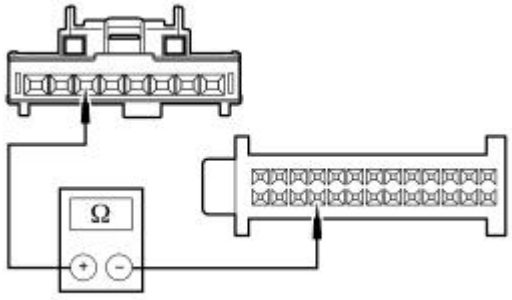
- **Is the resistance less than 5 ohms?**

F4 CHECK THE STEERING WHEEL CIRCUITS FOR AN OPEN	

• **NOTE:** For Navigator only.
• Measure the resistance between:
  ▪ RH steering wheel control switch connector pin 7 and LH steering wheel control switch connector pin 8.
  ▪ RH steering wheel control switch connector pin 8 and LH steering wheel control switch connector pin 9.
 
 	
N0055826
• **NOTE:** For Expedition only.
• Measure the resistance between:
  ▪ RH steering wheel control switch connector pin 4 and LH steering wheel control switch connector pin 7.
  ▪ RH steering wheel control switch connector pin 3 and LH steering wheel control switch connector pin 8.
 
 	
N0040353
• **Is the resistance less than 5 ohms?**
	Yes
	INSTALL a new RH steering wheel control switch. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
	
	No
	REPAIR steering wheel circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

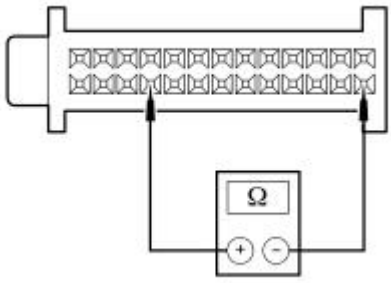
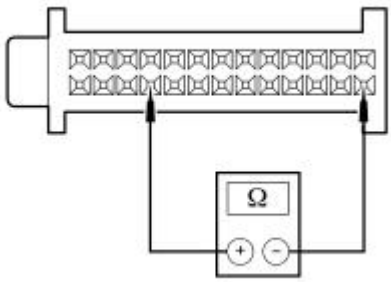
F5 CHECK CIRCUIT CH447 (YE/GY) TO THE LH SWITCH FOR AN OPEN	
• **NOTE:** For Navigator only. • Measure the resistance between EATC module C228a-	**Yes** GO to F6 .

1, circuit CH447 (YE/GY) and the LH steering wheel control switch connector pin 7.  N0055827 • **NOTE:** For Expediton only. • Measure the resistance between EATC module C228a-1, circuit CH447 (YE/GY) and the LH steering wheel control switch connector pin 5.  N0061813 • **Is the resistance less than 5 ohms?**	**No** REPAIR circuit CH447 (YE/GY) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F6 CHECK CIRCUIT RH111 (GY/BU) TO THE LH SWITCH FOR AN OPEN • **NOTE:** For Navigator only. • Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and LH steering wheel control switch connector pin 10.  N0055828 • **NOTE:** For Expedition only. • Measure the resistance between EATC module C228a-10, circuit RH111 (GY/BU) and LH steering wheel control switch connector pin 6.	**Yes** INSTALL a new LH steering wheel control switch. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

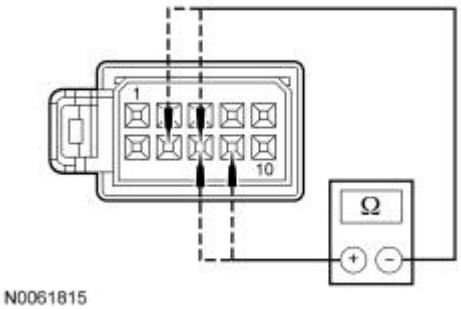
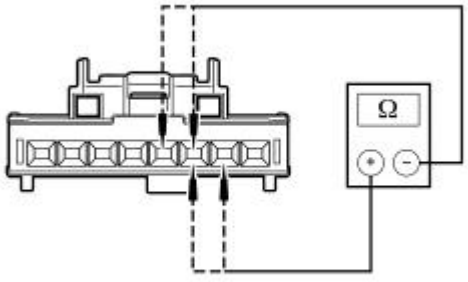


N0061814

- **Is the resistance less than 5 ohms?**

F7 CHECK THE RH STEERING WHEEL CONTROL SWITCH	
• Disconnect: RH Steering Wheel Control Switch. • Measure the resistance between EATC module C228b-1, circuit CH447 (YE/GY) and EATC module C228a-10, circuit RH111 (GY/BU).  N0055824 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new RH steering wheel control switch. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to F8 .
F8 CHECK THE LH STEERING WHEEL CONTROL SWITCH	
• Disconnect: LH Steering Wheel Control Switch. • Measure the resistance between EATC module C228b-1, circuit CH447 (YE/GY) and EATC module C228a-10, circuit RH111 (GY/BU).  N0055824 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F9 . **No** REPAIR circuit CH447 (YE/GY) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F9 CHECK THE STEERING WHEEL CIRCUITS FOR A SHORT TOGETHER	

• **NOTE:** For Navigator only.
• Measure the resistance between:
  ▪ RH steering wheel control switch connector pin 7, and RH steering wheel control switch connector pin 8.
  ▪ RH steering wheel control switch connector pin 7, and RH steering wheel control switch connector pin 9.
	Yes
	INSTALL a new LH steering wheel control switch. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

■ RH steering wheel control switch connector pin 8, and RH steering wheel control switch connector pin 9.  N0061815 • **NOTE:** For Expedition only. • Measure the resistance between: ■ RH steering wheel control switch connector pin 4, and RH steering wheel control switch connector pin 3. ■ RH steering wheel control switch connector pin 4, and RH steering wheel control switch connector pin 2. ■ RH steering wheel control switch connector pin 3, and RH steering wheel control switch connector pin 2.  N0061816 • **Are the resistances greater than 10,000 ohms?**	**No** REPAIR the steering wheel circuits for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F10 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC On-Demand Self Test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test G: The Air Inlet Door is Inoperative

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

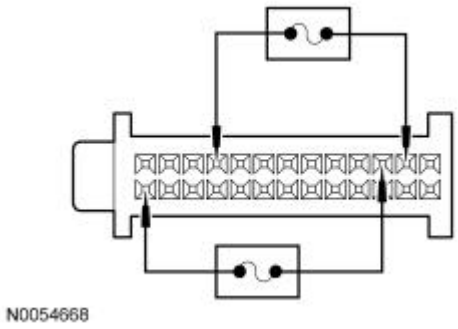
Normal Operation

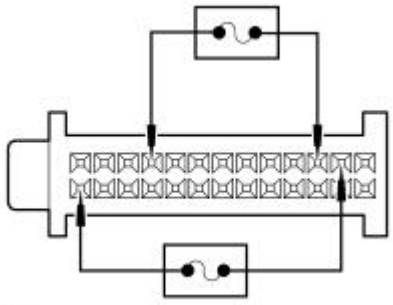
Under normal operation, the air inlet door actuator motors are supplied voltage or ground on circuit CH202 (BU/GN), depending on desired actuator rotation, by the electronic manual temperature control (EMTC) module or electronic automatic temperature control (EATC) module. The EMTC module or EATC module then supplies the appropriate voltage or ground to the other side of the actuator motor on circuit CH203 (GN/BN).

Possible Causes

- An open, short to voltage, ground or together in circuits CH202 (BU/GN) or CH203 (GN/BN)
- Air inlet door actuator
- EATC module
- EMTC module
- Stuck or bound linkage or door

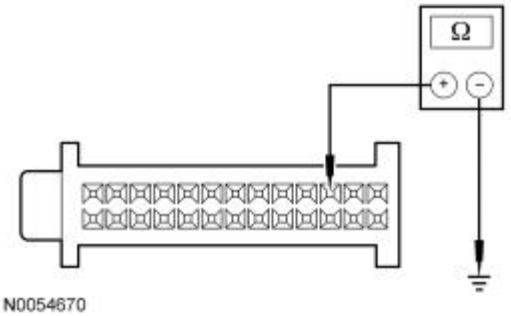
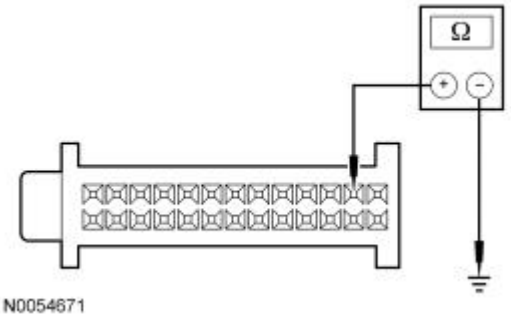
PINPOINT TEST G: THE AIR INLET DOOR IS INOPERATIVE

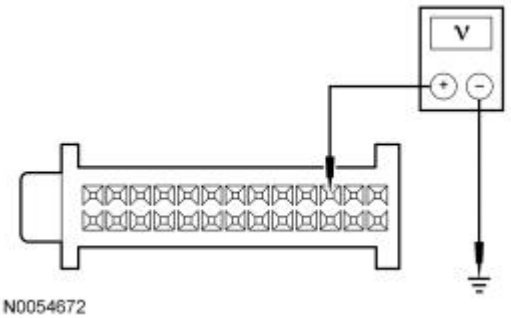
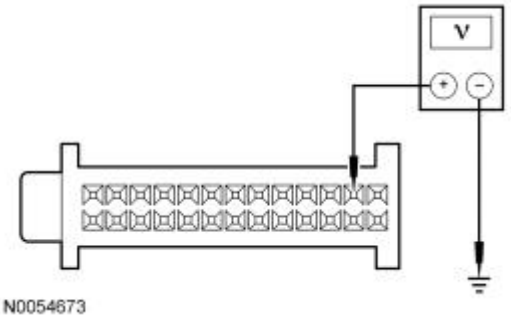
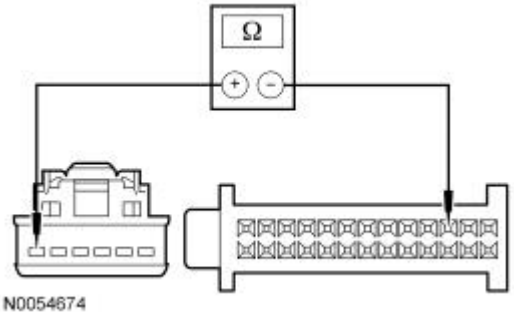
Test Step	Result / Action to Take
G1 CHECK THE AIR INLET DOOR ACTUATOR CLOCKWISE OPERATION	
• Disconnect: EMTC Module C294a or EATC Module C228a. • Remove the door actuator and disengage the actuator driveshaft from the actuator door. • Mark the door actuator driveshaft position. • Connect a fused jumper wire between EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN) and C294a-23 or C228a-23, circuit GD133 (BK). Connect a second fused jumper wire between EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN) and C294a-13 or C228a-13, circuit SBP15 (WH/RD).  N0054668 • **Does the actuator motor move in the clockwise direction?**	**Yes** GO to G2 . **No** GO to G3 .
G2 CHECK THE AIR INLET DOOR ACTUATOR COUNTERCLOCKWISE OPERATION	
• Connect a fused jumper wire between EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN) and C294a-13 or C228a-13, circuit SBP15 (WH/RD). Connect a second fused jumper wire between EMTC module or EATC module EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN) and C294a-23 or C228a-23, circuit GD133 (BK).	**Yes** INSPECT for binding or broken door and linkage. If no condition is found. GO to G10 . **No** GO to G3 .

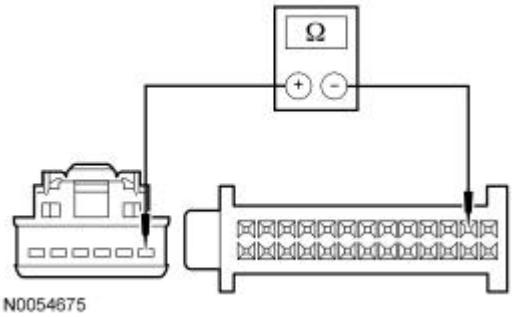
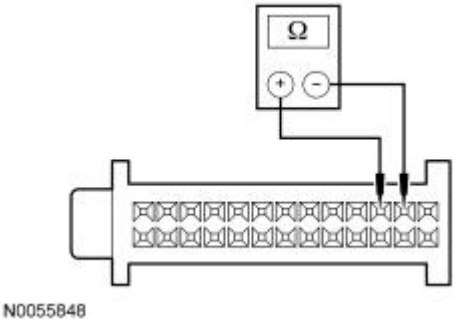


N0054669

- **Does the actuator motor move in the counterclockwise direction?**

G3 CHECK CIRCUIT CH202 (BU/GN) FOR A SHORT TO GROUND	
• Disconnect: Recirc Door Actuator C2363. • Measure the resistance between ground and EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN).  N0054670 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G4 . **No** REPAIR circuit CH202 (BU/GN) for a short to ground. TEST the system for normal operation.
G4 CHECK CIRCUIT CH203 (GN/BN) FOR A SHORT TO GROUND	
• Measure the resistance between ground and EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN).  N0054671 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G5 . **No** REPAIR circuit CH203 (GN/BN) for a short to ground. TEST the system for normal operation.
G5 CHECK CIRCUIT CH202 (BU/GN) FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between ground and EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN).	**Yes** REPAIR circuit CH202 (BU/GN) for a short to power. TEST the system for normal operation. **No** GO to G6 .

 N0054672 • **Is voltage present?**	
G6 CHECK CIRCUIT CH203 (GN/BN) FOR A SHORT TO POWER	
• Measure the voltage between ground and EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN).  N0054673 • **Is voltage present?**	**Yes** REPAIR circuit CH203 (GN/BN) for a short to power. TEST the system for normal operation. **No** GO to G7 .
G7 CHECK CIRCUIT CH202 (BU/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN) and recirc door actuator C2363-6, circuit CH202 (BU/GN).  N0054674 • **Is the resistance less than 5 ohms?**	**Yes** GO to G8 . **No** REPAIR circuit CH202 (BU/GN) for an open. TEST the system for normal operation.
G8 CHECK CIRCUIT CH203 (GN/BN) FOR AN OPEN	
• Measure the resistance between EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN) and recirc door actuator C2363-1, circuit CH203 (GN/BN).	**Yes** GO to G9 . **No** REPAIR circuit CH203 (GN/BN) for an open. TEST the system for normal operation.

 N0054675 • **Is the resistance less than 5 ohms?**	
G9 CHECK CIRCUIT CH203 (GN/BN) FOR A SHORT TO CIRCUIT CH202 (BU/GN)	
• Measure the resistance between EMTC module C294a-15 or EATC module C228a-15, circuit CH203 (GN/BN) and EMTC module C294a-16 or EATC module C228a-16, circuit CH202 (BU/GN).  N0055848 • **Is the resistance less than 5 ohms?**	**Yes** INSPECT for binding or broken linkage. If no condition is found, GO to G11 . **No** REPAIR circuit CH203 (GN/BN) for a short to circuit CH202 (BU/GN). TEST the system for normal operation.
G10 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
G11 CHECK ACTUATOR CONNECTION	

• **NOTE:** NOTE: EATC only.
• Clear the DTCs.
• Disconnect the actuator connector.
• Check for:
  ▪ corrosion.
  ▪ pushed-out connectors.
  ▪ incorrectly seated connector.
• Connect and correctly seat the actuator connector.
	Yes
	INSTALL a new actuator. REFER to Section 412-01 . TEST the system for normal operation.
	
	No

• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** NOTE: EATC only. • Carry out the EATC On-Demand Self Test. • Operate the system. • **Does the concern return?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test H: Incorrect/Erratic Direction of Airflow From Outlets

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the mode door actuator clockwise, the electronic manual temperature control (EMTC) module or electronic automatic temperature control (EATC) module supplies voltage to the FLOOR/DEFROST/PANEL mode door actuator motor through the circuit CH228 (YE/GY), and supplies ground through circuit CH229 (WH/BU). To rotate the mode door actuator counterclockwise, the EMTC module or EATC module reverses the voltage and ground circuits.

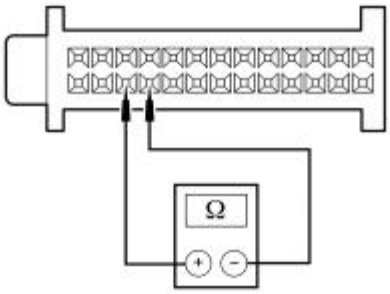
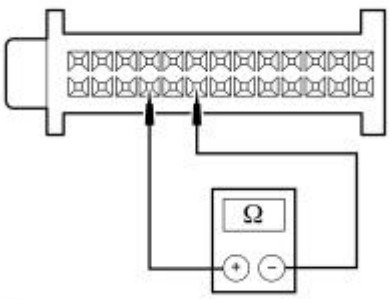
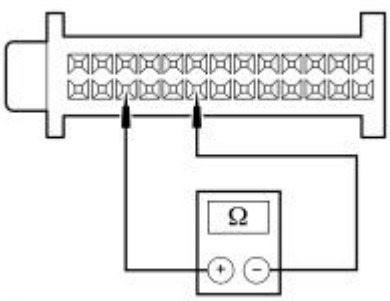
The mode door actuator feedback resistor is supplied a ground from the EMTC module or EATC module through circuit RH111 (GY/BU) and a 5-volt reference voltage on circuit LH111 (BN/WH). The EMTC module or EATC module reads the voltage on the mode door actuator feedback circuit VH436 (YE/VT) to determine the mode door actuator position by the position of the actuator feedback resistor wiper arm.

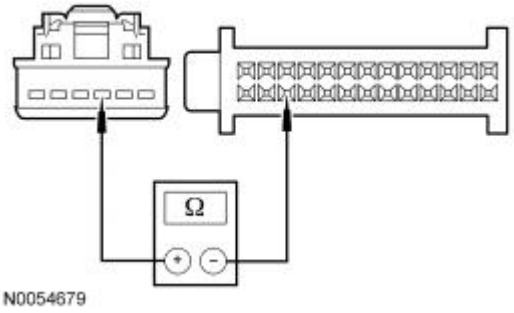
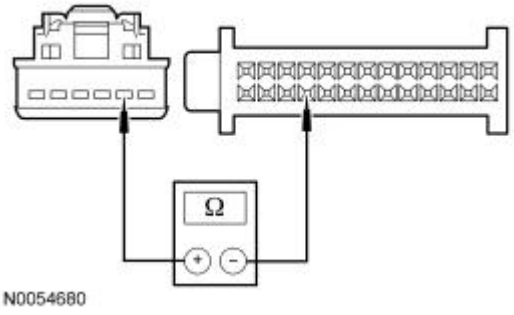
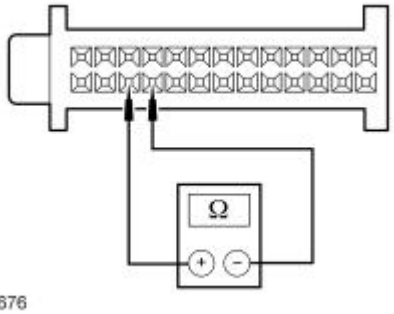
Possible Causes

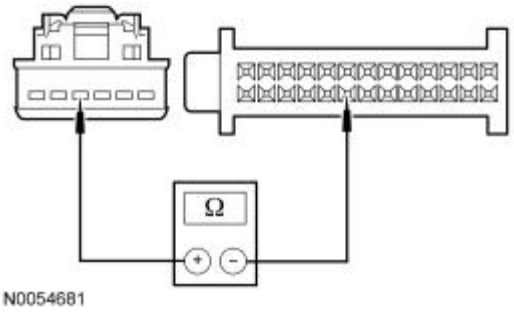
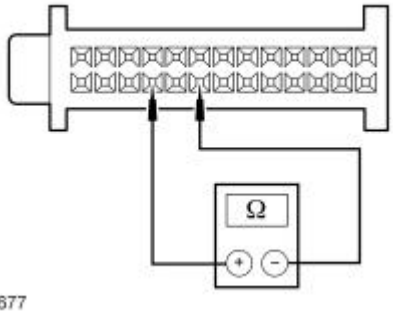
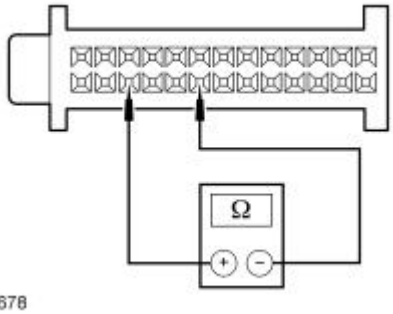
- An open, short to voltage, ground or together in circuits CH229 (WH/BU), CH228 (YE/GY), RH111 (GY/BU), LH111 (BN/WH) and VH436 (YE/VT)
- A short to ground in circuits CH229 (WH/BU), CH228 (YE/GY), RH111 (GY/BU), LH111 (BN/WH) and VH436 (YE/VT)
- A short to ground in circuits CH229 (WH/BU), CH228 (YE/GY), LH111 (BN/WH) and VH436 (YE/VT)
- A short to voltage in circuits CH229 (WH/BU), CH228 (YE/GY), LH111 (BN/WH) and VH436 (YE/VT)
- A short together in circuits CH229 (WH/BU), CH228 (YE/GY), RH111 (GY/BU), LH111 (BN/WH) and VH436 (YE/VT)
- Mode door actuator
- EATC module
- EMTC module
- Stuck or bound linkage or door

PINPOINT TEST H: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS

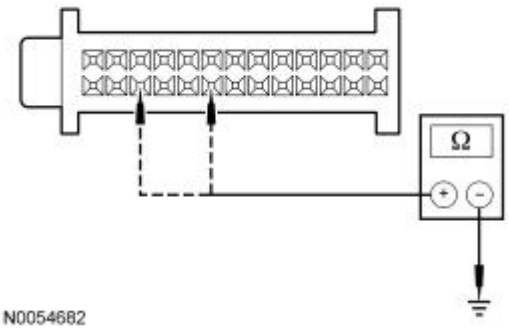
Test Step	Result / Action to Take
H1 CHECK THE AIRFLOW	
• Key in ON position. • Check the airflow in the PANEL, RECIRC, DEFROST and FLOOR modes. • **Is the airflow correct in each setting?**	**Yes** The system is operating normally.

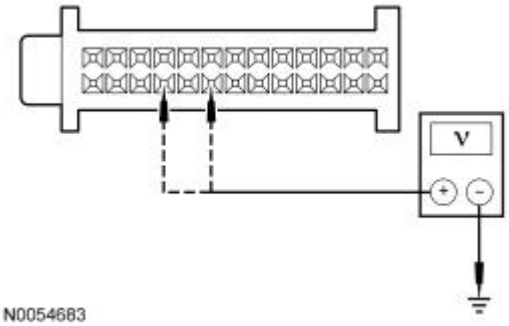
	No GO to H2 . If the RECIRC button does not change the air inlet door position, Go To Pinpoint Test D .
H2 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE • Disconnect: EATC Module C228a or EMTC Module C294a. • **NOTE:** EATC only. • Disconnect: RH Temperature Blend Door Actuator C2092. • Disconnect: LH Temperature Blend Door Actuator C2091. • Disconnect: Air Inlet Door Actuator C2363. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054676 • **Is the resistance between 16,800 and 25,200 ohms?**	**Yes** GO to H3 . **No** If the resistance is greater than 25,200 ohms, GO to H5 . If the resistance is less than 16,800 ohms, GO to H7 .
H3 CHECK THE POTENTIOMETER LOW SIDE RESISTANCE • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).  N0054677 • **Are the resistances between 500 and 20,500 ohms?**	**Yes** GO to H4 . **No** If the resistance is greater than 20,500 ohms, GO to H8 . If the resistance is less than 500 ohms, GO to H9 .
H4 CHECK THE POTENTIOMETER HIGH SIDE RESISTANCE • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).  N0054678	**Yes** GO to H11 . **No** If the resistance is greater than 20,500 ohms, INSTALL a new door actuator. TEST the system for normal operation. If the resistance is less than 500 ohms, GO to H10 .

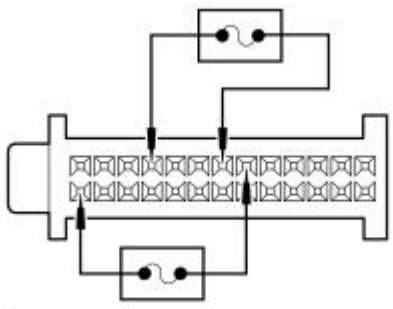
• **Is the resistance between 500 and 20,500 ohms?**	
H5 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and floor/defrost/panel door actuator C2278-3, circuit LH111 (BN/WH).  N0054679 • **Is the resistance less than 5 ohms?**	**Yes** GO to H6 . **No** REPAIR circuit LH111 (BN/WH) for an open. TEST the system for normal operation.
H6 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• Measure the resistance between EATC module C228a-10 or EMTC module , circuit RH111 (GY/BU) and floor/defrost/panel door actuator C2278-2, circuit RH111 (GY/BU).  N0054680 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) for an open. TEST the system for normal operation.
H7 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR A SHORT TOGETHER	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054676 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit LH111 (BN/WH) for a short together. TEST the system for normal operation.
H8 CHECK CIRCUIT VH436 (YE/VT) FOR AN OPEN	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between floor/defrost/panel door actuator, EATC module C228a-8 or EMTC module C294a-8, circuit VH436	**Yes** INSTALL a new door actuator. TEST the

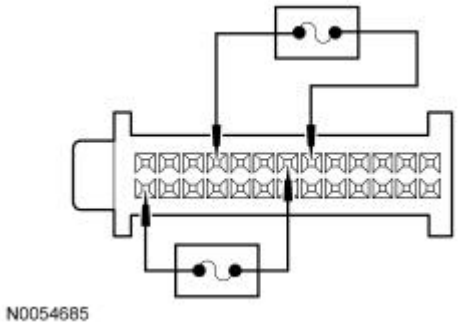
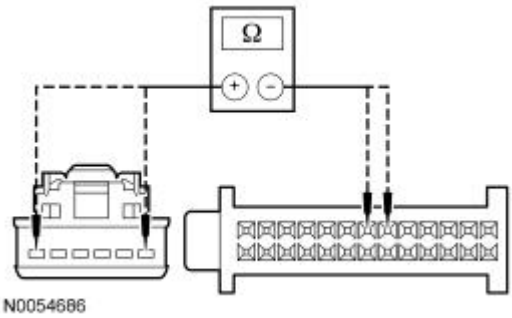
(YE/VT) and floor/defrost/panel door actuator C2278-4, circuit VH436 (YE/VT).  N0054681 • **Is the resistance less than 5 ohms?**	system for normal operation. **No** REPAIR circuit VH436 (YE/VT) for an open. TEST the system for normal operation.
H9 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH436 (YE/VT)	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).  N0054677 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit VH436 (YE/VT) for a short together. TEST the system for normal operation.
H10 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH436 (YE/VT)	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).  N0054678 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuit LH111 (BN/WH) and circuit VH436 (YE/VT) for a short together. TEST the system for normal operation.
H11 CHECK CIRCUIT LH111 (BN/WH) OR CIRCUIT VH436 (YE/VT) FOR A SHORT TO GROUND	

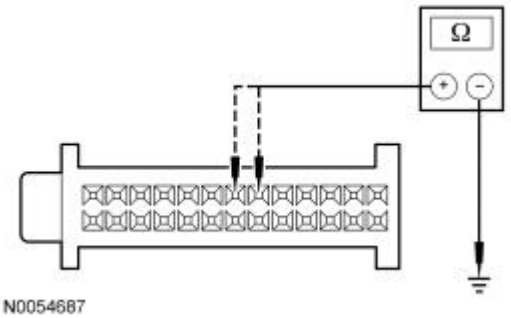
• Disconnect: Floor/Defrost/Panel Door Actuator C2278.
• Measure the resistance between ground and the following:
  ▪ EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH).
  ▪ EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).
	Yes
	GO to H12 .
	
	No
	REPAIR circuit LH111 (BN/WH) or circuit

 N0054682 • **Are the resistances greater than 10,000 ohms?**	VH436 (YE/VT) for a short to ground. TEST the system for normal operation.
H12 CHECK CIRCUIT RH111 (GY/BU) OR CIRCUIT VH436 (YE/VT) FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and the following:
  ▪ EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).
  ▪ EATC module C228a-8 or EMTC module C294a-8, circuit VH436 (YE/VT).
 
N0054683
• **Is voltage present?**
	Yes
	REPAIR circuit RH111 (GY/BU) or circuit VH436 (YE/VT) for a short to power. TEST the system for normal operation.
	
	No
	GO to H13 .

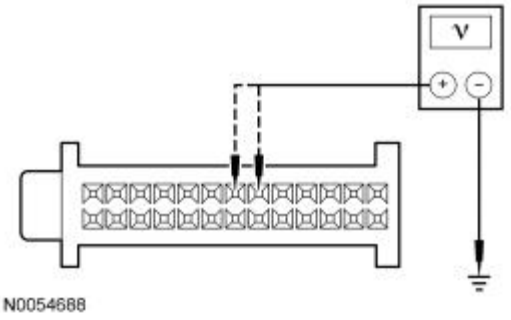
H13 CHECK THE DOOR ACTUATOR CLOCKWISE OPERATION	
• Key in OFF position. • Connect: Floor/Defrost/Panel Door Actuator C2278. • Remove the door actuator and disengage the actuator driveshaft from the actuator door. • Mark the door actuator driveshaft position. • Key in ON position. • Connect a fused jumper wire between EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU). Connect a second fused jumper wire between EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY).  N0054684	**Yes** GO to H14 . **No** GO to H15 .

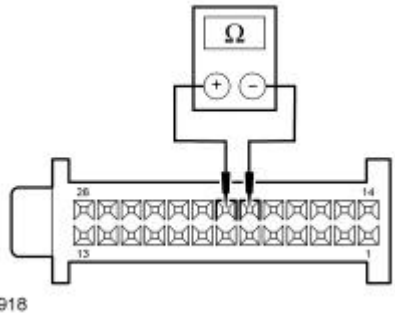
• **Does the actuator motor move in the clockwise direction?**	
H14 CHECK THE DOOR ACTUATOR COUNTERCLOCKWISE OPERATION	
• Connect a fused jumper wire between EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU). Connect a second fused jumper wire between EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY).  N0054685 • **Does the actuator motor move in the counterclockwise direction?**	**Yes** INSPECT for binding or broken door and linkage. If no condition is found, GO to H19 . **No** GO to H15 .
H15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN	
• Disconnect: Floor/Defrost/Panel Door Actuator C2278. • Measure the resistance between: ▪ EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU) and floor/defrost/panel door actuator C2278-1, circuit CH229 (WH/BU). ▪ EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY) and floor/defrost/panel door actuator C2278-6, circuit CH228 (YE/GY).  N0054686 • **Are the resistances less than 5 ohms?**	**Yes** GO to H16 . **No** REPAIR the circuit CH228 (YE/GY) or circuit CH229 (WH/BU) for an open. TEST the system for normal operation.
H16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ▪ EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU). ▪ EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY).	**Yes** GO to H17 . **No** REPAIR the circuit CH228 (YE/GY) or circuit CH229 (WH/BU) for a short to ground. TEST the system for normal operation.



- **Are the resistances greater than 10,000 ohms?**

H17 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and:
  ▪ EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU).
  ▪ EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY).
 
 	
• **Is voltage present?**
	Yes
	REPAIR the circuit CH228 (YE/GY) or circuit CH229 (WH/BU) for a short to power. TEST the system for normal operation.
	
	No
	GO to H18 .

H18 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER	
• Key in OFF position. • Measure the resistance between EATC module C228a-20 or EMTC module C294a-20, circuit CH228 (YE/GY) and EATC module C228a-19 or EMTC module C294a-19, circuit CH229 (WH/BU).  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuit CH228 (YE/GY) and CH229 (WH/BU) for a short together. TEST the system for normal operation.
H19 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system.	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for

• **Does the concern return?**	normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test I: The EATC System is Inoperative, Intermittent or Incorrect Operation

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the electronic automatic temperature control (EATC) module receives a ground through circuit GD133 (BK). The EATC module is supplied constant battery voltage through circuit SBP15 (WH/RD) and ignition switched voltage through circuit CBP37 (WH).

NOTE: For a complete explanation of the EATC system functions, refer to Description and Operation in this section.

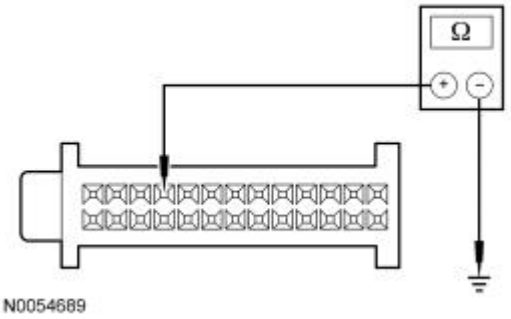
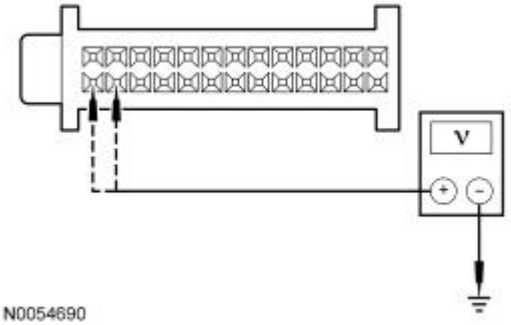
Possible Causes

- Fuse(s)
- An open in circuit GD133 (BK), SBP15 (WH/RD) or CBP37 (WH)
- EATC module

PINPOINT TEST I: THE EATC SYSTEM IS INOPERATIVE, INTERMITTENT OR INCORRECT OPERATION

Test Step	Result / Action to Take
I1 VERIFY AUTOMATIC OPERATION	
• Key in ON position. • With the engine running, press the AUTO button. • **Does the indicator above the AUTO button illuminate and the selected temperature for both the driver and passenger appear in the display window?**	**Yes** GO to I2 . **No** GO to I11 .
I2 CARRY OUT THE EATC MODULE SELF-TEST	
• Key in ON position. • Carry out the EATC module self-test. Refer to the Electronic Automatic Temperature Control Module Self-Test in this section. Record the DTCs displayed, if any. • **Were any DTCs displayed as a result of the EATC self-test?**	**Yes** REFER to the EATC module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as required. **No** GO to I3 .
I3 CHECK THE VACUUM FLUORESCENT DISPLAY	

• Exit self-test by pressing the DEFROST button. Observe the button indicators and function symbols displayed on the vacuum fluorescent display while changing the temperature, blower speed and functions. • **Are the display and indicators correct and complete without any missing elements?**	**Yes** GO to I4 . **No** INSTALL a new EATC module. TEST the system for normal operation.
I4 CHECK THE BLOWER MANUAL OVERRIDE OPERATION	
• Press the blower motor speed override control fully up and fully down. • **Does the blower motor speed increase from low speed to high and high speed to low?**	**Yes** GO to I5 . **No** If the blower motor is inoperative, Go To Pinpoint Test P . If the blower motor does not operate correctly, Go To Pinpoint Test Q .
I5 VERIFY THE DEFROST OVERRIDE OPERATION	
• Press the override button for DEFROST operation. • **Is outside air being discharged from the windshield defroster nozzle and the side window demisters?**	**Yes** GO to I6 . **No** Go To Pinpoint Test H .
I6 VERIFY THE FLOOR OVERRIDE OPERATION	
• Press the override button for FLOOR operation. • **Is outside air being discharged from the floor duct?**	**Yes** GO to I7 . **No** Go To Pinpoint Test H .
I7 VERIFY THE PANEL OVERRIDE OPERATION	
• Press the override button for PANEL operation. • **Is outside air being discharged from the instrument panel registers?**	**Yes** GO to I8 . **No** Go To Pinpoint Test H .
I8 VERIFY THE A/C CLUTCH DOES NOT ENGAGE IN THE PANEL MODE	
• In PANEL operation and the A/C OFF, listen for the compressor clutch to engage. • **Does the A/C clutch engage with the PANEL override button pressed?**	**Yes** Go To Pinpoint Test L . **No** GO to I9 .
I9 VERIFY THE A/C CLUTCH ENGAGEMENT IN THE A/C MODE	
• Make sure the ambient air temperature is above 6°C (43°F). • Press the override button for A/C operation. • **Does the A/C clutch engage when the A/C override button is pressed?**	**Yes** GO to I10 . **No** Go To Pinpoint Test K .
I10 VERIFY THE RECIRC OVERRIDE OPERATION	
• Press the PANEL and RECIRC override buttons. • **Is recirculated air being discharged from the instrument panel registers?**	**Yes** The test is complete. The system is functioning normally.

	No Go To Pinpoint Test G .
I11 CHECK THE EATC MODULE FUNCTIONS • Press each function button and observe the display. • **Does the EATC perform and display any functions?**	**Yes** INSTALL a new EATC module. TEST the system for normal operation. **No** GO to I12 .
I12 CHECK CIRCUIT GD133 (BK) FOR AN OPEN • Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between EATC module C228a-23, circuit GD133 (BK) and ground.  N0054689 • **Is the resistance less than 5 ohms?**	**Yes** GO to I13 . **No** REPAIR circuit GD133 (BK) for an open. TEST the system for normal operation.
I13 CHECK CIRCUIT SBP15 (WH/RD) AND CIRCUIT CBP37 (WH) FOR AN OPEN • Key in ON position. • Measure the voltage between EATC module C228a-13, circuit SBP15 (WH/RD), C228a-12, circuit CBP37 (WH) and ground.  N0054690 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new EATC module. TEST the system for normal operation. **No** VERIFY smart junction box (SJB) fuse 15 (10A) and fuse 37 (10A) is OK. If OK, REPAIR circuit SBP15 (WH/RD) or CBP37 (WH) for an open. TEST the system for normal operation.

Pinpoint Test J: Insufficient, Erratic or No Heat

Normal Operation

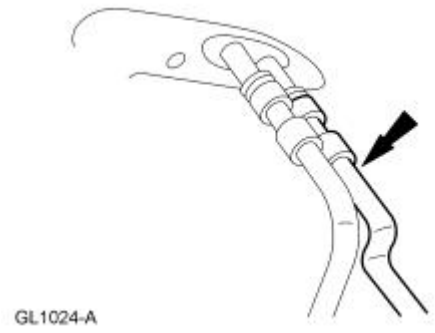
Under normal operation, warm coolant flows from the engine through the heater core and back to the engine.

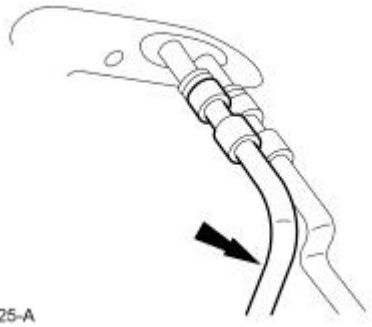
Possible Causes

- Plugged heater core
- Coolant level

- Temperature blend door

PINPOINT TEST J: INSUFFICIENT, ERRATIC OR NO HEAT

Test Step	Result / Action to Take
J1 CHECK FOR CORRECT ENGINE COOLANT LEVEL	
• Key in OFF position. • Check the engine coolant level when hot and cold. • **Is the engine coolant at the correct level (hot/cold) as indicated on the engine coolant recovery reservoir?**	**Yes** GO to J3 . **No** GO to J2 .
J2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS	
• Pressure test the cooling system for leaks. Refer to Section 303-03 . • **Does the engine cooling system leak?**	**Yes** REPAIR the engine coolant leak. TEST the system for normal operation. **No** GO to J3 .
J3 CHECK FOR COOLANT FLOW TO THE HEATER CORE	
WARNING: The heater core inlet hose will become too hot to handle and may cause serious burns if the system is working correctly. • Run the engine until it reaches normal operation temperature. Select the FLOOR position on the control assembly. Set the temperature control to full warm. • Feel the heater core inlet hose to see if it is hot.  GL1024-A • **Is the heater core inlet hose hot?**	**Yes** GO to J4 . **No** REFER to Section 303-03 to check cooling system function.
J4 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE	
WARNING: The heater core outlet hose will become too hot to handle and may cause serious burns if the system is operating correctly. • Feel the heater core outlet hose to see if it is hot.	**Yes** Go To Pinpoint Test J and diagnose for a blend door actuator. **No** INSTALL a new heater core. TEST the system for normal operation.



- **Is the heater core outlet hose hot?**

Pinpoint Test K: The Air Conditioning (A/C) is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested, a message is sent over the MSCAN bus to the PCM. Ignition voltage is provided to the A/C clutch relay switch. When the powertrain control module (PCM) energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD138 (BK/WH).

Possible Causes

- Fuse
- An open in circuits CH401 (VT/WH) or GD138 (BK/WH)
- PCM
- EATC module
- EMTC module
- A/C evaporator discharge temperature sensor
- A/C pressure transducer
- A/C compressor clutch field coil
- A/C control relay
- A/C clutch air gap
- Battery junction box (BJB)

PINPOINT TEST K: THE AIR CONDITIONING (A/C) IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Some PCM DTCs may inhibit air conditioning (A/C) operation. If any PCM DTCs are retrieved, diagnose those first. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

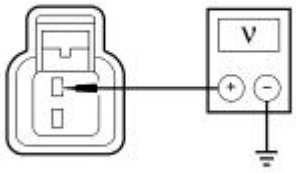
NOTE: Before carrying out the following test, diagnose any instrument cluster DTCs.

NOTE: When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.

NOTE: Before carrying out the following test, check that the A/C system pressure is above 290 kPa (42

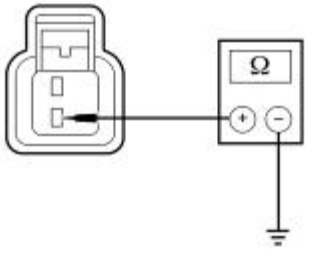
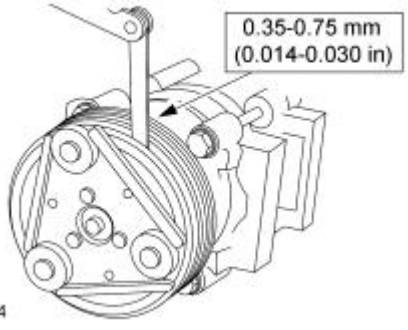
psi). If the pressure is below 290 kPa (42 psi), refer to Fluorescent Dye Leak Detection in this section.

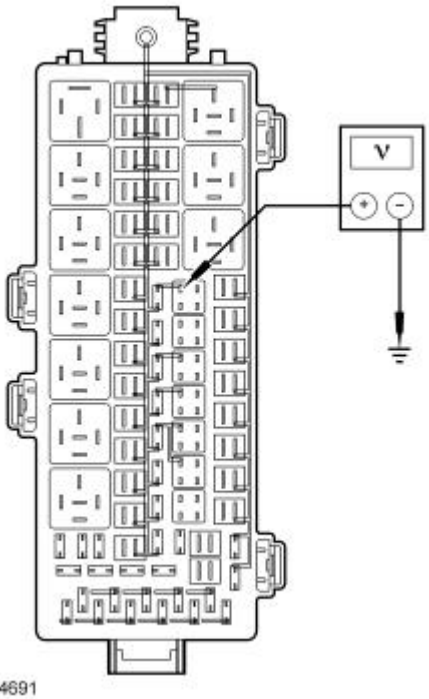
Test Step	Result / Action to Take
K1 CHECK THE A/C PRESSURE PCM PID	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: A/C Pressure PCM PID. • With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the A/C pressure PID. • **Are the pressure values of the manifold gauge set and the A/C pressure PID similar?**	**Yes** GO to K2. **No** INSTALL a new A/C pressure transducer. TEST the system for normal operation.
K2 CHECK THE A/C SWITCH PID WITH THE A/C ON	
• Enter the following diagnostic mode on the diagnostic tool: PCM A/C Switch PID. • Press the PANEL and A/C manual override buttons on the EATC module or select PANEL mode and press the A/C button on the EMTC module. • **Does the PCM A/C switch PID read ON?**	**Yes** EATC, GO to K3. EMTC, CARRY OUT the A/C evaporator discharge temperature sensor component test in this section. If the sensor tests OK, GO to K4. **No** GO to K10.
K3 CHECK THE A/C EVAPORATOR DISCHARGE TEMPERATURE PID	
• Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F). • Enter the following diagnostic mode on the diagnostic tool: A/C Evaporator Discharge Temperature EATC PID. • **Does the A/C evaporator discharge temperature PID read similar to the ambient temperature?**	**Yes** GO to K4. **No** INSTALL a new A/C evaporator discharge temperature sensor. TEST the system for normal operation.
K4 CHECK THE A/C CLUTCH RELAY PID WITH THE A/C ON	
• Enter the following diagnostic mode on the diagnostic tool: PCM A/C Clutch Relay PID. • **Does the PCM A/C clutch relay PID read ON?**	**Yes** GO to K5. **No** GO to K11.
K5 CHECK THE VOLTAGE AT THE A/C COMPRESSOR CLUTCH FIELD COIL	
• Key in OFF position. • Disconnect: A/C Compressor Clutch Field Coil C100. • Key in ON position. • Press the PANEL and A/C manual override buttons on the EATC module or select MAX A/C on the EMTC module. • Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH) and ground.	**Yes** GO to K6. **No** GO to K8.



A0048576

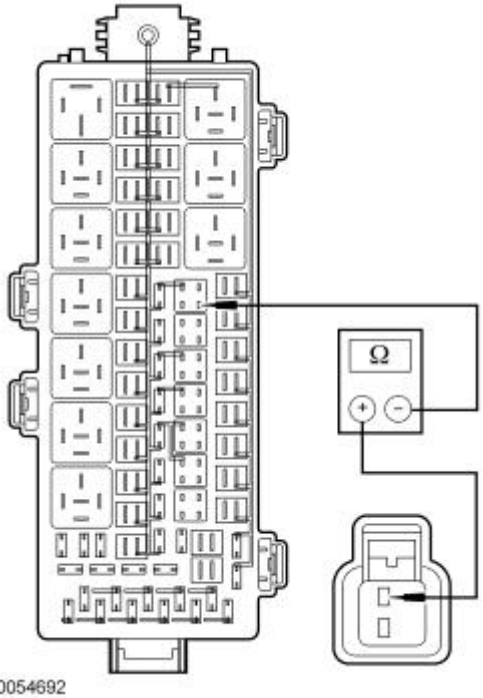
- **Is the voltage greater than 10 volts?**

K6 CHECK THE GROUND AT THE A/C COMPRESSOR CLUTCH FIELD COIL	
• Key in OFF position. • Measure the resistance between A/C compressor clutch field coil C100-2, circuit GD138 (BK/WH) and ground.  N0003086 • **Is the resistance less than 5 ohms?**	**Yes** GO to K7 . **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
K7 CHECK THE A/C COMPRESSOR CLUTCH AIR GAP	
• Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley.  A0031504 • **Is the A/C compressor clutch air gap greater than 0.75 mm (0.030 in)?**	**Yes** ADJUST the A/C compressor clutch gap. REFER to Air Conditioning (A/C) Clutch Air Gap Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new A/C compressor clutch field coil. TEST the system for normal operation.
K8 CHECK THE A/C CLUTCH RELAY FOR VOLTAGE	
• Key in OFF position. • Disconnect: A/C Clutch Relay. • Key in ON position. • Measure the voltage between the A/C clutch relay socket and ground.	**Yes** GO to K9 . **No** VERIFY battery junction box (BJB) fuse 30 (10A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.



N0054691

- **Is the voltage greater than 10 volts?**

K9 CHECK CIRCUIT CH401 (VT/WH) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the A/C clutch relay socket, circuit CH401 (VT/WH) and A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH).  N0054692 • **Is the resistance less than 5 ohms?**	**Yes** CARRY OUT the A/C clutch relay component test. If the relay tests OK, GO to K10 . **No** REPAIR circuit CH401 (VT/WH) for an open. TEST the system for normal operation.
K10 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process.	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-

• **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
K11 CHECK THE PCM MODULE CONNECTION	

• Clear the DTCs.
• Disconnect all of the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out connectors.
  ▪ incorrectly seated connector.
• Connect and correctly seat all of the PCM connectors.
• Operate the system.
• **Does the concern return?**
	Yes
	INSTALL a new PCM. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Air Conditioning (A/C) is Always On

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested, a message is sent over the MSCAN bus to the powertrain control module (PCM). Ignition voltage is provided to the A/C clutch relay switch. When the PCM energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD138 (BK/WH).

Possible Causes

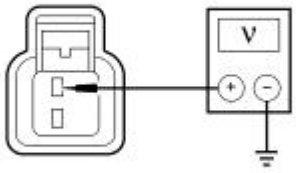
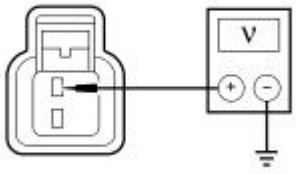
- An short to voltage on circuit CH401 (VT/WH)
- PCM
- EATC module
- EMTC module
- A/C evaporator discharge temperature sensor
- A/C pressure transducer
- A/C control relay
- A/C clutch air gap

PINPOINT TEST L: THE AIR CONDITIONING (A/C) IS ALWAYS ON

NOTE: Before carrying out the following test, diagnose any PCM or instrument cluster DTCs.

NOTE: When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.

Test Step	Result / Action to Take
L1 CHECK THE A/C PRESSURE PCM PID • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: A/C Pressure PCM PID. • With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the A/C pressure PID. • **Are the pressure values of the manifold gauge set and the A/C pressure PID similar?**	**Yes** GO to L2 . **No** INSTALL a new A/C pressure transducer. TEST the system for normal operation.
L2 CHECK THE A/C REQUEST PID WITH THE A/C OFF • Enter the following diagnostic mode on the diagnostic tool: PCM A/C Request PID. • **Does the PCM A/C request PID read ON?**	**Yes** EATC, GO to L3 . EMTC, CARRY OUT the A/C evaporator discharge temperature sensor component test in this section. If the sensor tests OK, GO to L4 . **No** GO to L5 .
L3 CHECK THE A/C EVAPORATOR TEMPERATURE PID • Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F). • Enter the following diagnostic mode on the diagnostic tool: A/C Evaporator Discharge Temperature ETC PID. • **Does the A/C evaporator discharge temperature PID read similar to the ambient temperature?**	**Yes** GO to L4 . **No** INSTALL a new A/C evaporator discharge temperature sensor. TEST the system for normal operation.
L4 CHECK THE A/C SWITCH PID WITH THE A/C OFF • Enter the following diagnostic mode on the diagnostic tool: PCM A/C Switch PID. • **Does the PCM A/C switch PID read ON?**	**Yes** GO to L8 . **No** GO to L9 .
L5 CHECK THE A/C CLUTCH RELAY PID WITH THE A/C OFF • Enter the following diagnostic mode on the diagnostic tool: PCM A/C Clutch Relay PID. • **Does the PCM A/C clutch relay PID read ON?**	**Yes** REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to L6 .
L6 CHECK FOR VOLTAGE TO THE A/C COMPRESSOR CLUTCH FIELD COIL • Key in OFF position. • Disconnect: A/C Compressor Clutch Field Coil C100. • Key in ON position. • Select the OFF position on the EMTC module. • Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH) and ground.	**Yes** GO to L7 . **No** ADJUST the A/C compressor clutch gap. REFER to Air Conditioning (A/C) Clutch Air Gap Adjustment in this section. TEST the system for normal operation.

 A0048576 • **Is the voltage greater than 10 volts?**	
L7 CHECK CIRCUIT CH401 (VT/WH) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: A/C Clutch Relay. • Key in ON position. • Measure the voltage between A/C compressor clutch field coil C100-1, circuit CH401 (VT/WH) and ground.  A0048576 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit CH401 (VT/WH) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new A/C clutch relay. CHECK the A/C clutch diode. INSTALL a new diode if necessary. TEST the system for normal operation.
L8 CHECK THE MODULE CONNECTION • Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

L9 CHECK THE PCM MODULE CONNECTION
• Clear the DTCs.
• Disconnect all of the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out connectors.
  ▪ incorrectly seated connector.
• Connect and correctly seat all of the PCM connectors.
• Operate the system.
• **Does the concern return?**
	Yes
	INSTALL a new PCM. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: Temperature Control is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the blend door actuator clockwise, the electronic manual temperature control (EMTC) module or electronic automatic temperature control (EATC) module supplies voltage to the blend door actuator motors through the door actuator feed A circuits, and supplies ground through the door actuator feed B circuits. To rotate the blend door actuator counterclockwise, the EMTC module or EATC module reverses the voltage and ground circuits.

The blend door actuator feedback resistors are supplied a ground from the EMTC module or EATC module by the blend door actuator return circuits and a 5-volt reference voltage on the blend door actuator reference circuits. The EMTC module or EATC module reads the voltage on the blend door actuator feedback circuits to determine the blend door actuator position by the position of the actuator feedback resistor wiper arm.

Door actuator feed A circuits
- LH blend — CH238 (YE/OG)
- RH blend — CH213 (BN/GN)

Door actuator feed B circuits
- LH blend — CH239 (BU/WH)
- RH blend — CH212 (BU/OG)

Door actuator return circuits
- LH blend — RH111 (GY/BU)
- RH blend — RH111 (GY/BU)

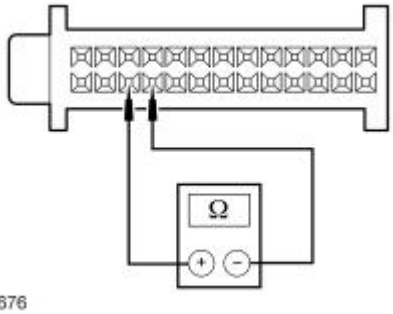
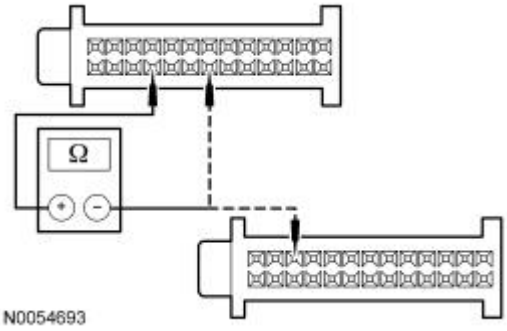
Door actuator reference circuits
- LH blend — LH111 (BN/WH)
- RH blend — LH111 (BN/WH)

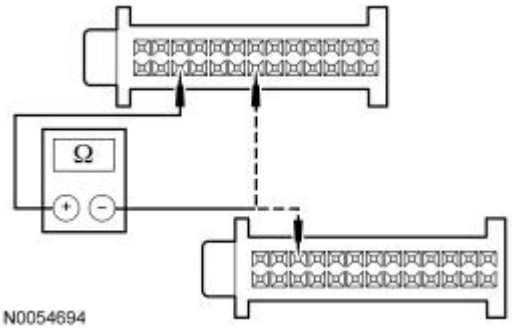
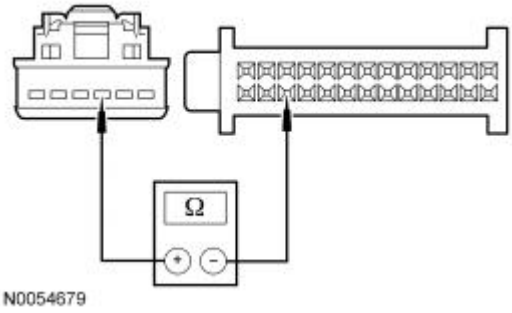
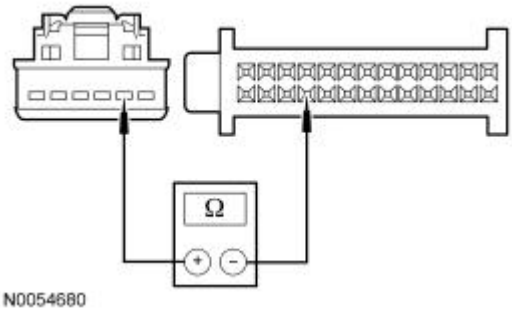
Door actuator feedback circuits
- LH blend — VH440 (BU/BN)
- RH blend — VH441 (WH/BN)

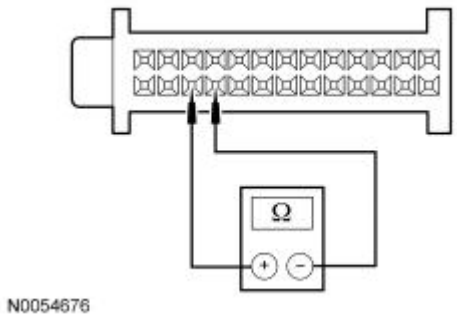
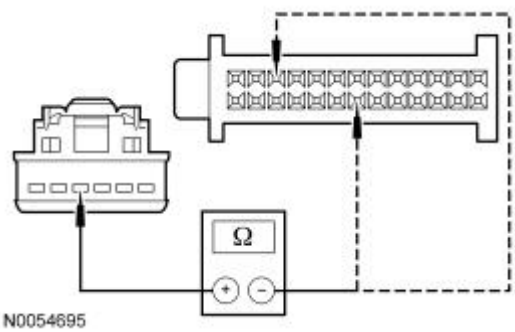
Possible Causes
- An open, short to voltage, ground or together in door actuator open, close, return, reference or feedback circuits
- Blend door actuator
- EATC module
- EMTC module
- Stuck or bound linkage or door

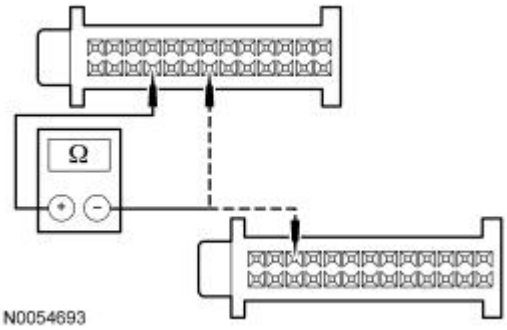
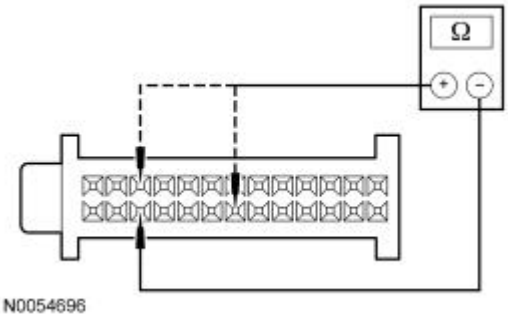
PINPOINT TEST M: TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

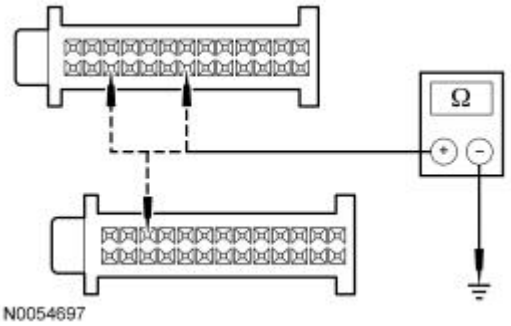
Test Step	Result / Action to Take

M1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE	
• Disconnect: EATC Module C228a or EMTC Module C294a. • Disconnect: EATC Module C228b. • Disconnect: For DTC B2266, RH Temperature Blend Door Actuator C2092. • Disconnect: For DTC B2267, LH Temperature Blend Door Actuator C2091. • Disconnect: Mode Door Actuator C2278. • Disconnect: Air Inlet Door Actuator C2363. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054676 • **Is the resistance between 8,400 and 12,600 ohms?**	**Yes** GO to M2 . **No** If the resistance is greater than 12,600 ohms, GO to M4 . If the resistance is less than 8,400 ohms, GO to M6 .
M2 CHECK THE POTENTIOMETER LOW SIDE RESISTANCE	
• Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and the following: ▪ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN). ▪ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).  N0054693 • **Are the resistances between 250 and 10,250 ohms?**	**Yes** GO to M3 . **No** If the resistance is greater than 10,250 ohms, GO to M7 . If the resistance is less than 250 ohms, GO to M8 .
M3 CHECK THE POTENTIOMETER HIGH SIDE RESISTANCE	
• Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and the following: ▪ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN). ▪ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).	**Yes** GO to M10 . **No** If the resistance is greater than 10,250 ohms, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the resistance is less than 250

 N0054694 • **Are the resistances between 250 and 10,250 ohms?**	ohms, GO to M9 .
M4 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN • Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and the following: ▪ For DTC B2266, LH blend door actuator C2091-3, circuit LH111 (BN/WH). ▪ For DTC B2267, RH blend door actuator C2092-3, circuit LH111 (BN/WH).  N0054679 • **Are the resistances less than 5 ohms?**	**Yes** GO to M5 . **No** REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M5 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and the following: ▪ For DTC B2266, LH blend door actuator C2091-2, circuit RH111 (GY/BU). ▪ For DTC B2267, RH blend door actuator C2092-2, circuit RH111 (GY/BU).  N0054680 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

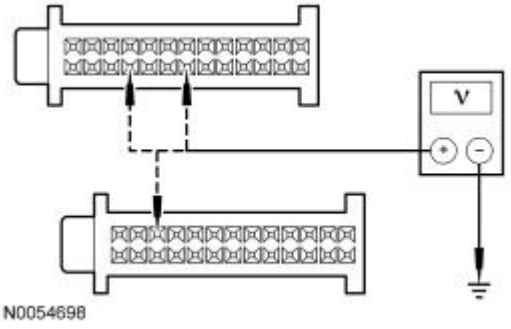
M6 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR A SHORT TOGETHER	
• Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054676 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M7 CHECK CIRCUIT VH441 (WH/BN) OR CIRCUIT VH440 (BU/BN) FOR AN OPEN	
• Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between the following: ▪ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN) and floor door actuator C2091-4, circuit VH440 (BU/BN). ▪ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN) and RH blend door actuator C2092-4, circuit VH441 (WH/BN).  N0054695 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit VH441 (WH/BN) or circuit VH440 (BU/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M8 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH441 (WH/BN) OR CIRCUIT VH440 (BU/BN)	
• Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and the following: ▪ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN).	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111

■ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).  • **Is the resistance greater than 10,000 ohms?**	(GY/BU) and circuit VH441 (WH/BN) or circuit VH440 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M9 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH441 (WH/BN) OR CIRCUIT VH440 (BU/BN)	
• Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and the following: ■ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN). ■ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit LH111 (BN/WH) and circuit VH441 (WH/BN) or circuit VH440 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M10 CHECK CIRCUITS LH111 (BN/WH), VH440 (BU/BN), OR VH441 (WH/BN) FOR A SHORT TO GROUND	
• Disconnect: For DTC B2266, LH Blend Door Actuator C2091. • Disconnect: For DTC B2267, RH Blend Door Actuator C2092. • Measure the resistance between ground and the following: ■ EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH). ■ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN). ■ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).	**Yes** GO to M11 . **No** REPAIR circuit LH111 (BN/WH), VH441 (WH/BN) or VH440 (BU/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

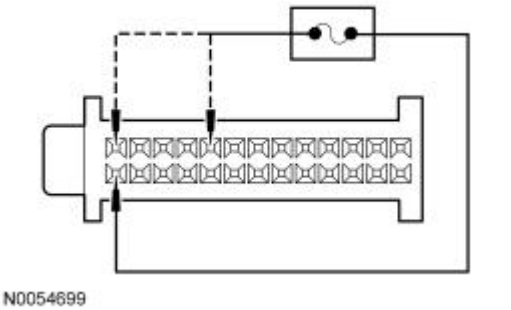


- **Are the resistances greater than 10,000 ohms?**

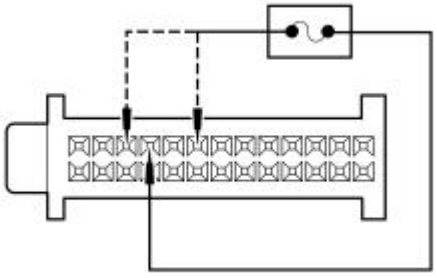
M11 CHECK CIRCUITS RH111 (GY/BU), VH440 (BU/BN) OR VH441 (WH/BN) FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and the following:
  ▪ EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).
  ▪ For DTC B2266, EATC module C228a-7 or EMTC module C294a-7, circuit VH440 (BU/BN).
  ▪ For DTC B2267, EATC module C228b-24, circuit VH441 (WH/BN).
 
 	
• **Are voltages present?**
	Yes
	REPAIR circuits RH111 (GY/BU), VH441 (WH/BN) or VH440 (BU/BN) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
	
	No
	GO to M12 .

M12 CHECK THE DOOR ACTUATOR CLOCKWISE OPERATION	

• Remove the door actuator and disengage the actuator driveshaft from the actuator door.
• Mark the door actuator driveshaft position.
• Connect a fused jumper wire between EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and:
  ▪ For DTC B2266, EATC module C228a-22 or EMTC module C294a-22, circuit CH238 (YE/OG).
  ▪ For DTC B2267, EATC module C228a-26, circuit CH213 (BN/GN).
 
 	
	Yes
	GO to M13 .
	
	No
	GO to M14 .

- Connect a second fused jumper wire between EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and:
  - For DTC B2266 or LH blend door actuator, EATC module C228a-21 or EMTC module C294a-21, circuit CH239 (BU/WH).
  - For DTC B2267 or RH blend door actuator, EATC module C228a-24, circuit CH212 (BU/OG).

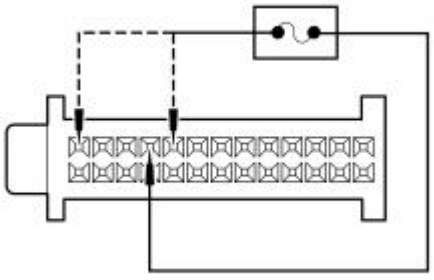


N0054700

- **Does the actuator motor move in the clockwise direction?**

M13 CHECK THE DOOR ACTUATOR COUNTERCLOCKWISE OPERATION

- Connect a fused jumper wire between EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and :
  - For DTC B2266, EATC module C228a-22 or EMTC module C294a-22, circuit CH238 (YE/OG).
  - For DTC B2267, EATC module C228a-26, circuit CH213 (BN/GN).

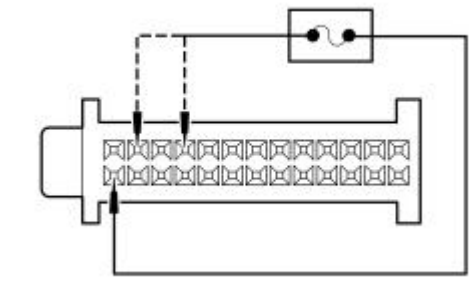


N0054701

- Connect a second fused jumper wire between EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and:
  - For DTC B2266, EATC module C228a-21 or EMTC module C294a-21, circuit CH239 (BU/WH).
  - For DTC B2267, EATC module C228b-25, circuit CH212 (BU/OG).

Yes
INSPECT for binding or broken door and linkage. If no condition is found, GO to M18 .

No
GO to M14 .

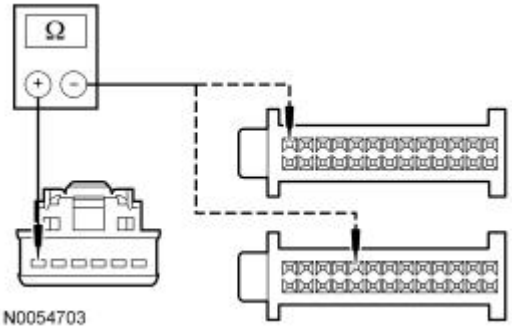


N0054702

- **Does the actuator motor move in the counterclockwise direction?**

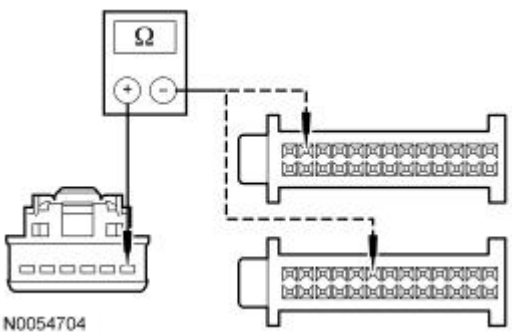
M14 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

- Disconnect: For DTC B2266, LH Blend Door Actuator C2091.
- Disconnect: For DTC B2267, RH Blend Door Actuator C2092.
- Measure the resistance between:
  - For DTC B2266, EATC module C228a-22 or EMTC module C294a-22, circuit CH238 (YE/OG) and LH blend door actuator C2091-6, circuit CH238 (YE/OG).
  - For DTC B2267, EATC module C228b-26, circuit CH213 (BN/GN) and RH blend door actuator C2092-6, circuit CH213 (BN/GN).



N0054703

- Measure the resistance between:
  - For DTC B2266, EATC module C228a-21 or EMTC module C294a-21, circuit CH239 (BU/WH) and LH blend door actuator C2091-1, circuit CH239 (BU/WH).
  - For DTC B2267, EATC module C228b-25, circuit CH212 (BU/OG) and RH blend door actuator C2092-1, circuit CH212 (BU/OG).

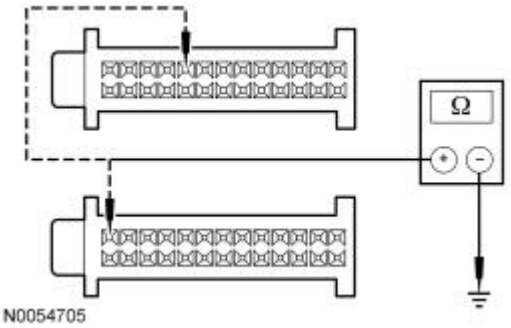
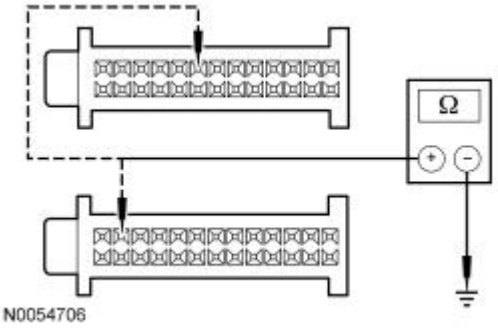
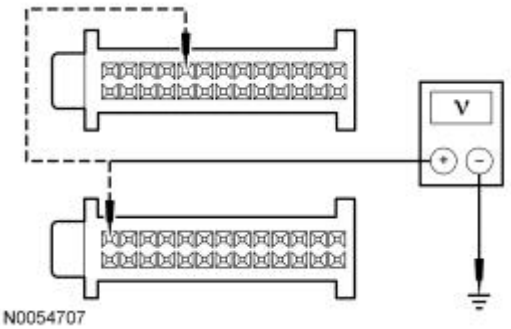


N0054704

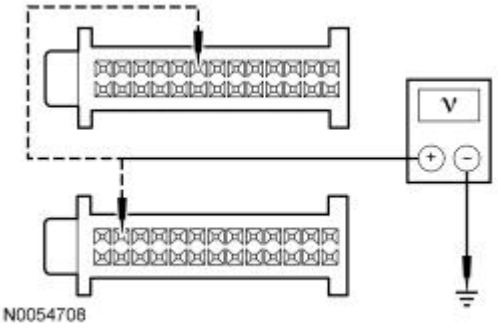
- **Are the resistances less than 5 ohms?**

Yes
GO to M15 .

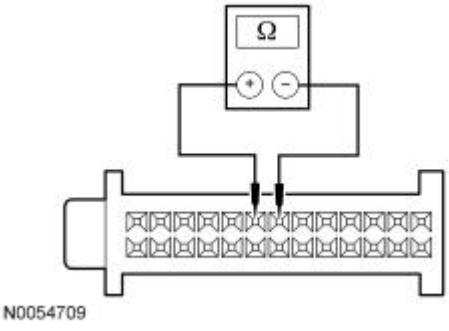
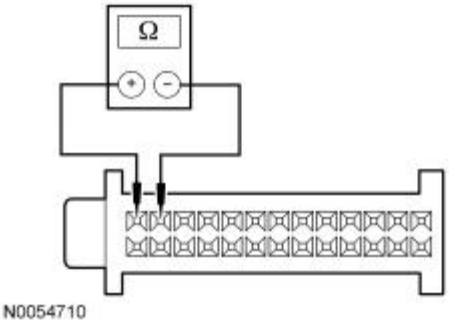
No
REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

M15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ▪ For DTC B2266, EATC module C228a-22 or EMTC module C294a-22, circuit CH238 (YE/OG). ▪ For DTC B2267, EATC module C228b-26, circuit CH213 (BN/GN).  N0054705 • Measure the resistance between ground and: ▪ For DTC B2266, EATC module C228a-21 or EMTC module C294a-21, circuit CH239 (BU/WH). ▪ For DTC C2267, EATC module C228b-25, circuit CH212 (BU/OG).  N0054706 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to M16 . **No** REPAIR the circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between ground and: ▪ For DTC B2266, EATC module C228a-22 or EMTC module C294a-22, circuit CH238 (YE/OG). ▪ For DTC C2267, EATC module C228b-26, circuit CH213 (BN/GN).  N0054707 • Measure the voltage between ground and: ▪ For DTC B2266, EATC module C228a-21 or EMTC	**Yes** REPAIR the circuit(s) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to M17 .

module C294a-21, circuit CH239 (BU/WH).
- For DTC C2267, EATC module C228b-25, circuit CH212 (BU/OG).



- **Is voltage present?**

M17 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER	
• Key in OFF position. • **NOTE:** For DTC B2266. • Measure the resistance between EATC module C228a-21 or EMTC module C228a-21, circuit CH239 (BU/WH) and EATC module C228a-22 or EMTC module C228a-22, circuit CH238 (YE/OG).  • **NOTE:** For DTC C2267. • Measure the resistance between EATC module C228b-25 or EMTC module C294b-25, circuit CH212 (BU/OG) and EATC module C228b-26 or EMTC module C294b-26, circuit CH213 (BN/GN).  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit(s) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
M18 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC systems only. • Carry out the EATC on-demand self test. • Operate the system.	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation.

• **Does the concern return?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test N: The Blower Motor is Inoperative — EMTC

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

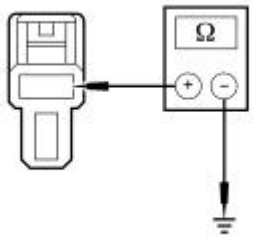
Under normal operation, the blower motor relay coil receives ignition voltage through circuit CBB67 (GN/BN). The coil receives ground from the electronic manual temperature control (EMTC) module through circuit CH123 (VT/GN) if any function selector position but OFF is selected. Voltage is supplied to the relay switch contact. When the relay coil is energized, voltage is delivered to the blower motor through circuit CH402 (YE/GN). Ground for the blower motor is provided through circuit CH430 (VT/OG) from the blower resistor or the blower switch (HI). The blower resistor and blower switch is grounded through circuit GD138 (BK/WH).

Possible Causes

- Fuse(s)
- An open in circuit CH430 (VT/OG), GD138 (BK/WH), CH402 (YE/GN), CH123 (VT/GN) or CBB67 (GN/BN)
- Blower motor
- Blower motor relay
- Blower motor switch
- Battery junction box (BJB)
- EMTC module

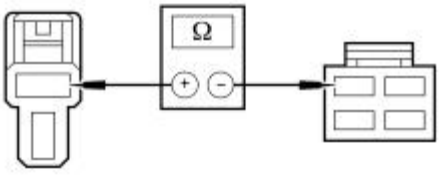
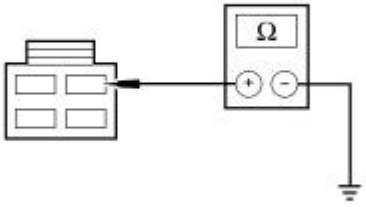
PINPOINT TEST N: THE BLOWER MOTOR IS INOPERATIVE — EMTC

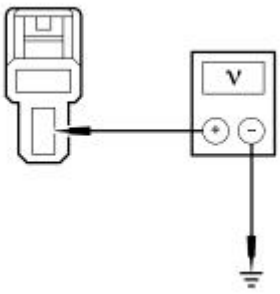
Test Step	Result / Action to Take
N1 CHECK CIRCUIT CH430 (VT/OG) FOR GROUND	
• Disconnect: Blower Motor C288. • Turn the function selector switch to the PANEL position. • Turn the blower motor switch to the HI position. • Measure the resistance between blower motor connector C288-1, circuit CH430 (VT/OG) and ground.	**Yes** GO to N4 . **No** GO to N2 .



N0054711

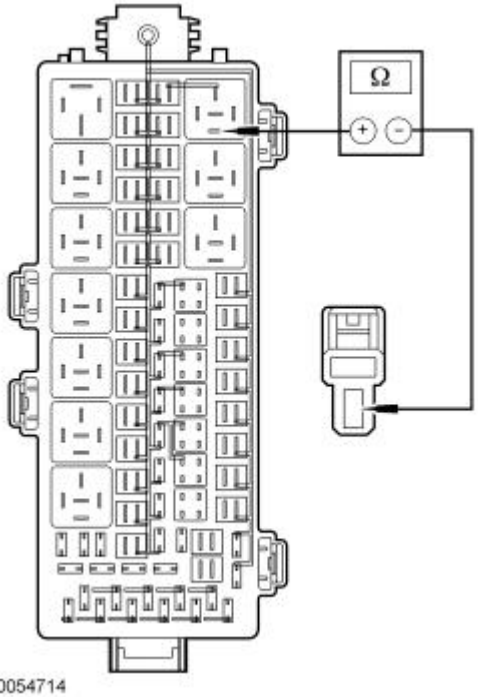
- **Is the resistance less than 5 ohms?**

N2 CHECK CIRCUIT CH430 (VT/OG) FOR AN OPEN	
• Disconnect: Blower Motor Switch C294b. • Measure the resistance between blower motor switch C294c-2, circuit CH430 (VT/OG) and blower motor C288-1, circuit CH430 (VT/OG).  N0054712 • **Is the resistance less than 5 ohms?**	**Yes** GO to N3 . **No** REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.
N3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between blower motor switch C294c-1, circuit GD138 (BK/WH) and ground.  A0040182 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor switch. TEST the system for normal operation. **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
N4 CHECK A/C BLOWER MOTOR CIRCUIT CH402 (YE/GN) FOR VOLTAGE	
• Key in ON position. • Measure the voltage between blower motor connector C288-2, circuit CH402 (YE/GN) and ground.	**Yes** INSTALL a new blower motor. TEST the system for normal operation. **No** GO to N5 .

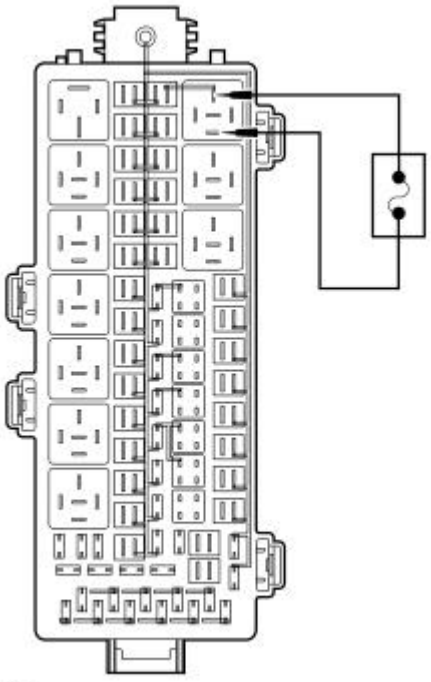


N0054713

- **Is the voltage greater than 10 volts?**

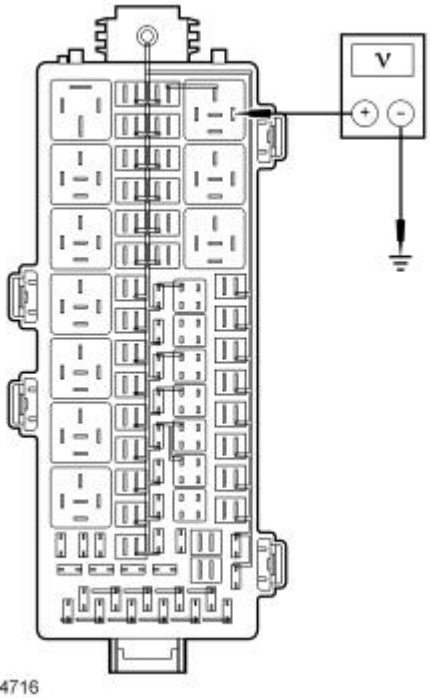
N5 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Blower Motor Relay. • Measure the resistance between blower motor relay connector pin 87, circuit CH402 (YE/GN) and blower motor C288-2, circuit CH402 (YE/GN).  N0054714 • **Is the resistance less than 5 ohms?**	**Yes** GO to N6 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

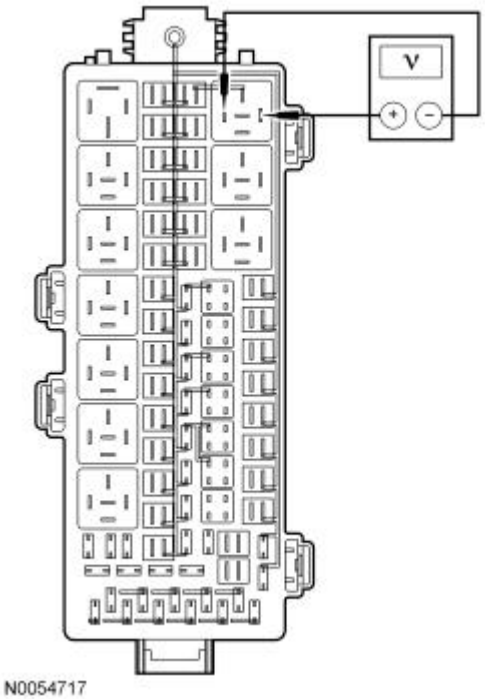
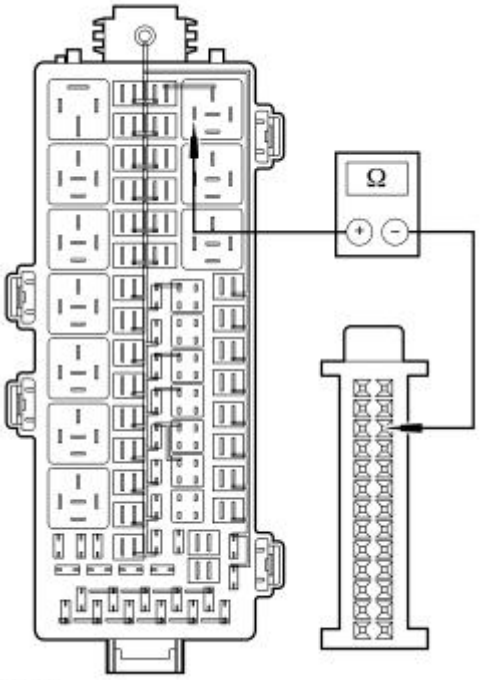
N6 CHECK THE BLOWER MOTOR RELAY	
• Connect: Blower Motor C288. • Key in ON position. • Connect a fused jumper lead between blower motor relay socket pin 30 and pin 87, circuit CH402 (YE/GN).	**Yes** GO to N7 . **No** VERIFY battery junction box (BJB) fuse 24 (40A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.



N0054715

- **Does the blower motor operate?**

N7 CHECK THE RELAY COIL SUPPLY VOLTAGE	
• Key in OFF position. • Measure the voltage between blower motor relay socket pin 85, circuit CBB67 (GN/BN) and ground.  N0054716 • **Is the voltage greater than 10 volts?**	**Yes** GO to N8 . **No** VERIFY smart junction box (SJB) fuse 67 (10A) is OK. If OK, REPAIR circuit CBB67 (GN/BN) for an open. TEST the system for normal operation.
N8 CHECK THE BLOWER MOTOR RELAY	
• Key in ON position. • Measure the voltage between blower motor relay socket pin 86, circuit CH123 (VT/GN) and socket pin 85, circuit CBB67 (GN/BN).	**Yes** INSTALL a new blower motor relay. TEST the system for normal operation.

 N0054717 • **Is the voltage greater than 10 volts?**	**No** GO to N9 .
N9 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: EMTC Module C294a. • Measure the resistance between blower motor relay connector pin 86, circuit CH123 (VT/GN) and EMTC module C294a-24, circuit CH123 (VT/GN).  N0054718 • **Is the resistance less than 5 ohms?**	**Yes** GO to N10 . **No** REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.
N10 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control	**Yes** INSTALL a new EMTC

(EMTC) Module Cold Boot Process. • Operate the system. • **Does the concern return?**	module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test O: The Blower Motor Does Not Operate Correctly — EMTC

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

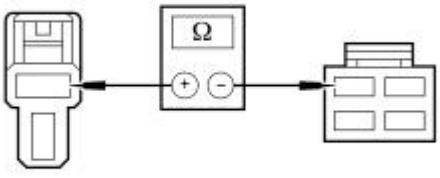
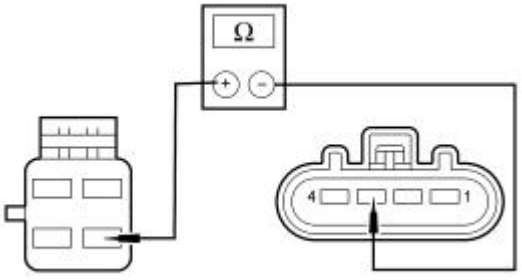
Under normal operation, the blower motor is provided a ground from the blower resistor through circuit CH430 (VT/OG). The resistor gets a ground from circuit GD138 (BK/WH) in the lowest blower setting. In MED-LO and MED-HI the resistor gets a ground from the blower motor switch through circuit CH428 (GN/WH) or CH429 (GY/BN), depending on selected speed. In HI, the blower motor is grounded directly through the blower motor switch from circuit CH430 (VT/OG) to circuit GD138 (BK/WH). The blower switch receives its ground from circuit GD138 (BK/WH).

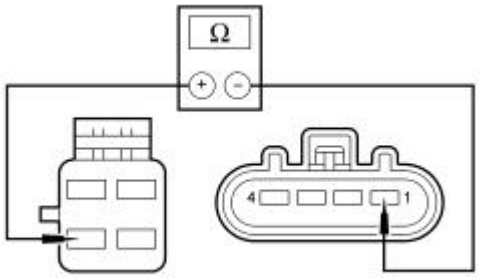
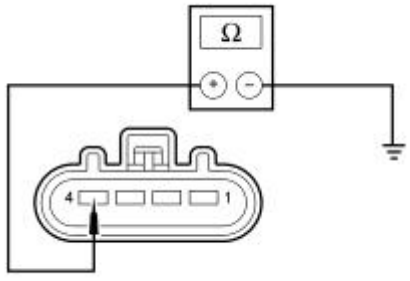
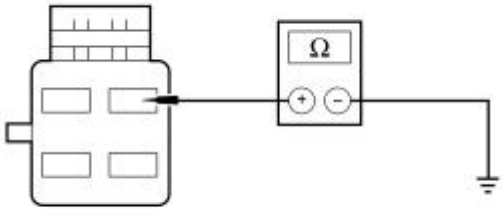
Possible Causes

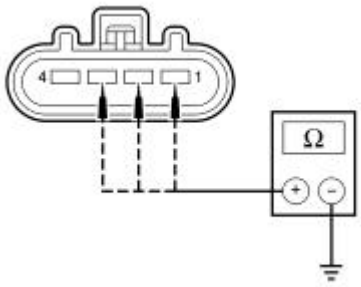
- An open in circuit GD138 (BK/WH), CH428 (GN/WH), CH429 (GY/BN) or CH430 (VT/OG)
- A short to ground in circuit CH428 (GN/WH), CH429 (GY/BN) or CH430 (VT/OG)
- A short together in circuits CH428 (GN/WH), CH429 (GY/BN) or CH430 (VT/OG)
- Blower motor resistor
- Blower motor switch

PINPOINT TEST O: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY — EMTC

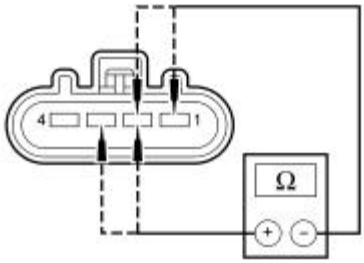
Test Step	Result / Action to Take
O1 CHECK THE BLOWER MOTOR OPERATION	
• Key in ON position. • Turn the function selector switch to the FLOOR position. • Select all blower speed positions. • **Does the blower motor operate in any position?**	**Yes** If the blower motor does not operate in HI, GO to O2 . If the blower motor does not operate in MED-HI, GO to O3 . If the blower motor does not operate in MED-LO, GO to O4 . If the blower motor does not operate in LO, GO to O5 . For all other symptoms, GO to O7 .

	No Go To Pinpoint Test N .
O2 CHECK CIRCUIT CH430 (VT/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Blower Motor Switch C294c. • Disconnect: Blower Motor C288. • Measure the resistance between blower motor switch C294c-2, circuit CH430 (VT/OG) and blower motor C288-1, circuit CH430 (VT/OG).  N0054712 • **Is the resistance less than 5 ohms?**	**Yes** GO to O6 . **No** REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.
O3 CHECK CIRCUIT CH429 (GY/BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Blower Motor Switch C294c. • Disconnect: Blower Motor Resistor C2185. • Measure the resistance between blower motor switch C294c-3, circuit CH429 (GY/BN) and blower motor resistor C2185-3, circuit CH429 (GY/BN).  A0071487 • **Is the resistance less than 5 ohms?**	**Yes** GO to O6 . **No** REPAIR circuit CH429 (GY/BN) for an open. TEST the system for normal operation.
O4 CHECK CIRCUIT CH428 (GN/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: Blower Motor Switch C294c. • Disconnect: Blower Motor Resistor C2185. • Measure the resistance between blower motor switch C294c-4, circuit CH428 (GN/WH) and blower motor resistor C2185-1, circuit CH428 (GN/WH).	**Yes** GO to O6 . **No** REPAIR circuit CH428 (GN/WH) for an open. TEST the system for normal operation.

 A0071488 • **Is the resistance less than 5 ohms?**	
O5 CHECK BLOWER MOTOR RESISTOR GROUND CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between blower motor resistor C2185-4, circuit GD138 (BK/WH) and ground.  A0035320 • **Is the resistance less than 5 ohms?**	**Yes** GO to O6 . **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
O6 CHECK THE BLOWER MOTOR RESISTOR	
• Carry out the blower motor resistor component test in this section. • **Does the blower motor resistor test good?**	**Yes** GO to O7 . **No** INSTALL a new blower motor resistor. TEST the system for normal operation.
O7 CHECK THE BLOWER MOTOR SWITCH CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between blower motor switch C294c-1, circuit GD138 (BK/WH) and ground.  A0020414 • **Is the resistance less than 5 ohms?**	**Yes** GO to O8 . **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
O8 CHECK CIRCUITS CH430 (VT/OG), CH428 (GN/WH) AND CH429 (GY/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Blower Motor C288.	**Yes** GO to O9 .

• Disconnect: Blower Motor Resistor C2185.
• Place the blower switch in the lowest setting.
• Measure the resistance between ground and blower motor resistor C2185, circuit:
  ▪ CH428 (GN/WH) pin 1
  ▪ CH430 (VT/OG) pin 2
  ▪ CH429 (GY/BN) pin 3
 
 	
A0051664
• **Are the resistances less than 5 ohms?**
	No
	REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

O9 CHECK THE BLOWER MOTOR CIRCUITS FOR SHORTS TOGETHER	

• Measure the resistance between blower motor resistor C2185:
  ▪ pin 1, circuit CH428 (GN/WH) and pin 2, circuit CH430 (VT/OG).
  ▪ pin 1, circuit CH428 (GN/WH) and pin 3, circuit CH429 (GY/BN).
  ▪ pin 2, circuit CH430 (VT/OG) and pin 3, circuit CH429 (GY/BN).
 
 	
A0051665
• **Are the resistances greater than 10,000 ohms?**
	Yes
	INSTALL a new blower motor switch. TEST the system for normal operation.
	
	No
	REPAIR the affected circuits. TEST the system for normal operation.

Pinpoint Test P: The Blower Motor is Inoperative — EATC

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

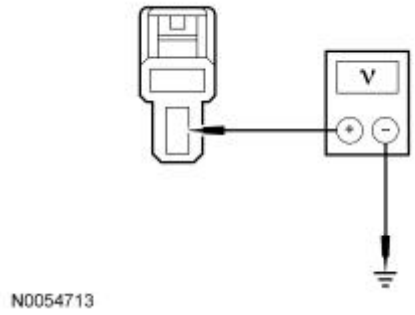
Normal Operation

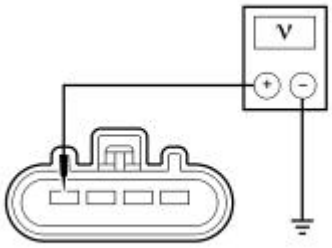
Under normal operation, the blower motor relay coil receives a ground from the electronic automatic temperature control (EATC) module through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit CBB67 (GN/BN). Voltage is supplied to the relay switch contact. When the relay coil is energized, voltage is delivered to the blower motor and the blower motor control module through circuit CH402 (YE/GN). Ground for the motor is provided through circuit VH301 (YE/BU) from the blower control module. Ground for the blower control module is provided by circuit GD138 (BK/WH). The EATC module sends a pulse width modulated signal to the blower control module through circuit VH101 (WH/VT) to control the blower speed.

Possible Causes

- Fuse(s)
- An open in circuit GD138 (BK/WH), CH402 (YE/GN), CH123 (VT/GN), VH301 (YE/BU), VH101 (WH/VT) or CBB67 (GN/BN)
- A short to ground in circuit VH101 (WH/VT)
- A short to voltage in circuit CH123 (VT/GN)
- Blower motor relay
- Blower motor control module
- EATC module
- Blower motor
- Battery junction box (BJB)

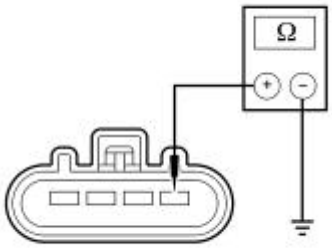
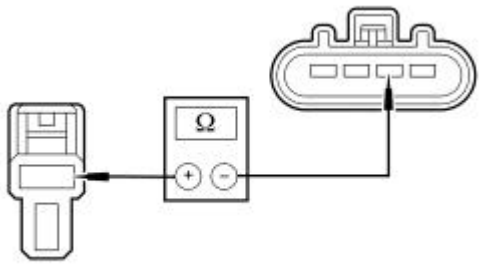
PINPOINT TEST P: THE BLOWER MOTOR IS INOPERATIVE — EATC

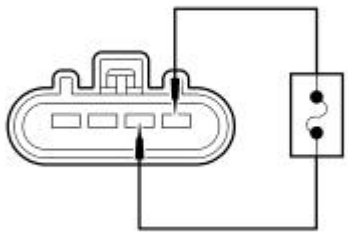
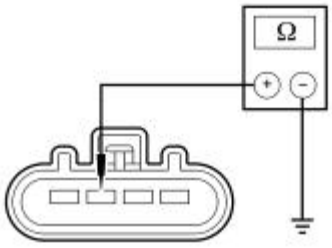
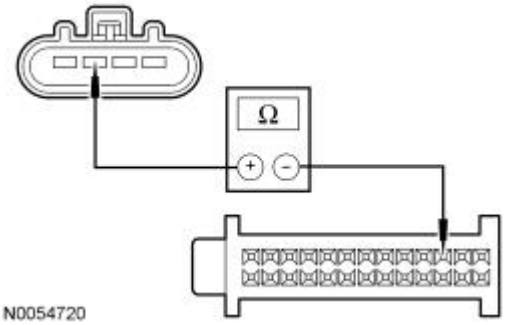
Test Step	Result / Action to Take
P1 VERIFY THE BLOWER MOTOR OPERATION	
• Key in ON position. • Press the PANEL button on the EATC module. Adjust the blower motor setting to LO and then to HI. • **Is the blower motor inoperative in all settings?**	**Yes** GO to P2 . **No** Go To Pinpoint Test N .
P2 CHECK FOR VOLTAGE TO THE BLOWER MOTOR	
• Key in OFF position. • Disconnect: Blower Motor C288. • Key in ON position. • Measure the voltage between blower motor C288-2, circuit CH402 (YE/GN) and ground.  N0054713 • **Is the voltage greater than 10 volts?**	**Yes** GO to P3 . **No** GO to P9 .
P3 CHECK FOR VOLTAGE TO THE BLOWER MOTOR CONTROLLER	
• Key in OFF position. • Disconnect: Blower Motor Speed Control C297. • Key in ON position. • Measure the voltage between blower motor speed control C297-4, circuit CH402 (YE/GN) and ground.	**Yes** GO to P4 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

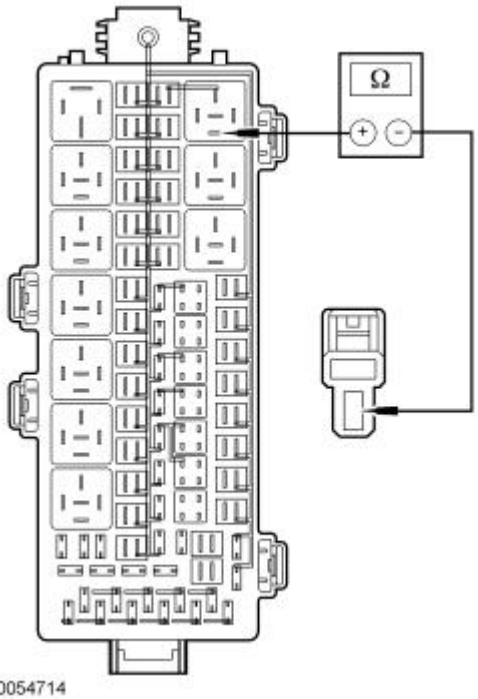


N0001798

- **Is the voltage greater than 10 volts?**

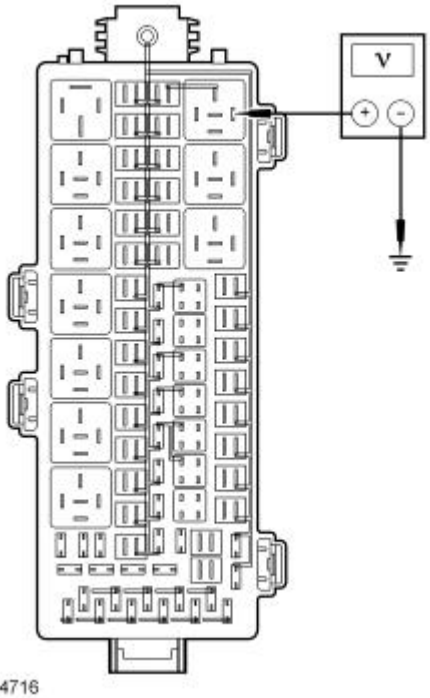
P4 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between blower motor speed control C297-1, circuit GD138 (BK/WH) and ground.  N0001799 • **Is the resistance less than 5 ohms?**	**Yes** GO to P5 . **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
P5 CHECK CIRCUIT VH301 (YE/BU) FOR AN OPEN	
• Measure the resistance between blower motor C288-1, circuit VH301 (YE/BU) and blower motor speed control C297-2, circuit VH301 (YE/BU).  N0054719 • **Is the resistance less than 5 ohms?**	**Yes** GO to P6 . **No** REPAIR circuit VH301 (YE/BU) for an open. TEST the system for normal operation.
P6 CHECK THE BLOWER MOTOR	
• Connect: Blower Motor C288. • Connect a fused jumper lead between blower motor speed control C297-2, circuit VH301 (YE/BU) and C297-1, circuit GD138 (BK/WH).	**Yes** GO to P7 . **No** INSTALL a new blower motor. TEST the system for normal operation.

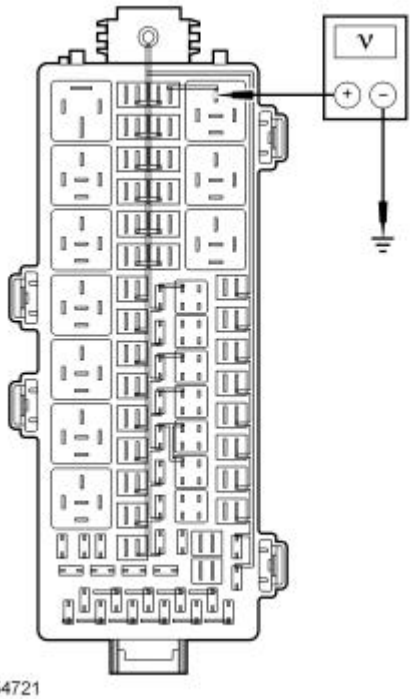
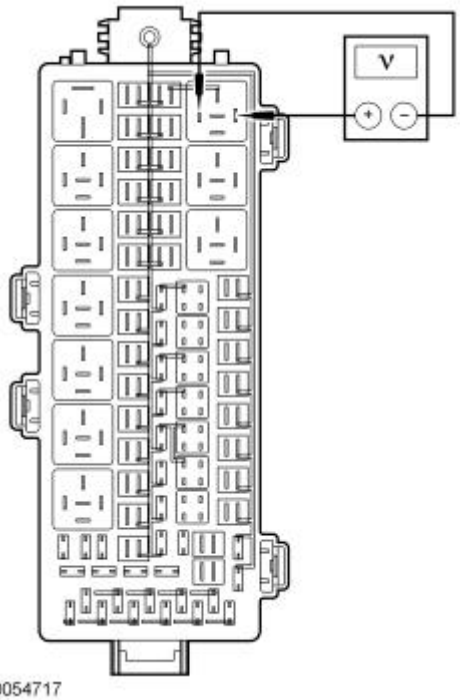
 N0001800 • Key in ON position. • **Does the blower motor operate?**	
P7 CHECK CIRCUIT VH101 (WH/VT) FOR A SHORT TO GROUND	
• Key in OFF position. • Remove the fused jumper lead from blower motor speed control C297. • Disconnect: EATC Module C228b. • Measure the resistance between blower motor speed control C297-3, circuit VH101 (WH/VT) and ground.  N0001801 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to P8 . **No** REPAIR circuit VH101 (WH/VT) for a short to ground. TEST the system for normal operation.
P8 CHECK CIRCUIT VH101 (WH/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between blower motor speed control C297-3, circuit VH101 (WH/VT) and EATC module C228b-16, circuit VH101 (WH/VT).  N0054720 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor speed control. TEST the system for normal operation. If the blower motor is still inoperative, INSTALL a new EATC module. TEST the system for normal operation. **No** REPAIR circuit VH101 (WH/VT) for an open. TEST the system for normal operation.
P9 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Blower Motor Relay. • Measure the resistance between blower motor relay socket pin 87, circuit CH402 (YE/GN) and blower motor C288-2, circuit CH402 (YE/GN).	**Yes** GO to P10 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

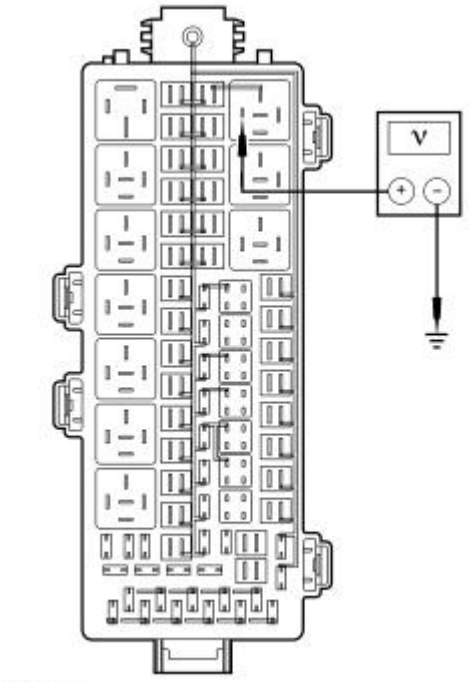
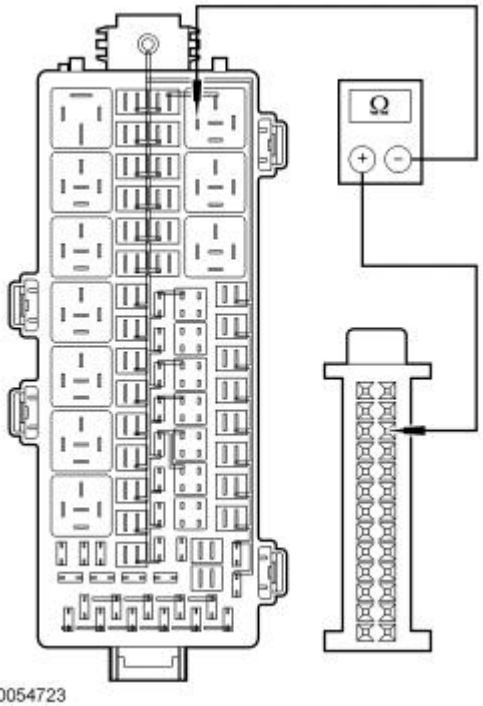


N0054714

- **Is the resistance less than 5 ohms?**

P10 CHECK THE RELAY COIL SUPPLY VOLTAGE	
• Measure the voltage between blower motor relay socket pin 85, circuit CBB67 (GN/BN) and ground.  N0054716 • **Is the voltage greater than 10 volts?**	**Yes** GO to P11 . **No** VERIFY smart junction box (SJB) fuse 67 (10A) is OK. If OK, REPAIR circuit CBB67 (GN/BN) for an open. TEST the system for normal operation.
P11 CHECK THE RELAY SWITCH POWER CIRCUIT FOR AN OPEN	
• Measure the voltage between blower motor relay socket pin 30 and ground.	**Yes** GO to P12 . **No**

 N0054721 • **Is the voltage greater than 10 volts?**	VERIFY battery junction box (BJB) fuse 24 (40A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.
P12 CHECK THE EATC MODULE OUTPUT	
• Key in ON position. • Measure the voltage between blower motor relay socket pin 85, circuit CBB67 (GN/BN) and socket pin 86, circuit CH123 (VT/GN).  N0054717 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new blower motor relay. TEST the system for normal operation. **No** GO to P13 .
P13 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: EATC Module C228a.	**Yes** REPAIR circuit CH123 (VT/GN)

• Key in ON position. • Measure the voltage between blower motor relay socket pin 86, circuit CH123 (VT/GN) and ground.  N0054722 • **Is voltage present?**	for a short to voltage. TEST the system for normal operation. **No** GO to P14 .
P14 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN	
• Measure the resistance between EATC module C228a-24, circuit CH123 (VT/GN) and blower motor relay socket pin 86, circuit CH123 (VT/GN).  N0054723 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new EATC module. TEST the system for normal operation. **No** REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

Pinpoint Test Q: The Blower Motor Does Not Operate Correctly — EATC

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

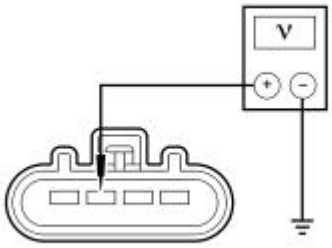
Under normal operation, the blower motor relay coil receives a ground from the electronic automatic temperature control (EATC) module through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit CBB67 (GN/BN). Voltage is supplied to the relay switch contact. When the relay coil is energized, voltage is delivered to the blower motor and the blower motor control module through circuit CH402 (YE/GN). Ground for the motor is provided through circuit VH301 (YE/BU) from the blower control module. Ground for the blower control module is provided by circuit GD138 (BK/WH). The EATC module sends pulse a width modulated signal to the blower control module through circuit VH101 (WH/VT) to control the blower speed.

Possible Causes

- An open in circuit VH101 (WH/VT)
- A short to ground in circuit VH301 (YE/BU) or circuit CH123 (VT/GN)
- A short to voltage in circuit VH101 (WH/VT) or circuit CH402 (YE/GN)
- Blower motor control module
- EATC module

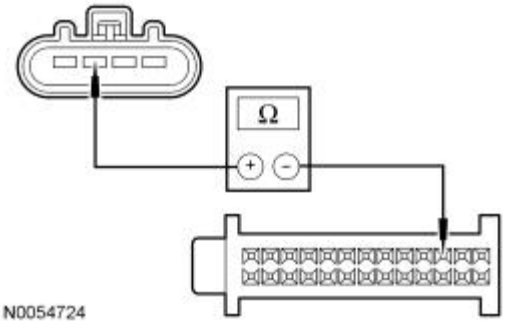
PINPOINT TEST Q: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY — EATC

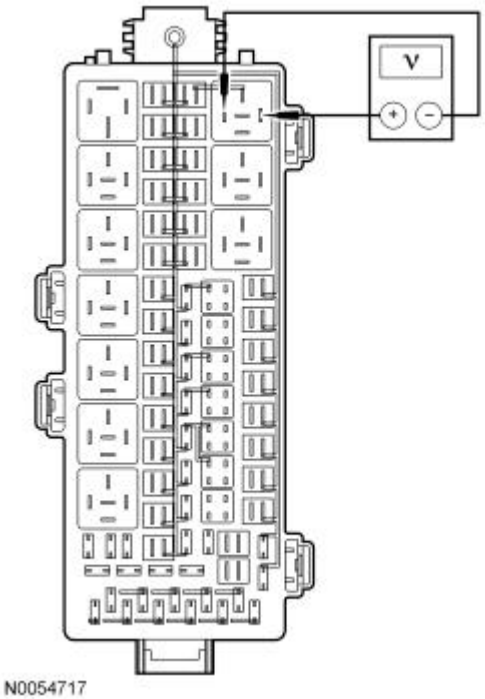
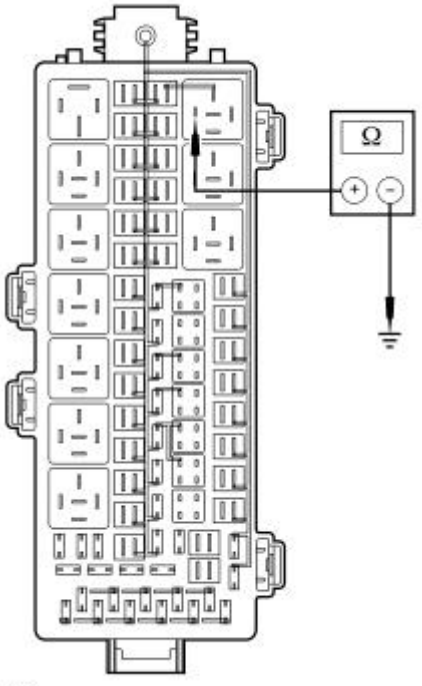
Test Step	Result / Action to Take
Q1 VERIFY THE BLOWER MOTOR OPERATION • Key in ON position. • Press the PANEL button on the EATC module. Adjust the blower motor setting to LO and then to HI. • **Does the blower motor operate at any setting?**	**Yes** If the blower motor operates always in HI, GO to Q2 . If the blower motor is always ON, GO to Q5 . **No** Go To Pinpoint Test P .
Q2 CHECK CIRCUIT VH301 (YE/BU) FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: Blower Motor Speed Control C297. • Key in ON position. • **Does the blower motor operate?**	**Yes** REPAIR circuit VH301 (YE/BU) for a short to ground. TEST the system for normal operation. **No** GO to Q3 .
Q3 CHECK CIRCUIT VH101 (WH/VT) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: EATC Module C228b. • Key in ON position. • Measure the voltage between blower motor speed control C297-3, circuit VH101 (WH/VT) and ground.	**Yes** REPAIR circuit VH101 (WH/VT) for a short to voltage. TEST the system for normal operation. **No** GO to Q4 .

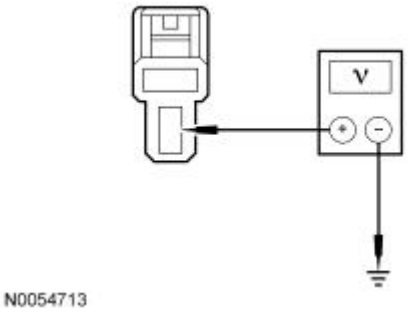


N0001804

- **Is voltage present?**

Q4 CHECK CIRCUIT VH101 (WH/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between blower motor speed control C297-3, circuit VH101 (WH/VT) and EATC module C228b-16, circuit VH101 (WH/VT).  N0054724 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor speed control. TEST the system for normal operation. **No** REPAIR circuit VH101 (WH/VT) for an open. TEST the system for normal operation.
Q5 CHECK THE EATC MODULE OUTPUT	
• Key in OFF position. • Disconnect: Blower Motor Relay. • Key in ON position. • Press the EATC OFF button. • Measure the voltage between blower motor relay socket pin 85, circuit CBB67 (GN/BN) and socket pin 86, circuit CH123 (VT/GN).	**Yes** GO to Q6 . **No** GO to Q7 .

 N0054717 • **Is the voltage greater than 10 volts?**	
Q6 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: EATC Module C228a. • Measure the resistance between blower motor relay socket pin 86, circuit CH123 (VT/GN) and ground.  N0054725 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Q8 . **No** REPAIR circuit CH123 (VT/GN) for a short to ground. TEST the system for normal operation.
Q7 CHECK CIRCUIT CH402 (YE/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position.	**Yes**

• Disconnect: Blower Motor C288. • Key in ON position. • Measure the voltage between blower motor C288-2, circuit CH402 (YE/GN) and ground.  N0054713 • **Is the voltage greater than 10 volts?**	REPAIR circuit CH402 (YE/GN) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new blower motor speed control. TEST the system for normal operation. If the blower motor still does not operate correctly, GO to Q8 .
Q8 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test R: The Auxiliary Blower Motor is Inoperative

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

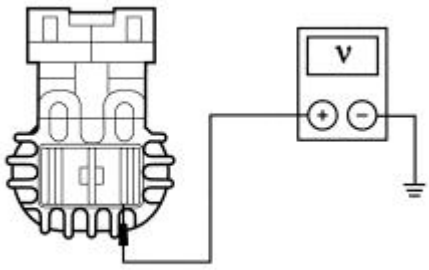
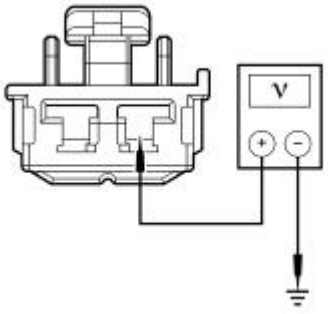
Under normal operation, the auxiliary blower motor relay 1 coil receives ignition voltage through circuit CBP46 (WH/BU). The coil receives ground from the electronic automatic temperature control (EATC) module or electronic manual temperature control (EMTC) module through circuit CH112 (VT/WH) if any auxiliary blower speed but OFF is selected. Voltage is supplied to the relay switch contact through circuit SBB11 (BU/RD). When the relay coil is energized, voltage is delivered to the blower motor through circuit CHA05 (BN/WH). Ground for the blower motor is provided through circuit CHA06 (YE/VT) from the blower motor resistor. The blower resistor is grounded through circuit GD151 (BK/GN).

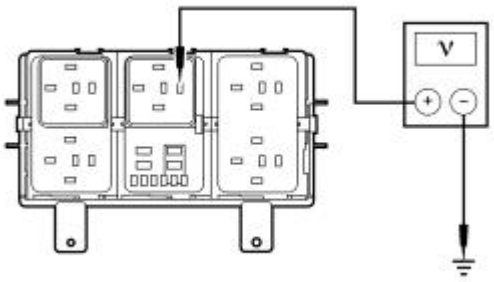
Possible Causes

- Fuse(s)
- An open in circuit SBB11 (BU/RD), CH112 (VT/WH), GD151 (BK/GN), CHA05 (BN/WH), CHA06 (YE/VT) or CBP46 (WH/BU).
- Auxiliary blower motor
- Auxiliary blower motor relay 1
- Auxiliary blower motor resistor
- EATC module

- EMTC module

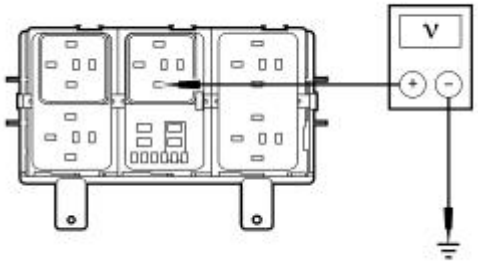
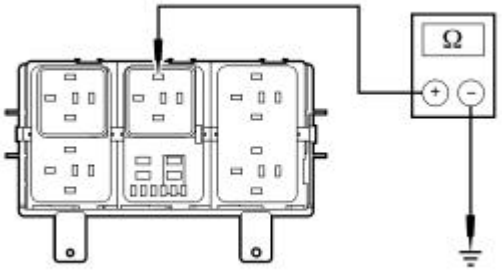
PINPOINT TEST R: THE AUXILIARY BLOWER MOTOR IS INOPERATIVE

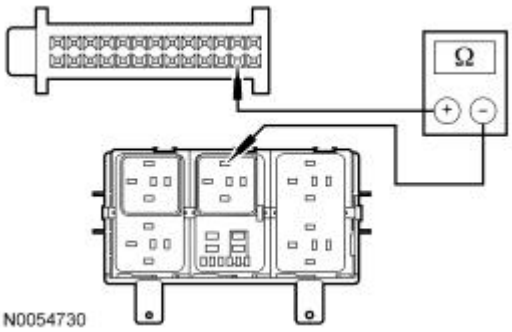
Test Step	Result / Action to Take
R1 CHECK CIRCUIT CHA05 (BN/WH) FOR VOLTAGE • Key in OFF position. • Disconnect: Auxiliary Blower Motor C4106 (Expedition/Navigator) or C4334 (Expedition EL/Navigator L). • Key in ON position. • **NOTE:** Expedition/Navigator only. • Measure the voltage between auxiliary blower motor C4334-1, circuit CHA05 (BN/WH) and ground.  AM0416-A • **NOTE:** Expedition EL/Navigator L only. • Measure the voltage between auxiliary blower motor C4106-2, circuit CHA05 (BN/WH) and ground.  N0054726 • **Is the voltage greater than 10 volts?**	**Yes** GO to R6 . **No** GO to R2 .
R2 CHECK CIRCUIT SBB11 (BU/RD) FOR VOLTAGE • Key in OFF position. • Disconnect: Auxiliary Blower Motor Relay 1. • Key in ON position. • Measure the voltage between the auxiliary blower motor relay 1 socket pin 87, circuit SBB11 (BU/RD) and ground.	**Yes** GO to R3 . **No** VERIFY battery junction box (BJB) fuse 11 (30A) is OK. If OK, REPAIR circuit SBB11 (BU/RD) for an open. TEST the system for normal operation.



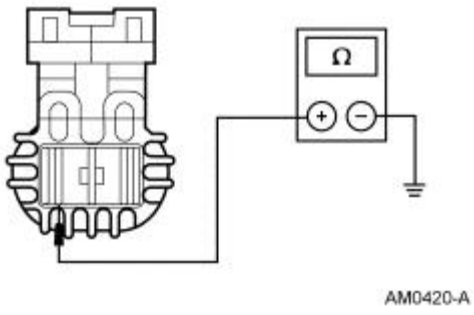
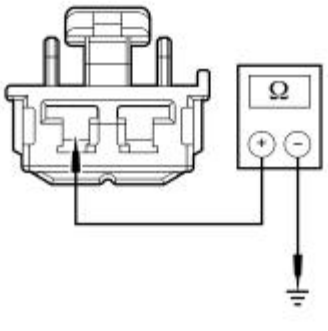
N0054727

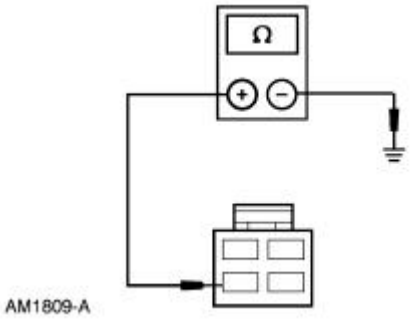
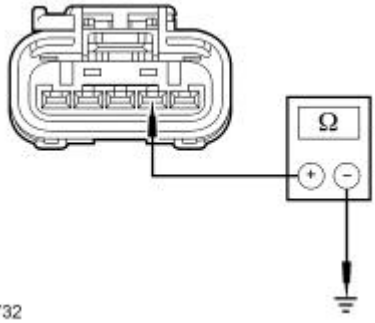
- **Is the voltage greater than 10 volts?**

R3 CHECK CIRCUIT CBP46 (WH/BU) FOR VOLTAGE	
• Measure the voltage between the auxiliary blower motor relay 1 socket pin 86, circuit CBP46 (WH/BU) and ground.  N0054728 • **Is the voltage greater than 10 volts?**	**Yes** GO to R4 . **No** VERIFY smart junction box (SJB) fuse 46 (7.5A) is OK. If OK, REPAIR circuit CBP46 (WH/BU) for an open. TEST the system for normal operation.
R4 CHECK CIRCUIT CH112 (VT/WH) FOR GROUND	
• With the auxiliary blower on, measure the resistance between the auxiliary blower motor relay 1 socket pin 85, circuit CH112 (VT/WH) and ground.  N0054729 • **Is the resistance less than 5 ohms?**	**Yes** CARRY OUT the relay component test on the auxiliary blower motor relay 1. If OK, REPAIR circuit CHA05 (BN/WH) for an open. TEST the system for normal operation. **No** GO to R5 .
R5 CHECK CIRCUIT CH112 (VT/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228b or EMTC Module C294b. • Measure the resistance between EATC module C228b-2 or EMTC module C294b-2, circuit CH112 (VT/WH) and auxiliary blower motor relay 1 socket pin 85, circuit CH112 (VT/WH).	**Yes** GO to R8 . **No** REPAIR circuit CH112 (VT/WH) for an open. TEST the system for normal operation.



- **Is the resistance less than 5 ohms?**

R6 CHECK CIRCUIT CHA06 (YE/VT) FOR GROUND	
• Key in OFF position. • **NOTE:** Expedition/Navigator only. • Measure the resistance between auxiliary blower motor C4334-2, circuit CHA06 (YE/VT) and ground.  • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between auxiliary blower motor C4106-1, circuit CHA06 (YE/VT) and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new auxiliary blower motor. TEST the system for normal operation. **No** GO to R7 .
R7 CHECK CIRCUIT GD151 (BK/GN) FOR GROUND	
• Key in OFF position. • Disconnect: Auxiliary Blower Motor Resistor C4343 (Expedition/Navigator) or C4107 (Expedition EL/Navigator L). • **NOTE:** Expedition/Navigator only. • Measure the resistance between auxiliary blower motor resistor C4343-4, circuit GD151 (BK/GN) and ground.	**Yes** CARRY OUT the component test on the auxiliary blower motor resistor. If OK, REPAIR circuit CHA06 (YE/VT) for an open. TEST the system for normal operation. **No** REPAIR circuit GD151 (BK/GN) for an open. TEST the system for normal operation.

 AM1809-A • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between auxiliary blower motor resistor C4107-2, circuit GD151 (BK/GN) and ground.  N0054732 • **Is the resistance less than 5 ohms?**	
R8 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR The DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test S: The Auxiliary Blower Motor Does Not Operate Correctly

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, ground for the blower motor is provided through circuit CHA06 (YE/VT) from the blower motor resistor. The blower resistor is grounded through circuit GD151 (BK/GN). The blower motor relay coils are supplied through circuit SBB11 (BU/RD). Blower motor speed is received by the electronic automatic temperature control (EATC) module or electronic manual temperature control (EMTC) module from the rear auxiliary control through circuit VHA17 (VT/GN). Reference voltage for the

blower speed selector resistor is provided by the EMTC or EATC module through circuit LH111 (BN/WH). The auxiliary blower motor relay 1 coil receives ground from the EMTC or EATC module through circuit CH112 (VT/WH) if any blower speed but OFF is selected.

In LO, ground for the blower motor is provided through the blower motor resistor.

In MED-LO, blower motor relay 2 is grounded by the EMTC or EATC module through circuit CH114 (GN/WH). Blower motor ground circuit CHA06 (YE/VT) is connected through one half of the blower motor resistor to circuit CHA08 (GN/OG). Circuit CHA08 (GN/OG) is connected through blower motor speed relay 2 to the blower motor resistor through circuit CHA07 (BU/GY). The blower resistor is grounded through circuit GD151 (BK/GN).

In MED-HI, blower motor relay 3 is grounded by the EMTC or EATC module through circuit CH113 (VT/GY). Blower motor ground circuit CHA06 (YE/VT) is connected through blower motor relay 3 to circuit CHA08 (GN/OG). Circuit CHA08 (GN/OG) is connected through one half of the blower motor resistor to the blower motor resistor to ground circuit GD151 (BK/GN).

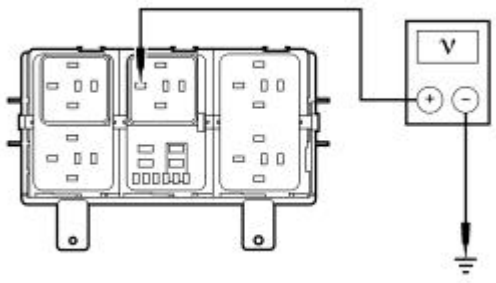
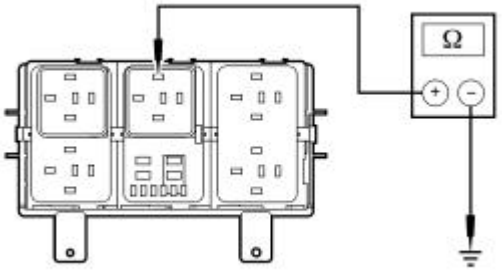
In HI, blower motor relays 2 and 3 are grounded by the EMTC or EATC module through circuit CH114 (GN/WH) and CH113 (VT/GY). Blower motor ground circuit CHA06 (YE/VT) is connected through blower motor speed relay 3 to circuit CHA08 (GN/OG). Circuit CHA08 (GN/OG) is connected through blower motor relay 2 to the blower motor resistor ground circuit GD151 (BK/GN) by circuit CHA07 (BU/GY).

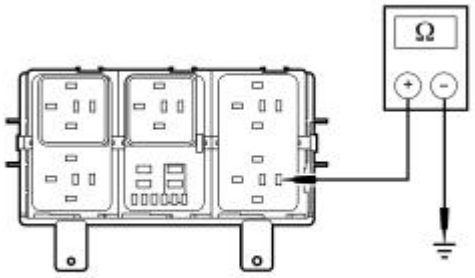
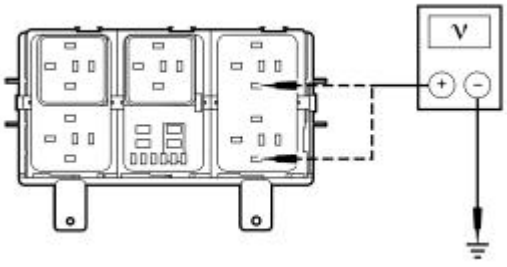
Possible Causes

- An open in circuit CH114 (GN/WH), CH113 (VT/GY), SBB11 (BU/RD), CHA08 (GN/OG), CHA07 (BU/GY) or CHA06 (YE/VT)
- A short to ground in circuit CH112 (VT/WH), CH114 (GN/WH), CH113 (VT/GY), CHA06 (YE/VT) or CHA08 (GN/OG)
- A short to voltage in circuit CHA05 (BN/WH)
- A short together in circuits CHA08 (GN/OG), CHA07 (BU/GY) and CHA06 (YE/VT)
- Auxiliary blower motor relay 1
- Auxiliary blower motor relay 3
- Auxiliary blower motor relay 2
- Auxiliary blower motor resistor
- EATC module
- EMTC module

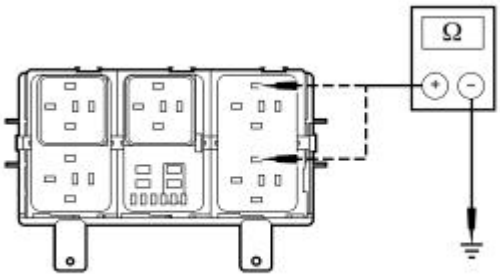
PINPOINT TEST S: THE AUXILIARY BLOWER MOTOR DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
S1 CHECK THE AUXILIARY BLOWER MOTOR OPERATION	
• Key in ON position. • Turn the auxiliary climate controls OFF. • **Is the auxiliary blower motor ON?**	**Yes** CARRY OUT the relay component test on the auxiliary blower motor relay 1. If OK, GO to S2 . **No** GO to S4 .
S2 CHECK CIRCUIT CHA05 (BN/WH) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Auxiliary Blower Motor C4106 (Expedition/Navigator) or C4334 (Expedition EL/Navigator L). • Disconnect: Auxiliary Blower Motor Relay 1 .	**Yes** REPAIR circuit CHA05 (BN/WH) for a short to voltage. TEST the system for normal operation.

• Key in ON position. • Measure the voltage between the auxiliary blower motor relay 1 socket pin 30, circuit CHA05 (BN/WH) and ground.  N0054733 • **Is voltage present?**	**No** GO to S3 .
S3 CHECK CIRCUIT CH112 (VT/WH) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: EATC C228b. • Measure the resistance between ground and auxiliary blower motor relay 1 socket pin 85, circuit CH112 (VT/WH).  N0054729 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S14 . **No** REPAIR circuit CH112 (VT/WH) for a short to ground. TEST the system for normal operation.
S4 CHECK THE AUXILIARY BLOWER MOTOR OPERATION	
• Select all auxiliary blower speeds. • **Is the auxiliary blower motor always 1 speed?**	**Yes** GO to S5 . **No** GO to S6 .
S5 CHECK CIRCUIT CHA06 (YE/VT) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Auxiliary Blower Motor Relay 3. • Disconnect: Auxiliary Blower Motor Resistor C4343 (Expedition/Navigator) or C4107 (Expedition EL/Navigator L). • Measure the resistance between auxiliary blower motor relay 3 socket pin 87, circuit CHA06 (YE/VT) and ground.	**Yes** GO to S14 . **No** REPAIR circuit CHA06 (YE/VT) for a short to ground. TEST the system for normal operation.

 N0054734 • **Is the resistance less than 5 ohms?**	
S6 CHECK THE AUXILIARY BLOWER MOTOR OPERATION • Select all auxiliary blower speeds. • **Is the auxiliary blower motor inoperative in any speed?**	**Yes** CARRY OUT the component test on the auxiliary blower motor resistor. If OK, REPAIR circuit CHA06 (YE/VT) for an open. TEST the system for normal operation. **No** CARRY OUT the relay component test on the auxiliary blower motor relay 2 and 3. If OK, GO to S7.
S7 CHECK CIRCUIT SBB11 (BU/RD) FOR VOLTAGE • Key in OFF position. • Disconnect: Auxiliary Blower Motor Speed Relay 2 and 3. • Key in ON position. • Measure the voltage between the auxiliary blower motor relay 2 and 3 socket pin 86, circuit SBB11 (BU/RD) and ground.  N0054735 • **Is the voltage greater than 10 volts?**	**Yes** GO to S8. **No** REPAIR circuit SBB11 (BU/RD) for an open. TEST the system for normal operation.

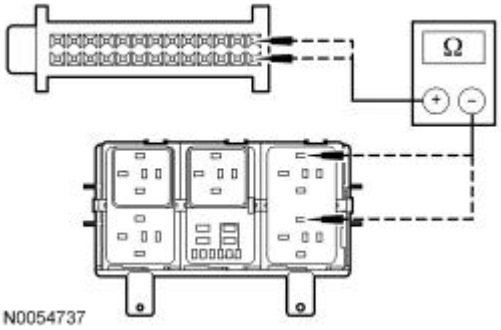
S8 CHECK CIRCUIT CH114 (GN/WH) AND CIRCUIT CH113 (VT/GY) FOR A SHORT TO GROUND
• Key in OFF position.
• Disconnect: EATC Module C228b or EMTC Module C294b.
• Measure the resistance between ground and:
  ▪ auxiliary blower motor relay 3 socket pin 85, circuit CH114 (GN/WH).
  ▪ auxiliary blower motor relay 2 socket pin 85, circuit CH113 (VT/GY).
	Yes
	GO to S9.
	
	No
	REPAIR circuit CH114 (GN/WH) or CH113 (VT/GY) for a short to ground. TEST the system for normal operation.



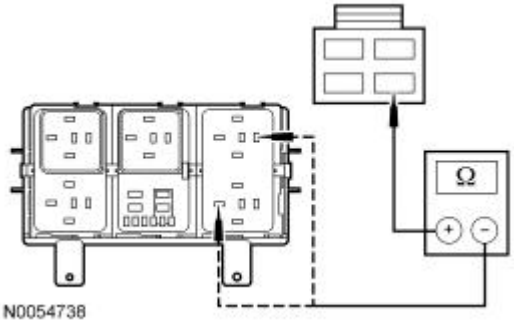
N0054736

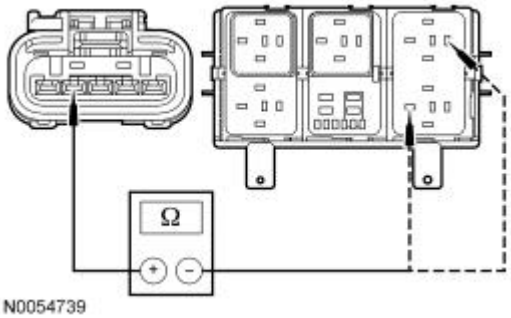
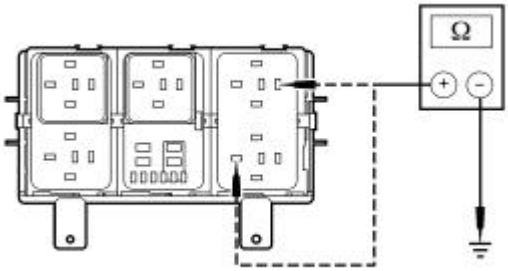
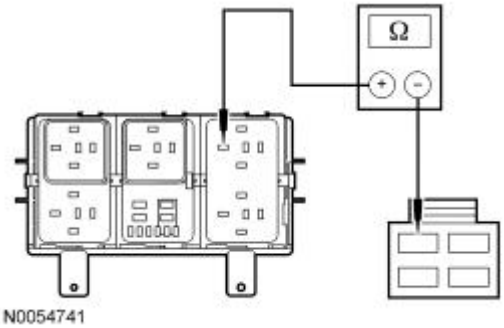
- **Are the resistances greater than 10,000 ohms?**

S9 CHECK CIRCUIT CH114 (GN/WH) AND CIRCUIT CH113 (VT/GY) FOR AN OPEN	

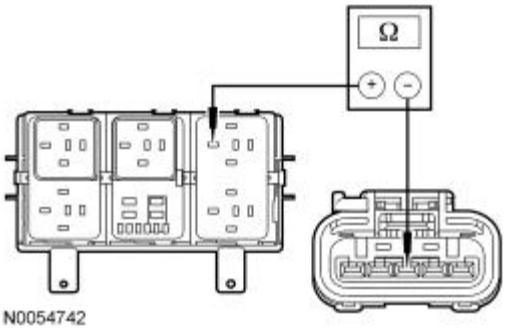
• Measure the resistance between:
  ▪ EATC module C228b-14 or EMTC module C294b-14, circuit CH114 (GN/WH) and auxiliary blower motor relay 3 socket pin 85, circuit CH114 (GN/WH).
  ▪ EATC module C228b-1 or EMTC module C294b-1, circuit CH113 (VT/GY) and auxiliary blower motor relay 2 socket pin 85, circuit CH113 (VT/GY).
 
 	
N0054737
• **Are the resistances less than 5 ohms?**
	Yes
	GO to S10 .
	
	No
	REPAIR circuit CH114 (GN/WH) or CH113 (VT/GY) for an open. TEST the system for normal operation.

S10 CHECK CIRCUIT CHA08 (GN/OG) FOR AN OPEN	

• Disconnect: Auxiliary Blower Motor Resistor C4343 (Expedition/Navigator) or C4107 (Expedition EL/Navigator L).
• **NOTE:** Expedition/Navigator only.
• Measure the resistance between auxiliary blower motor resistor C4343-3, circuit CHA08 (GN/OG) and:
  ▪ auxiliary blower motor relay 3 socket pin 30, circuit CHA08 (GN/OG).
  ▪ auxiliary blower motor relay 2 socket pin 87, circuit CHA08 (GN/OG).
 
 	
N0054738
• **NOTE:** Expedition EL/Navigator L only.
	Yes
	GO to S11 .
	
	No
	REPAIR circuit CHA08 (GN/OG) for an open. TEST the system for normal operation.

• Measure the resistance between auxiliary blower motor resistor C4107-4, circuit CHA08 (GN/OG) and: ▪ auxiliary blower motor relay 3 socket pin 30, circuit CHA08 (GN/OG). ▪ auxiliary blower motor relay 2 socket pin 87, circuit CHA08 (GN/OG).  N0054739 • **Are the resistances less than 5 ohms?**	
S11 CHECK CIRCUIT CHA08 (GN/OG) FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ▪ auxiliary blower motor relay 3 socket pin 30, circuit CHA08 (GN/OG). ▪ auxiliary blower motor relay 2 socket pin 87, circuit CHA08 (GN/OG).  N0054740 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S12 . **No** REPAIR circuit CHA08 (GN/OG) for a short to ground. TEST the system for normal operation.
S12 CHECK CIRCUIT CHA07 (BU/GY) FOR AN OPEN	
• **NOTE:** Expedition/Navigator only. • Measure the resistance between auxiliary blower motor resistor C4343-2, circuit CHA07 (BU/GY) and auxiliary blower motor relay 2 socket pin 30, circuit CHA07 (BU/GY).  N0054741 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between auxiliary blower motor resistor C4107-3, circuit CHA07 (BU/GY) and auxiliary	**Yes** GO to S13 . **No** REPAIR circuit CHA07 (BU/GY) for an open. TEST the system for normal operation.

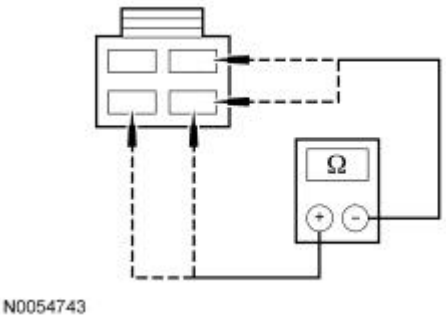
blower motor relay 2 socket pin 30, circuit CHA07 (BU/GY).



- **Is the resistance less than 5 ohms?**

S13 CHECK CIRCUITS CHA08 (GN/OG), CHA07 (BU/GY) AND CHA06 (YE/VT) FOR A SHORT TOGETHER

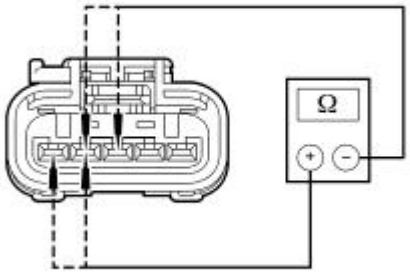
- **NOTE:** Expedition/Navigator only.
- Measure the resistance between auxiliary blower motor resistor :
  - C4343-1, circuit CHA06 (YE/VT) and auxiliary blower motor resistor C4343-3, circuit CHA08 (GN/OG).
  - C4343-1, circuit CHA06 (YE/VT) and auxiliary blower motor resistor C4343-2, circuit CHA07 (BU/GY).
  - C4343-3, circuit CHA08 (GN/OG) and auxiliary blower motor resistor C4343-2, circuit CHA07 (BU/GY).



- **NOTE:** Expedition EL/Navigator L only.
- Measure the resistance between auxiliary blower motor resistor :
  - C4107-5, circuit CHA06 (YE/VT) and auxiliary blower motor resistor C4107-4, circuit CHA08 (GN/OG).
  - C4107-5, circuit CHA06 (YE/VT) and auxiliary blower motor resistor C4107-3, circuit CHA07 (BU/GY).
  - C4107-4, circuit CHA08 (GN/OG) and auxiliary blower motor resistor C4107-3, circuit CHA07 (BU/GY).

Yes
REPAIR circuit CHA06 (YE/VT) for an open between auxiliary blower motor relay 3 and the auxiliary blower motor resistor. TEST the system for normal operation.

No
REPAIR circuit CHA08 (GN/OG), CHA07 (BU/GY) or CHA06 (YE/VT) for a short together. TEST the system for normal operation.

 N0054744 • **Are the resistances greater than 10,000 ohms?**	
S14 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test T: The Temperature Control is Inoperative/Does Not Operate Correctly Using the Front/Rear Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the temperature door actuator clockwise, the electronic manual temperature control (EMTC) or electronic automatic temperature control (EATC) module supplies voltage to the auxiliary temperature door actuator through the circuit CH233 (VT/BN), and supplies ground through circuit CH234 (YE/GN). To rotate the auxiliary temperature door actuator counterclockwise, the EMTC or EATC module reverses the voltage and ground circuits.

The auxiliary temperature door actuator feedback resistor is supplied a ground from the EMTC or EATC module through circuit RH111 (GY/BU) and a 5-volt reference voltage on circuit LH111 (BN/WH). The EMTC or EATC module reads the voltage on the auxiliary temperature door actuator feedback circuit VH439 (GY/VT) to determine the auxiliary temperature door actuator position by the position of the actuator feedback resistor wiper arm.

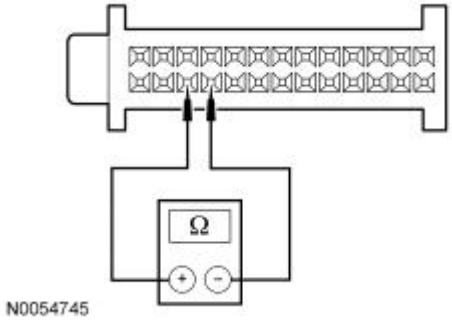
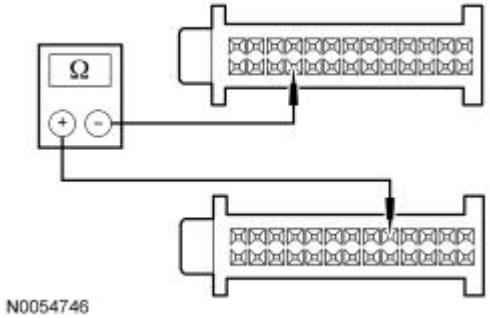
The auxiliary temperature control is supplied a 5-volt reference through circuit LH111 (BN/WH) and ground through circuit RH111 (GY/BU). When the temperature control is adjusted, the EMTC or EATC receives the signal through circuit VHA15 (YE/GY).

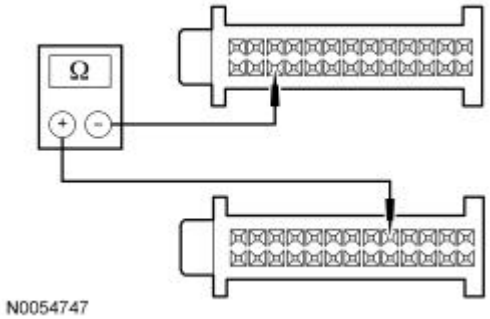
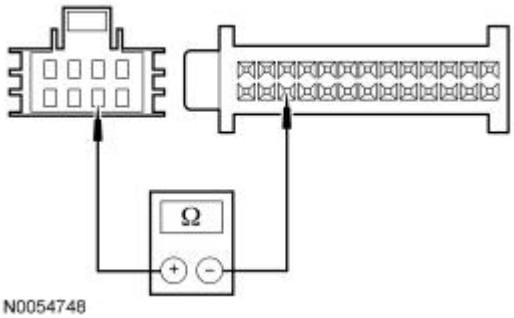
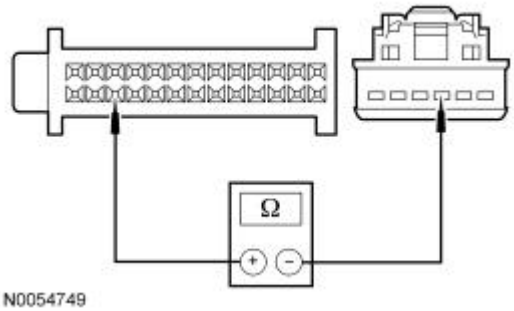
Possible Causes

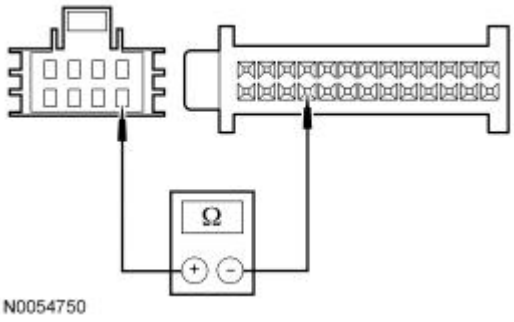
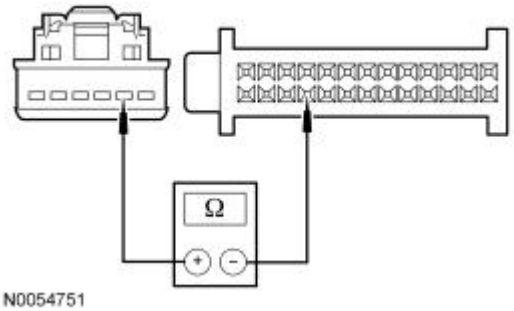
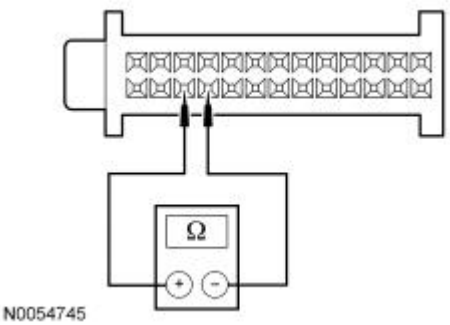
- An open, short to voltage, ground or together in circuits CH233 (VT/BN), CH234 (YE/GN), RH111

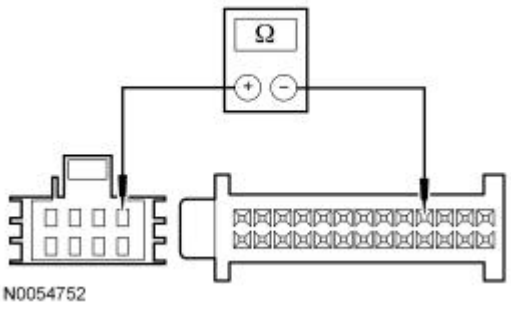
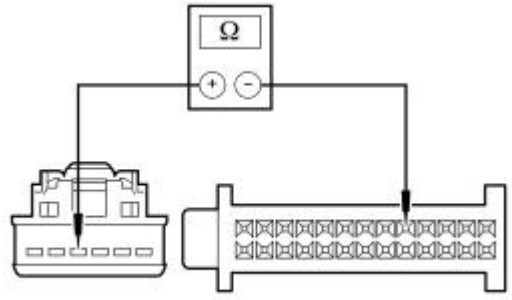
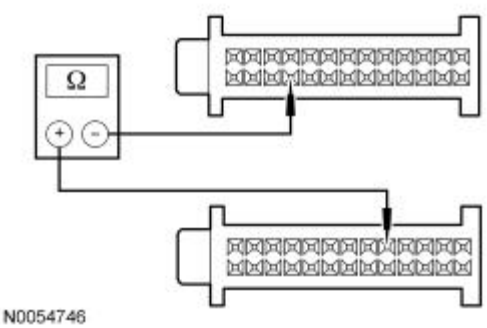
(GY/BU), LH111 (BN/WH) and VH439 (GY/VT)
- A short to ground in circuits CH233 (VT/BN), CH234 (YE/GN), LH111 (BN/WH) and VH439 (GY/VT)
- A short to voltage in circuits CH233 (VT/BN), CH234 (YE/GN), RH111 (GY/BU) and VH439 (GY/VT)
- A short together in circuits CH233 (VT/BN), CH234 (YE/GN), RH111 (GY/BU), LH111 (BN/WH) and VH439 (GY/VT)
- Auxiliary temperature door actuator
- EATC module
- Stuck or bound linkage or door

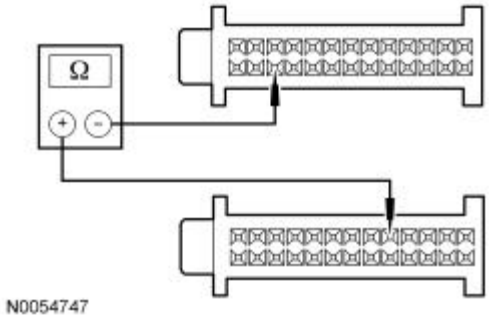
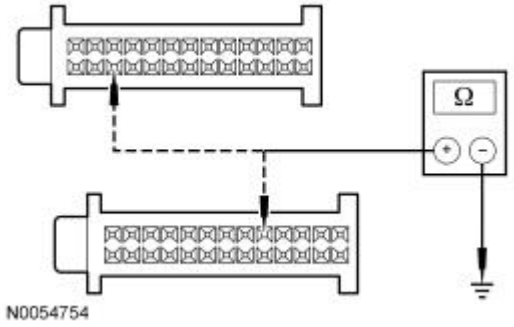
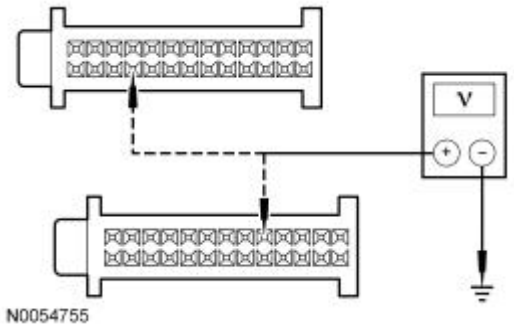
PINPOINT TEST T: THE TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY USING THE FRONT/REAR AUXILIARY CLIMATE CONTROLS

Test Step	Result / Action to Take
T1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE - Disconnect: EATC Module C228a or EMTC Module C294a. - Disconnect: EATC Module C228b or EMTC Module C294b. - Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). - Disconnect: Auxiliary Climate Controls C3198. - Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054745 - **Is the resistance between 8,400 and 12,600 ohms?**	**Yes** GO to T2. **No** If the resistance is greater than 12,600 ohms, GO to T4. If the resistance is less than 8,400 ohms, GO to T6.
T2 CHECK THE POTENTIOMETER LOW SIDE RESISTANCE - Measure the resistance between EATC module C228a-10 or EMTC module C294a-10 or EMTC module C294b-18, circuit RH111 (GY/BU) and EATC module C228b-18, circuit VH439 (GY/VT).  N0054746	**Yes** GO to T3. **No** If the resistance is greater than 10,250 ohms, GO to T7. If the resistance is less than 250 ohms, GO to T8.

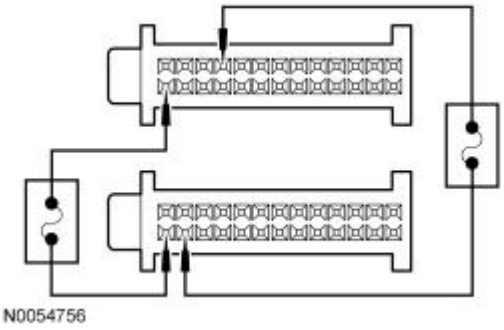
• **Is the resistance between 250 and 10,250 ohms?**	
T3 CHECK THE POTENTIOMETER HIGH SIDE RESISTANCE	
• Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT).  N0054747 • **Is the resistance between 250 and 10,250 ohms?**	**Yes** GO to T10 . **No** If the resistance is greater than 10,250 ohms, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the resistance is less than 250 ohms, GO to T9 .
T4 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • **NOTE:** Expedition/Navigator only. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and auxiliary temperature door actuator C3004-6, circuit LH111 (BN/WH).  N0054748 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and auxiliary temperature door actuator C4341-3, circuit LH111 (BN/WH).  N0054749 • **Is the resistance less than 5 ohms?**	**Yes** GO to T5 . **No** REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T5 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• **NOTE:** Expedition/Navigator only.	**Yes**

• Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and auxiliary temperature door actuator C3004-5, circuit RH111 (GY/BU).  N0054750 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and auxiliary temperature door actuator C4341-2, circuit RH111 (GY/BU).  N0054751 • **Is the resistance less than 5 ohms?**	INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T6 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR A SHORT TOGETHER	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054745 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T7 CHECK CIRCUIT VH439 (GY/VT) FOR AN OPEN	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • **NOTE:** Expedition/Navigator only. • Measure the resistance between EATC module C228b-18	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal

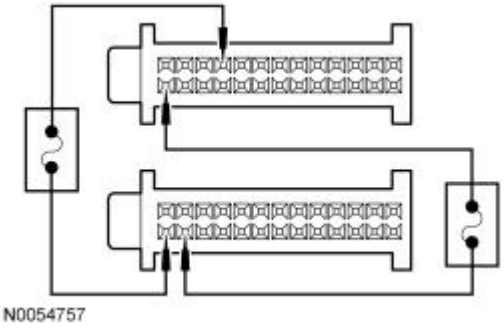
or EMTC module C294b-18, circuit VH439 (GY/VT) and auxiliary temperature door actuator C3004-1, circuit VH439 (GY/VT).  N0054752 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT) and auxiliary temperature door actuator C4341-4, circuit VH439 (GY/VT).  N0054753 • **Is the resistance less than 5 ohms?**	operation. **No** REPAIR circuit VH439 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T8 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH439 (GY/VT)	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT).  N0054746 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T9 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH439 (GY/VT)	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal

EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT).  N0054747 • **Is the resistance greater than 10,000 ohms?**	operation. **No** REPAIR circuit LH111 (BN/WH) and circuit VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T10 CHECK CIRCUIT LH111 (BN/WH) OR CIRCUIT VH439 (GY/VT) FOR A SHORT TO GROUND	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Measure the resistance between ground and the following: ▪ EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH). ▪ EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT).  N0054754 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to T11 . **No** REPAIR circuit LH111 (BN/WH) or circuit VH439 (GY/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T11 CHECK CIRCUIT RH111 (GY/BU) OR CIRCUIT VH439 (GY/VT) FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between ground and the following: ▪ EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU). ▪ EATC module C228b-18 or EMTC module C294b-18, circuit VH439 (GY/VT).  N0054755 • **Are voltages present?**	**Yes** REPAIR circuit RH111 (GY/BU) or VH439 (GY/VT) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to T12 .

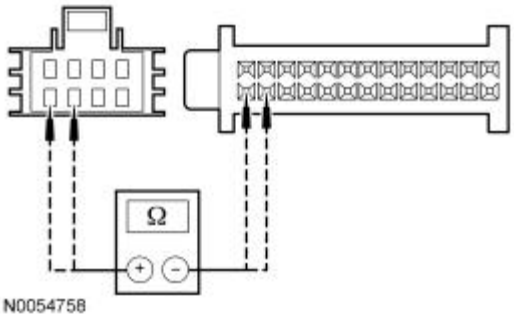
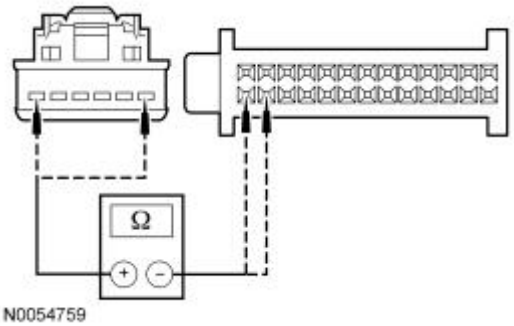
T12 CHECK THE DOOR ACTUATOR CLOCKWISE OPERATION	

• Key in OFF position.
• Connect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L).
• Remove the door actuator and disengage the actuator driveshaft from the actuator door.
• Mark the door actuator driveshaft position.
• Key in ON position.
• Connect a fused jumper wire between:
  ▪ EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN).
  ▪ EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN).
 
N0054756
• **Does the actuator motor move in the clockwise direction?**
	Yes
	GO to T13 .
	
	No
	GO to T14 .

T13 CHECK THE DOOR ACTUATOR COUNTERCLOCKWISE OPERATION	

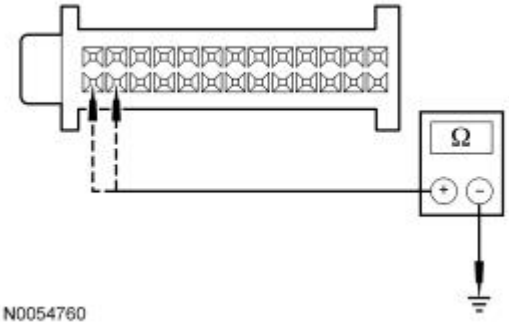
• Connect a fused jumper wire between:
  ▪ EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN).
  ▪ EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN).
 
N0054757
• **Does the actuator motor move in the counterclockwise direction?**
	Yes
	INSPECT for binding or broken door and linkage. If no condition is found, GO to T18 .
	
	No
	GO to T14 .

T14 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN	
• Disconnect: Auxiliary Temperature Door Actuator C3004	**Yes**

(Expedition/Navigator) or C4341 (Expedition EL/Navigator L).
• **NOTE:** Expedition/Navigator only.
• Measure the resistance between EATC module:
  ▪ C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN) and auxiliary temperature door actuator C3004-8, circuit CH233 (VT/BN).
  ▪ C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN) and auxiliary temperature door actuator C3004-7, circuit CH234 (YE/GN).
 
 	
N0054758
• **NOTE:** Expedition EL/Navigator L only.
• Measure the resistance between EATC module:
  ▪ C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN) and auxiliary temperature door actuator C4341-6, circuit CH233 (VT/BN).
  ▪ C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN) and auxiliary temperature door actuator C4341-1, circuit CH234 (YE/GN).
 
 	
N0054759
• **Are the resistances less than 5 ohms?**
	GO to T15 .
	
	No
	REPAIR the circuit CH233 (VT/BN) or circuit CH234 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

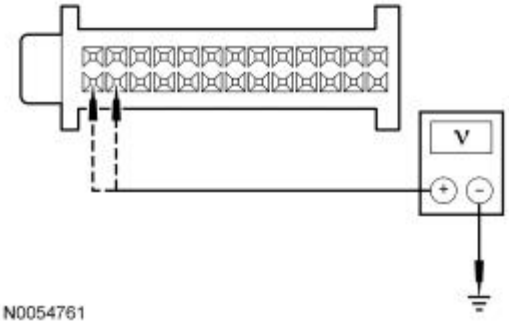
T15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND	

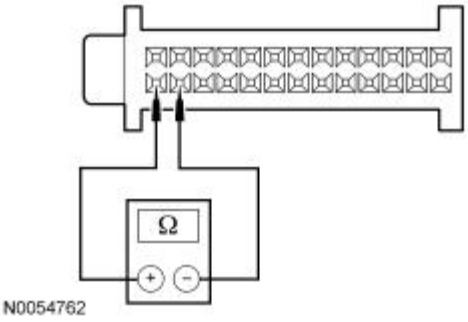
• Measure the resistance between ground and EATC module:
  ▪ C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN).
  ▪ C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN).
	Yes
	GO to T16 .
	
	No
	REPAIR the circuit CH233 (VT/BN) or circuit CH234 (YE/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



- **Are the resistances greater than 10,000 ohms?**

T16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and EATC module:
  ▪ C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN).
  ▪ C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN).
 
 	
• **Is voltage present?**
	Yes
	REPAIR the circuit CH233 (VT/BN) or CH234 (YE/GN) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
	
	No
	GO to T17 .

T17 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER	
• Key in OFF position. • Measure the resistance between EATC module C228b-12 or EMTC module C294b-12, circuit CH234 (YE/GN) and EATC module C228b-13 or EMTC module C294b-13, circuit CH233 (VT/BN).  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit CH233 (VT/BN) or CH234 (YE/GN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
T18 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC only. • Carry out the EATC on-demand self test.	**Yes** For EATC systems, INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation.

• Operate the system. • **Does the concern return?**	For EMTC systems, Go To Pinpoint Test v **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test U: The Panel/Floor Control is Inoperative/Does Not Operate Correctly Using the Front/Rear Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the mode door actuator clockwise, the electronic manual temperature control (EMTC) or electronic automatic temperature control (EATC) module supplies voltage to the auxiliary panel/floor door actuator through the circuit CH207 (BU/GY), and supplies ground through circuit CH208 (GN/OG). To rotate the auxiliary panel/floor door actuator counterclockwise, the EMTC or EATC module reverses the voltage and ground circuits.

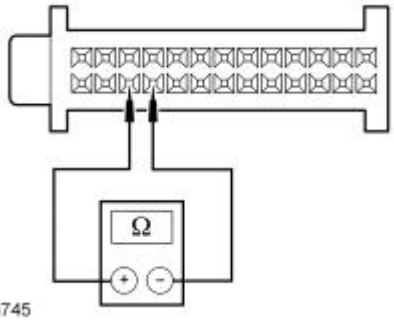
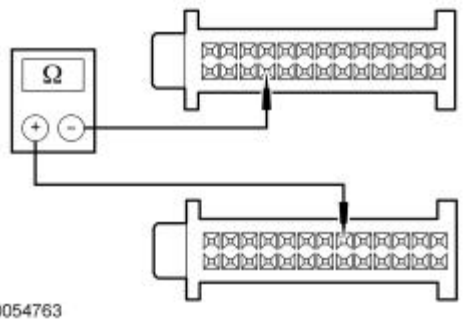
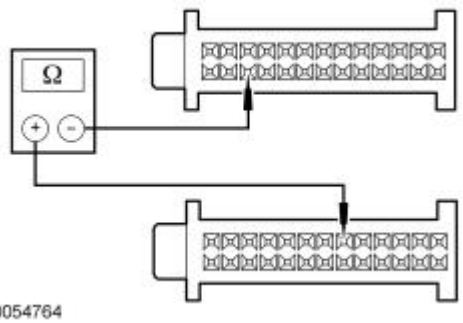
The auxiliary panel/floor door actuator feedback resistor is supplied a ground from the EMTC or EATC module through circuit RH111 (GY/BU) and a 5-volt reference voltage on circuit LH111 (BN/WH). The EMTC or EATC module reads the voltage on the auxiliary panel/floor door actuator feedback circuit VH438 (GN/VT) to determine the auxiliary panel/floor door actuator position by the position of the actuator feedback resistor wiper arm.

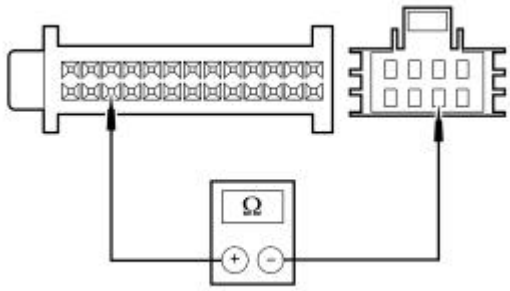
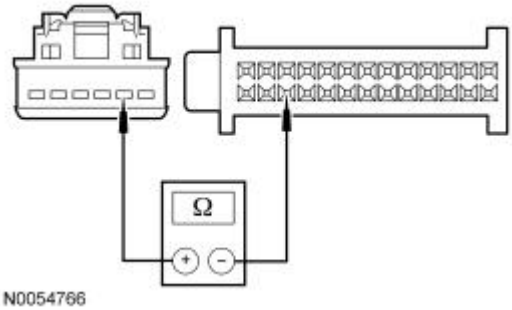
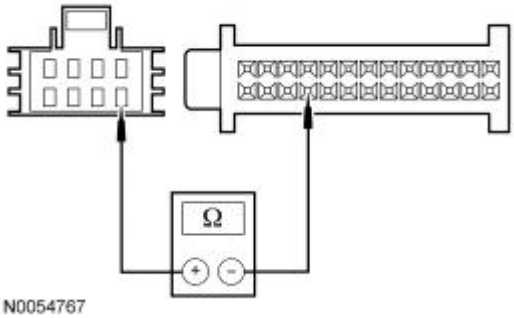
The auxiliary panel/floor control is supplied a 5-volt reference through circuit LH111 (BN/WH) and ground through circuit RH111 (GY/BU). When the panel/floor control is adjusted, the EMTC or EATC receives the signal through circuit VHA15 (YE/GY).

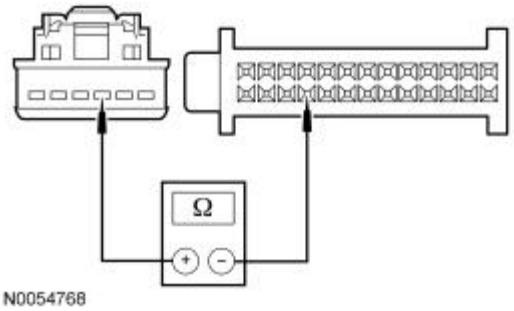
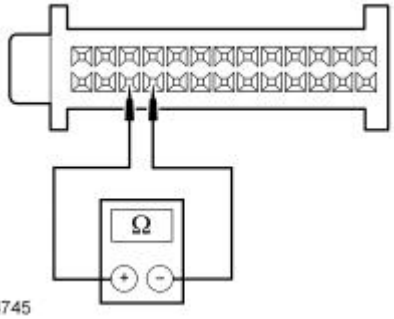
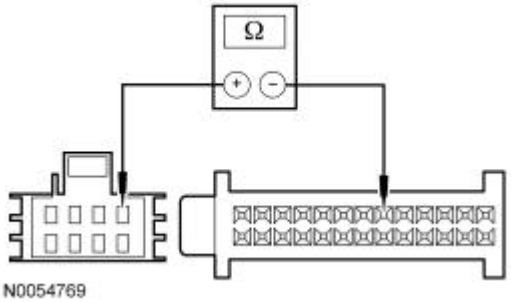
Possible Causes

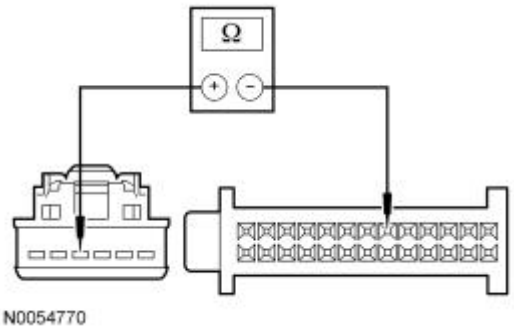
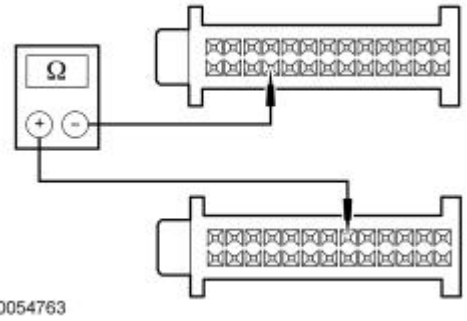
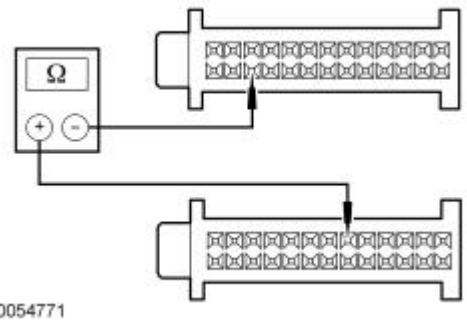
- An open, short to voltage, ground or together in circuits CH207 (BU/GY), CH208 (GN/OG), RH111 (GY/BU), LH111 (BN/WH) and VH438 (GN/VT)
- A short to ground in circuits CH207 (BU/GY), CH208 (GN/OG), LH111 (BN/WH) and VH438 (GN/VT)
- A short to voltage in circuits CH207 (BU/GY), CH208 (GN/OG), RH111 (GY/BU) and VH438 (GN/VT)
- A short together in circuits CH207 (BU/GY), CH208 (GN/OG), RH111 (GY/BU), LH111 (BN/WH) and VH438 (GN/VT)
- Auxiliary panel/floor door actuator
- EATC module
- Stuck or bound linkage or door

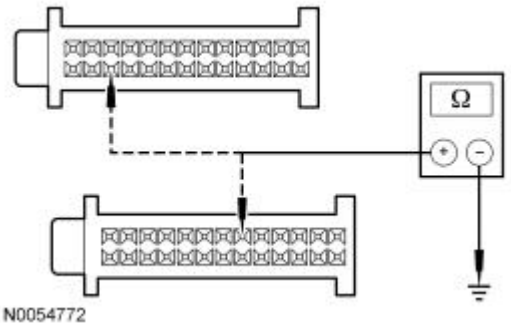
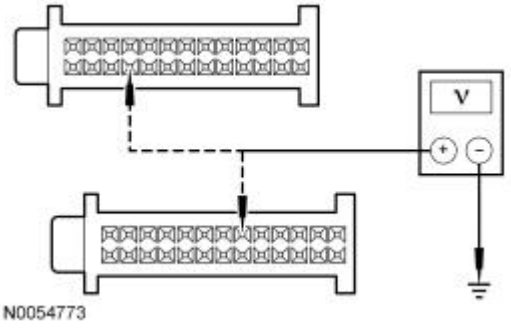
PINPOINT TEST U: THE PANEL/FLOOR CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY USING THE FRONT/REAR AUXILIARY CLIMATE CONTROLS

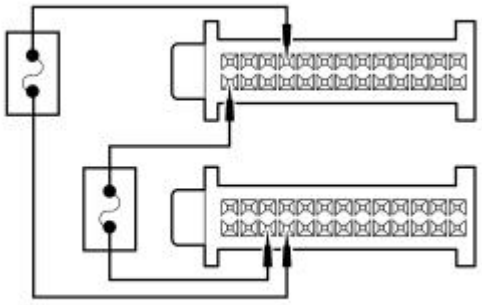
Test Step	Result / Action to Take
U1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE	
• Disconnect: EATC Module C228a or EMTC Module C294a. • Disconnect: EATC Module C228b or EMTC Module C294b. • Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Disconnect: Auxiliary Climate Controls C3198. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054745 • **Is the resistance between 8,400 and 12,600 ohms?**	**Yes** GO to U2 . **No** If the resistance is greater than 12,600 ohms, GO to U4 . If the resistance is less than 8,400 ohms, GO to U6 .
U2 CHECK THE POTENTIOMETER LOW SIDE RESISTANCE	
• Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054763 • **Is the resistance between 250 and 10,250 ohms?**	**Yes** GO to U3 . **No** If the resistance is greater than 10,250 ohms, GO to U7 . If the resistance is less than 250 ohms, GO to U8 .
U3 CHECK THE POTENTIOMETER HIGH SIDE RESISTANCE	
• Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054764	**Yes** GO to U10 . **No** If the resistance is greater than 10,250 ohms, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the resistance is less than 250 ohms, GO to U9 .

• **Is the resistance between 250 and 10,250 ohms?**	
U4 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • **NOTE:** Expedition/Navigator only. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and auxiliary panel/floor door actuator C3044-6, circuit LH111 (BN/WH).  N0054765 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and auxiliary panel/floor door actuator C4342-2, circuit LH111 (BN/WH).  N0054766 • **Is the resistance less than 5 ohms?**	**Yes** GO to U5 . **No** REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
U5 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN	
• **NOTE:** Expedition/Navigator only. • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and auxiliary panel/floor door actuator C3044-5, circuit RH111 (GY/BU).  N0054767 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

auxiliary panel/floor door actuator C4342-3, circuit RH111 (GY/BU).  N0054768 • **Is the resistance less than 5 ohms?**	
U6 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR A SHORT TOGETHER	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU).  N0054745 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
U7 CHECK CIRCUIT VH438 (GN/VT) FOR AN OPEN	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • **NOTE:** Expedition/Navigator only. • Measure the resistance between EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT) and auxiliary panel/floor door actuator C3044-1, circuit VH438 (GN/VT).  N0054769 • **NOTE:** Expedition EL/Navigator L only. • Measure the resistance between EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT) and auxiliary panel/floor door actuator C4342-4, circuit VH438	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit VH438 (GN/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

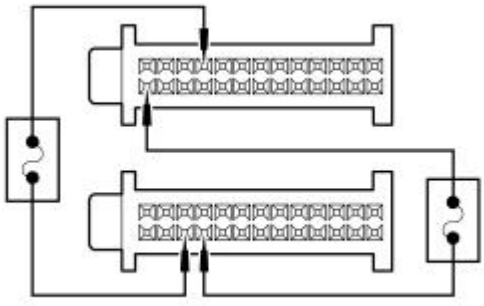
(GN/VT).  N0054770 • **Is the resistance less than 5 ohms?**	
U8 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH438 (GN/VT)	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU) and EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054763 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit RH111 (GY/BU) and circuit VH438 (GN/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
U9 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH438 (GN/VT)	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Measure the resistance between EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH) and EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054771 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit LH111 (BN/WH) and circuit VH438 (GN/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
U10 CHECK CIRCUIT LH111 (BN/WH) OR CIRCUIT VH438 (GN/VT) FOR A SHORT TO GROUND	
• Disconnect: Auxiliary Panel/Floor Door Actuator C3044	**Yes**

(Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Measure the resistance between ground and the following: ▪ EATC module C228a-11 or EMTC module C294a-11, circuit LH111 (BN/WH). ▪ EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054772 • **Are the resistances greater than 10,000 ohms?**	GO to U11 . **No** REPAIR circuit LH111 (BN/WH) or circuit VH438 (GN/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
U11 CHECK CIRCUIT RH111 (GY/BU) OR CIRCUIT VH438 (GN/VT) FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between ground and the following: ▪ EATC module C228a-10 or EMTC module C294a-10, circuit RH111 (GY/BU). ▪ EATC module C228b-19 or EMTC module C294b-19, circuit VH438 (GN/VT).  N0054773 • **Are voltages present?**	**Yes** REPAIR circuit RH111 (GY/BU) or circuit VH438 (GN/VT) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to U12 .
U12 CHECK THE DOOR ACTUATOR CLOCKWISE OPERATION	
• Key in OFF position. • Connect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Remove the door actuator and disengage the actuator driveshaft from the actuator door. • Mark the door actuator driveshaft position. • Key in ON position. • Connect a fused jumper wire between: ▪ EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY). ▪ EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG).	**Yes** GO to U13 . **No** GO to U14 .


N0054774

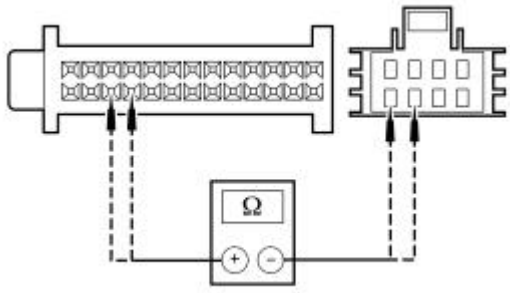
- **Does the actuator motor move in the clockwise direction?**

U13 CHECK THE DOOR ACTUATOR COUNTERCLOCKWISE OPERATION	

• Connect a fused jumper wire between:
  ▪ EATC module C228a-23 or EMTC module C294a-23, circuit GD133 (BK) and EATC module C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY).
  ▪ EATC module C228a-13 or EMTC module C294a-13, circuit SBP15 (WH/RD) and EATC module C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG).
 
N0054775
• **Does the actuator motor move in the counterclockwise direction?**
	Yes
	INSPECT for binding or broken door and linkage. If no condition is found, GO to U18 .
	
	No
	GO to U14 .

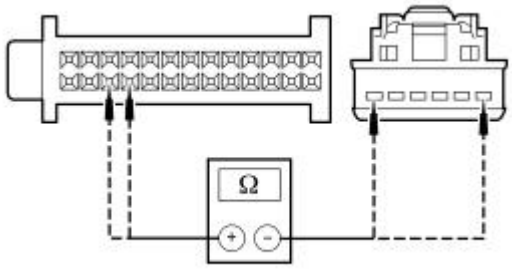
U14 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN	

• Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L).
• **NOTE:** Expedition/Navigator only.
• Measure the resistance between EATC module:
  ▪ C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY) and auxiliary panel/floor door actuator C3044-8, circuit CH207 (BU/GY).
  ▪ C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG) and auxiliary panel/floor door actuator C3044-7, circuit CH208 (GN/OG).
	Yes
	GO to U15 .
	
	No
	REPAIR the circuit CH207 (BU/GY) or CH208 (GN/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



N0054776

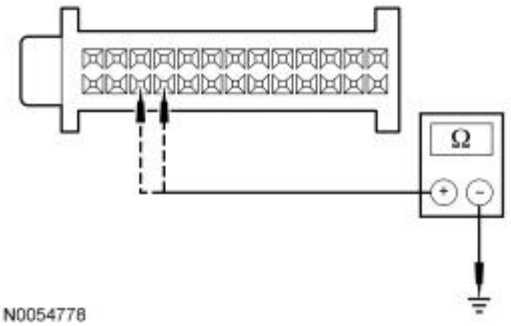
- **NOTE:** Expedition EL/Navigator L only.
- Measure the resistance between EATC module:
  - C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY) and auxiliary panel/floor door actuator C4342-1, circuit CH207 (BU/GY).
  - C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG) and auxiliary panel/floor door actuator C4342-6, circuit CH208 (GN/OG).



N0054777

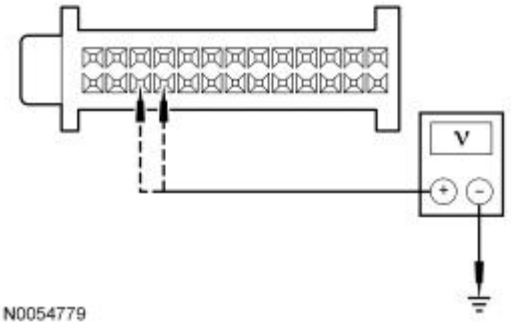
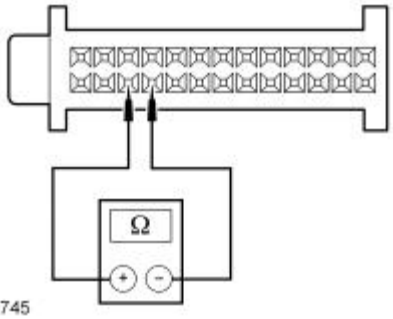
- **Are the resistances less than 5 ohms?**

U15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO GROUND	

• Measure the resistance between ground and EATC module:
  ▪ C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY).
  ▪ C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG).
 
 	
N0054778
• **Are the resistances greater than 10,000 ohms?**
	Yes
	GO to U16 .
	
	No
	REPAIR the circuit CH207 (BU/GY) or CH208 (GN/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

U16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TO POWER	

• Key in ON position.
• Measure the voltage between ground and EATC module:
  ▪ C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY).
  ▪ C228b-10 or EMTC module C294b-10, circuit CH208
	Yes
	REPAIR the circuit CH207 (BU/GY) or CH208 (GN/OG) for a short to power. CLEAR the DTCs. REPEAT the self-

(GN/OG).  N0054779 • **Is voltage present?**	test. TEST the system for normal operation. **No** GO to U17 .
U17 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR A SHORT TOGETHER	
• Key in OFF position. • Measure the resistance between EATC module C228b-10 or EMTC module C294b-10, circuit CH208 (GN/OG) and EATC module C228b-11 or EMTC module C294b-11, circuit CH207 (BU/GY).  N0054745 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. TEST the system for normal operation. **No** REPAIR circuits CH207 (BU/GY) and CH208 (GN/OG) for a short together. TEST the system for normal operation.
U18 CHECK THE MODULE CONNECTION	
• Carry out the Electronic Automatic Temperature Control (EATC) Module and Electronic Manual Temperature Control (EMTC) Module Cold Boot Process. • **NOTE:** EATC only. • Carry out the EATC on-demand self test. • Operate the system. • **Does the concern return?**	**Yes** EATC systems, INSTALL a new EATC module. REFER to Section 412-01 . TEST the system for normal operation. EMTC systems, Go To Pinpoint Test v **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test V: The Temperature, Panel/Floor and Blower Motor Controls are Inoperative/Do Not Operate Correctly Using the Front/Rear Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the panel/floor and cool/warm signal is received by the electronic manual temperature control (EMTC) or electronic automatic temperature control (EATC) module from the rear auxiliary control through circuit VHA15 (YE/GY). The blower speed signal is received by the EMTC or EATC from the rear auxiliary control through circuit VHA17 (VT/GN). Reference voltage for the auxiliary controls signal resistor is provided by the EMTC or EATC module through circuit LH111 (BN/WH). Ground for the auxiliary controls signal resistor is provided by the EMTC or EATC module through circuit RH111 (GY/BU).

The control is supplied a 5-volt reference through circuit LH111 (BN/WH) and ground through circuit RH111 (GY/BU). When the temperature control is adjusted, the EMTC or EATC receives the signal through circuit VHA15 (YE/GY).

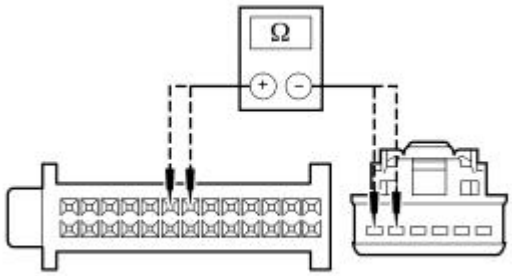
Possible Causes

- An open in circuit RH111 (GY/BU), VHA15 (YE/GY), VHA17 (VT/GN) or LH111 (BN/WH)
- A short to ground in circuit VHA15 (YE/GY), VHA17 (VT/GN) or LH111 (BN/WH)
- A short to voltage in circuit VHA15 (YE/GY), VHA17 (VT/GN) or RH111 (GY/BU)
- A short together circuits RH111 (GY/BU) and VHA15 (YE/GY), VHA17 (VT/GN) or LH111 (BN/WH)
- Rear auxiliary control
- EATC module
- EMTC module

PINPOINT TEST V: THE TEMPERATURE, PANEL/FLOOR AND BLOWER MOTOR CONTROLS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY USING THE FRONT/REAR AUXILIARY CLIMATE CONTROLS

Test Step	Result / Action to Take
V1 CHECK EMTC/EATC DTCS	
• Key in ON position. • Check for EMTC/EATC DTCs. • **Is DTC B2918 or B2919 present?**	**Yes** One DTC present, GO to V2 . Both DTCs present, GO to V5 . **No** GO to V7 .
V2 CHECK CIRCUIT VHA15 (YE/GY) OR CIRCUIT VHA17 (VT/GN) FOR AN OPEN	

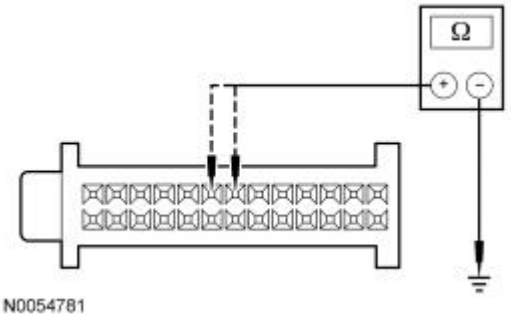
• Key in OFF position.
• Disconnect: Auxiliary Controls C3198.
• Disconnect: EATC Module C228b or EMTC Module C294b.
• Measure the resistance between EATC module:
  ▪ (DTC B2918 only) C228b-21, circuit VHA15 (YE/GY) and auxiliary controls C3198-5, circuit VHA15 (YE/GY).
  ▪ (DTC B2919 only) C228b-20, circuit VHA17 (VT/GN) and auxiliary controls C3198-6, circuit VHA17 (VT/GN).
	Yes
	GO to V3 .
	
	No
	REPAIR circuit VHA15 (YE/GY) or circuit VHA17 (VT/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.



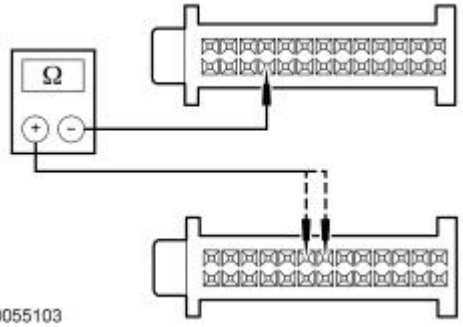
N0054780

- **Are the resistances less than 5 ohms?**

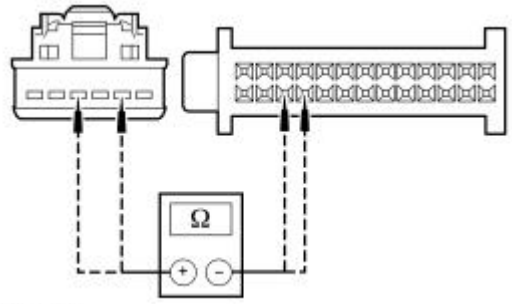
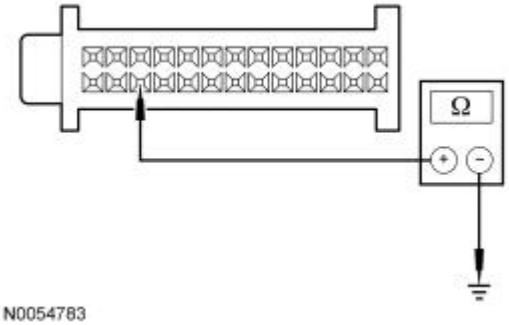
V3 CHECK CIRCUIT VHA15 (YE/GY) OR CIRCUIT VHA17 (VT/GN) FOR A SHORT TO GROUND	

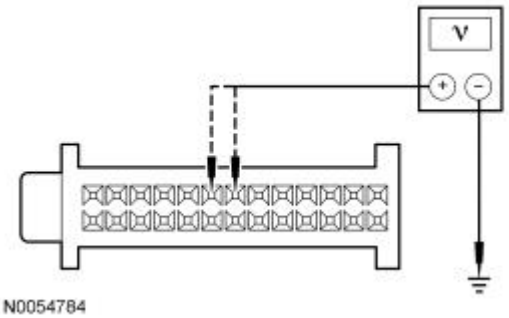
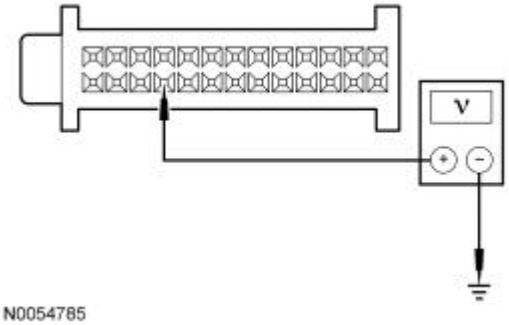
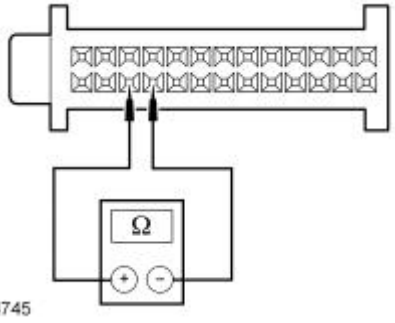
• Measure the resistance between ground and:
  ▪ (DTC B2918 only) EMTC module C294b-21or EATC module C228b-21, circuit VHA15 (YE/GY).
  ▪ (DTC B2919 only) EMTC module C294b-20 or EATC module C228b-20, circuit VHA17 (VT/GN).
 
 	
N0054781
• **Are the resistances greater than 10,000 ohms?**
	Yes
	GO to V4 .
	
	No
	REPAIR circuit VHA15 (YE/GY) or circuit VHA17 (VT/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

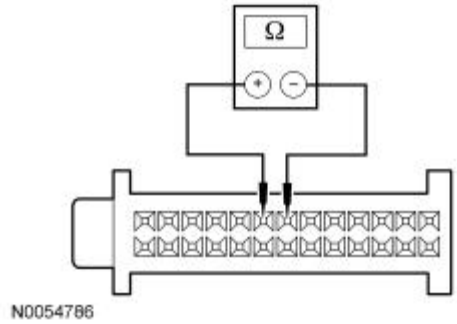
V4 CHECK CIRCUIT VHA15 (YE/GY) OR CIRCUIT VHA17 (VT/GN) FOR A SHORT TO CIRCUIT RH111 (GY/BU)	

• Measure the resistance between EMTC module C294a-10 or EATC module C228a-10, circuit RH111 (GY/BU) and:
  ▪ (DTC B2918 only) EMTC module C294b-21 or EATC module C228b-21, circuit VHA15 (YE/GY).
  ▪ (DTC B2919 only) EMTC module C294b-20 or EATC module C228b-20, circuit VHA17 (VT/GN).
 
 	
N0055103
• **Are the resistances greater than 10,000 ohms?**
	Yes
	INSTALL a new EATC or EMTC module. REFER to Section 412-01 . TEST the system for normal operation.
	
	No
	REPAIR circuit VHA15 (YE/GY) or circuit VHA17 (VT/GN) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

V5 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: Auxiliary Controls C3198. • Disconnect: EATC Module C228a or C244a.	**Yes** GO to V6 .

• Measure the resistance between: ▪ EMTC module C294a-11 or EATC module C228a-11, circuit LH111 (BN/WH) and auxiliary controls C3198-4, circuit LH111 (BN/WH). ▪ EMTC module C294a-10 or EATC module C228a-10, circuit RH111 (GY/BU) and auxiliary controls C3198-2, circuit RH111 (GY/BU).  N0054782 • **Is the resistance greater than 10,000 ohms?**	**No** REPAIR circuit RH111 (GY/BU) or circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
V6 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO GROUND	
• Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Measure the resistance between ground and EMTC module C294a-11 or EATC module C228a-11, circuit LH111 (BN/WH).  N0054783 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to V7 . **No** REPAIR circuit LH111 (BN/WH) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
V7 CHECK CIRCUIT VHA15 (YE/GY) AND CIRCUIT VHA17 (VT/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Auxiliary Controls C3198. • Disconnect: EATC Module C228b or EMTC Module C294b. • Key in ON position. • Measure the voltage between: ▪ EMTC module C294b-20 or EATC module C228b-20, circuit VHA17 (VT/GN). ▪ EMTC module C294b-21 or EATC module C228b-21, circuit VHA15 (YE/GY).	**Yes** REPAIR circuit VHA15 (YE/GY) or circuit VHA17 (VT/GN) for a short to voltage. TEST the system for normal operation. **No** GO to V8 .

 N0054784 • **Are voltages present?**	
V8 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Auxiliary Temperature Door Actuator C3004 (Expedition/Navigator) or C4341 (Expedition EL/Navigator L). • Disconnect: Auxiliary Panel/Floor Door Actuator C3044 (Expedition/Navigator) or C4342 (Expedition EL/Navigator L). • Key in ON position. • Measure the voltage between ground and EMTC module C294a-10 or EATC module C228a-10, circuit RH111 (GY/BU).  N0054785 • **Is voltage present?**	**Yes** REPAIR circuit RH111 (GY/BU) for a short to voltage. TEST the system for normal operation. **No** GO to V9 .
V9 CHECK CIRCUIT RH111 (GY/BU) AND CIRCUIT LH111 (BN/WH) FOR A SHORT TOGETHER	
• Key in OFF position. • Measure the resistance between EMTC module C294a-11 or EATC module C228a-11, circuit LH111 (BN/WH) and EMTC module C294a-10 or EATC module C228a-10, circuit RH111 (GY/BU).  N0054745 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to V10 . **No** REPAIR circuit RH111 (GY/BU) and circuit LH111 (BN/WH) for a short together. TEST the system for normal operation.
V10 CHECK CIRCUIT VHA15 (YE/GY) AND CIRCUIT VHA17 (VT/GN) FOR A SHORT TOGETHER	
• Measure the resistance between EMTC module C294b-21 or EATC module C228b-21, circuit VHA15 (YE/GY) and EMTC	**Yes** INSTALL a new auxiliary

module C294b-20 or EATC module C228b-20, circuit VHA17 (VT/GN).  • **Is the resistance greater than 10,000 ohms?**	control. TEST the system for normal operation. **No** REPAIR circuit VHA15 (YE/GY) and circuit VHA17 (VT/GN) for a short together. TEST the system for normal operation.

Pinpoint Test W: DTC B1676 — Battery Voltage Out of Range

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

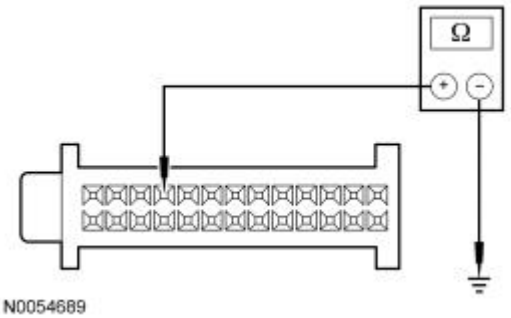
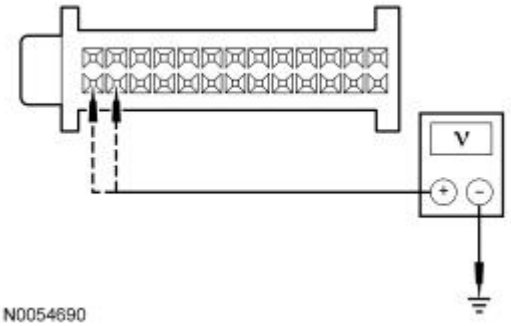
Under normal operation, the EMTC or EATC module receives a ground through circuit GD133 (BK). The EMTC or EATC module is supplied constant battery voltage through circuit SBP15 (WH/RD) and ignition switched voltage through circuit CBP37 (WH).

Possible Causes

- Fuse(s)
- An open in circuit GD133 (BK), SBP15 (WH/RD) or CBP37 (WH)
- EATC module
- EMTC module

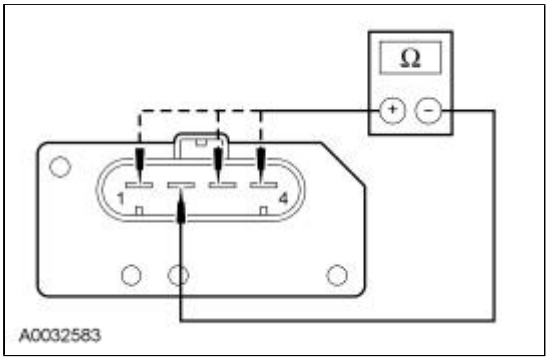
PINPOINT TEST W: DTC B1676 — BATTERY VOLTAGE OUT OF RANGE

Test Step	Result / Action to Take
W1 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a or EMTC C294a. • Measure the resistance between EMTC C294a-23 or EATC module C228a-23, circuit GD133 (BK) and ground.	**Yes** GO to W2 . **No** REPAIR circuit GD133 (BK). TEST the system for normal operation.

 N0054689 • **Is the resistance less than 5 ohms?**	
W2 CHECK CIRCUIT SBP15 (WH/RD) AND CIRCUIT CBP37 (WH) FOR AN OPEN	
• Key in ON position. • Measure the voltage between EMTC module C294a-13 or EATC module C228a-13, circuit SBP15 (WH/RD), EMTC module C294a-12 or EATC module C228a-12, circuit CBP37 (WH) and ground.  N0054690 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new EMTC or EATC module. TEST the system for normal operation. **No** If DTC B1676 is present in mutiple modules, refer to section Section 414-00 . If DTC B1676 is present only in the EMTC or EATC module, VERIFY smart junction box (SJB) fuse 15 (10A) and fuse 37 (10A) is OK. If OK, REPAIR circuit SBP15 (WH/RD) or CBP37 (WH) for an open. TEST the system for normal operation.

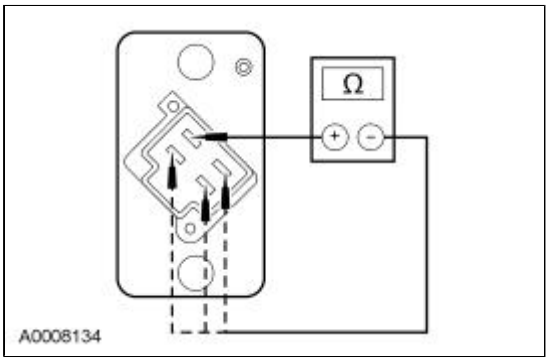
Component Tests

Resistor — Blower Motor



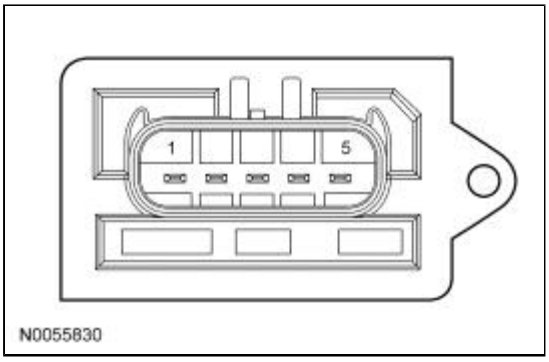
Blower Motor Resistor Pins	Resistance
4 and 2	2.1-2.6 ohms
2 and 3	0.3-0.4 ohms
2 and 1	0.9-1.0 ohms

Resistor — Auxiliary Blower Motor (Expedition/Navigator)



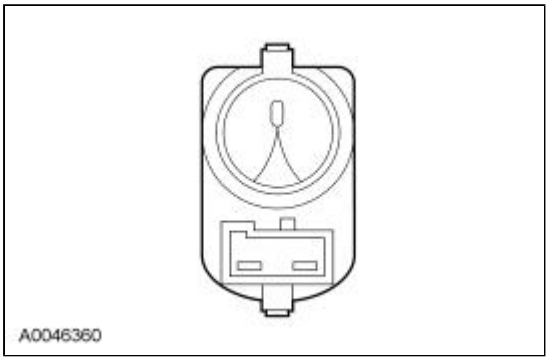
Blower Motor Resistor Pins	Resistance
4 and 2	0 ohms
4 and 3	0.3-0.4 ohms
4 and 1	1.4-1.7 ohms
3 and 1	1.1-1.4 ohms

Resistor — Auxiliary Blower Motor (Expedition EL/Navigator L)



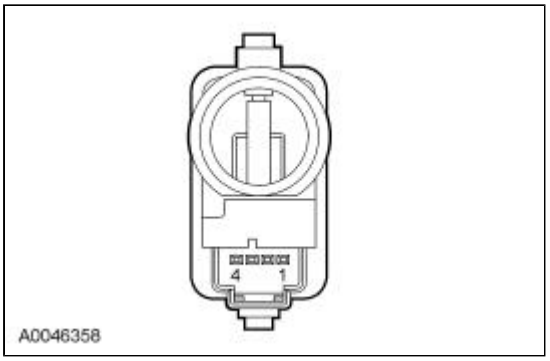
Blower Motor Resistor Pins	Resistance
2 and 3	0 ohms
2 and 4	0.3-0.4 ohms
2 and 2	1.4-1.7 ohms
4 and 5	1.1-1.4 ohms

Temperature Sensor — In-Vehicle, Expedition



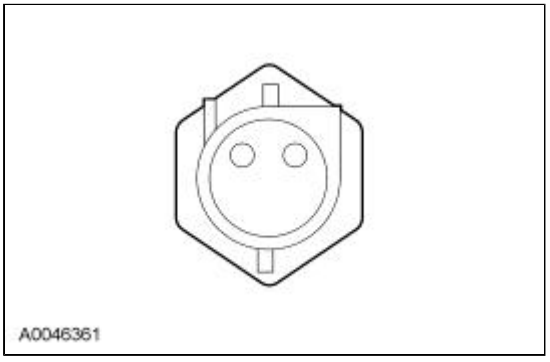
Temperature	Resistance
10-20°C (50-68°F)	37,000-58,000 ohms
20-30°C (68-86°F)	24,000-37,000 ohms
30-40°C (86-104°F)	16,000-24,000 ohms

Temperature Sensor — In-Vehicle, Navigator



Temperature	Resistance between pins 1 and 3
10-20°C (50-68°F)	37,000-58,000 ohms
20-30°C (68-86°F)	24,000-37,000 ohms
30-40°C (86-104°F)	16,000-24,000 ohms

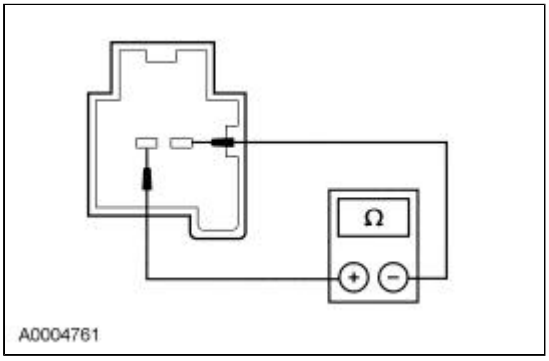
Temperature Sensor — Ambient



Ambient Temperature	Resistance
10-20°C (50-68°F)	37,000-58,000 ohms
20-30°C (68-86°F)	24,000-37,000 ohms

30-40°C (86-104°F)	16,000-24,000 ohms

Temperature Sensor — Evaporator Discharge



Ambient Temperature	Resistance
-40°C (-40°F)	832,591-1,017,523 ohms
-20°C (-4°F)	263,111-290,807 ohms
0°C (32°F)	91,058-100,644 ohms
20°C (68°F)	35,473-39,207 ohms
25°C (77°F)	28,500-31,500 ohms
40°C (104°F)	15,307-16,919 ohms
60°C (140°F)	7,171-7,925 ohms
100°C (212°F)	1,976-2,184 ohms
120°C (248°F)	1,131-1,251 ohms

Heater Core

WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with the vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

1. **NOTE:** Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

   Inspect for evidence of coolant leakage at the heater hose to heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

2. **NOTE:** Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the heater hose connection and damage the heater core.

   Check the integrity of the heater hose clamps.

Heater Core — Plugged

WARNING: The heater core inlet hose will become too hot to handle if the system is working correctly.

1. Check to see that the engine coolant is at the correct level.

2. Start the engine and turn on the heater.

3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot.

4. If the outlet only is not hot:
   - the heater core may have an air pocket.
   - the heater core may be plugged.

5. If the inlet only is not hot:
   - the thermostat may not be working correctly.

Heater Core — Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

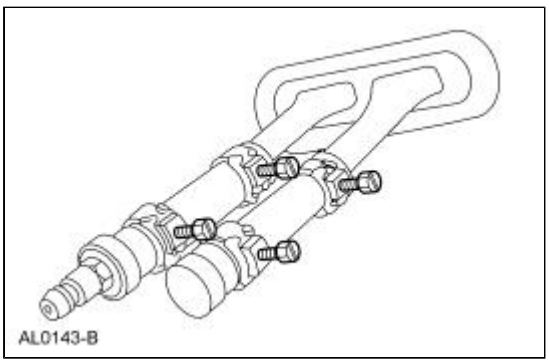
1. **NOTE:** Due to space limitations, a bench test may be necessary for pressure testing.

   Drain the coolant from the cooling system.

2. Disconnect the heater hoses from the heater core.

3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube.

4. Fill the heater core and heater hoses with water and install the plug BT-7422-B and the adapter BT-7422-A from the Pressure Test Kit. Secure the heater hoses, plug and adapter with hose clamps.



5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.

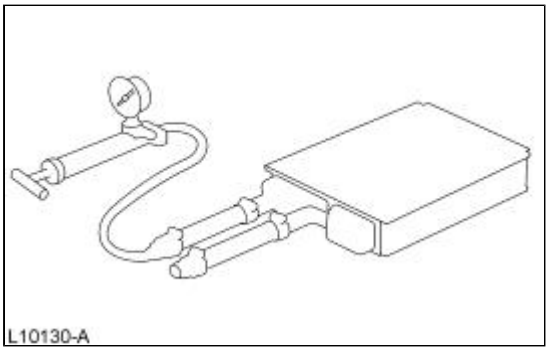
6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core.

7. Observe the pressure gauge for a minimum of 3 minutes.

8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the vehicle and carry out the bench test.

Heater Core — Bench Test

1. Remove the heater core from the vehicle.
2. Drain all of the coolant from the heater core.
3. Connect the 101 mm (4 in) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter.
4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water.
5. If a leak is observed, install a new heater core.



Evaporator/Condenser Core — On-Vehicle Leak Test

1. Discharge and recover the refrigerant. Refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.
2. Disconnect the suspect evaporator core or condenser core from the A/C system.
3. Clean the manifold fittings.
4. Connect the appropriate test fittings from the A/C Fittings Set to the condenser or evaporator core tube connections.
5. **NOTE:** The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter that will activate the valve. The test is not valid if the shut-off valve does not open.

   Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.
6. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set low pressure gauge indicates 101 kPa (30 in-Hg). The 45-minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.
7. If the low pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves

and observe the low pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.

8. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
    - If the low pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
    - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
    - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.
    - If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.

9. If the evaporator core or condenser core does leak, as verified by the above procedure, install a new evaporator core or condenser core.

A/C Compressor — External Leak Test

1. Install the A/C Pressure Test Adapter on the port of the A/C compressor, using the existing manifold retaining bolt.

2. Connect the high and low pressure lines of a manifold gauge set or a refrigerant recovery/recycling station such as the R-134a A/C service center to the corresponding fittings on the A/C Pressure Test Adapter.

3. Attach the center hose of a manifold gauge set to a refrigerant container standing in an upright position.

4. Hand-rotate the compressor shaft 10 complete revolutions to distribute the oil inside the A/C compressor.

5. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.

6. Using the Refrigerant Leak Detector, check for leaks at the compressor shaft.

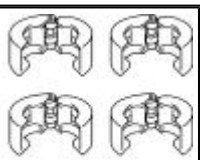
7. If a shaft seal leak is found, install a new compressor shaft seal. If an external leak is found, install a new A/C compressor.

8. When the leak test is complete, recover the refrigerant from the compressor.

Spring Lock Coupling

Printable View (186 KB)

Special Tool(s)

 ST2352-A	Remover, Refrigerant Coupling Spring 412-039 (T84L-19623-B)

Material

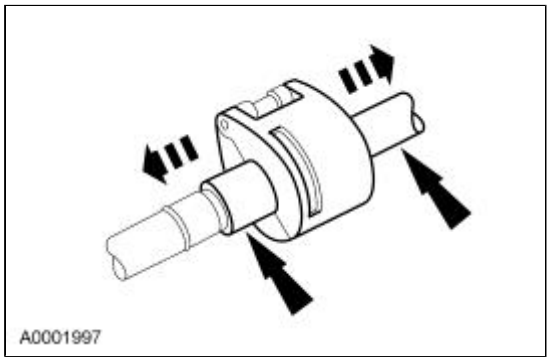
Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Disconnect

1. Remove the spring lock coupling clip, if equipped.

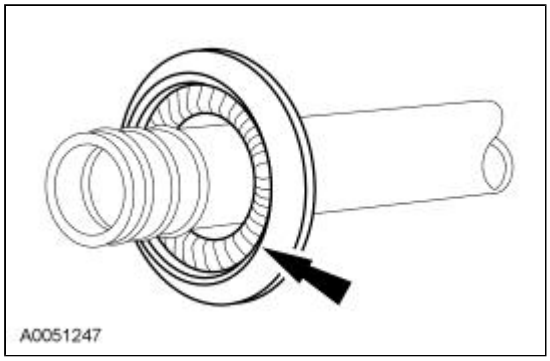
2. **CAUTION: Do not use metal tools to remove the O-ring seals. They can cause axial scratches across the O-ring seal grooves, resulting in refrigerant leaks.**

   Push the tool into the cage opening to release the female fitting from the spring lock coupling spring and pull the fitting apart.
   - Remove the O-ring seals using a non-metallic tool.



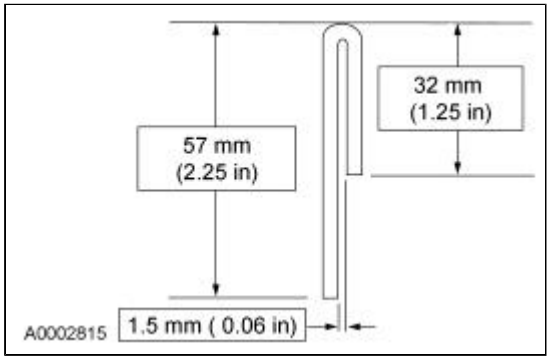
3. **CAUTION: Do not use a screwdriver or similar tool to remove the A/C tube lock coupling spring; this can cause axial scratches across the O-ring seal grooves resulting in refrigerant leaks.**

   Remove the spring lock coupling spring with a small hooked wire.



Cleaning

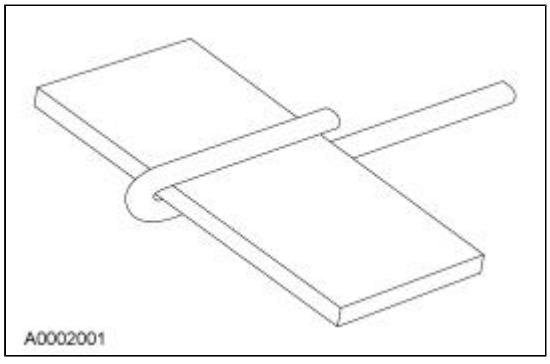
1. Fabricate a cleaning tool from a 1/8 inch diameter brazing rod.



2. Cut an abrasive pad from maroon colored 3M Scotch Brite® with the dimensions corresponding to the coupling size.

Coupling Size	Pad Size
3/8 in	25 x 50 mm (1 x 2 in)
1/2 in	25 x 50 mm (1 x 2 in)
5/8 in	25 x 76 mm (1 x 3 in)
3/4 in	25 x 102 mm (1 x 4 in)

3. Assemble the pad to the tool.

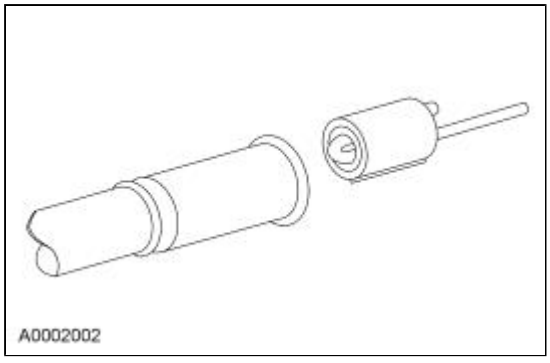


4. Coat the abrasive pad with mineral oil.

5. Roll the pad on the tool and install it in a variable speed drill motor.

6. **CAUTION: Maintain low speed drill rotation when inserting or removing the cleaning tool to prevent axial scratches which may cause future leaks.**

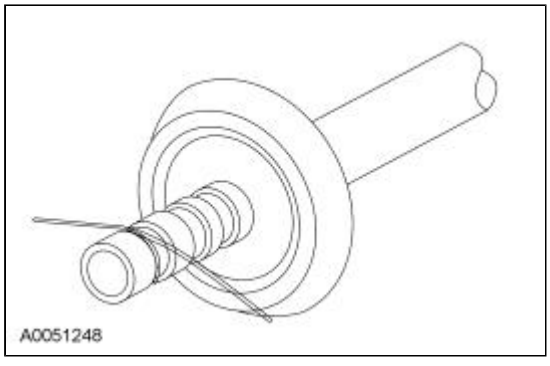
   Polish for one minute at moderate speed (less than 1,500 rpm) or until the surface is clean and free of scratches or foreign material.



7. Clean the fitting with a lint-free cloth.

8. Inspect the surface for grooves or scratches. If grooves and scratches are still present, install a new component.

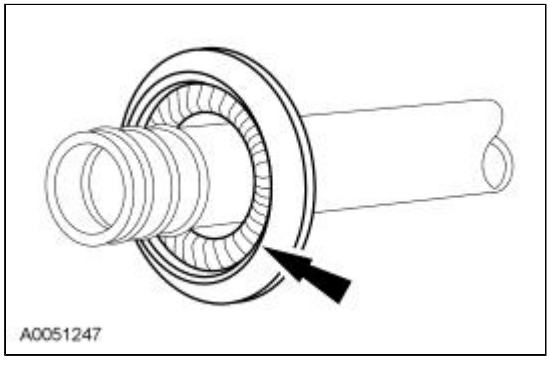
9. Clean the O-ring seal grooves with a 300 mm (12 in) length of natural fiber string.
   - Loop the string around the grooves and pull the string back and forth.



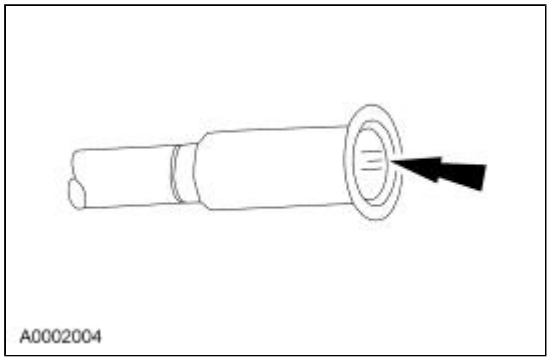
10. Remove any foreign material from the grooves with a lint-free cloth.

Connect

1. Install the spring lock coupling spring.

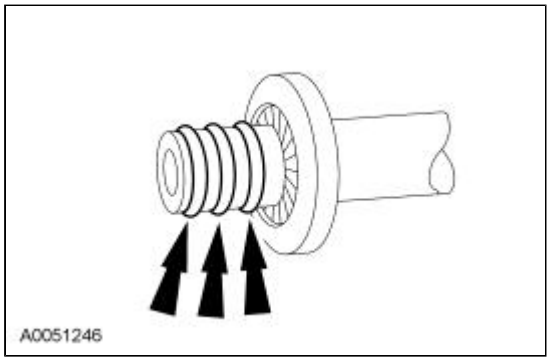


2. Lubricate the inside of the coupling with PAG oil.

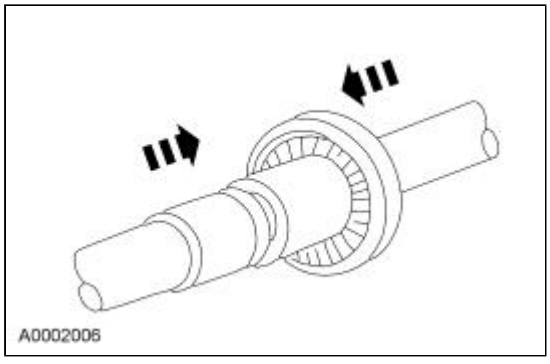


3. **CAUTION: Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Master Parts Catalog may result in intermittent leakage during vehicle operation.**

   Install the O-ring seals.



4. Connect the spring lock coupling fittings with a twisting motion until the spring lock coupling spring snaps over the flared end of the female fitting.



5. Install the spring lock coupling clip.

Heater Hose Coupling

Printable View (136 KB)

Special Tool(s)

ST1648-A	Remover, Heater Hose Inlet Tube 412-042 (T85T-18539-AH)

Disconnect

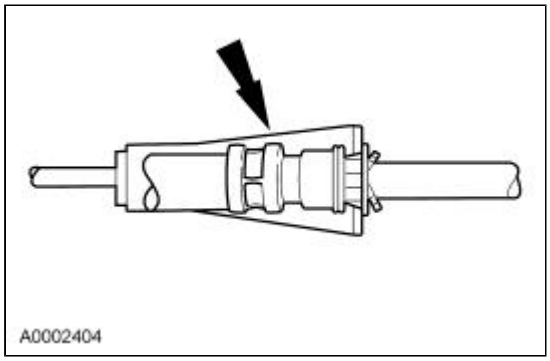
1. **WARNING: The engine must be off, fully cool and the cooling system fully depressurized before attempting to disconnect any heater water hoses. Failure to comply with this warning can result in serious injury or burns from hot liquid escaping out of the engine cooling system.**

   Depressurize the engine cooling system.

2. Push the heater water hose toward the tube to fully expose the locking tabs.

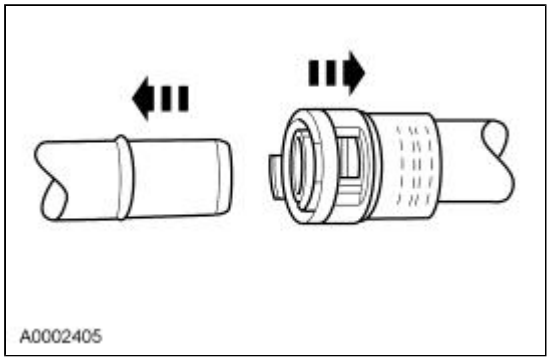
3. **NOTE:** When compressing the white coupling retainer, the Heater Hose Disconnect Tool must be perpendicular to and on the highest point of the coupling.

   Push the special tool over the coupling retainer windows to compress the retainer locking tabs.

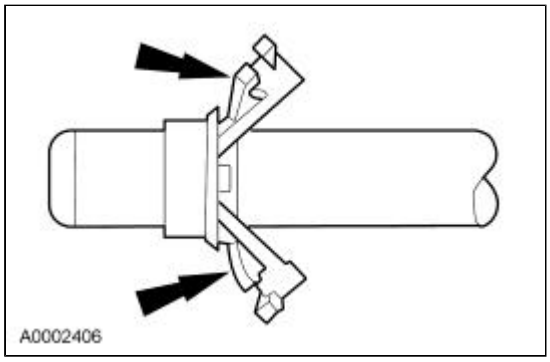


4. **NOTE:** A slight twisting motion while pulling on the heater water hose may be necessary to assist in the removal.

   Pull the heater water hose away from the heater core tube.



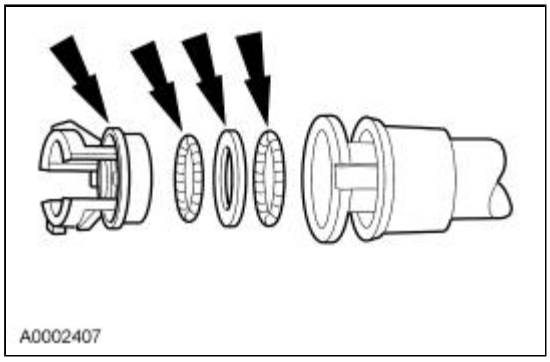
5. Plug the heater water hose.
6. Remove the white coupling retainer from the tube.
7. Spread the retainer tabs apart and slide the retainer off the tube.



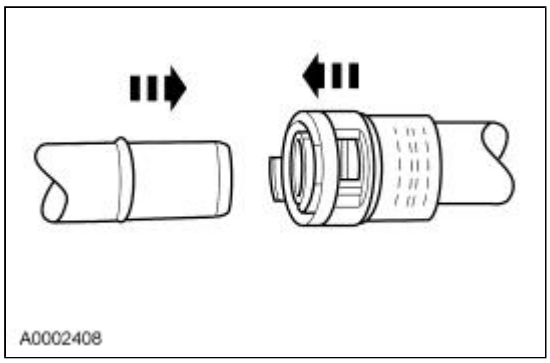
8. Discard the retainer.

Connect

1. Clean the tubes and lubricate with MERPOL® meeting Ford specification ESE-M99B144-B or plain water.
2. Install a new coupling retainer, spacer, and lubricated O-ring seals into the quick disconnect coupling housing.



3. Push the heater water hose with a quick disconnect coupling onto the tube.

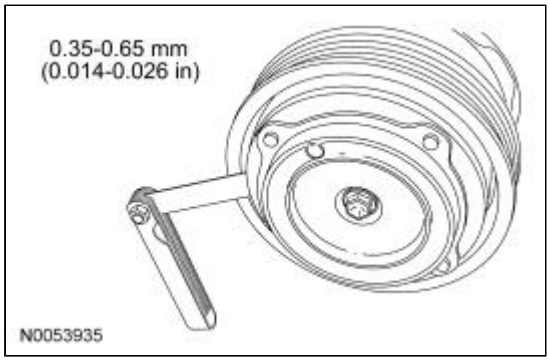


4. Make sure the coupling is fully engaged by lightly pulling on the heater water hose.

Air Conditioning (A/C) Clutch Air Gap Adjustment

Printable View (91 KB)

1. Check the A/C clutch air gap at 3 equally spaced places between the clutch plate and the A/C clutch pulley.



2. Remove the clutch plate. Add or remove spacers between the clutch plate hub and the compressor shaft until the clearance is within specification.

Electronic Leak Detection

Printable View (119 KB)

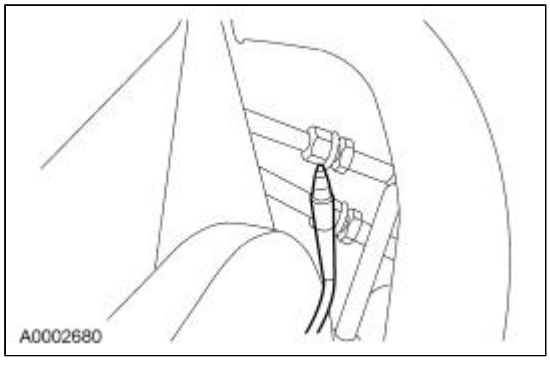
Special Tool(s)

ST2351-A	H10PM Refrigerant Leak Detector With Battery 216-00001 or equivalent

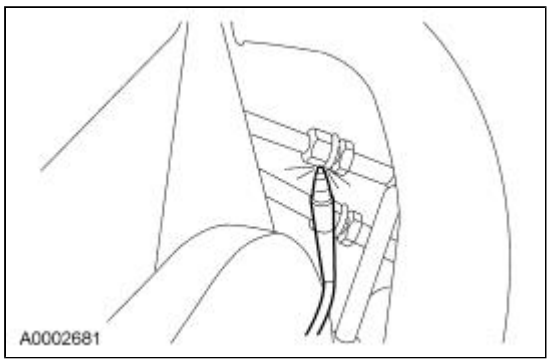
CAUTION: Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner or other cleaning solvents can cause the same problem. Using a fan to ventilate the area to be tested before proceeding with the leak detection procedure is helpful in removing small traces of contamination from the air, but the fan should be turned off during actual testing.

1. **NOTE:** The system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

   Leak test the refrigerant system using the leak detector. Follow the instructions included with the leak detector for handling and operation techniques.

   
   A0002680

2. If a leak is found, recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.
   - Repair the system.
   - Test the system for normal operation.

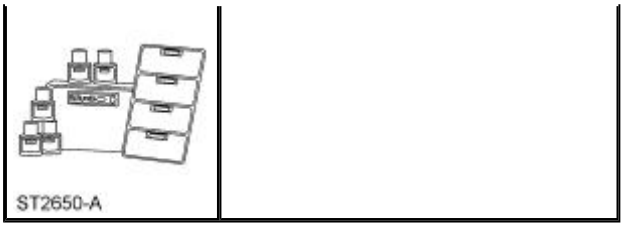

A0002681

Fluorescent Dye Leak Detection

Printable View (212 KB)

Special Tool(s)

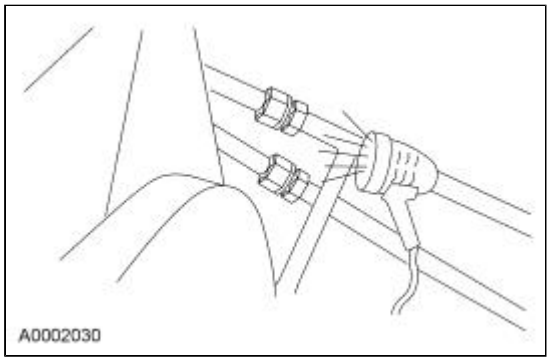
ST2738-A	R-134a Refrigerant Center 176-00002 or equivalent
ST2739A	R-134a Refrigerant Center 023-00174 or equivalent
ST1928-A	R-134a Manifold Gauge Set 023-00047 or equivalent
ST1261-A	120 Watt UV Spot Lamp 164-R0721 or equivalent
ST2651-A	High Intensity UV Lamp — 12 Volt 164-R6000 or equivalent
ST1705-B	R-134a Fluorescent Dye Injector 164-R0775 or equivalent
ST2649-A	Deluxe Injector Loop Kit 219-00069 or equivalent
	R-134a Leak Detection Dye 164-R6060



Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line and fitting in the refrigerant system for a leak.

1. Check for leaks using a Rotunda-approved UV lamp.
    - Inspect all components, lines and fittings of the refrigerant system.



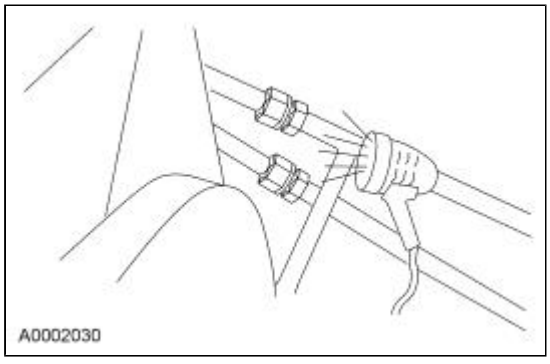
2. If a leak is found, recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

3. Repair the refrigerant system leak(s).

4. Evacuate and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

5. After the leak(s) is repaired, remove any traces of fluorescent dye with a general purpose oil solvent.

6. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with a Rotunda-approved UV lamp.



Fluorescent Dye Injection — Using an A/C Refrigerant Center and Dye Injector

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in

refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

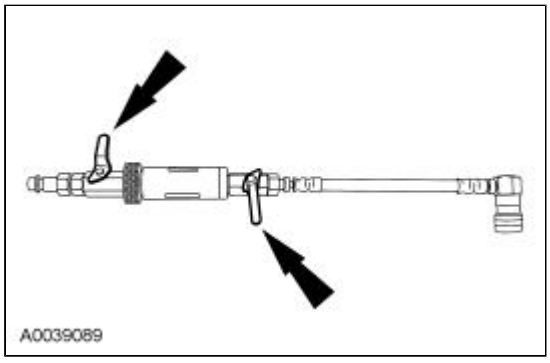
NOTE: Before using the R-134a fluorescent dye injector for the first time, refer to the manufacturer's instructions on evacuation of any non-condensable gasses from the hoses.

NOTE: Only connect the R-134a fluorescent dye injector to a manifold and gauge set or R-134a service center when fluorescent dye is to be injected. The R-134a fluorescent dye injector has a one way check valve that will prevent refrigerant system recovery and evacuation.

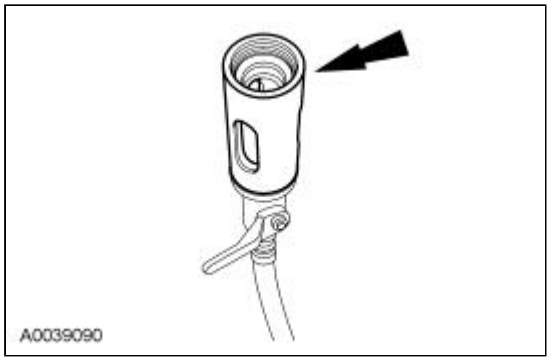
NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

1. Connect an R-134a A/C refrigerant service center or a manifold and gauge set to the refrigerant system service port valves.

2. Verify that the valves on the fluorescent dye injector are closed.



3. Fill the fluorescent dye injector reservoir with 7 ml (0.25 oz) of fluorescent dye.



4. Install the fluorescent dye injector between the low-pressure service gauge port valve and the R-134a refrigerant service center or manifold gauge set.

5. Open all valves and inject the fluorescent dye into the refrigerant system.

6. When fluorescent dye injection is complete, close all valves.

7. Recover the refrigerant from the R-134a fluorescent dye injector.

8. Remove the fluorescent dye injector from the low-pressure service gauge port valve and the R-134a A/C refrigerant service center or manifold gauge set.

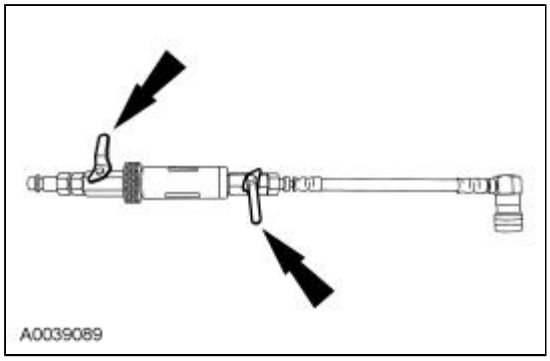
Fluorescent Dye Injection — Using a Dye Injector Loop Kit

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

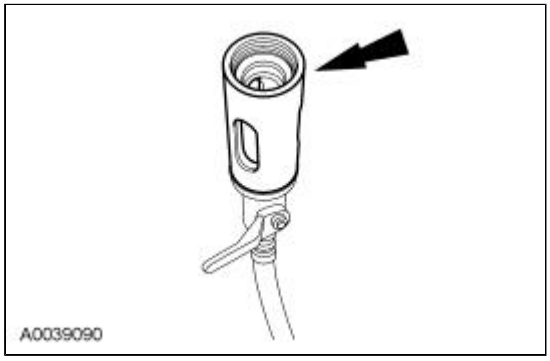
NOTE: Before using the R-134a fluorescent dye injector for the first time, refer to the equipment manufacturer's instructions on evacuation of non-condensable gasses from the hoses.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F).

1. Verify that the valves on the deluxe injector loop kit are closed.



2. Fill the deluxe injector loop kit reservoir with 7 ml (0.25 oz) of fluorescent dye.

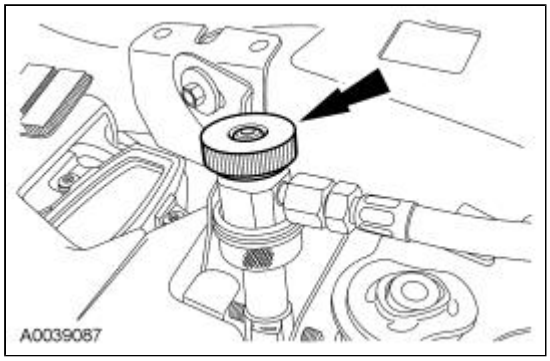


3. Install the deluxe injector loop kit between the high-pressure and low-pressure service gauge port valves.

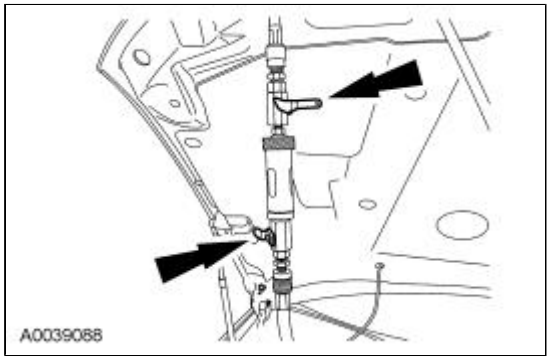
4. **CAUTION: Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine.**

   Start the engine.

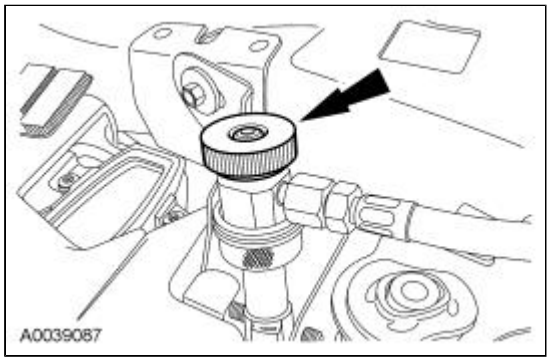
5. Open the high-pressure service valve.



6. Open the deluxe injector loop kit valves and inject the fluorescent dye into the refrigerant system.

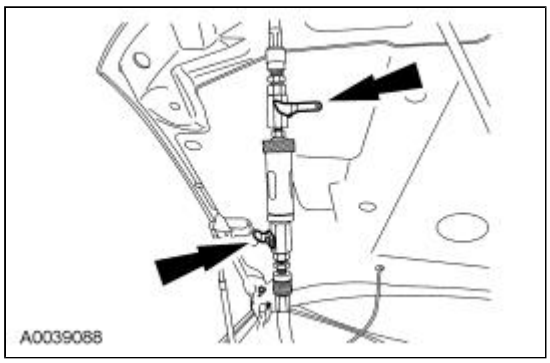


7. Close the high-pressure service valve to allow the pressure inside the deluxe injector loop kit to equalize with the suction side of the refrigerant system.



8. **NOTE:** Close the valves on the deluxe injector loop kit while the A/C compressor is operating.

   Close the valves on the deluxe injector loop kit.



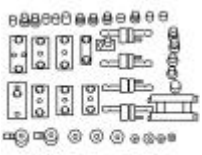
9. **NOTE:** Leave all valves on the special tool closed when not in use.

Disconnect the high-pressure and low-pressure service valves and remove the deluxe injector loop kit from the vehicle.

Air Conditioning (A/C) System Flushing

Printable View (101 KB)

Special Tool(s)

ST2466-A	A/C Flush and Purge Machine 219-00022 (part of 219-00023) or equivalent
 ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 (part of 219-00023) or equivalent
ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent

Material

Item	Specification
A/C System Flushing Solvent YN-23	—
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

WARNING: Use extreme care and observe all safety and service precautions related to the use of refrigerants.

WARNING: Due to refrigerant hazards, always wear safety goggles and non-penetrable gloves when working on or flushing A/C systems.

CAUTION: An A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.

CAUTION: Suction accumulator or receiver/drier, thermal expansion valve (TXV) and/or

evaporator core orifice, and hoses with mufflers, should be removed when flushing the A/C system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The 3.785 liters (1 gallon) of A/C System Flushing Solvent YN-23 and FL1-A filter used in A/C Flush and Purge Machine 219-00022 are intended for use on one vehicle only. They may be used to flush both the A/C condenser core and the A/C evaporator core on an individual vehicle, but under no circumstances should they be used on more than one vehicle.

NOTE: Prior to using the A/C Flush and Purge Machine 219-00022 for the first time, review the operating instructions.

NOTE: Only the A/C Flush and Purge Machine kit 219-00023, which includes A/C Flush and Purge Machine 219-00022, A/C Flush and Purge Fitting Kit 219-00024 and A/C Systems Flushing Solvent, is approved for use on Ford vehicles. No other flushing device or solvent is approved for flushing heat exchangers (A/C condenser, A/C evaporator). Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.

NOTE: Ford Motor Company has approved a procedure to provide technicians with a non-CFC method of flushing contaminated A/C system heat exchangers. The procedure allows the specific components to be cleaned and flushed while installed in their normal in-vehicle location. The types of contamination flushed include particle matter that results from A/C compressor or desiccant failure and gummy residue that can form when refrigerant oil is overheated during A/C compressor seizure. The flushing process is a 2-step procedure that involves the use of an A/C Flush and Purge Machine 219-00022 to:

- circulate the flushing solvent through the heat exchanger in the reverse direction of normal refrigerant flow (back-flushing). Particulate matter picked up during flushing is filtered from the returning solvent before the solvent is returned to the reservoir for continued circulation.
- remove the flushing solvent from the heat exchanger. In this step of the procedure, pressurized air 621-862 kPa (90-125 psi) is used to push and evaporate any remaining flush solvent from the heat exchanger.

1. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Disconnect the refrigerant lines from the heat exchanger(s) to be flushed.

3. Connect the A/C flush and purge machine fitting kit and the A/C flush and purge machine to the heat exchanger to be flushed. Do not flush through the evaporator core orifice (if equipped), TXV (if equipped) or hoses with mufflers. Internal plumbing and material make-up of these components make it impossible to correctly remove foreign material or residual flushing solvent.

4. **NOTE:** Use 3.785L (1 gal) of A/C Systems Flushing Solvent to flush the heat exchanger for a minimum of 15 minutes. The flush solvent may be used for one or both heat exchangers in the A/C system. However, the flush solvent is intended for one vehicle only. The filter used on the flushing unit is also intended for use on one vehicle only.

   Flush the heat exchanger for a minimum of 15 minutes.

5. Apply 621-862 kPa (90-125 psi) pressurized air to the component for a minimum of 30 minutes. The 30-minute purge time is required to force and evaporate all residual solvent from the A/C system component. Failure to successfully remove all residual solvent within the component can result in system damage when reconnected and operated. Dispose of the used flush solvent and filter in accordance with local, state and federal regulations.

6. **NOTE:** A/C system filtering as described in this section is optional if system flushing is carried out. However, the filter kit use is recommended after flushing if the A/C system contamination is extensive.

   Install a new A/C evaporator core orifice (if equipped) and/or TXV (if equipped) in any vehicle

being serviced for an internal A/C compressor or desiccant failure.

7. Install new refrigerant hoses with mufflers if clogged with foreign material.

8. Install a new suction accumulator (if equipped), receiver/drier (if equipped) or receiver/drier cartridge (if equipped) in any vehicle being serviced for an internal A/C compressor or desiccant failure.

9. Reconnect the heat exchanger being serviced.

10. If a new A/C compressor is not to be installed, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

11. If a new A/C compressor is not to be installed, evacuate, leak test and charge the A/C system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Air Conditioning (A/C) System Recovery, Evacuation and Charging

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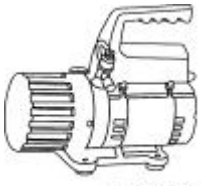
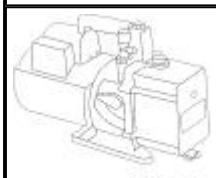
Special Tool(s)

ST2738-A	R-134a Refrigerant Center 176-00002 or equivalent
ST2739A	R-134a Refrigerant Center 023-00174 or equivalent
ST1928-A	R-134a Manifold Gauge Set 023-00047 or equivalent
 ST1685-A	1.2 CFM Vacuum Pump 023-00162 or equivalent
 ST1686-A	4.0 CFM Vacuum Pump 023-00163 or equivalent
ST2742-A	Automatic Refrigerant Charging Meter 023-00155 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant System Recovery

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation and charging may be accomplished using a separate recovery station, vacuum pump, charging meter and manifold gauge set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Prior to recovering, you must verify the purity of the refrigerant. For additional information, refer to Refrigerant Identification Testing in this section.

2. Connect an R-134a refrigerant service center to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer.

4. Once the refrigerant service center has recovered the refrigerant, switch OFF the power supply.

5. Allow the system to set for about 2 minutes, and observe the system vacuum reading. If the vacuum is not lost, disconnect the recovery equipment.

6. If the system does lose vacuum, repeat Steps 3 through 5 until the vacuum level remains stable for 2 minutes.

7. Carry out the required repairs.

Refrigerant System Evacuation Using an R-134a Service Center

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation and charging may be accomplished using a separate recovery station, vacuum pump, charging meter and manifold gauge set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect an R-134a service center to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the vacuum pump for a minimum of 45 minutes.

3. Turn OFF the vacuum pump. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Evacuation Using an R-134a Manifold Gauge Set

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation and charging may be accomplished using a separate recovery station,

vacuum pump, charging meter and manifold gauge set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect the R-134a manifold gauge set to the low-side and high-side service gauge port valves.

2. Connect the center (yellow) hose from the manifold gauge set to the suction port on the vacuum pump.

3. Open all valves on the R-134a manifold gauge set and both service gauge port valves.

4. Turn on the vacuum pump and evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the vacuum pump for a minimum of 45 minutes.

5. Close the high-side and low-side valves on the manifold gauge set (not the service gauge port valves) and turn OFF the vacuum pump.

6. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Charging Using an R-134a Service Center

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation and charging may be accomplished using a separate recovery station, vacuum pump, charging meter and manifold gauge set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

2. Connect an R-134a A/C service center to the low-side and high-side service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Set the refrigerant charge amount, and charge the refrigerant system following the instructions provided by the equipment manufacturer.

Refrigerant System Charging

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation and charging may be accomplished using a separate recovery station, vacuum pump, charging meter and manifold gauge set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional

information, refer to Refrigerant Oil Adding in this section.

2. Assemble the R-134a manifold gauge set, automatic refrigerant charging meter and R-134a supply tank following the automatic refrigerant charging meter operating instructions.

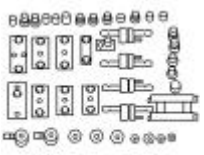
3. Charge the refrigerant system following the automatic refrigerant charging meter operating instructions.

4. If the refrigerant flow stops before the refrigerant charge is complete, start the engine, select A/C operation and allow the refrigerant charge to complete.

Refrigerant System Filtering Following Air Conditioning (A/C) Compressor Installation

Printable View (132 KB)

Special Tool(s)

 ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 or equivalent
ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
ST1252-A	Set, A/C Fittings 412-DS028 (014-00333, D93L-19703-B) or equivalent
ST2819-A	Adapter Set, In-Line Connector Leak Check 412-DS036 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

WARNING: Use extreme care and observe all safety and service precautions related to the use of refrigerants.

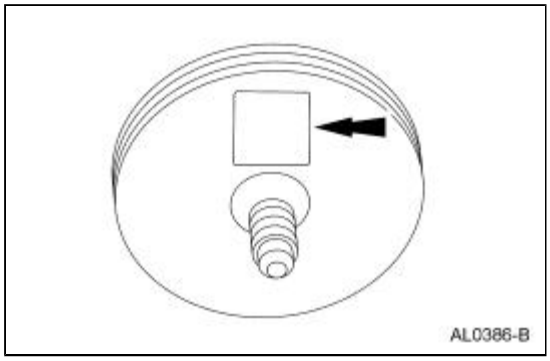
WARNING: Due to refrigerant hazards, always wear safety goggles and non-penetrable gloves when working on A/C systems.

CAUTION: An A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery

equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer's procedures and instructions.

CAUTION: On vehicles being serviced for an internal compressor or desiccant failure, a new suction accumulator or receiver/drier, thermal expansion valve or evaporator core orifice and any hoses containing mufflers must be installed prior to filtering the A/C system. Internal plumbing of these devices makes it impossible to correctly remove any foreign material/debris. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The filter is intended for use on one vehicle only.

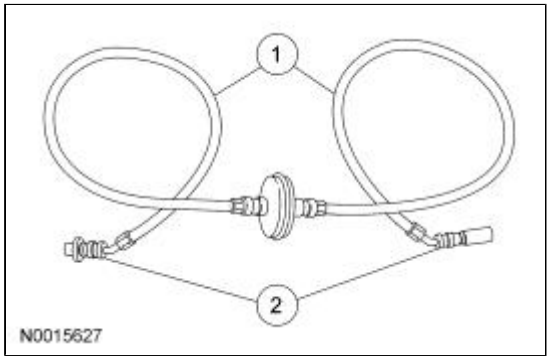
1. Orient the filter inlet toward the A/C condenser core.



2. **CAUTION: The flexible extension adapters included in the A/C Flush Adapter Kit (219-00074) are designed for low-pressure flushing and are not designed for use with a charged refrigerant system. Do not make the condenser fitting connections using the flexible extension adapters or damage to the adapters and loss of refrigerant will occur.**

   NOTE: The pancake filter is not permanently installed and will be removed at the end of this procedure.

   Disconnect the condenser outlet fitting and temporarily install the pancake filter between the 2 halves of the fitting.
   1. Use flexible refrigerant hose of 17,238 kPa (2,500 psi) burst rating.
   2. Make the connections using the correct adapters.



3. Lubricate the refrigerant system with the correct amount of clean refrigerant compressor oil. For additional information, refer to Refrigerant Oil Adding in this section.

4. Evacuate and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

5. Check all refrigerant system hoses, lines and the position of the newly installed filters to be sure

they do not interfere with other engine compartment components. If necessary, use tie-straps to make adjustments.

6. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Select A/C operation and set the blower motor speed to maximum. Start the engine and let it idle briefly. Make sure the A/C system is operating correctly.

7. Gradually bring the engine up to 1,200 rpm by running it at lower rpms for short periods (first at 800 rpm, then at 1,000 rpm). Set the engine at 1,200 rpm and run it for one hour with the A/C system operating.

8. Stop the engine.

9. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

10. Remove the fittings, flexible hoses and pancake filter from between the condenser and the condenser to evaporator tube.

11. Discard the pancake filter. It can be used one time only.

12. Reconnect the condenser outlet fitting.

13. Evacuate, charge and leak-test the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Oil Adding

Printable View (107 KB)

Special Tool(s)

ST2740A	Dye/Lubricant Injector 164-R0775
ST2737-A	Add-On Module Kit 219-00069

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant Oil Adding

CAUTION: During normal A/C operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

1. Refer to the chart below for refrigerant oil adding amounts and methods of installation.

Component	PAG Oil Amount	Method of Adding
A/C Compressor	See heading below	Add directly to A/C compressor before installation.
Suction Accumulator or Receiver/Drier	See heading below	Add directly to suction accumulator inlet port or inject to low-side service port during system charging.
Evaporator Core	45 ml (1.5 fl oz) added to the amount collected during refrigerant recovery	Add directly to evaporator core inlet tube or inject to low-side service port during system charging.
Condenser Core	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Add directly to condenser core inlet or inject to low-side service port during system charging.
Evaporator Core Orifice or Thermostatic Expansion	The amount collected during refrigerant recovery	Inject to low-side service port during system charging.

Valve		
A/C Pressure Relief Valve	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.
Refrigerant Hose/Line	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [a]	Inject to low-side service port during system charging.
O-ring Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [b]	Inject to low-side service port during system charging.
Service Port Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.

[a] If an excessive amount of refrigerant oil is lost due to a hose rupture/separation or other damage, the total system refrigerant oil capacity must be added.
[b] The amount specified may be used for one or multiple O-ring leak repairs. Do not multiply the refrigerant oil amount by the number of O-ring leaks being repaired.

Refrigerant Oil Adding for New A/C Compressor Installation

NOTE: Service A/C compressors are shipped without refrigerant oil.

1. Rotate the old A/C compressor shaft 8 to 10 full rotations (clockwise) while collecting the refrigerant oil in a clean measuring cup.
    - Add the same amount plus the amount collected during refrigerant recovery.

Refrigerant Oil Adding for New Suction Accumulator or Receiver/Drier Installation

1. Drill one 12.7 mm (1/2 in) hole in the old suction accumulator or receiver/drier cylinder and drain the oil into a clean measuring cup.

2. Add the quantity of oil drained, plus the amount collected during refrigerant recovery and 60 ml (2 fl oz).

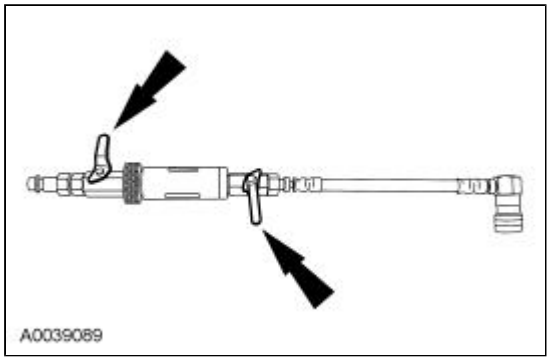
Oil Injection Using a Dye/Lubricant Injector

NOTE: If fluorescent leak detection dye is also to be added during A/C charging, the dye may be added to the dye/lubricant injector along with the refrigerant oil.

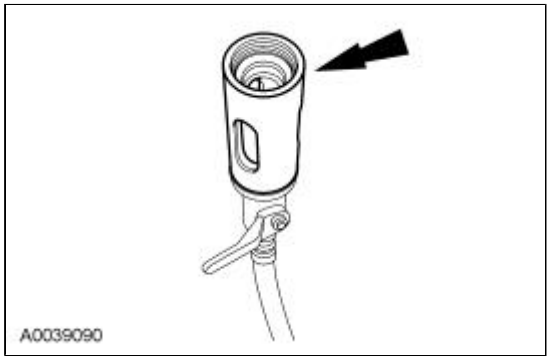
1. Evacuate the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Assemble the dye/lubricant injector using the correct adapters to match the amount of refrigerant compressor oil to be injected.

3. Verify that all the valves on the dye/lubricant injector are closed.



4. Fill the dye/lubricant injector with the correct amount of clean, new PAG oil.



5. Install the dye/lubricant injector between the low-side service gauge port valve and the refrigerant service station or manifold gauge set.

6. Open all valves and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Identification Testing

Printable View (87 KB)

Special Tool(s)

ST1457-A	Refrigerant Identifier with Air-Radiator 198-00003 or equivalent

Refrigerant Identification

1. **NOTE:** An A/C refrigerant analyzer must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

   Follow the instructions included with the refrigerant identifier to obtain the sample for testing.

2. The scan tool will display one of the following:
   - If the purity level of R-134a is 98% or greater by weight, the green PASS light emitting diode (LED) will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons and air will be displayed on the digital display.
   - If refrigerant R-134a does not meet the 98% purity level, the red FAIL LED will light and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will be displayed on the digital display.
   - If hydrocarbon concentrations are 2% or greater by weight, the red FAIL LED will light, "Hydrocarbon High" will be displayed on the digital display, and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will also be displayed on the digital display.

3. The percentage of air contained in the sample will be displayed if the R-134a content is 98% or greater. The scan tool eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the scan tool has determined that a refrigerant source is pure (R-134a is 98% or greater by weight) and air concentration levels are 2% or greater by weight, the scan tool will prompt the user if an air purge is desired.

4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.

Contaminated Refrigerant Handling

CAUTION: If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a recovery/recycling equipment.

NOTE: A new suction accumulator or receiver/drier must be installed as directed by the air conditioning system flushing procedure.

1. Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant only.
   - If this equipment is not available, contact an A/C service facility in your area with the

correct equipment to carry out this service.

2. Determine and correct the cause of the customers initial concern.
3. Flush the air conditioning system.
4. Dispose of the contaminated refrigerant in accordance with all federal, state and local regulations.

Air Conditioning (A/C) Odor Treatment

Printable View (92 KB)

Special Tool(s)

ST2940-A	Flexible Applicator Tool Kit 258-00004
ST2813-A	30 oz Sure Shot Pressure Sprayer 167-R4700 or equivalent

Material

Item	Specification
A/C Cooling Coil Coating YN-29	—

A/C Odor Treatment

WARNING: Avoid contact with eyes and skin. Contact with eyes and skin will cause irritation. Wear chemical goggles when using the A/C cooling coil coating.

WARNING: This procedure should only be carried out in well ventilated areas. Open all windows and doors of the vehicle. Leave doors and windows open during the entire procedure. Avoid breathing vapors.

WARNING: Read all instructions and warnings packaged with the A/C cooling coil coating. For additional information, see the material safety data sheet (MSDS) for this product.

NOTE: There are typically 4 types of objectionable odors found in a vehicle:

- Chemical odors
- Environmental odors
- Human and other interior-generated odors
- Microbiological odors

Before determining that A/C order treatment is required, the source and the circumstances under which the odor occurs must be determined.

NOTE: Chemical odors are usually constant regardless of the climate control system setting although they may be enhanced by A/C operation. Most chemical odors are caused by fluid leaks or incorrectly cured adhesives. Chemical odors can be eliminated by repairing the leaking component and removing any residue.

NOTE: Environmental odors usually occur for a short time and diminish after the vehicle passes through the affected area. These odors are typically only detected when the vehicle windows are open, or when the climate control system is operating in a mode that allows for fresh air. Environmental odors cannot be eliminated because they are external in source, but they may be minimized by switching to a climate control setting that uses recirculated air.

NOTE: Human and other interior-generated odors occur while the source is present and may linger for a short time after. These odors may be more noticeable during A/C operation. Human odors may be eliminated by removing the source and cleaning the affected area.

NOTE: Microbiological odors, if in the A/C system, usually last for about 30 seconds after the system is turned on. They will be detected while the A/C is turned on and using either outside or recirculated air. Microbiological odors that occur in areas other than the A/C system (for example, water in doors or wet carpeting) may last indefinitely and will be more intense when recirculated air is used. Microbiological odors will not be present at temperatures at or below 10°C (50°F).

Microbiological odors can be eliminated by removing the source and treating the affected area. Standing water must be allowed to drain and dry out. A/C systems may be treated by using A/C cooling coil coating as described in the service procedure below.

Microbiological odors result from microbial growth supported by warm temperatures and moisture. Microbiological odors are described as musty/mildew type smells and may occur on/in:

- foam seals.
- rubber seals.
- adhesives.
- standing water.
- water soaked carpet/trim.

1. Identify the type of odor present in the vehicle. Do not proceed with A/C odor treatment if the odor source is found to be outside of the A/C system. Refer to the following chart for examples.

Odor Source	Odor Description
Chemical Odors	
Coolant	Sweet smell
Fuel	Gasoline or diesel fuel smell
Oil	Oil type or burning smell
Power Steering Fluid	Oil type or burning smell
Transmission Fluid	Oil type or burning smell
Washer Fluid	Alcohol type smell
Gear Lube	Garlic/sulfur smell
Refrigerant Oil	Ether type smell
Carpet/trim Adhesives	Fishy, urine or sweet smell
Evaporator Core Coating	Wet cement type smell
Environmental Odors	
Exhaust	Exhaust, fuel or burning type smell
Industrial Pollutants	Various smells
Dust	Musty, mildew or wet cement type smell
Pollen	Sweet smell
Tobacco	Burning, tar smell
Human and Other Interior Generated Odors	

Body Secretions	Body odor
Perfuming Agents	Sweet or fragrance smell
Clothing	Musty, mildew or body odors
Food/Beverage	Sweet, musty, mildew or fishy smell
Microbiological Odors	
Microbiological Odors Occurring Inside of A/C System	Musty, mildew smell lasting about 30 seconds after A/C is turned on
Microbiological Odors Occurring Outside of A/C System	Musty, mildew smell lasting indefinitely and possibly more pronounced when using recirculated air

2. Identify the source of the odor.
   - Check the passenger and driver side carpet for moisture. Continue diagnosis if moisture is found.
   - Check the blower motor and blower motor cover (if equipped) for moisture resulting from water bypassing the cowl baffling system. Continue diagnosis if moisture is present.
   - Check the evaporator core drain tube for restriction.
   - Check the cowl top panel and air inlet screen for standing water or foreign material. If possible, remove any standing water and clean the air inlet screen using a wet/dry vacuum.
3. Open all vehicle windows.
4. Disconnect the low-side A/C pressure switch (cycling or low-charge protection) electrical connector.
5. Remove the evaporator air discharge temperature sensor (if equipped).
6. Set the following.
   - Enable the A/C using fresh air inlet.
   - Adjust the temperature setting to full warm.
   - Adjust the blower motor speed to HI.
7. Run the engine for 25 minutes to dry out the A/C system.
8. Turn the ignition OFF.
9. Remove the blower motor.
10. **NOTE:** Blower motor speed controls that are mounted outside of the evaporator core housing and not exposed to the blower motor airflow do not need to be removed.

    Remove the blower motor resistor (if equipped) or blower motor speed control (if equipped and exposed to the inside of the evaporator core housing).
11. **CAUTION: To avoid damage to the vehicle interior, do not spill or spray this product on any interior surface.**

    Add one full bottle of A/C cooling coil coating to the applicator or sprayer.
12. Insert the nozzle into the evaporator housing and direct the spray toward the evaporator core face. Spray the entire evaporator core face until empty.
13. Install the blower motor and blower motor resistor (if equipped) or blower motor speed control (if equipped).

14. Install the evaporator air discharge temperature sensor (if equipped),
15. Repeat Steps 6 through 8 to cure the evaporator core coating.
16. Connect the low-side A/C pressure switch (cycling or low-charge protection) electrical connector.

Printable View (82 KB)

General Specifications

Item	Specification
Magnetic Clutch	
Clutch air gap clearance	0.35-0.65 mm (0.014-0.026 in)
Lubricant	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C clutch disc and hub bolt	13	10	—
A/C compressor discharge fitting nut	15	11	—
A/C compressor suction fitting nut	15	11	—
A/C compressor stud bolts	25	18	—
Air inlet duct bracket nut	7	—	62
Auxiliary evaporator line fitting nuts	15	11	—
Condenser inlet fitting bolt	15	11	—
Condenser inlet jumper line fitting nut	15	11	—
Condenser outlet fitting nut	15	11	—
Evaporator core housing nuts	7	—	62
High-pressure Schrader-type valve	2.5	—	22
High-pressure service gauge port valve cap	0.8	—	7
Instrument panel bracket bolts	9	—	80
Low-pressure Schrader-type valve	1.8	—	16
Low-pressure service gauge port valve cap	0.8	—	7
Plenum chamber nut	7	—	62
Steering column reinforcement bolts	9	—	80
Transmission cooler tube support bracket nut	25	18	—
Thermostatic expansion valve (TXV) bolts	8	—	71
TXV fitting bolt	8	—	71
TXV manifold and tube suction fitting nut	15	—	11

Air Conditioning

Printable View (139 KB)

The air conditioning system components are the following:

- A/C compressor
- A/C condenser core
- A/C evaporator core
- Receiver/drier cartridge
- Connecting refrigerant lines
- Thermostatic expansion valve
- Evaporator discharge air temperature sensor
- A/C high-pressure cutoff switch
- Low charge protection switch
- A/C compressor pressure relief valve

The refrigerant system incorporates an A/C compressor controlled by the powertrain control module (PCM) through an A/C clutch relay.

The A/C compressor clutch will only be engaged by the PCM if all of the following conditions are met:

- The climate control assembly is set to a mode which provides an A/C request to the PCM.
- The evaporator discharge air temperature sensor is reading a temperature above 3°C (37°F).
- The A/C pressure transducer is not reading an excessively high or excessively low pressure in the refrigerant system.
- The A/C compressor relay is switched to the CLOSED position by the PCM.
- The engine coolant temperature is not excessively high.
- The PCM has not detected a wide open throttle (WOT) condition.

Refer to Section 412-00 for operating specifications.

An A/C compressor pressure relief valve is installed in the A/C compressor to protect the refrigerant system against excessively high refrigerant pressure.

Refrigerant flow into the evaporator core is metered by a thermostatic expansion valve.

A/C Compressor and Clutch Assembly

NOTE: Internal FS20 A/C compressor components are not serviced separately. The A/C compressor is serviced only as an assembly. The clutch disc and hub, A/C compressor pulley and bearing and clutch field coil are serviceable.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

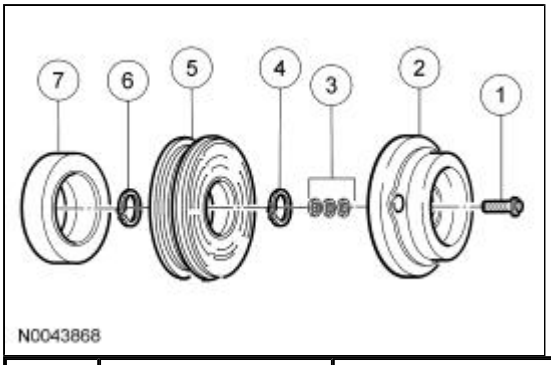
The FS20 A/C compressor uses the following:

- A non-serviceable shaft seal.
- A pressure relief valve installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures.
- PAG oil or equivalent. This oil contains special additives required for the A/C compressor.

- PAG oil may have some slightly dark-colored streaks while maintaining normal oil viscosity. This is normal for this A/C compressor because of break-in wear that can discolor the oil.

Use standard oil matching procedures when installing new compressors.

A/C Compressor Clutch Assembly



Item	Part Number	Description
1	W711887	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19N689	A/C clutch disc and hub spacer
4	N805338	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W711883	A/C clutch field coil snap ring
7	19D798	A/C clutch field coil

The magnetic A/C clutch has the following characteristics:

- The A/C clutch drives the compressor shaft.
- When battery positive voltage (B+) is applied to the A/C clutch field coil, the clutch disc and hub assembly is drawn toward the A/C clutch pulley.
- The magnetic force locks the clutch disc and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate.
- When B+ is removed from the A/C clutch field coil, springs in the clutch disc and hub assembly move the clutch disc away from the A/C clutch pulley.

Thermostatic Expansion Valve

The thermostatic expansion valve (TXV) is located between the evaporator core lines and the thermostatic expansion valve manifold and tube assembly at the RH rear of the engine compartment. The TXV provides a restriction to the flow of refrigerant from the high-pressure side of the refrigerant system, and separates the low-pressure and high-pressure sides of the refrigerant system. Refrigerant entering and exiting the evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Evaporator Discharge Air Temperature Sensor

The evaporator discharge air temperature sensor communicates the evaporator discharge air temperature to the electronic manual temperature control (EMTC) module (if equipped) or electronic

automatic temperature control (EATC) module (if equipped).

The PCM maintains evaporator core temperature and prevents icing of the evaporator core, by disengaging the A/C compressor clutch when the evaporator discharge air temperature sensor reading falls below acceptable levels, and by engaging the A/C compressor clutch when the discharge air temperature rises above acceptable levels.

The evaporator discharge air temperature sensor is located on the heater core and evaporator core housing in the air-stream leaving the evaporator core.

A/C Pressure Transducer

The A/C pressure transducer communicates the compressor discharge pressure to the PCM. The PCM will interrupt A/C compressor operation in the event that the A/C pressure transducer indicates excessively high system discharge pressures. It is also used to sense low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM will not allow the clutch to engage.

A/C Condenser/Power Steering Combo Cooler

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

The A/C condenser/power steering combo cooler is an aluminum fin-and-tube design heat exchanger located in front of the vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

The receiver/drier is incorporated onto the LH side of the condenser core. The receiver/drier cartridge is a separate component and can be removed and installed separately from the condenser core.

The top portion of the condenser/power steering combo cooler is partitioned from the refrigerant system and is used for power steering fluid cooling.

Evaporator Core

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle. Refer to Section 412-00 .

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube, continues over to the remaining plate/fin sections and then moves out of the evaporator core through the evaporator core outlet tube. Air from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

Receiver/Drier

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

The receiver/drier is integral to the A/C condenser/power steering combo cooler. It stores high-pressure liquid after it leaves the condenser core. An A/C desiccant cartridge mounted inside the receiver/drier removes any retained moisture from the refrigerant. The receiver/drier cartridge is a separate component and can be removed and installed separately from the A/C condenser/power steering combo cooler.

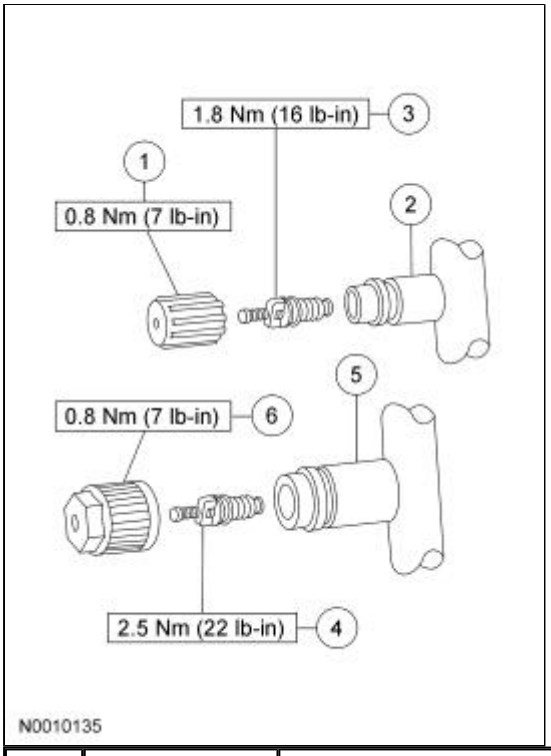
A/C Compressor Pressure Relief Valve

An A/C compressor pressure relief valve is incorporated in the compressor to prevent damage to the A/C compressor and other system components, and to avoid total refrigerant loss by relieving unusually high refrigerant system discharge pressure buildups. For information, regarding operating pressure(s) specifications, refer to Section 412-00 .

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the high-pressure side of the TXV manifold and tube at the RH rear of the engine compartment.

The low-pressure service gauge port valve is located on the low-pressure side of the TXV manifold and tube at the RH rear of the engine compartment.



Item	Part Number	Description
1	19D702	Low-pressure service gauge port valve cap
2	—	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	—	High-pressure service gauge port valve
6	19D702	High-pressure service gauge port valve cap

The fitting is an integral part of the refrigeration line or component.

- Special couplings are required for both the high-side and low-side service gauge ports.
- A very small amount of leakage will always be detectable around the Schrader-type valve, with the service gauge port valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.
- The service gauge port valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C service gauge port valve caps to the correct torque after they are removed.

Refrigerant System Dye

Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage. Refer to Section 412-00 .

Air Distribution and Filtering

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NOTE: The air distribution system of this vehicle cannot be equipped with a cabin air filter.

There are 2 sources of air available to the air distribution system:

- Outside air
- Recirculated air

Recirculated air can be selected in any mode other than DEFROST using the RECIRC button on vehicles with manual climate control. Recirculated air is automatically used when the climate control assembly is set to the MAX A/C or OFF mode. Vehicles equipped with dual-zone electronic automatic temperature control (EATC) use recirculated air only when in the AUTOMATIC mode (if functioning to obtain selected temperatures), or when the RECIRC function is selected in any mode other than DEFROST.

Air distribution within the vehicle is determined by the function selector position (manual A/C), or the dual-zone EATC system in the AUTOMATIC mode. The air distribution mode on vehicles equipped with dual-zone EATC can be overridden by the driver if desired. Airflow mode doors are used to direct airflow within the plenum chamber. An electric actuator and cam assembly is used to position the airflow mode control doors.

Vehicles equipped with dual-zone EATC use a heater core and evaporator core housing with 2 separate temperature blend doors. This allows for individual temperature settings to be selected for the RH and LH air outlets. The airflow mode doors are not partitioned for separate RH and LH airflow positions, therefore the airflow mode will always remain similar for the RH and LH sides of the vehicle regardless of the temperatures selected.

Air enters the passenger compartment from the following:

- Instrument panel A/C registers
- Floor duct
- Windshield defroster
- Side window demisters
- Rear seat airflow duct (if equipped)

Passenger compartment air is exhausted from the vehicle through open windows or body air vents.

Control Components

Printable View (70 KB)

Two climate control systems are available:

- Electronic manual temperature control (EMTC) (Expedition only)
- Dual-zone electronic automatic temperature control (EATC)

Refer to the appropriate heading below for information concerning each system.

Manual Climate Control

The manual climate control components are used to select the following:

- Air inlet source (outside or recirculated)
- Blower motor speed
- Discharge air temperature (temperature blend)
- Discharge air location (DEFROST, PANEL, FLOOR)
- A/C compressor operation

Control System Inputs — Electronic Manual Temperature Control

Climate Control Assembly (EMTC Module)

The climate control assembly integrates the temperature control, airflow mode selection, A/C request button, recirculated air request button and rear defog switch into a single unit.

The temperature control setting determines air temperature. Movement of the temperature control from COOL (blue) to WARM (red) causes a corresponding movement of the temperature blend door and determines the air discharge temperature that the air distribution system will maintain. The temperature control switch is an integral part of the climate control assembly and cannot be installed separately.

The airflow mode setting determines discharge air location. Movement of the mode selector causes a corresponding movement of the airflow mode door actuators. The mode selector is an integral part of the climate control assembly and cannot be installed separately.

The A/C request button determines A/C compressor operation, except when the mode selector is in the OFF, MAX or DEFROST mode. The A/C request button is an integral part of the climate control assembly and cannot be installed separately.

The recirculated air request button determines air inlet source, except when the airflow mode selector is in the OFF, MAX or DEFROST mode. The recirculated air request button is an integral part of the climate control assembly and cannot be installed separately.

The rear defog button signals activation of the heated backlight and heated mirrors. The rear defog button is an integral part of the manual climate control assembly and cannot be installed separately.

The EMTC module is not equipped with self-test capabilities.

Blower Motor Switch

The blower motor switch controls blower motor speed by adding or bypassing resistors in the blower motor resistor in all function selector positions except OFF. The blower motor switch is mounted to the

climate control assembly and can be separately installed.

Control System Outputs — Electronic Manual Temperature Control

Blower Motor Resistor

The blower motor switch varies the blower motor ground circuit resistance by adding or bypassing series resistance in the blower motor resistor. Increased resistance will lower the blower motor speed, and lowered resistance will increase blower motor speed. When the blower motor is in the HIGH position, the blower motor resistor is bypassed.

The blower motor resistor is located on the heater core and evaporator core housing near the blower motor.

Temperature Blend Door Actuator

The temperature blend door actuator moves the temperature blend door on command from the EMTC module.

The temperature blend door actuator contains a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a wiper which is driven along the variable resistor by the actuator shaft. The signal returned to the EMTC module from the wiper indicates the position of the temperature blend door. The EMTC module drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected EMTC module wiper voltage value.

The temperature blend door actuator is located on the heater core and evaporator core housing.

Mode Door Actuators

Electric mode door actuators are used to position the 3 airflow mode doors on command from the EMTC module. The 2 mode door actuators each contain a reversible electric motor. The DEFROST/PANEL/FLOOR door actuator contains a potentiometer to allow the EMTC module to monitor the position of the airflow mode doors. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a wiper which is driven along the variable resistor by the actuator shaft. The signal returned to the EMTC module from the wiper indicates the position of the airflow mode door. The air inlet mode door actuator is driven to the full RECIRC or full FRESH air inlet position, and does not require a potentiometer circuit to monitor its position.

Dual-Zone Electronic Automatic Temperature Control

The dual-zone EATC module analyzes input from the following major sources:

- Temperature, mode and blower selection (made by the vehicle occupants)
- In-vehicle temperature
- In-vehicle humidity (Navigator only)
- Ambient temperature
- Evaporator discharge air temperature
- Sunload
- Vehicle speed
- Engine coolant temperature

Using these inputs, the dual-zone EATC module determines the correct conditions for the following outputs:

- A/C compressor operation

- Blower speed
- LH side temperature blend door position
- RH side temperature blend door position
- Airflow mode door positions

Control System Inputs — Dual-Zone EATC

EATC Module (Climate Control Assembly)

The EATC module provides an interface for the vehicle occupants to control the climate control system, or automatically controls the climate control system in the AUTO mode. The EATC module has a vacuum fluorescent display for displaying set temperature, airflow direction, blower speed and diagnostic trouble codes (DTCs). An on-board diagnostic (OBD) feature is incorporated to supply the technician with DTCs. These DTCs help direct the technician to the inoperative component.

Steering Wheel Audio/Climate Control Switch

The steering wheel audio/climate control switch allows the driver to adjust the passenger compartment temperature setting and manually override the blower motor speed setting.

For removal and installation of the steering wheel audio/climate control switch, refer to Section 415-01 .

Ambient Air Temperature Sensor

The ambient air temperature sensor contains a thermistor, which measures the temperature of outside air as a resistance and sends that reading to the dual-zone EATC module.

In-Vehicle Temperature/Humidity Sensor — Navigator

The in-vehicle temperature sensor contains 2 thermistors, which separately measure the in-vehicle air temperature and humidity and send those readings to the EATC module. An aspirator hose and elbow is connected between the heater core and evaporator core housing and the in-vehicle temperature and humidity sensor. The aspirator hose uses airflow from the heater core and evaporator core housing air stream to create a venturi-type suction to draw in-vehicle air through the in-vehicle temperature sensor and across the thermistors.

In-Vehicle Temperature Sensor — Expedition

The in-vehicle temperature sensor contains a thermistor, which measures the in-vehicle air temperature and sends that reading to the EATC module. An aspirator hose and elbow is connected between the heater core and evaporator core housing and the in-vehicle temperature sensor. The aspirator hose uses airflow through the heater core and evaporator core housing to create a venturi-type suction to draw in-vehicle air through the in-vehicle temperature sensor and across the thermistor.

Dual-Zone Solar Amplifier (Sunload Sensor)

The solar amplifier is a dual-zone type that supplies separate information to the dual-zone EATC module indicating LH side and RH side sunload. For information on the location and service of the solar amplifier, refer to Section 417-01 .

Control System Outputs — EATC

Blower Motor Speed Control

The blower motor speed control controls the blower motor speed by converting low power signals from the EATC module to a high current, variable ground feed for the blower motor. A delay function is used to provide a gradual increase or decrease in blower motor speed under all conditions.

The blower motor speed control is located on the heater core and evaporator core housing near the blower motor.

Temperature Blend Door Actuators

The dual-zone EATC system uses 2 temperature blend door actuators to control 2 separate temperature blend doors. The temperature blend doors independently vary the LH side and RH side temperature settings, as desired. The temperature blend door actuators each contain a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a wiper which is driven along the variable resistor by the actuator shaft. The signal returned to the EATC module from the wiper indicates the position of the temperature blend door. The EATC module drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected EATC module wiper voltage value.

Mode Door Actuators

Electric mode door actuators are used to position the 3 airflow mode doors on command from the EATC module. The 2 mode door actuators each contain a reversible electric motor. The DEFROST/PANEL/FLOOR door actuator contains a potentiometer to allow the EATC module to monitor the position of the airflow mode doors. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal return circuit is connected to a wiper, which is driven along the variable resistor by the actuator shaft. The signal returned to the EATC module from the wiper indicates the position of the airflow mode door. The air inlet mode door actuator is driven to the full RECIRC or full FRESH air inlet position, and does not require a potentiometer circuit to monitor its position.

Heating and Ventilation

Printable View (64 KB)

The heating and ventilation system has the following features:

- Controls the temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle.
- Delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.
- Cooling or heating can be adjusted to maintain the desired temperature.
- Uses a reheat method to provide conditioned air to the passenger compartment.
- All airflow from the blower motor passes through the A/C evaporator core.
- Temperature blending is controlled by the temperature blend door(s), which regulate(s) the amount of air that flows through and around the heater core, where it is then mixed and distributed.

Blower Motor

The blower motor pulls air from the air inlet and forces it into the heater core and evaporator core housing and the plenum chamber where it is mixed and distributed.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer the heat to air passing through the plenum.

Heater Core and Evaporator Core Housing

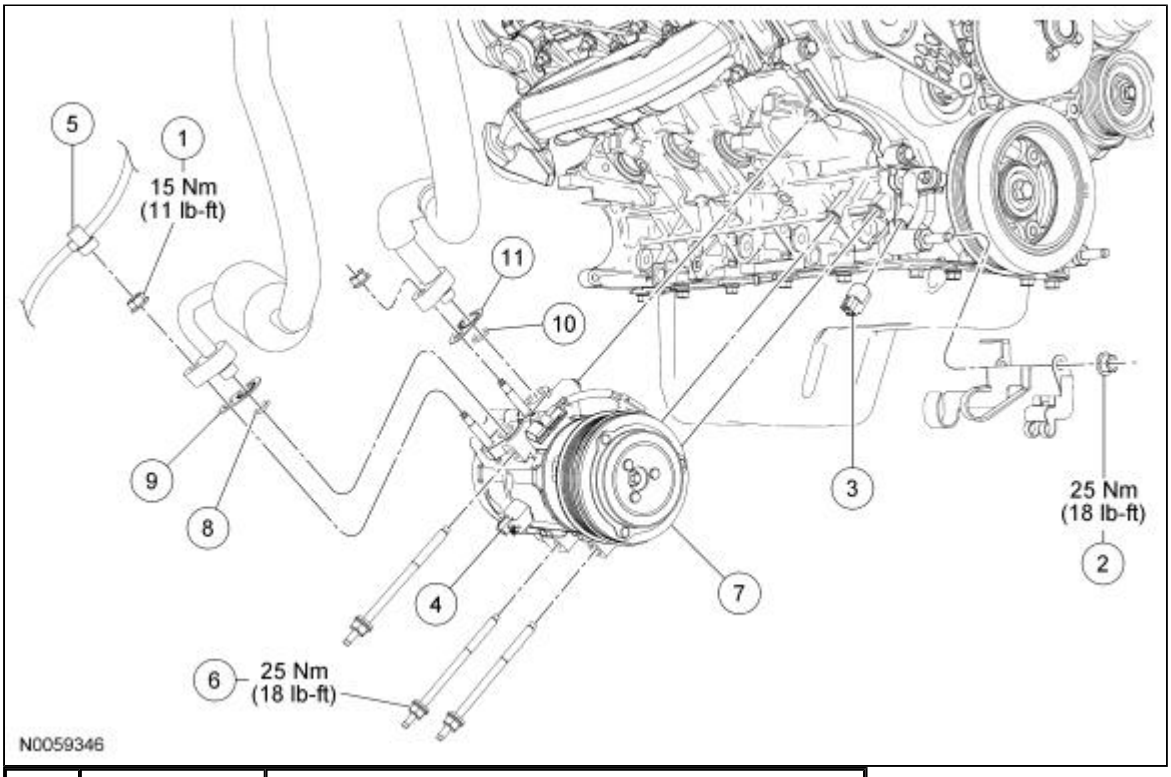
The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then directed through or around the heater core by the temperature blend door(s). After passing through the heater core, the airflow is distributed to plenum chamber where it is distributed to the selected vehicle outlets.

Air Conditioning (A/C) Compressor

Printable View (254 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	A/C compressor fitting nut (2 required)
2	N804758	Transmission cooler tube support bracket nut
3	12B637	Crankshaft position sensor electrical connector
4	12B637	Clutch field coil electrical connector
5	—	Wire harness retainer (part of 12B637)
6	W707821	A/C compressor stud bolt (3 required)
7	19703	A/C compressor
8	19E889	1/2-inch O-ring seal
9	19B588	1/2-inch Gasket seal
10	19E889	5/8-inch O-ring seal
11	19B588	5/8-inch Gasket seal

Removal and Installation

CAUTION: If installing a new air conditioning (A/C) compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the air conditioning system:

- **If A/C flushing equipment is available, carry out flushing of the air conditioning system. For additional information, refer to Section 412-00 .**
- **If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to Section 412-00 .**
- **Install a new thermostatic expansion valve (TXV) and TXV filter as directed by the A/C flushing or filtering procedure.**
- **Install a new receiver/drier cartridge as directed by the A/C flushing or filtering procedure.**

NOTE: If installing a new A/C compressor, the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil must be inspected and transferred from the old unit to the new unit if suitable for reuse.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. If flushing of the air conditioning system has not been carried out, recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the drive belt from the A/C compressor pulley.

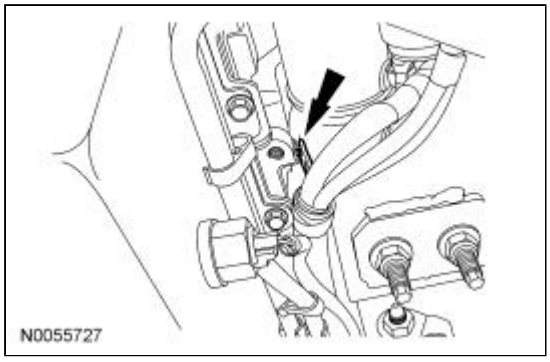
4. Detach the wire harness retainer from the A/C compressor stud and position the wire harness aside.

5. Remove the 2 A/C compressor fitting nuts and disconnect the fittings.
   - Discard the O-ring seals and gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).

Four wheel drive (4WD) vehicles

6. Release the tab on the bottom of the cooling fan shroud and rotate the lower portion of the cooling fan shroud upward.

7. Detach the battery cable pin-type retainer from the engine block below the starter motor.



8. Remove the transmission cooler tube support bracket nut and detach the battery cable bracket and transmission cooler line bracket from the front cover stud.

- To install, tighten to 25 Nm (18 lb-ft).

All vehicles

9. Disconnect the crankshaft position sensor electrical connector.

10. Disconnect the clutch field coil electrical connector.

11. Remove the 3 A/C compressor stud bolts.
    - To install, tighten to 25 Nm (18 lb-ft).

12. Remove the A/C compressor.

13. To install, reverse the removal procedure.
    - If a new A/C compressor is to be installed, the clutch assembly must be transferred from the old unit to the new unit. For additional information, refer to Clutch and Clutch Field Coil in this section.
    - Install new gasket seals and O-ring seals.
    - If filtering of the refrigerant system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

14. If filtering of the refrigerant system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Air Conditioning (A/C) Evaporator Discharge Air Temperature Sensor

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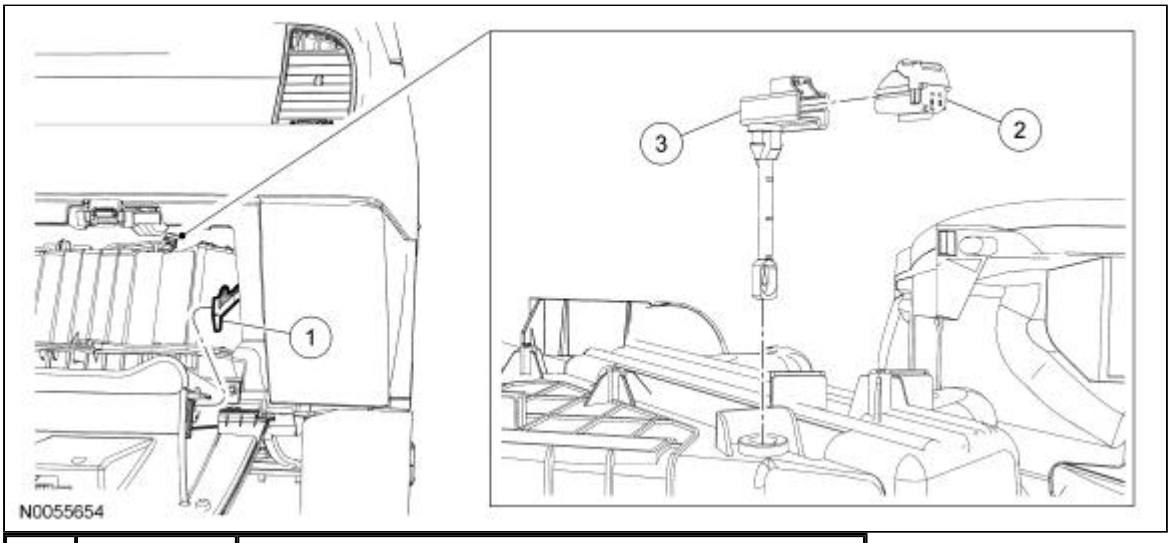

Item	Part Number	Description
1	—	Glove compartment dampener (part of 06024)
2	18B518	Evaporator discharge air temperature sensor electrical connector
3	19C734	Evaporator discharge air temperature sensor

Removal and Installation

1. Detach the glove compartment dampener and lower the glove compartment.
2. Disconnect the evaporator discharge air temperature sensor electrical connector.
3. Carefully pry the evaporator discharge air temperature sensor probe out of the heater core and evaporator core housing.
4. To install, reverse the removal procedure.

Ambient Air Temperature Sensor

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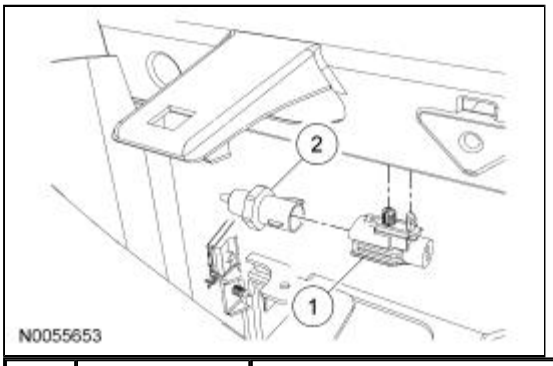

Item	Part Number	Description
1	12A581	Ambient air temperature sensor electrical connector
2	12A647	Ambient air temperature sensor

Removal and Installation

1. Remove the upper radiator sight shield.
2. Detach and disconnect the ambient temperature sensor electrical connector.
3. Remove the ambient air temperature sensor.
4. To install, reverse the removal procedure.

Blower Motor

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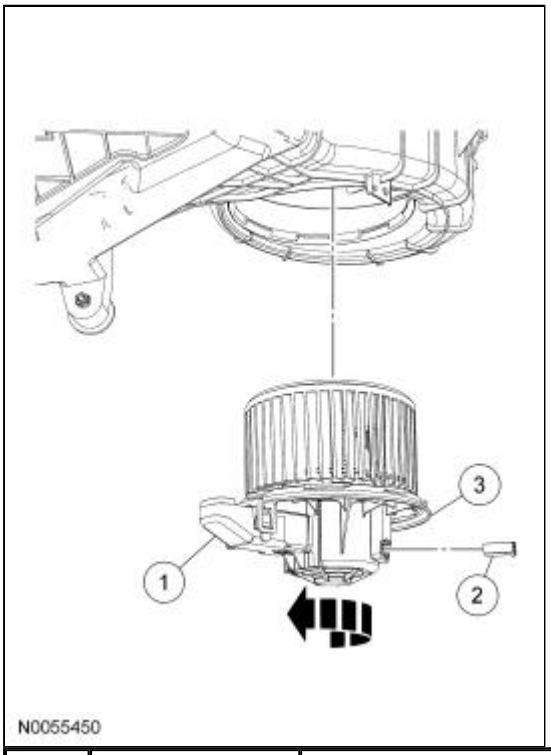

Item	Part Number	Description
1	—	Blower motor vent tube (part of 19805)
2	18B518	Blower motor electrical connector
3	19805	Blower motor

Removal and Installation

NOTE: The blower motor vent tube must be completely removed from the blower motor before it can be rotated and disengaged from the heater core and evaporator core housing.

1. Remove the RH lower instrument panel insulator (if equipped).
2. Remove the RH lower A-pillar junction box cover.
3. Position the carpet below the blower motor aside.
4. Release the 2 blower motor vent tube clips and remove the blower motor vent tube.
5. Disconnect the blower motor electrical connector.
6. **NOTE:** The blower motor will have to be carefully manipulated along the dash panel insulator, and the dash panel insulator will have to be slightly deflected to allow the blower motor to clear the heater core and evaporator core housing.

   Rotate the blower motor counterclockwise to disengage it from the housing and remove the blower motor.

7. To install, reverse the removal procedure.

Blower Motor Resistor

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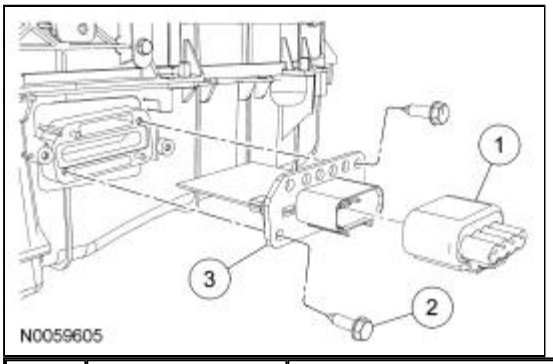


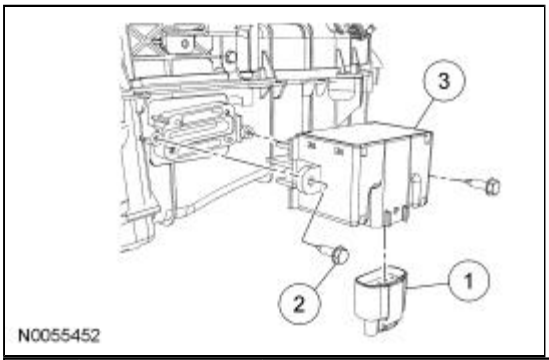
Item	Part Number	Description
1	18B518	Blower motor resistor electrical connector
2	W701696	Blower motor resistor screw (2 required)
3	18591	Blower motor resistor

Removal and Installation

1. Disconnect the blower motor resistor electrical connector.
2. Remove the 2 blower motor resistor screws.
3. Remove the blower motor resistor.
4. To install, reverse the removal procedure.

Blower Motor Speed Control

Printable View (90 KB)



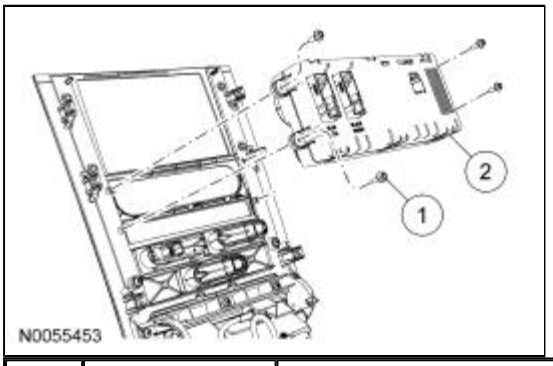
Item	Part Number	Description
1	18B518	Blower motor speed control electrical connector
2	W701696	Blower motor speed control screw (2 required)
3	19E624	Blower motor speed control

Removal and Installation

1. Remove the RH lower instrument panel insulator (if equipped).
2. Disconnect the blower motor speed control electrical connector.
3. Remove the 2 blower motor speed control screws.
4. Remove the blower motor speed control.
5. To install, reverse the removal procedure.

Climate Control Assembly

Printable View (116 KB)



Item	Part Number	Description
1	W706952	Climate control assembly screw (4 required)
2	19980	Climate control assembly

Removal and Installation

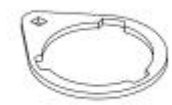
NOTE: Navigator shown, expedition similar.

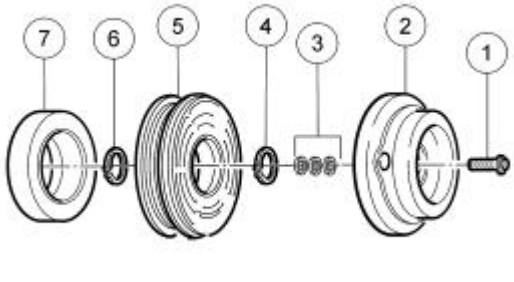
1. Remove the center instrument panel finish panel. For additional information, refer to Section 501-12 .
2. Remove the 4 climate control assembly screws.
3. Remove the climate control assembly.
4. To install, reverse the removal procedure.

Clutch and Clutch Field Coil

Printable View (185 KB)

Special Tool(s)

 ST2946-A	Holding Fixture, Compressor Clutch Disc and Hub 412-134
ST2382-A	Remover, Compressor Pulley 412-001 (T71P-19703-B)



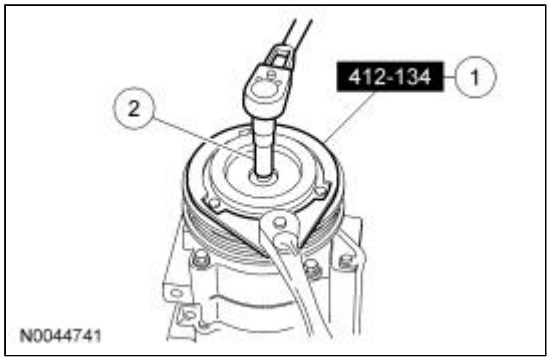
N0043868

Item	Part Number	Description
1	W711887	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19N689	A/C clutch hub disc and hub spacers
4	N805338	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W711883	A/C clutch field coil snap ring
7	19D798	A/C clutch field coil

Removal

1. Remove the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor in this section.

2. Remove the A/C clutch disc and hub nut.
   1. Using the special tool, hold the A/C clutch disc and hub.
   2. Remove the A/C clutch disc and hub nut.

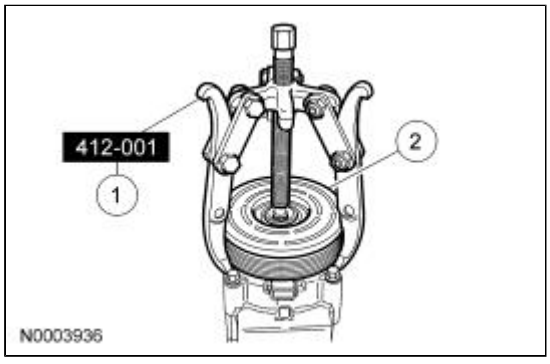


3. Remove the A/C clutch disc and hub.

4. Remove the A/C compressor pulley snap ring.

5. **CAUTION: Do not use air tools. Damage to the A/C clutch pulley or A/C compressor may result.**

   Using the special tool, remove the A/C compressor pulley.
   1. Install the special tool.
   2. Remove the A/C compressor pulley.



6. Remove the A/C clutch field coil snap ring.

7. Remove the A/C clutch field coil connector screw.

8. Remove the A/C clutch field coil.

Installation

NOTE: NOTE: The A/C clutch components should be reused unless obvious signs of damage are found. If excessive grooving is found, a new A/C clutch disc and hub and a new A/C compressor pulley must be installed together. Otherwise, each component can be installed individually where needed.

1. Visually inspect the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil for damage.
   - Inspect for physical damage, including cracked or melted components or discoloration due to excessive heat.
   - Inspect for excessive wear, including grooving in the A/C clutch disc and hub or A/C compressor pulley that is more than fingernail depth.
   - Inspect for roughness in the A/C compressor pulley bearing.

2. Clean the A/C clutch field coil and pulley mounting surfaces.

3. Install the A/C clutch field coil.

4. Install the A/C clutch field coil snap ring.

5. **NOTE:** The A/C compressor pulley is a tight fit on the A/C compressor. It must be correctly aligned during installation.

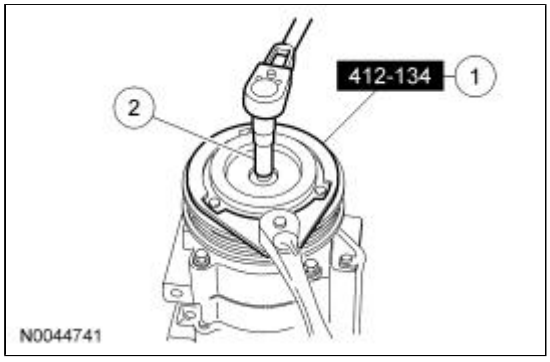
   Install the A/C compressor pulley.

6. Install the A/C compressor pulley snap ring with the bevel side out.

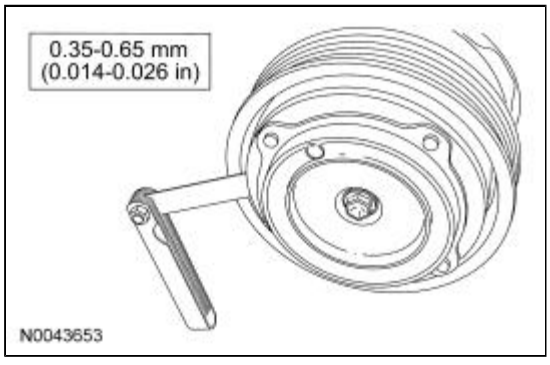
7. Place one nominal thickness A/C clutch disc and hub spacer inside the clutch hub spline opening.

8. Install the A/C clutch disc and hub.

9. Using the special tool, install the A/C compressor clutch disc and hub nut.
   1. Hold the A/C clutch disc and hub with the special tool.
   2. Tighten the nut to 13 Nm (10 lb-ft).



10. Measure and adjust the clutch air gap by removing or adding A/C clutch disc and hub spacers.



11. Install the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor in this section.

Compressor to Condenser Discharge Line

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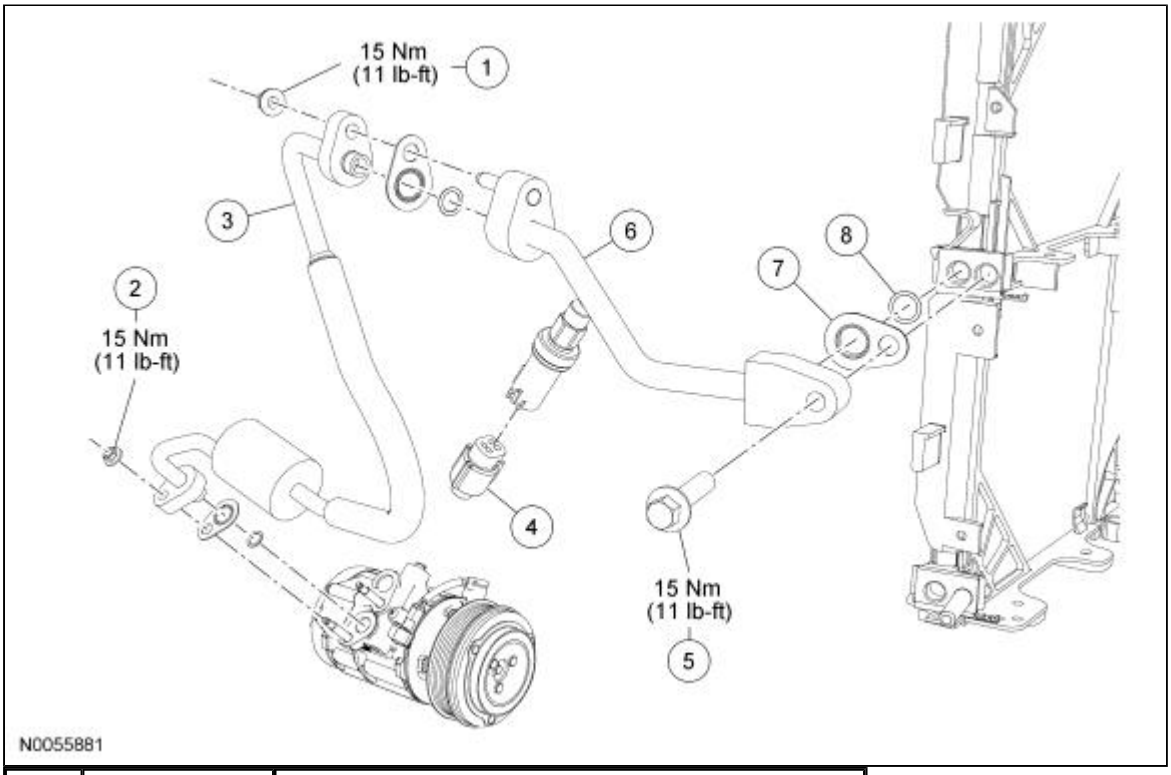
Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Condenser inlet jumper line fitting nut
2	W520413	Compressor discharge fitting nut
3	19972	Compressor-to-condenser line
4	12A581	A/C pressure transducer electrical connector
5	W500110	Condenser inlet fitting bolt
6	19E558	Condenser inlet jumper line
7	19B588	Gasket seal (3 required)
8	19E889	O-ring seal (3 required)

Removal and Installation

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the compressor discharge fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

3. Remove the condenser inlet jumper line fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

4. Remove the compressor-to-condenser discharge line.

5. If removing the condenser inlet jumper line, remove the RH headlamp assembly. For additional information, refer to Section 417-01 .

6. If removing the condenser inlet jumper line, disconnect the A/C pressure transducer electrical connector.

7. If removing the condenser inlet jumper line, remove the condenser inlet fitting bolt and disconnect the fitting.
   - Discard the O-ring and gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).

8. Remove the condenser inlet jumper line.

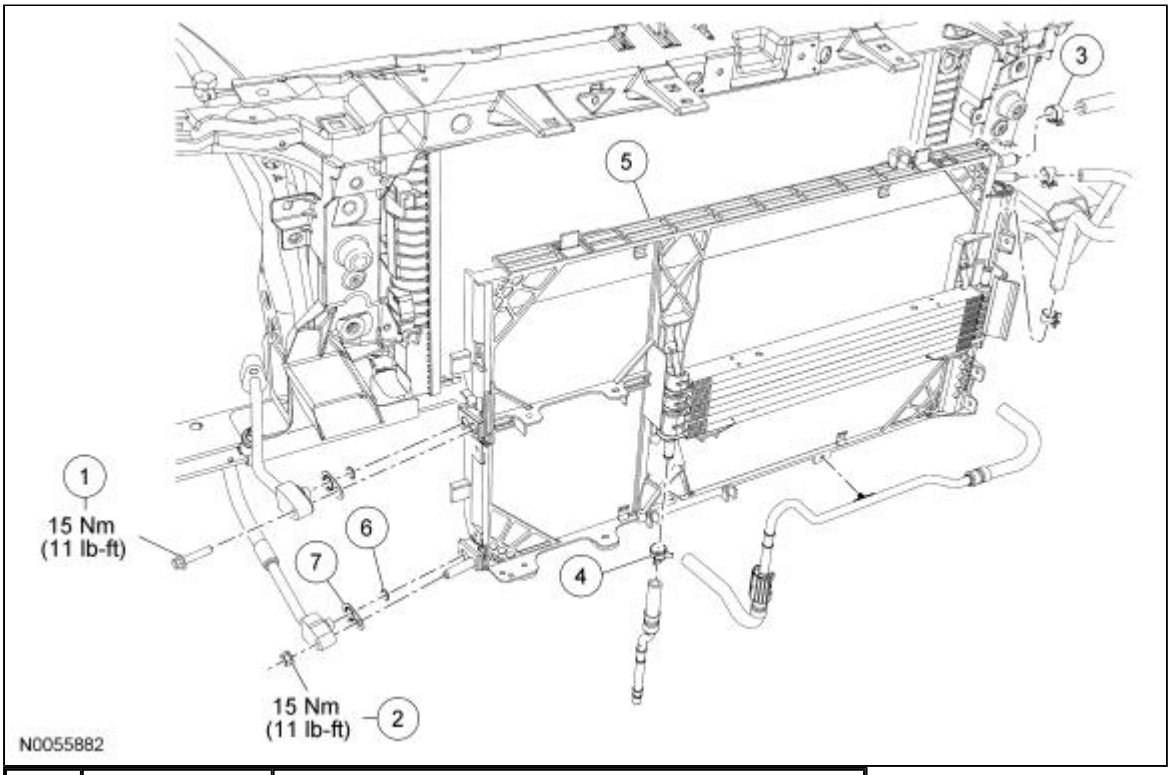
9. To install, reverse the removal procedure.
   - Install new gasket seals and O-ring seals.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

Condenser Core

Printable View (365 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W500110	Condenser inlet fitting bolt
2	W520413	Condenser outlet fitting nut
3	8287	Power steering cooler line clamp (2 required)
4	8287	Transmission cooler line clamp (2 required)
5	19712	Condenser core
6	19B558	O-ring seal (2 required)
7	19E889	Gasket seal (2 required)

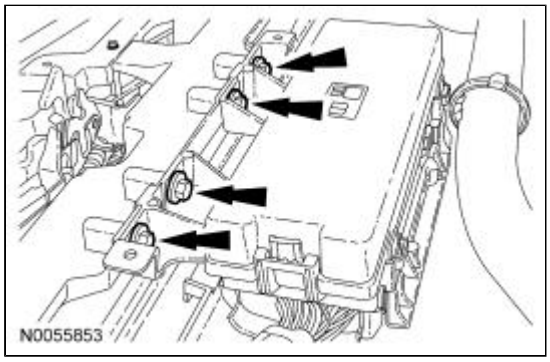
Removal and Installation

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

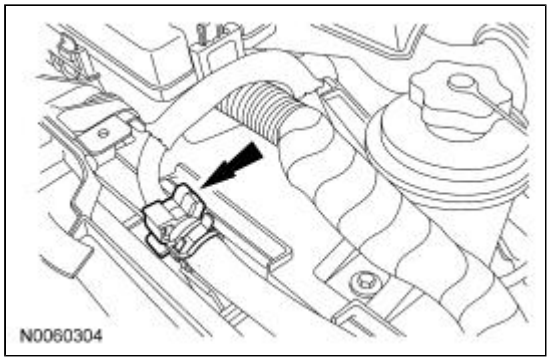
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section

100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .
3. Disconnect the battery cables. For additional information, refer to Section 414-01 .
4. Remove the upper radiator sight shield.
5. Remove the RH and LH headlamp assemblies. For additional information, refer to Section 417-01 .
6. Remove the air cleaner outlet tube. For additional information, refer to Section 303-12 .
7. Remove the 4 junction box bolts and position the junction box aside.

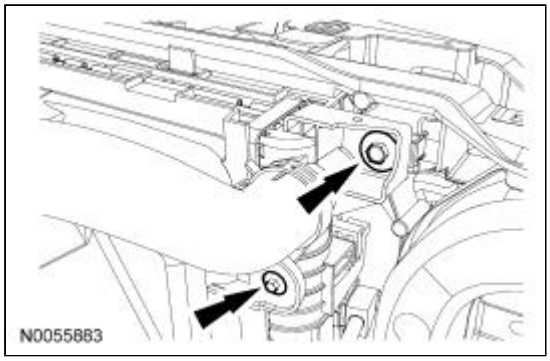


8. Detach the power steering cooler line clip.



9. Remove the condenser inlet fitting bolt and disconnect the fitting.
   - Discard the O-ring and gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
10. Remove the condenser outlet fitting nut and disconnect the fitting.
    - Discard the O-ring and gasket seals.
    - To install, tighten to 15 Nm (11 lb-ft).
11. **NOTE:** RH bolts shown, LH similar.

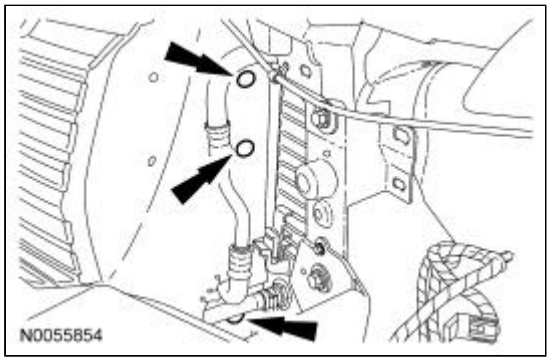
    Remove the 2 cooling module and 2 cooling fan shroud bolts.



12. Release the clamps and disconnect the 2 power steering cooler lines from the condenser core.

13. **NOTE:** LH air deflector shown, RH similar.

    Remove the 6 pin-type retainers and detach the RH and LH air deflectors from the condenser.



14. Remove the 9 lower radiator splash shield pin-type retainers and position the shield aside.

15. Release the clamps and disconnect the 2 transmission cooler lines from the transmission cooler.

16. Detach the transmission cooler line pin-type retainer from the condenser core bracket.

17. **NOTE:** The cooling module must be positioned rearward to raise and detach the 4 condenser mounts from the cooling module.

    NOTE: The condenser must be removed from below the vehicle.

    Detach and remove the condenser core and transmission cooler as an assembly.
    1. Position the cooling module rearward enough to allow the condenser to be lifted upward.
    2. Depress the retaining tabs on the 2 lower condenser mounting brackets and detach the 4 condenser mounting brackets from the cooling module
    3. Position the top of the condenser forward to detach the top lip of the condenser bracket from the cooling module and remove the condenser core and bracket.

18. To install, reverse the removal procedure.
    - Install new gasket seals and O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

19. Fill the power steering fluid level. For additional information, refer to Section 211-00 .

20. Fill the transmission fluid level. For additional information, refer to Section 307-01A or Section 307-01B .

21. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Floor Duct

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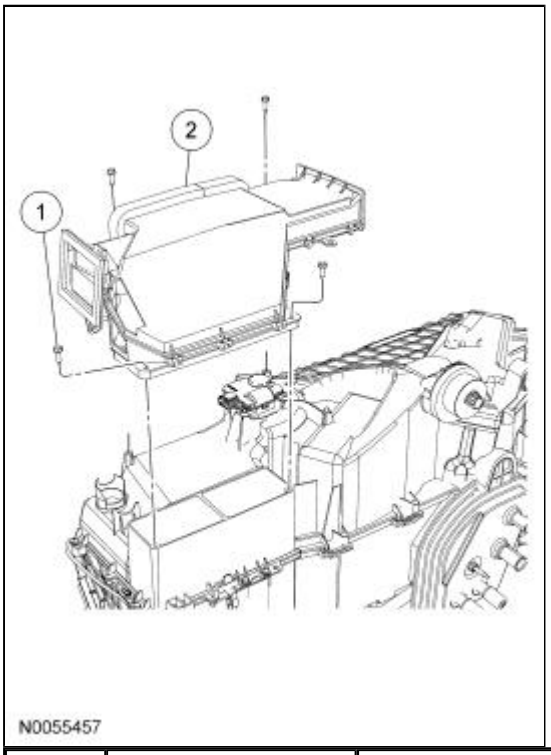


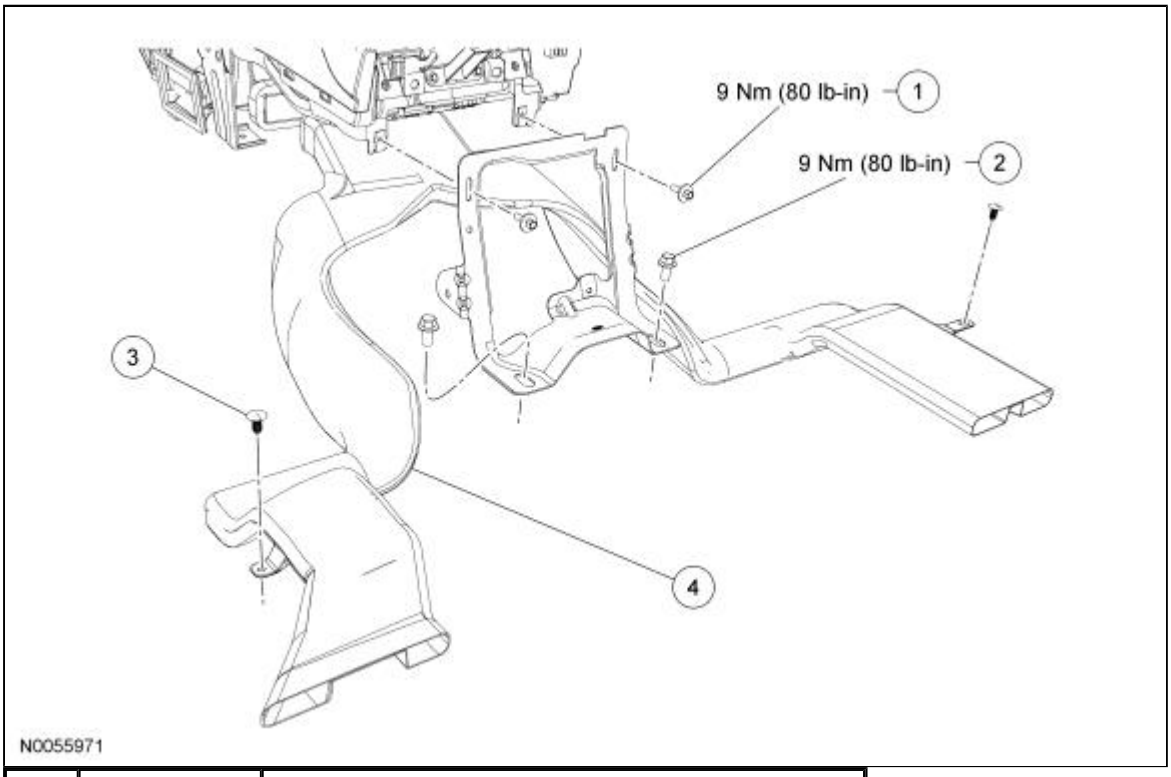
Item	Part Number	Description
1	W701696	Floor duct screw (4 required)
2	18C433	Floor duct

Removal and Installation

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.
2. Remove the 4 floor duct screws.
3. Remove the floor duct.
4. To install, reverse the removal procedure.

Footwell Duct — Rear

Printable View (131 KB)



Item	Part Number	Description
1	W704734	Instrument panel bracket upper bolt (2 required)
2	W505234	Instrument panel bracket lower bolt (2 required)
3	W705589	Rear footwell duct pin-type retainer (2 required)
4	—	Rear footwell duct

Removal and Installation

All vehicles

1. Remove the front seats. For additional information, refer to Section 501-10 .
2. Remove the front floor console. For additional information, refer to Section 501-12 .
3. Remove the RH and LH lower cowl trim panels and front door sill plates.

Navigator only

4. Remove the upper and lower instrument panel bracket bolts and position the instrument panel bracket aside.
   - To install, tighten to 9 Nm (80 lb-in).

All vehicles

5. Fold back the carpet to completely uncover the rear footwell duct.

6. Remove the 2 rear footwell duct pin-type retainers.
7. Remove the rear footwell duct.
8. To install, reverse the removal procedure.

Evaporator Core

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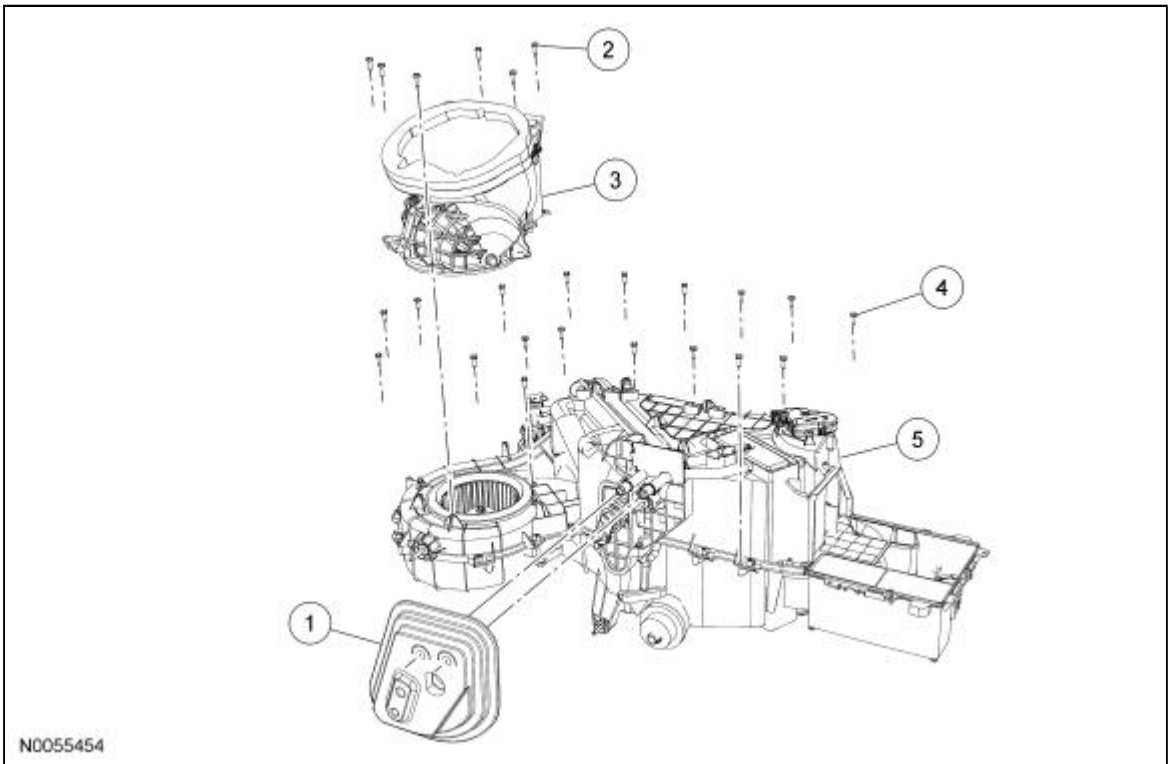


Item	Part Number	Description
1	19C593	Dash panel seal
2	W701696	Air inlet duct screw (6 required)
3	19A618	Air inlet duct
4	W701696	Heater core and evaporator core housing screw (15 required)
5	19B555	Heater core and evaporator core housing

Removal and Installation

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle.

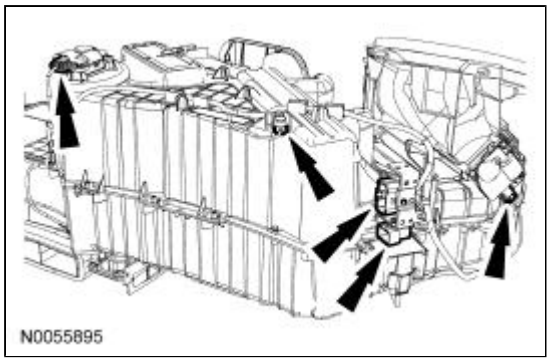
NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

NOTE: A new evaporator core seal is supplied as a kit with the evaporator core service part. Failure to install this seal, or failure to install it correctly, will result in air bypassing the evaporator core and loss of cooling efficiency.

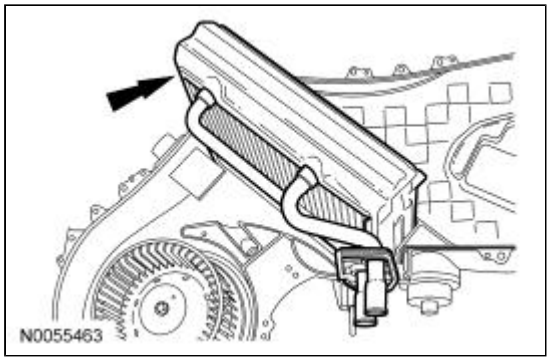
1. Remove the plenum chamber. For additional information, refer to Plenum Chamber in this section.

2. Remove 2 heater core quick disconnect fitting clips and the dash panel seal.

3. Detach the wire harness from the upper half of the heater core and evaporator core housing.



4. Remove the 6 air inlet duct screws and the air inlet duct.
5. Remove the 15 heater core and evaporator core housing screws.
6. Separate the 2 halves of the heater core and evaporator core housing.
7. Remove the evaporator core.



8. To install, reverse the removal procedure.

Heater Core

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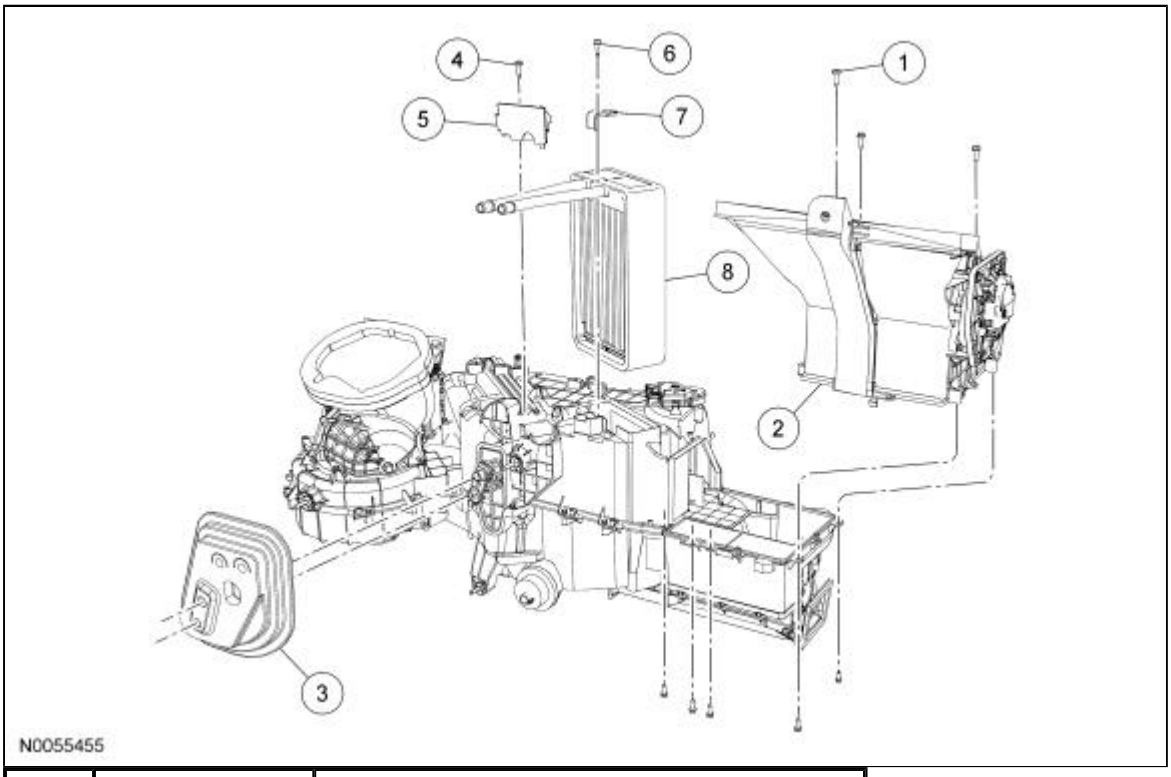
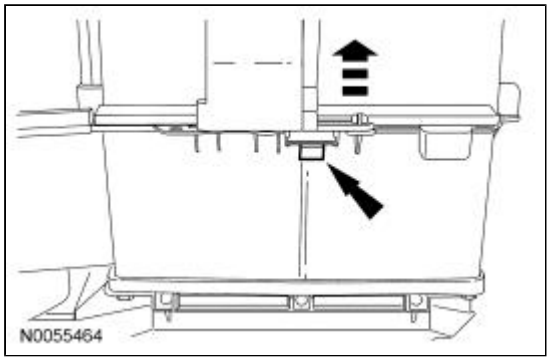


Item	Part Number	Description
1	W701696	Plenum chamber screw (8 required)
2	18471	Plenum chamber
3	19C593	Dash panel seal
4	W701696	Heater core tube bracket screw
5	18B689	Heater core tube bracket
6	W701696	Heater core bracket screw
7	18B689	Heater core bracket
8	18476	Heater core

Removal and Installation

NOTE: If a heater core leak is suspected, the heater core must be leak tested before it is removed from the vehicle. For additional information, refer to Section 412-00 .

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.
2. Remove the 8 plenum chamber screws.
3. Release the plenum chamber clip and position the plenum chamber aside.



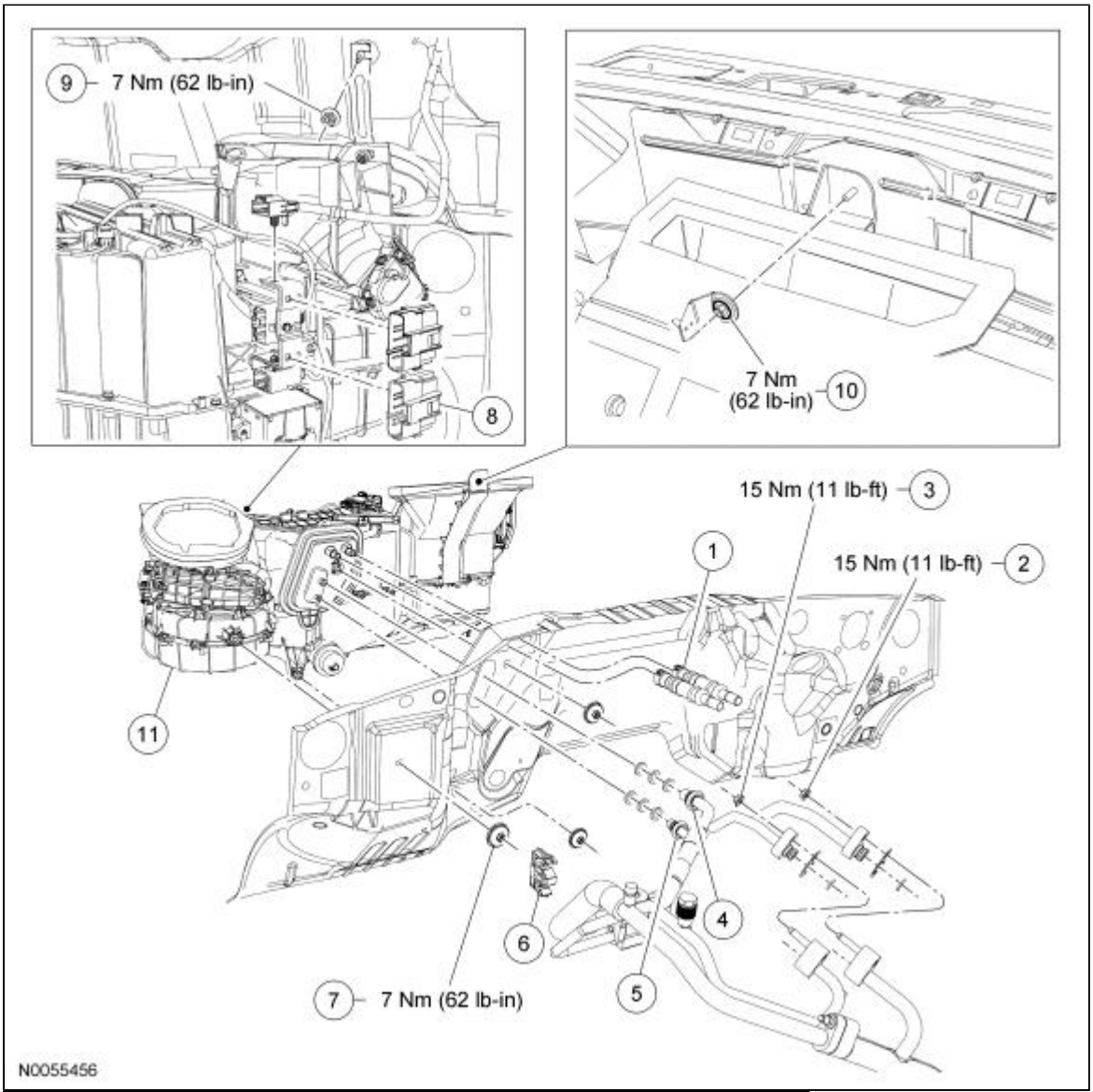
4. Remove 2 heater core fitting clips and the dash panel seal.
5. Remove the heater core tube bracket screw and the heater core tube bracket.
6. Remove the heater core bracket screw and the heater core bracket.
7. Remove the heater core.
8. To install, reverse the removal procedure.

Heater Core And Evaporator Core Housing

Printable View (363 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	18472	Heater core fitting (2 required)
2	W520413	Auxiliary evaporator outlet line fitting nut
3	W520413	Auxiliary evaporator inlet line fitting nut

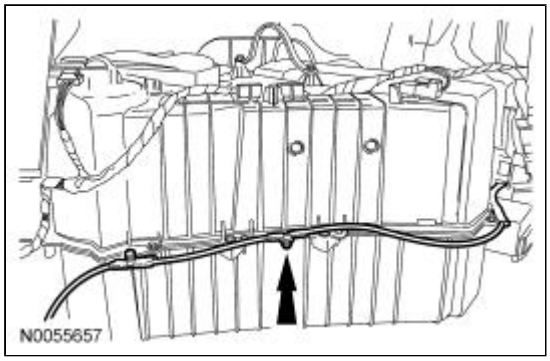
4	—	Evaporator outlet fitting (part of 19A498)
5	—	Evaporator inlet fitting (part of 19A498)
6	—	Thermostatic expansion valve (TXV) manifold and tube bracket (part of 19A498)
7	W708206	Heater core and evaporator core housing nut (3 required)
8	14401	Body harness electrical connector (3 required)
9	N806543	Air inlet duct bracket nut
10	—	Plenum chamber nut (part of 18471)
11	19B555	Heater core and evaporator core housing

Removal and Installation

NOTE: If an evaporator core leak is suspected, the evaporator must be vacuum leak tested before it is removed from the vehicle. For additional information, refer to Section 412-00 .

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Drain the engine coolant. For additional information, refer to Section 303-03 .
3. Remove the instrument panel. For additional information, refer to Section 501-12 .
4. Disconnect the 2 heater hose quick disconnect fittings at the heater core.
5. Remove the auxiliary evaporator outlet and inlet line fitting nuts and disconnect the fittings.
   - Discard the O-ring seals and gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
6. Disconnect the evaporator outlet and inlet fittings.
   - Discard the O-ring seals.
7. Detach the thermostatic expansion valve (TXV) manifold and tube assembly from the line 2 brackets.
8. Detach the TXV manifold and tube assembly bracket from the heater core and evaporator core housing stud at the dash panel.
9. Remove the 3 heater core and evaporator core housing nuts.
   - To install, tighten to 7 Nm (62 lb-in).
10. Detach the 4 satellite radio antenna cable pin-type retainers from the heater core and evaporator core housing (if equipped).

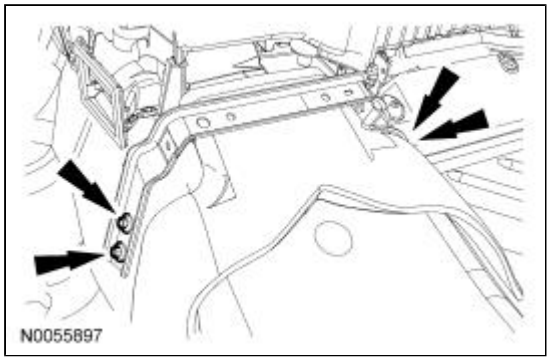


11. Detach the 3 body harness electrical connectors from the bracket below the air inlet duct.

12. Remove the air inlet duct bracket nut.
    - To install, tighten to 7 Nm (62 lb-in).

13. Remove the plenum chamber nut.
    - To install, tighten to 7 Nm (62 lb-in).

14. Remove the 4 tunnel instrument panel bracket bolts and the tunnel instrument panel bracket.



15. Detach the rear footwell duct from the heater core and evaporator core housing.

16. Remove the plenum chamber nut.

17. Remove the heater core and evaporator core housing.

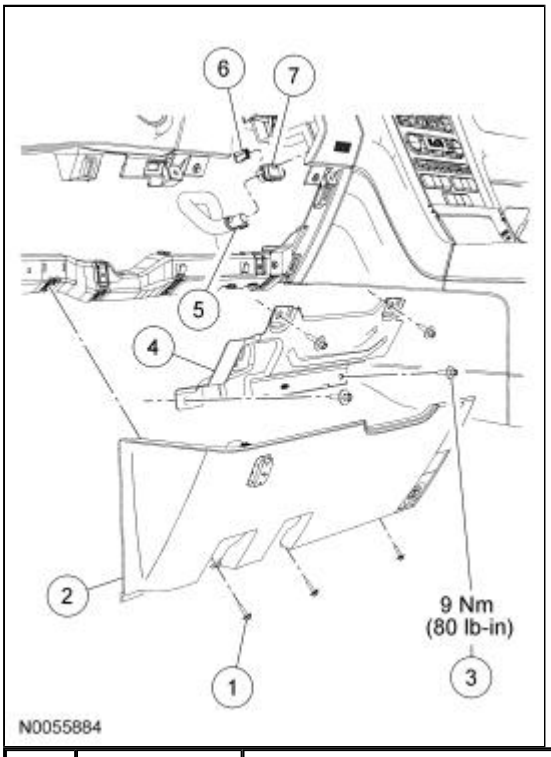
18. To install, reverse the removal procedure.
    - Install new gasket seals and O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

19. Fill the engine coolant level. For additional information, refer to Section 303-03 .

20. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

In-Vehicle Temperature and Humidity Sensor

Printable View (116 KB)



Item	Part Number	Description
1	W707628	Steering column cover screw (3 required)
2	7804459	Steering column cover
3	W71087	Steering column reinforcement bolt (4 required)
4	78017A26	Steering column reinforcement
5	19D888	Aspirator hose
6	14401	In-vehicle temperature and humidity sensor electrical connector
7	19C734	In-vehicle temperature and humidity sensor

Removal and Installation

1. Remove the 3 lower steering column cover screws and the lower steering column cover.
   - Disconnect the electrical connector.

2. Remove the 4 steering column reinforcement bolts and position the steering column reinforcement aside.
   - To install, tighten to 9 Nm (80 lb-in).

3. Remove the in-vehicle temperature and humidity sensor.
   1. Detach the in-vehicle temperature and humidity sensor from the instrument panel finish panel.
   2. Disconnect the aspirator hose.
   3. Disconnect the in-vehicle temperature and humidity sensor electrical connector.

4. To install, reverse the removal procedure.

In-Vehicle Temperature Sensor

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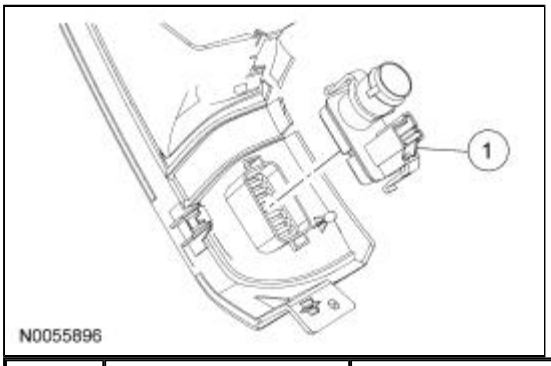


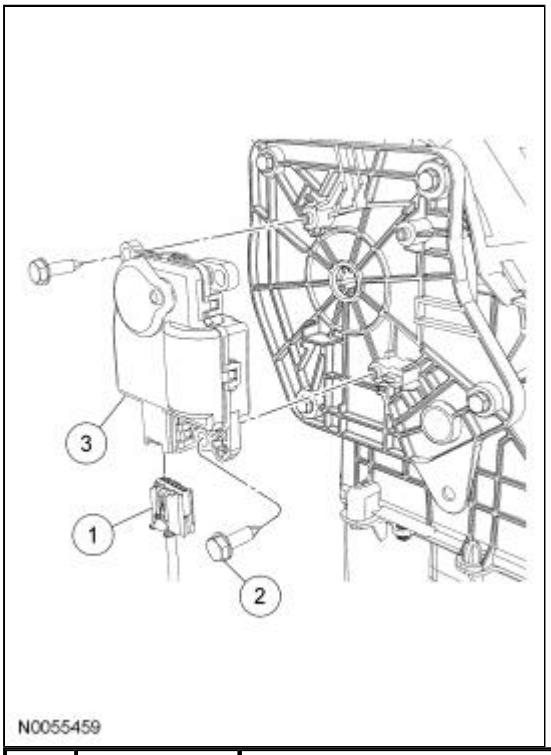
Item	Part Number	Description
1	19C734	In-vehicle temperature sensor

Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12
2. Remove the in-vehicle temperature sensor.
3. To install, reverse the removal procedure.

Mode Door Actuator — Defrost/Panel/Floor Door

Printable View (146 KB)



Item	Part Number	Description
1	18B518	Defrost/panel/floor door mode door actuator electrical connector
2	W701696	Defrost/panel/floor door mode door actuator screw (2 required)
3	19E616	Defrost/panel/floor door mode door actuator

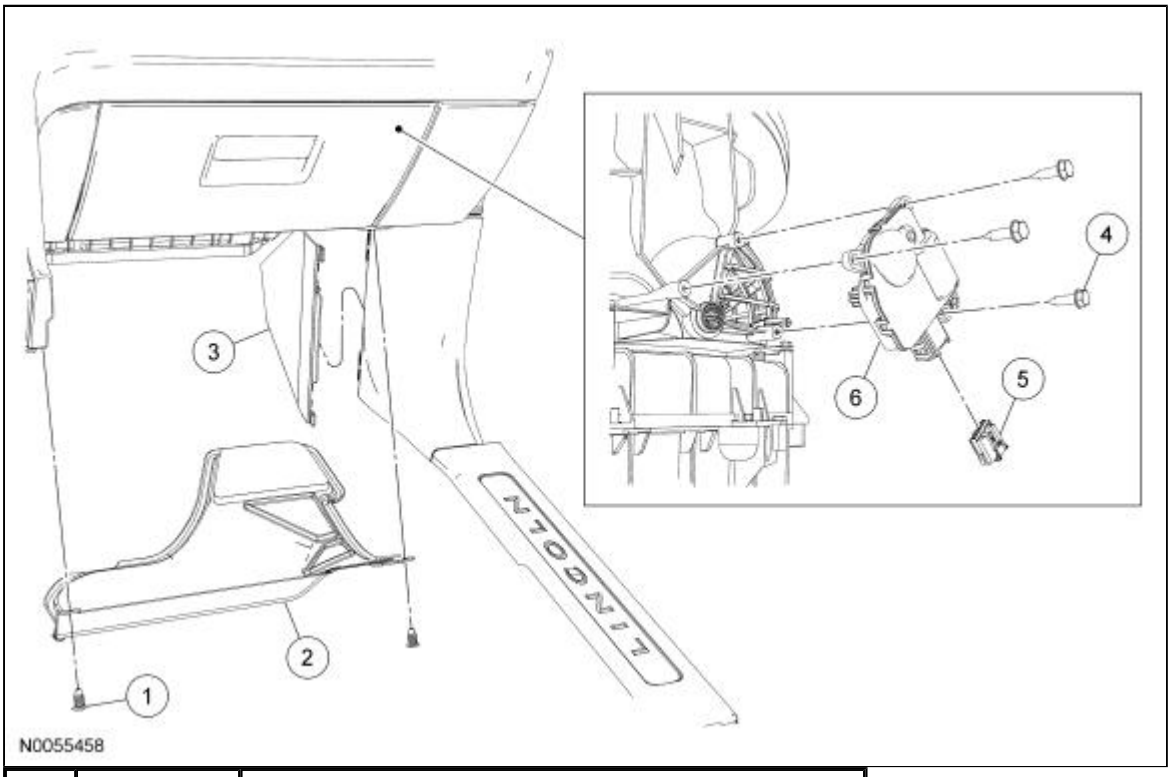
Removal and Installation

NOTE: The defrost/panel/floor mode door actuator can be accessed from underneath the LH side of the instrument panel.

1. Disconnect the defrost/panel/floor mode door actuator electrical connector.
2. Remove the 2 defrost/panel/floor mode door actuator screws.
3. Remove the defrost/panel/floor mode door actuator.
4. To install, reverse the removal procedure.

Mode Door Actuator — Air Inlet Door

Printable View (143 KB)



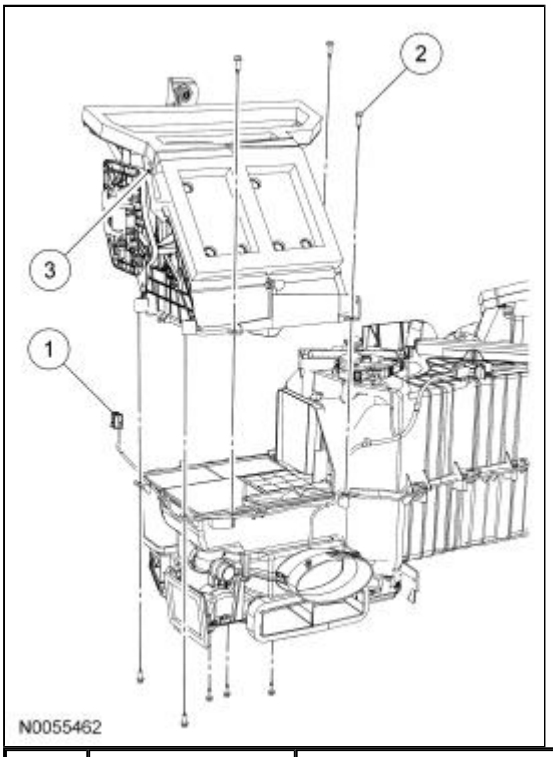
Item	Part Number	Description
1	—	RH lower instrument panel insulator pin-type retainer (2 required)
2	—	RH lower instrument panel insulator
3	02348	Junction box cover
4	W701696	Air inlet mode door actuator screw (3 required)
5	18B518	Air inlet mode door actuator electrical connector
6	19E616	Air inlet mode door actuator

Removal and Installation

1. Remove the RH lower instrument panel insulator (if equipped).
2. Remove the junction box cover at the RH lower A-pillar.
3. Remove the 3 air inlet mode door actuator screws.
4. Disconnect the air inlet mode door actuator electrical connector.
5. Remove the air inlet mode door actuator.
6. To install, reverse the removal procedure.

Plenum Chamber

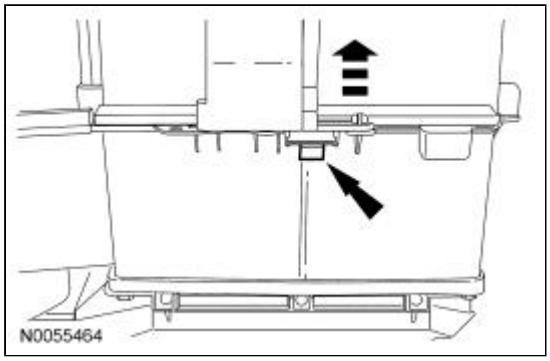
Printable View (145 KB)



Item	Part Number	Description
1	18B518	Mode door actuator electrical connector
2	W701696	Plenum chamber screw (8 required)
3	18471	Plenum chamber

Removal and Installation

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.
2. Disconnect the mode door actuator electrical connector and position the wire harness aside.
3. Remove the 8 plenum chamber screws.
4. Release the plenum chamber clip and remove the plenum chamber.



5. To install, reverse the removal procedure.

Receiver Drier

Printable View (120 KB)

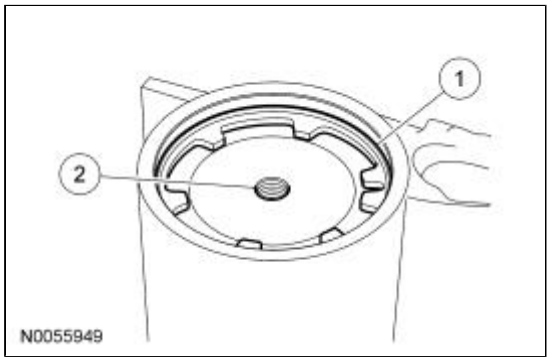
Material

Item	Specification
PAG Refrigerant Compressor Oil (R134a Systems) YN-12-D	WSH-M1C231-B

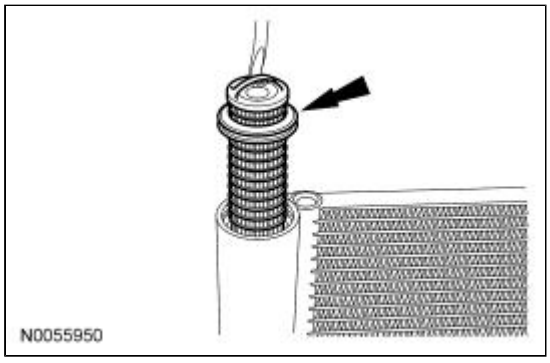
Removal and Installation

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

1. Remove the condenser core. For additional information, refer to Condenser Core in this section.
2. Unscrew and remove the plastic receiver/drier cap.
3. Remove the receiver/drier plug.
    1. Push the receiver/drier plug upwards and remove the snap ring.
    2. Install the bolt included with the receiver/drier cartridge service kit in the center of the receiver drier plug and remove the plug.



4. Using a suitable tool, grasp the receiver/drier cartridge grab handle and remove the receiver/drier cartridge.

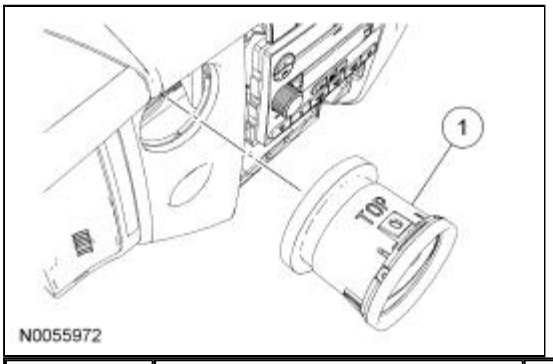


5. To install, reverse the removal procedure.

- Lubricate the receiver/drier plug O-ring seals using residual refrigerant oil from inside the receiver/drier.

Register — Expedition

Printable View (136 KB)



Item	Part Number	Description
1	19893	Register

Removal and Installation

LH register

1. Remove the steering column opening cover.
2. Remove the 4 steering column opening reinforcement bolts and the steering column reinforcement.
3. Remove the LH outer instrument panel trim panel.

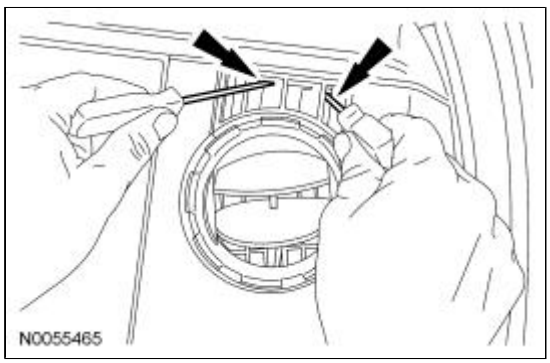
RH register

4. Lower the glove compartment

LH or RH register

5. Working through the instrument panel opening, depress the 2 clips on the sides of the register barrel and tilt the bottom of the register outward to keep the clips from re-engaging.
6. **NOTE:** RH register shown, LH similar.

   Using 2 suitable tools, release the clips through the demister nozzle opening and remove the register.



Center registers

7. Remove the center instrument panel finish panel. For additional information, refer to Section 501-12 .

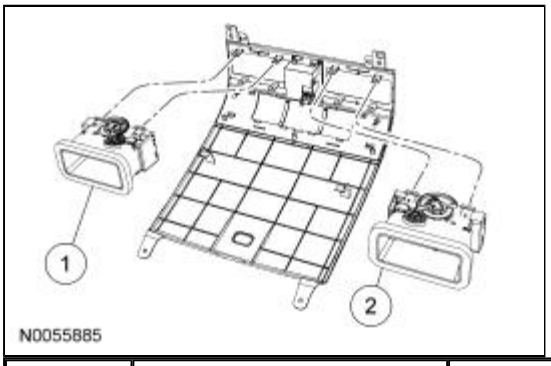
8. Working through the opening below the audio unit, release the 3 register retaining clips and remove the register.

All registers

9. To install, reverse the removal procedure.

Register — Center, Navigator

Printable View (93 KB)



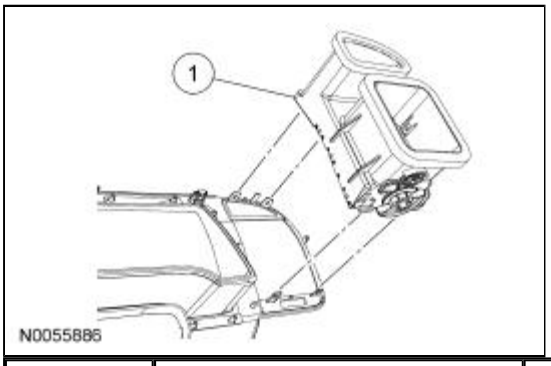
Item	Part Number	Description
1	19893	LH center register
2	19893	RH center register

Removal and Installation

1. Remove the upper center instrument panel finish panel. For additional information, refer to Section 501-12 .
2. Release the center register clips and remove the center registers.
3. To install, reverse the removal procedure.

Register — Driver Side, Navigator

Printable View (85 KB)



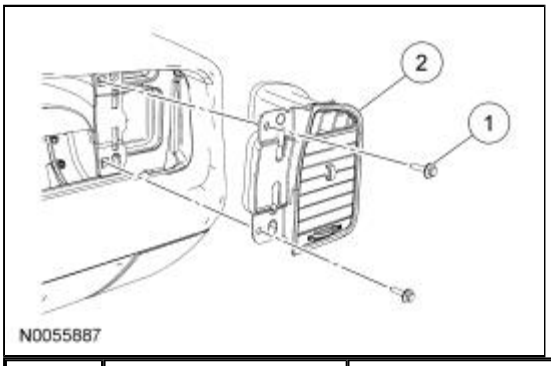
Item	Part Number	Description
1	19893	LH register

Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
2. Release the clips and remove the LH register.
3. To install, reverse the removal procedure.

Register — Passenger Side, Navigator

Printable View (87 KB)



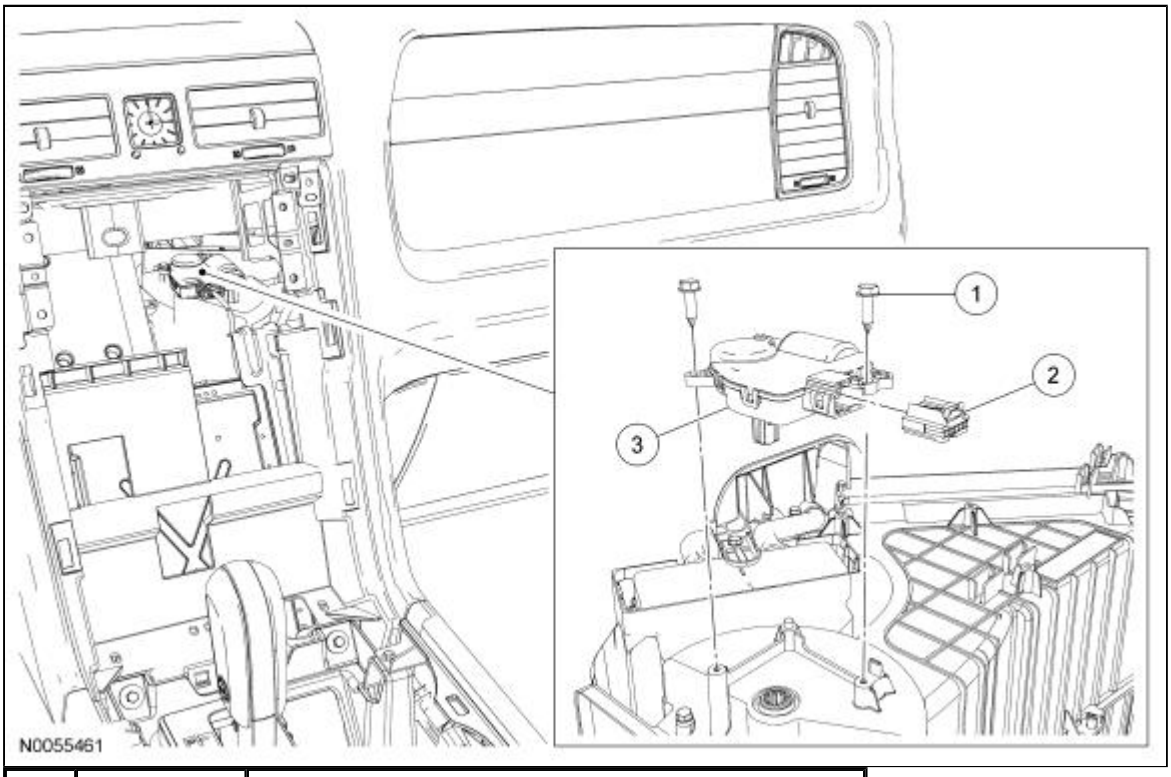
Item	Part Number	Description
1	W707628	RH register screw (2 required)
2	19893	RH register

Removal and Installation

1. Remove the passenger airbag module. For additional information, refer to Section 501-20B .
2. Remove the 2 RH register screws.
3. Remove the RH register.
4. To install, reverse the removal procedure.

Temperature Blend Door Actuator — RH

Printable View (221 KB)



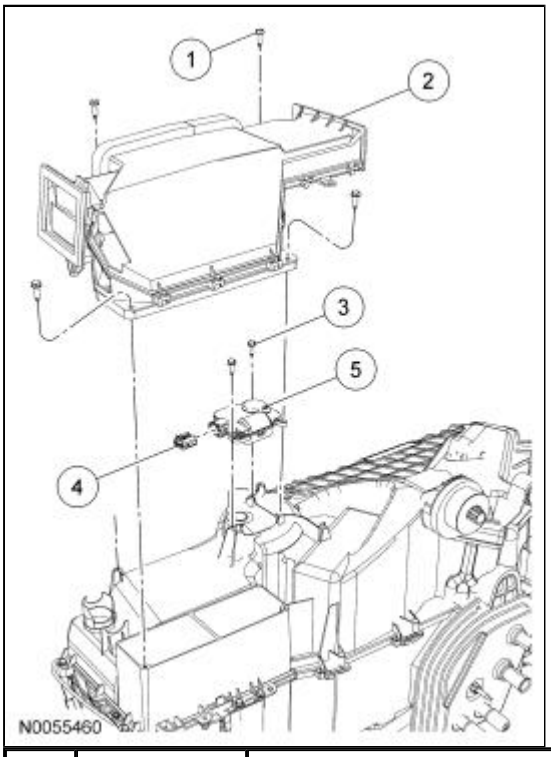
Item	Part Number	Description
1	W701696	RH temperature blend door actuator screw (2 required)
2	18B518	RH temperature blend door actuator electrical connector
3	19E616	RH temperature blend door actuator

Removal and Installation

1. Remove the audio unit. For additional information, refer to Section 415-01 .
2. Disconnect the RH temperature blend door actuator electrical connector.
3. Remove the 2 RH temperature blend door actuator screws.
4. Remove the RH temperature blend door actuator.
5. To install, reverse the removal procedure.

Temperature Blend Door Actuator — LH

Printable View (131 KB)



Item	Part Number	Description
1	W701696	Floor duct screw (4 required)
2	18C433	Floor duct
3	W701696	LH temperature blend door actuator screw (2 required)
4	18B518	LH temperature blend door actuator electrical connector
5	19E616	LH temperature blend door actuator

Removal and Installation

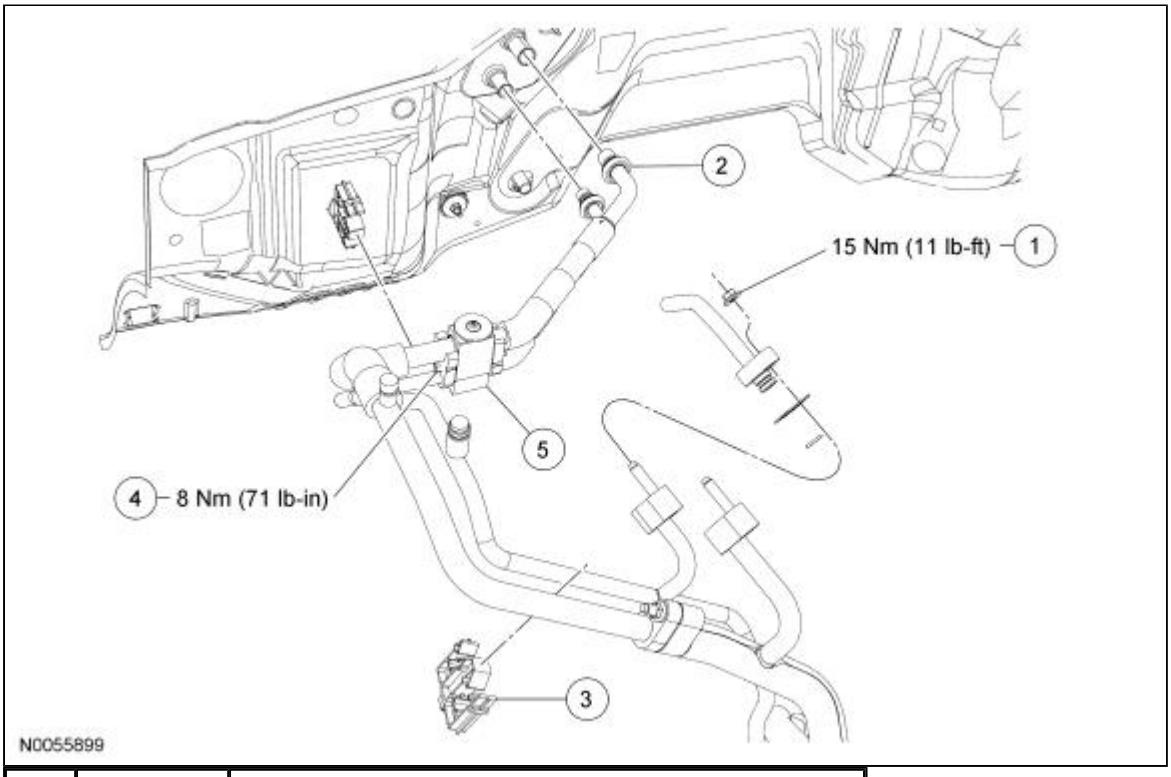
1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.
2. Remove the 4 floor duct screws.
3. Remove the floor duct.
4. Disconnect the LH temperature blend door actuator electrical connector.
5. Remove the 2 LH temperature blend door actuator screws.
6. Remove the LH temperature blend door actuator.
7. To install, reverse the removal procedure.

Thermostatic Expansion Valve

Printable View (210 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Auxiliary evaporator inlet line fitting nut
2	—	Evaporator fitting (2 required) (part of 19A498)
3	—	Thermostatic expansion valve (TXV) manifold and tube bracket (2 required) (part of 19A498)
4	W500110	Thermostatic expansion valve fitting bolt
5	19849	Thermostatic expansion valve

Removal and Installation

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

All vehicles

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

Vehicles with auxiliary A/C

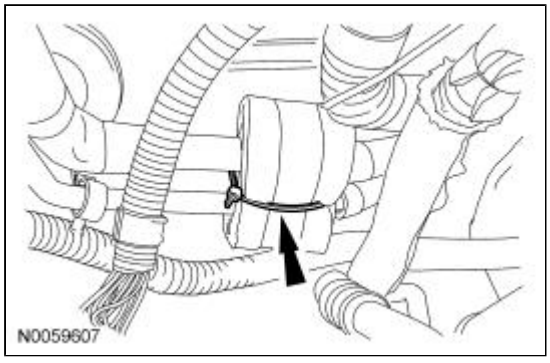
2. Remove the auxiliary evaporator inlet line fitting nut and disconnect the fitting.
    - Discard the gasket seal and O-ring seal.
    - To install, tighten to 15 Nm (11 lb-ft).

All vehicles

3. Disconnect the evaporator inlet and outlet fittings.
    - Discard the O-ring seals.

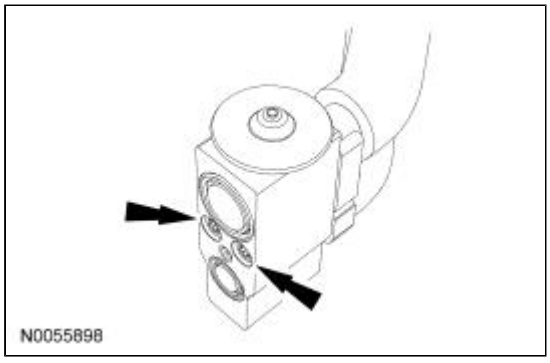
4. Detach the thermostatic expansion valve (TXV) manifold and tube assembly from the 2 TXV manifold and tube brackets.

5. Remove the tie-strap from the TXV insulator.



6. Remove the TXV fitting bolt.
    - Discard the O-ring seals.
    - To install, tighten to 8 Nm (71 lb-in).

7. Remove the 2 bolts and the TXV.
    - Discard the O-ring seals.
    - To install, tighten to 8 Nm (71 lb-in).



8. To install, reverse the removal procedure.
    - Install new gasket seals and O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

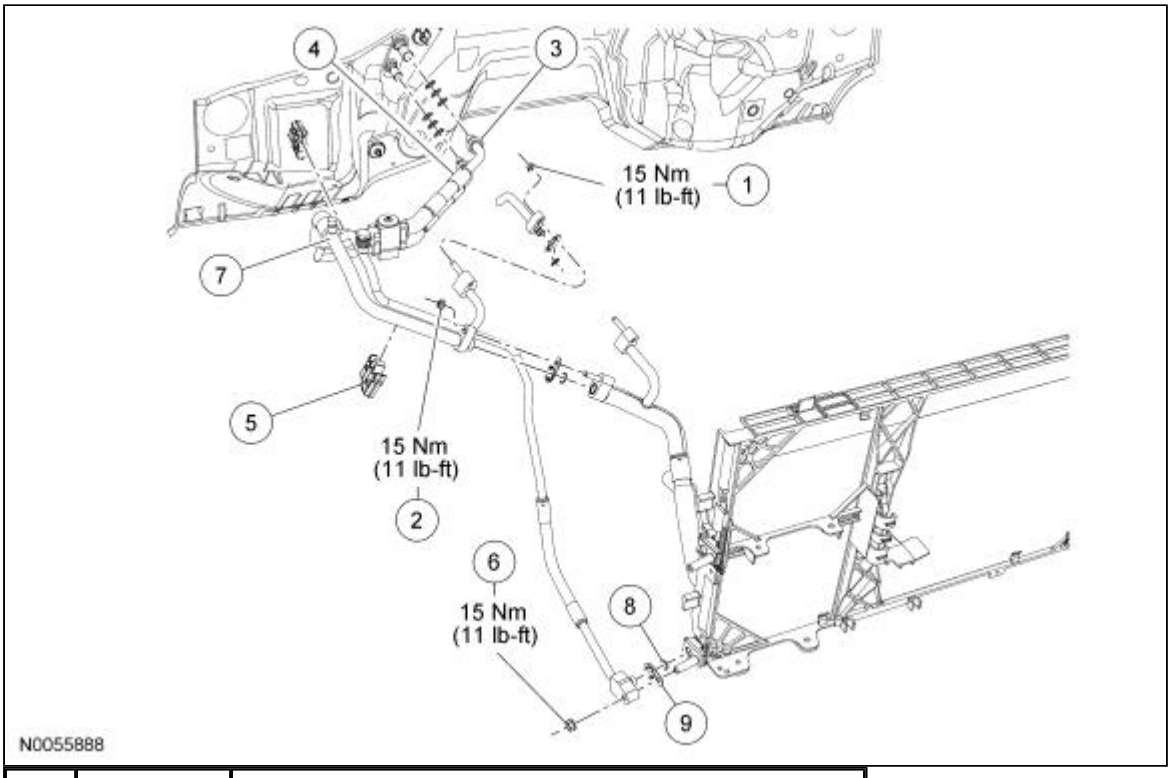
9. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Thermostatic Expansion Valve Manifold and Tube Assembly

Printable View (170 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Auxiliary evaporator inlet line fitting nut
2	W520413	Thermostatic expansion valve manifold and tube suction fitting nut
3	—	Evaporator outlet fitting (part of 19A498)
4	—	Evaporator inlet fitting (part of 19A498)
5	—	Thermostatic expansion valve manifold and tube bracket (2 required) (part of 19A498)
6	W520413	Condenser outlet fitting nut
7	19A498	Thermostatic expansion valve manifold and tube assembly
8	19E889	O-ring seal (9 required)
9	19B558	Gasket seal (3 required)

Removal and Installation

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the RH headlamp assembly. For additional information, refer to Section 417-01 .

3. Remove the auxiliary evaporator inlet line fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

4. Disconnect the evaporator core inlet and outlet fittings.
   - Discard the O-ring seals.

5. Detach the thermostatic expansion valve (TXV) manifold and tube assembly from the 2 TXV manifold and tube brackets.

6. Remove the condenser outlet fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

7. Remove the TXV manifold and tube suction fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

8. Remove the TXV manifold and tube assembly.

9. To install, reverse the removal procedure.
   - Install new O-ring seals.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

10. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Printable View (79 KB)

General Specifications

Item	Specification
Lubricants	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Torque Specifications

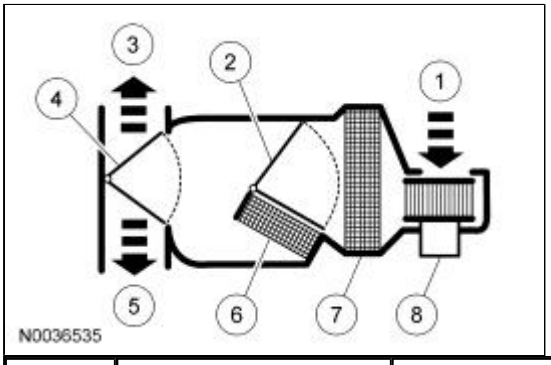
Description	Nm	lb-ft	lb-in
Auxiliary airflow duct bolt	8	—	71
Auxiliary evaporator inlet line front fitting nut	15	11	—
Auxiliary evaporator outlet and inlet line rear fitting nut	12	9	—
Auxiliary evaporator outlet line front fitting nut	15	11	—
Auxiliary heater core and evaporator core housing bolts	8	—	71
Auxiliary line bracket nuts	5	—	44
Floorpan bracket bolt	8	—	71
Thermostatic expansion valve (TXV) bolt	8	—	71

Auxiliary Climate Control

Printable View (102 KB)

An optional auxiliary climate control system is available. The system is a one-piece unit that is located on the RH side of the vehicle between the side windows and the floorpan, behind the rear wheel well. The driver has primary control of the auxiliary climate control system or can transfer control to a rear passenger control panel.

System Airflow



Item	Part Number	Description
1	—	Air inlet
2	—	Temperature blend door
3	—	Headliner airflow
4	—	Auxiliary mode door
5	—	Floor airflow
6	18476	Heater core
7	19860	Evaporator core
8	19805	Blower motor

The auxiliary air conditioning (A/C) and heating system has the following features:

- The auxiliary climate control system is functional whenever the instrument panel mounted climate control assembly is in any mode except OFF.
- The auxiliary blower motor recirculates the air inside the vehicle. Outside air is not available to the auxiliary system.
- Air is cooled and dehumidified by the auxiliary A/C evaporator core only if the front (main) climate control system is operating in a mode that requires A/C compressor operation.
- The temperature blend door and the auxiliary mode door are controlled by electric actuator motors.
- Movement of the auxiliary temperature control between cool and warm causes a corresponding movement of the temperature blend door to mix air flowing through and around the auxiliary heater core.
- Movement of the auxiliary mode control between PANEL and FLOOR causes a corresponding movement of the auxiliary mode door to direct airflow between the panel (headliner) registers and the floor duct.

Blower Motor

The auxiliary climate control system is equipped with a blower motor controlled by the blower motor switch on the front or rear auxiliary control assembly. The auxiliary blower motor is mounted to the auxiliary heater core and evaporator core housing behind the RH quarter trim panel.

Control Assembly

The auxiliary climate control system has dual controls for the front and rear passengers consisting of temperature/mode and blower speed. The front auxiliary A/C control functionality is integrated into the main instrument panel mounted climate control assembly. The rear auxiliary A/C control is mounted in the rear finish panel of the front floor console. Temperature and airflow mode are combined into a single setting. When the temperature is set to full cool the airflow mode will be automatically set to discharge from the headliner registers. When the temperature is set to full warm, the airflow mode will be set to discharge from the floor register.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer the heat to air passing through the auxiliary climate control housing.

Evaporator Core

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle. Refer to Section 412-00.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

The evaporator core is an aluminum plate/fin type and is located in the auxiliary climate control housing. A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and then moves out of the evaporator core through the evaporator core outlet tube. When the A/C compressor is operating, air from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

Thermostatic Expansion Valve (TXV)

The TXV restricts the flow of refrigerant from the high-pressure side of the refrigerant system and separates the low-pressure and high-pressure sides of the auxiliary refrigerant system. Refrigerant entering and exiting the auxiliary evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Auxiliary A/C — Heater Lines

The auxiliary lines are secured to the underbody of the vehicle. Each auxiliary line is only available as a multiple-piece kit for ease of installation.

Auxiliary Blower Motor

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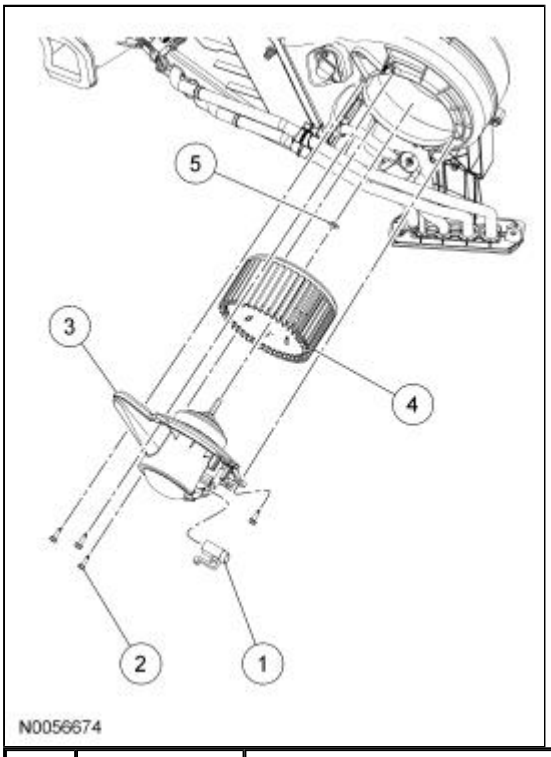


Item	Part Number	Description
1	13A409	Blower motor electrical connector (Expedition or Navigator)
1	19949	Blower motor electrical connector (Expedition EL)
2	W701696	Blower motor screw (Expedition or Navigator) (4 required)
2	—	Blower motor screw (Expedition EL) (3 required)
3	19805	Blower motor
4	19834	Blower motor wheel (Expedition or Navigator)
5	18A287	Blower motor wheel clip (Expedition EL)

Removal and Installation

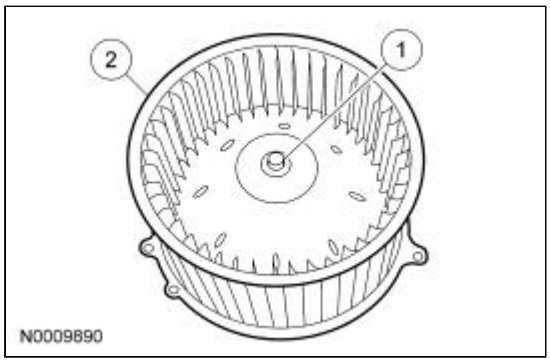
All vehicles

1. Remove the RH quarter trim panel. For additional information, refer to Section 501-05 .

2. Remove the blower motor.
   - Disconnect the blower motor electrical connector.
   - Remove the blower motor screws.
   - Remove the blower motor.

Expedition or Navigator only

3. Remove the blower motor wheel.
    1. Remove the blower motor wheel clip.
    2. Remove the blower motor wheel.

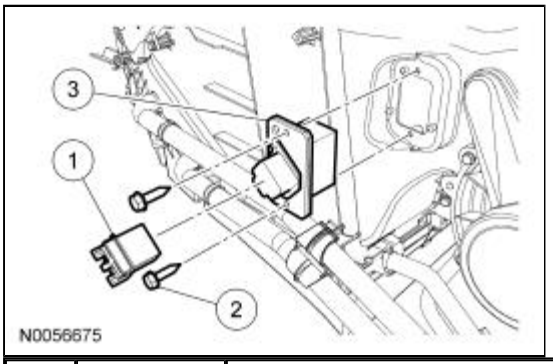


All vehicles

4. To install, reverse the removal procedure.

Auxiliary Blower Motor Resistor

Printable View (144 KB)



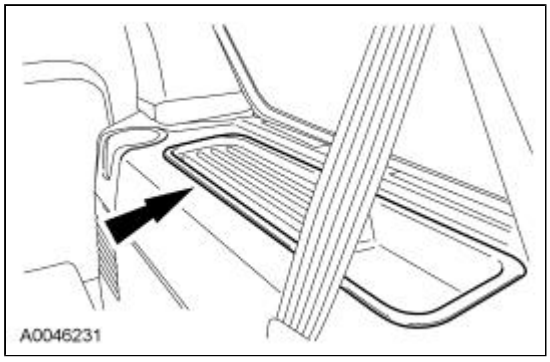
Item	Part Number	Description
1	13A409	Auxiliary blower motor resistor electrical connector (Expedition or Navigator)
1	19949	Auxiliary blower motor resistor electrical connector (Expedition EL)
2	W701696	Auxiliary blower motor resistor screw (Expedition or Navigator — 2 required) (Expedition EL — 1 required)
3	19A706	Auxiliary blower motor resistor

Removal and Installation

NOTE: Expedition or Navigator shown, Expedition EL similar.

All vehicles

1. Remove the RH quarter trim panel access panel.



Expedition or Navigator only

2. Remove the blower motor resistor.
   - Disconnect the blower motor resistor electrical connector.
   - Remove the 2 blower motor resistor screws and the blower motor resistor.

Expedition EL only

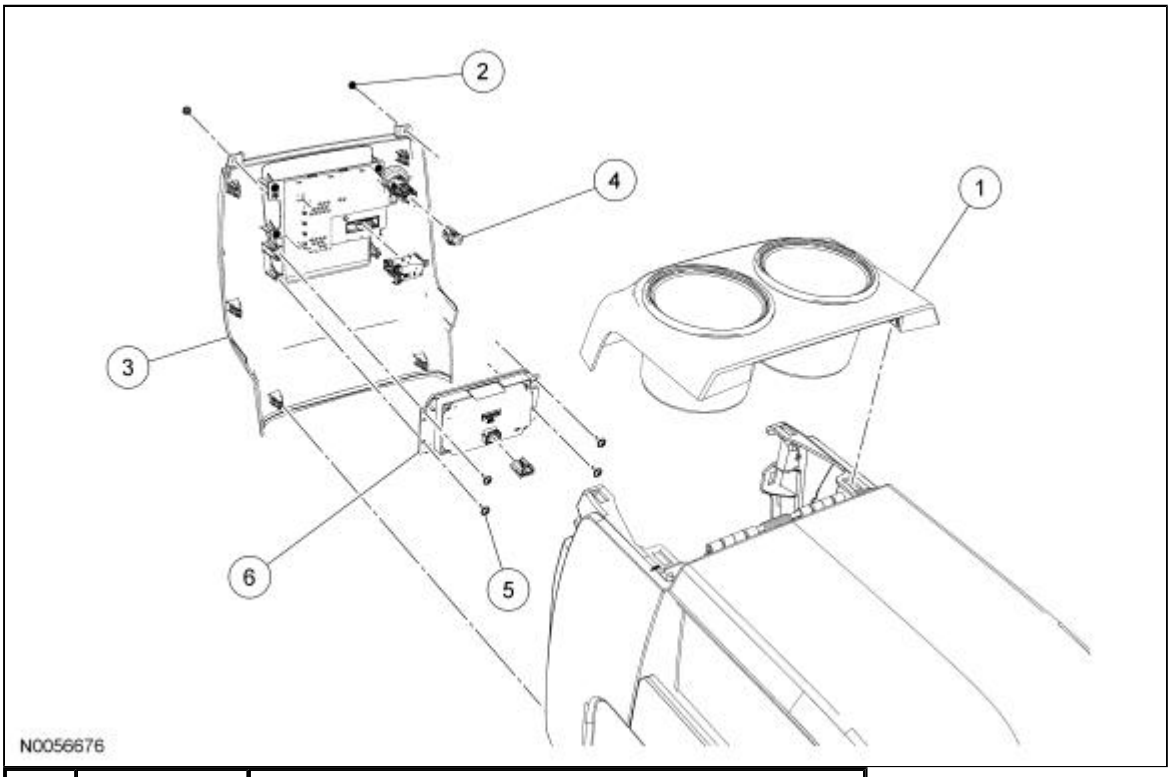
3. Remove the blower motor resistor.
    - Disconnect the blower motor resistor electrical connector.
    - Remove the blower motor resistor screw.
    - Detach the 2 blower motor resistor clips and remove the blower motor resistor.

All vehicles

4. To install, reverse the removal procedure.

Auxiliary Climate Control Assembly

Printable View (129 KB)



Item	Part Number	Description
1	7804567	Floor console upper finish panel
2	W708401	Floor console rear finish panel screw (2 required)
3	78045E24	Floor console rear finish panel
4	14A318	Floor console harness electrical connector (3 required)
5	W708401	Auxiliary climate control assembly screw (4 required)
6	19980	Auxiliary climate control assembly

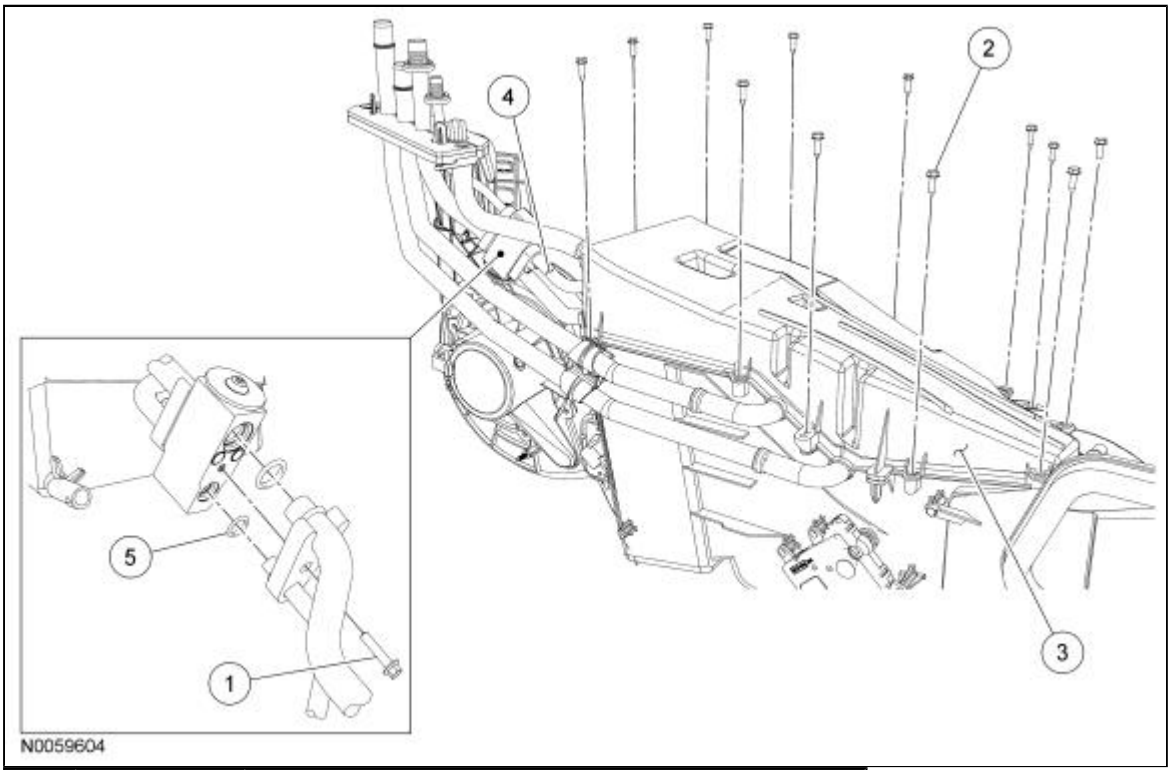
Removal and Installation

1. Remove the floor console upper finish panel.
2. Remove the 2 floor console rear finish panel screws.
3. Disengage the 6 clips and remove the floor console rear finish panel.
    - Disconnect the 3 floor console harness electrical connectors.
4. Remove the 4 auxiliary climate control assembly screws.
5. Remove the auxiliary climate control assembly.

6. To install, reverse the removal procedure.

Auxiliary Evaporator Core

Printable View (183 KB)



Item	Part Number	Description
1	—	Thermostatic expansion valve (TXV) fitting bolt
2	W701696	Evaporator/heater core access cover screw (12 required)
3	—	Evaporator/heater core access cover (part of 18D283)
4	19860	Evaporator core
5	19E889	O-ring seal (4 required)

Removal and Installation

NOTE: The auxiliary evaporator core is not available as a separate component for Expedition EL vehicles and is serviced only as an assembly with the auxiliary heater core and evaporator core housing. The auxiliary evaporator core is serviced as an individual component for Expedition and Navigator vehicles.

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

All vehicles

1. Remove the auxiliary heater core and evaporator core housing. For additional information, refer to Auxiliary Heater Core and Evaporator Core Housing — Expedition, Navigator or Auxiliary Heater Core — Expedition EL in this section.

Expedition EL

2. Transfer the components from the old heater core and evaporator core housing to the new heater core and evaporator core housing as needed.

3. Install the auxiliary heater core and evaporator core housing. For additional information, refer to Auxiliary Heater Core — Expedition EL in this section.

Expedition or Navigator only

4. Remove the thermostatic expansion valve (TXV) fitting bolt and disconnect the fitting.
    - Discard the O-ring seals.

5. Remove the 12 evaporator/heater core access cover screws.

6. Remove the evaporator/heater core access cover.
    - Disconnect the evaporator drain tube.

7. Remove the evaporator core.

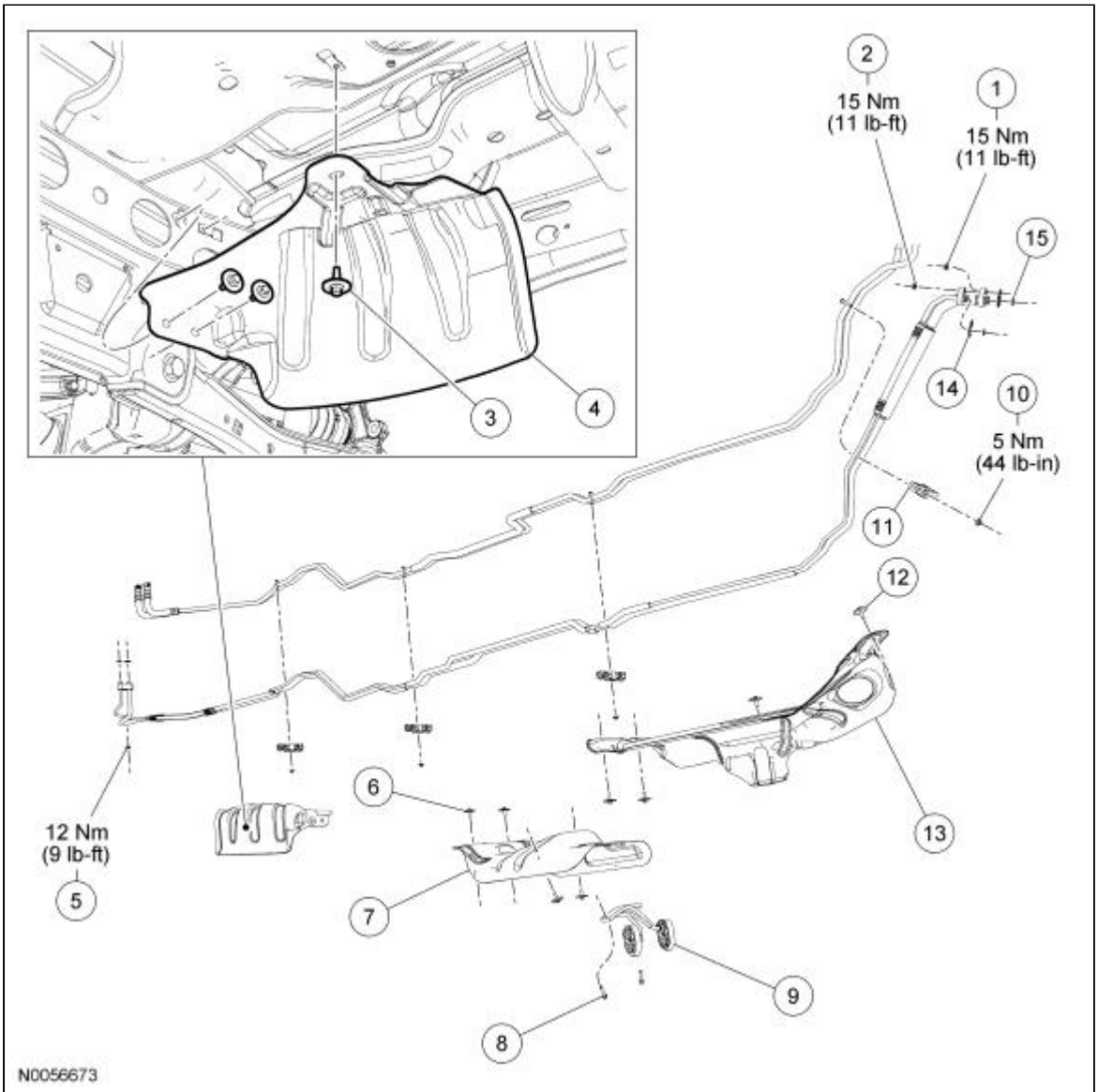
8. To install, reverse the removal procedure.
    - Install new O-ring seals.

Auxiliary Evaporator Outlet and Inlet Line

Printable View (358 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Auxiliary evaporator outlet line front fitting nut
2	W520413	Auxiliary evaporator inlet line front fitting nut
3	W707959	Spare tire carrier splash shield bolt (3 required)

4	1A484	Spare tire carrier splash shield
5	W520413	Auxiliary evaporator outlet and inlet line rear fitting nut (Expedition EL)
6	W707959	Muffler heat shield bolt (4 required)
7	5290	Muffler heat shield
8	W500225	Exhaust hanger bolt (2 required)
9	5B245	Exhaust hanger
10	W701694	Auxiliary line bracket nut (4 required)
11	18N332	Auxiliary line bracket (4 required)
12	W707959	Catalytic converter heat shield bolt (4 required)
13	5G221	Catalytic converter heat shield
14	19B558	Gasket seal (4 required)
15	19E889	O-ring seal (2 required)

Removal

NOTE: The auxiliary evaporator inlet and outlet lines are not supplied together as an assembly for Expedition or Navigator vehicles. The auxiliary evaporator inlet line and outlet line are each installed from the factory as one-piece assemblies. The replacement parts are supplied as separate kits containing multiple-piece lines for ease of installation.

NOTE: The auxiliary evaporator inlet and outlet lines for Expedition EL vehicles are installed from the factory as a single one-piece assembly including both lines. The replacement part is supplied as a multiple-piece kit for ease of installation.

NOTE: For Expedition or Navigator vehicles, the following procedure can be used to remove and install one or both the auxiliary evaporator inlet and auxiliary evaporator outlet lines. If only one auxiliary evaporator line is to be removed and installed, cut or disconnect only the desired line at the specified points within the procedure. For Expedition EL vehicles, both lines must be removed.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. **NOTE:** If only one auxiliary evaporator line is to be removed, disconnect only the desired line.

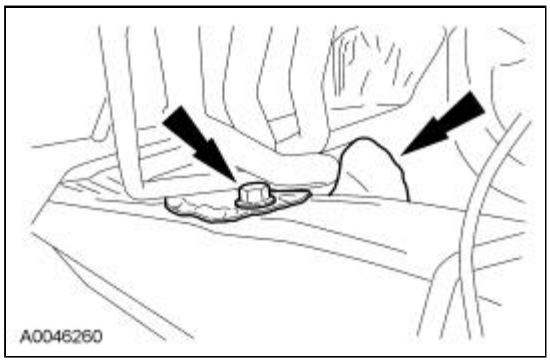
   Remove the auxiliary evaporator outlet and inlet line front fitting nut(s) and disconnect the fitting (s).
   - Discard the O-ring seals and gasket seals.

4. Remove the spare tire.

5. Remove the RH fender splash shield. For additional information, refer to Section 501-02 .

6. Working through the RH fender well opening, remove the front auxiliary line bracket nut and the front auxiliary line bracket.

7. Working through the RH fender well opening, remove the RH catalytic converter heat shield front bolt.



Expedition or Navigator only

8. **NOTE:** Both A/C fittings must be disconnected even if only one line is to be removed.

   Disconnect the auxiliary evaporator outlet and inlet line rear fittings.
   - Discard the O-ring seals.

Expedition EL only

9. Remove the RH rear wheel and tire assembly.

10. Remove the auxiliary evaporator outlet and inlet line rear fitting nut and disconnect the fitting.
    - Discard the gasket seals.

All vehicles

11. Remove the muffler. For additional information, refer to Section 309-00 .

12. Remove the 3 spare tire carrier splash shield bolts and the spare tire carrier splash shield.

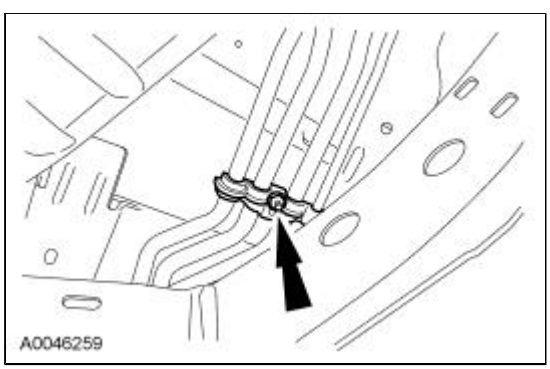
13. Remove the 3 muffler heat shield bolts and the heat shield.

14. Remove the 2 exhaust hanger bolts and the exhaust hanger.

15. Remove the RH catalyst monitoring sensor. For additional information, refer to Section 303-14 .

16. Remove the 3 remaining RH catalytic converter heat shield bolts and the heat shield.

17. Remove the 3 remaining auxiliary line bracket nuts and the auxiliary line brackets.



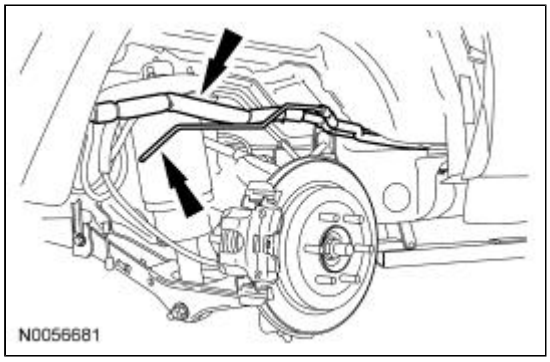
18. **NOTE:** If installing only one auxiliary evaporator line, cut only the desired line.

    Assemble and lay out the replacement line(s) in the same position as the existing line(s) and, using a suitable tool, cut the auxiliary evaporator line(s) in the same position as the fittings on the new line(s).

19. **NOTE:** Expedition EL shown.

    NOTE: For Expedition EL vehicles, the middle portion of the auxiliary evaporator outlet and inlet lines can be removed through the RH rear wheel well opening between the body and the frame.

    Remove the auxiliary evaporator line(s) in 3 separate pieces.



Installation

Expedition or Navigator only

1. Install the rear portion of the auxiliary evaporator line(s) and connect the auxiliary evaporator outlet and inlet line rear fittings.
    - Install new O-ring seals.

Expedition EL only

2. Install the rear portion of the auxiliary evaporator outlet and inlet line.

3. Connect the auxiliary evaporator outlet and inlet line rear fitting and install the nut.
    - Install new gasket seals.
    - Tighten to 12 Nm (9 lb-ft).

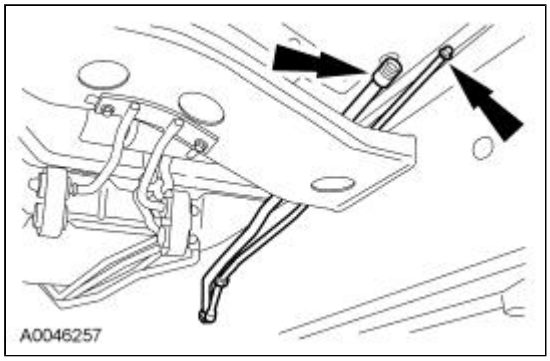
All vehicles

4. Install the front portion of the auxiliary evaporator outlet and inlet line(s).

5. Connect the evaporator outlet and inlet line front fitting(s) and install the nut(s).
    - Install new O-ring seals and gasket seals.
    - Tighten to 15 Nm (11 lb-ft).

6. **NOTE:** Loosely connect, but do not tighten, the fittings.

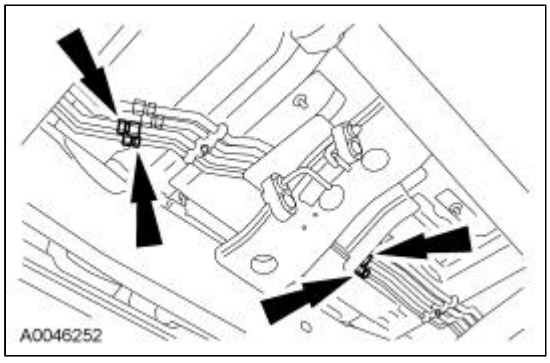
    Install the middle auxiliary evaporator line(s).



7. Starting from the rear of the vehicle, install the first 3 auxiliary line brackets and nuts.
    - Tighten to 5 Nm (44 lb-in).

8. **NOTE:** Expedition/Navigator shown, Expedition EL similar.

    Tighten the middle auxiliary evaporator line fittings.



9. Inspect the auxiliary evaporator lines for correct installation. Loosen, reposition and tighten as needed.

10. Install the RH catalytic converter heat shield and the 3 rear catalytic converter heat shield bolts.

11. Install the exhaust hanger and the 2 exhaust hanger bolts.

12. Install the muffler heat shield and the 3 muffler heat shield bolts.

13. Install the RH catalyst monitoring sensor. For additional information, refer to Section 303-14 .

14. Install the muffler. For additional information, refer to Section 309-00 .

15. Working through the RH fender well opening, Install the RH catalytic converter heat shield front bolt.

16. Install the front auxiliary line bracket and the front auxiliary line bracket nut.
    - Tighten to 5 Nm (44 lb-in).

17. Install the spare tire carrier splash shield and the 3 spare tire carrier splash shield bolts.

18. Install the RH front fender splash shield.

19. Install the RH front wheel.

Expedition EL only

20. Install the RH rear wheel and tire assembly.

All vehicles

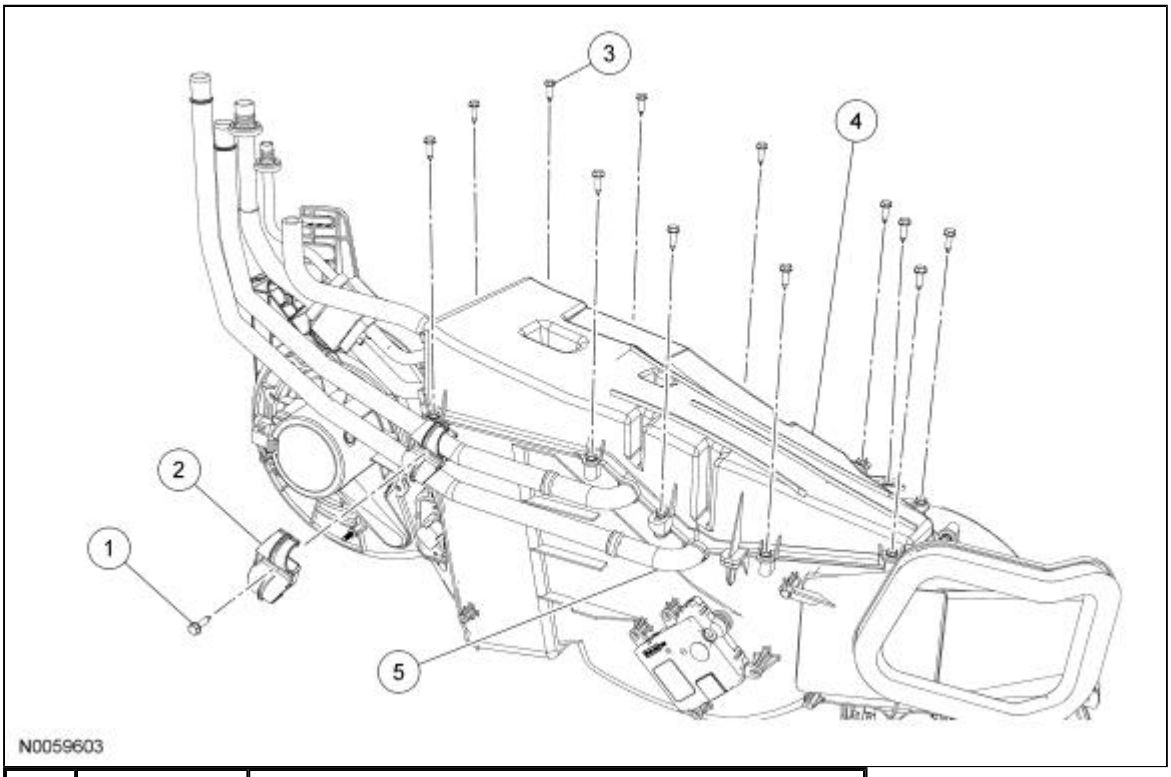
21. Install the spare tire.

22. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

23. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Heater Core — Expedition, Navigator

Printable View (206 KB)



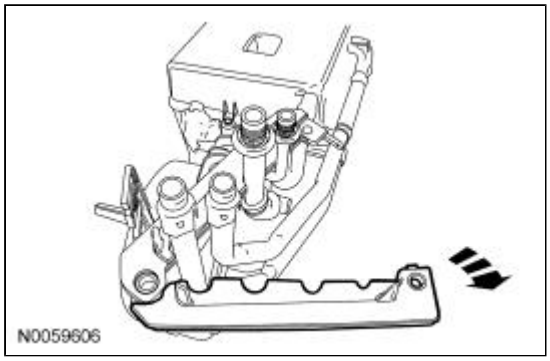
Item	Part Number	Description
1	W701696	Heater core tube bracket screw
2	18N332	Heater core tube bracket
3	W701696	Heater core cover screw (12 required)
4	—	Evaporator/heater core access cover (part of 18D283)
5	18476	Heater core

Removal and Installation

NOTE: If a heater core leak is suspected, the heater core must be pressure leak tested before it is removed from the vehicle.

1. Remove the auxiliary heater core and evaporator core housing. For additional information, refer to Auxiliary Heater Core and Evaporator Core Housing — Expedition, Navigator in this section.

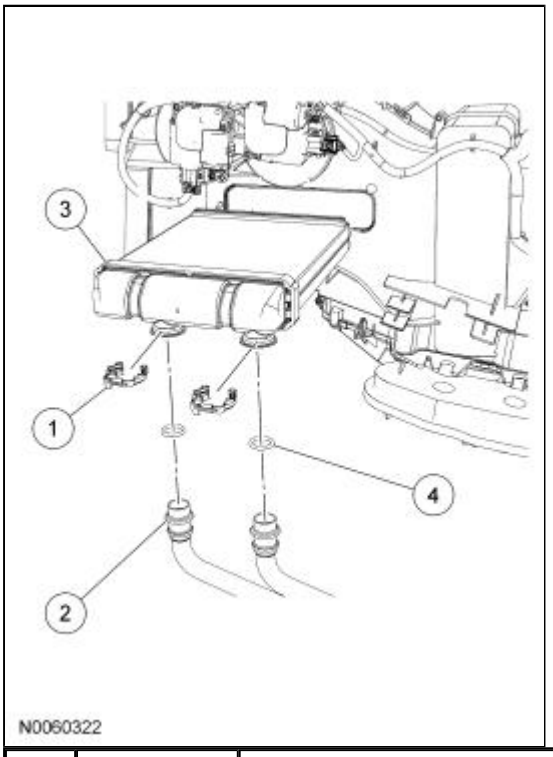
2. Release the clip and open the floorpan bracket.



3. Remove the heater core tube bracket screw and the heater core tube bracket.
4. Remove the 12 evaporator/heater core access cover screws.
5. Remove the evaporator/heater core access cover.
6. Remove the heater core.
7. To install, reverse the removal procedure.

Auxiliary Heater Core — Expedition EL

Printable View (215 KB)



Item	Part Number	Description
1	—	Auxiliary heater core tube fitting clip (2 required) (part of 18476)
2	—	Auxiliary heater core tube (2 required) (part of 18476)
3	18476	Auxiliary heater core
4	—	O-ring seal (2 required) (part of 18476)

Removal and Installation

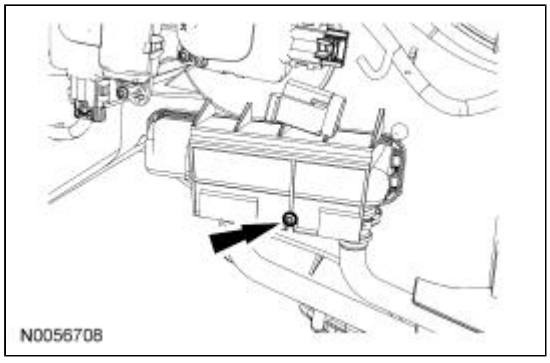
NOTE: If a heater core leak is suspected, the heater core must be pressure leak tested before it is removed from the vehicle.

NOTE: It is not necessary to install the new heater core tubes contained in the heater core service kit unless there is evidence of damage to the heater core tubes. New O-ring seals must be installed any time the heater core tubes are detached from the heater core.

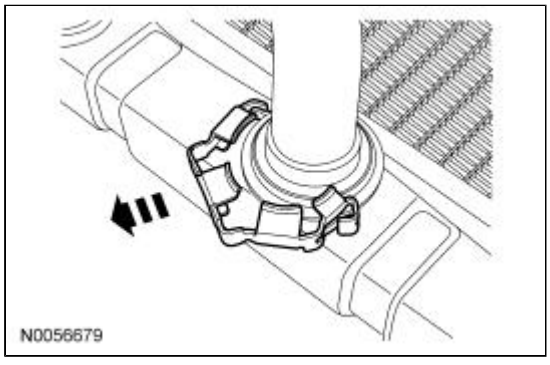
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the engine coolant. For additional information, refer to Section 303-03 .
3. Remove the RH quarter trim panel. For additional information, refer to Section 501-05 .
4. Position a suitable drain pan and disconnect the 2 auxiliary heater outlet and inlet line quick

disconnect fittings at the floorpan connections to allow any residual coolant to drain from the auxiliary heater core.

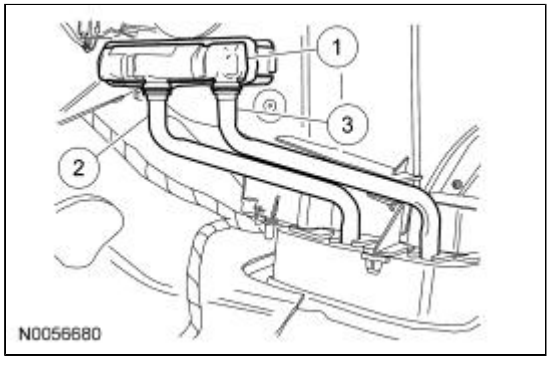
5. Remove the heater core door screw.



6. Remove the 2 auxiliary heater core tube fitting clips.



7. Disconnect the 2 auxiliary heater core tubes.
    1. Position the auxiliary heater core partially out of the housing.
    2. Disconnect the auxiliary heater core inlet tube.
    3. Disconnect the auxiliary heater core outlet tube.
        - Discard the O-ring seals.



8. Remove the auxiliary heater core.

9. **NOTE:** Use only the O-ring seals contained in the auxiliary heater core service kit.

   NOTE: Verify that the heater core tube fittings are completely seated in the heater core before installing the heater core tube fitting clips.

   To install, reverse the removal procedure.

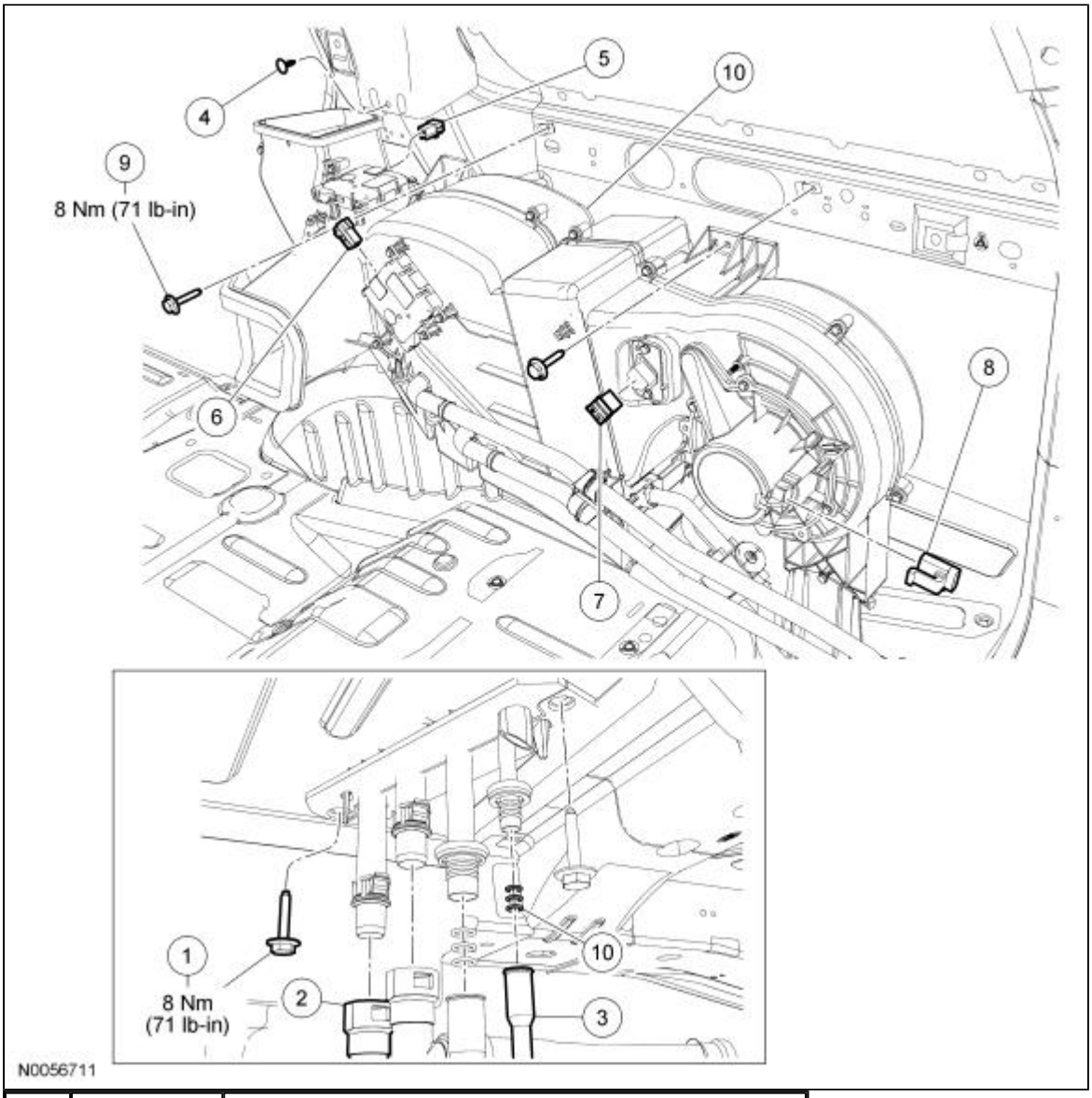
10. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Auxiliary Heater Core and Evaporator Core Housing — Expedition, Navigator

Printable View (277 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	—	Floorpan bracket bolt (2 required)
2	—	Auxiliary heater hose fitting (2 required) (part of 18476)

3	—	Auxiliary evaporator line fittings (2 required) (part of 19835)
4	W705589	Auxiliary headliner duct pin-type retainer
5	13A409	Auxiliary mode door actuator electrical connector
6	13A409	Auxiliary temperature blend door electrical connector
7	13A409	Blower motor resistor electrical connector
8	13A409	Blower motor electrical connector
9	W707103	Auxiliary heater core and evaporator core housing bolt (2 required)
10	18D283	Auxiliary heater core and evaporator core housing
11	19E889	O-ring seal (6 required)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Drain the engine coolant. For additional information, refer to Section 303-03 .

4. **NOTE:** Allow any residual coolant to drain from the auxiliary heater core after disconnecting the auxiliary heater hose fittings.

   Position a suitable drain pan and disconnect the 2 auxiliary heater hose fittings at the floorpan connection.

5. Disconnect the 2 auxiliary evaporator line fittings at the floorpan connection.
   - Discard the O-ring seals.

6. Remove the 2 floorpan bracket bolts.

7. Remove the auxiliary headliner duct pin-type retainer and disconnect the duct.

8. Disconnect the auxiliary mode door actuator electrical connector.

9. Disconnect the auxiliary temperature blend door actuator electrical connector.

10. Disconnect the auxiliary blower motor resistor electrical connector.

11. Disconnect the auxiliary blower motor electrical connector and detach the wire harness from the housing.

12. Remove the 2 auxiliary heater core and evaporator core housing bolts.
    - To install, tighten to 8 Nm (71 lb-in).

13. Remove the auxiliary heater core and evaporator core housing.

14. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

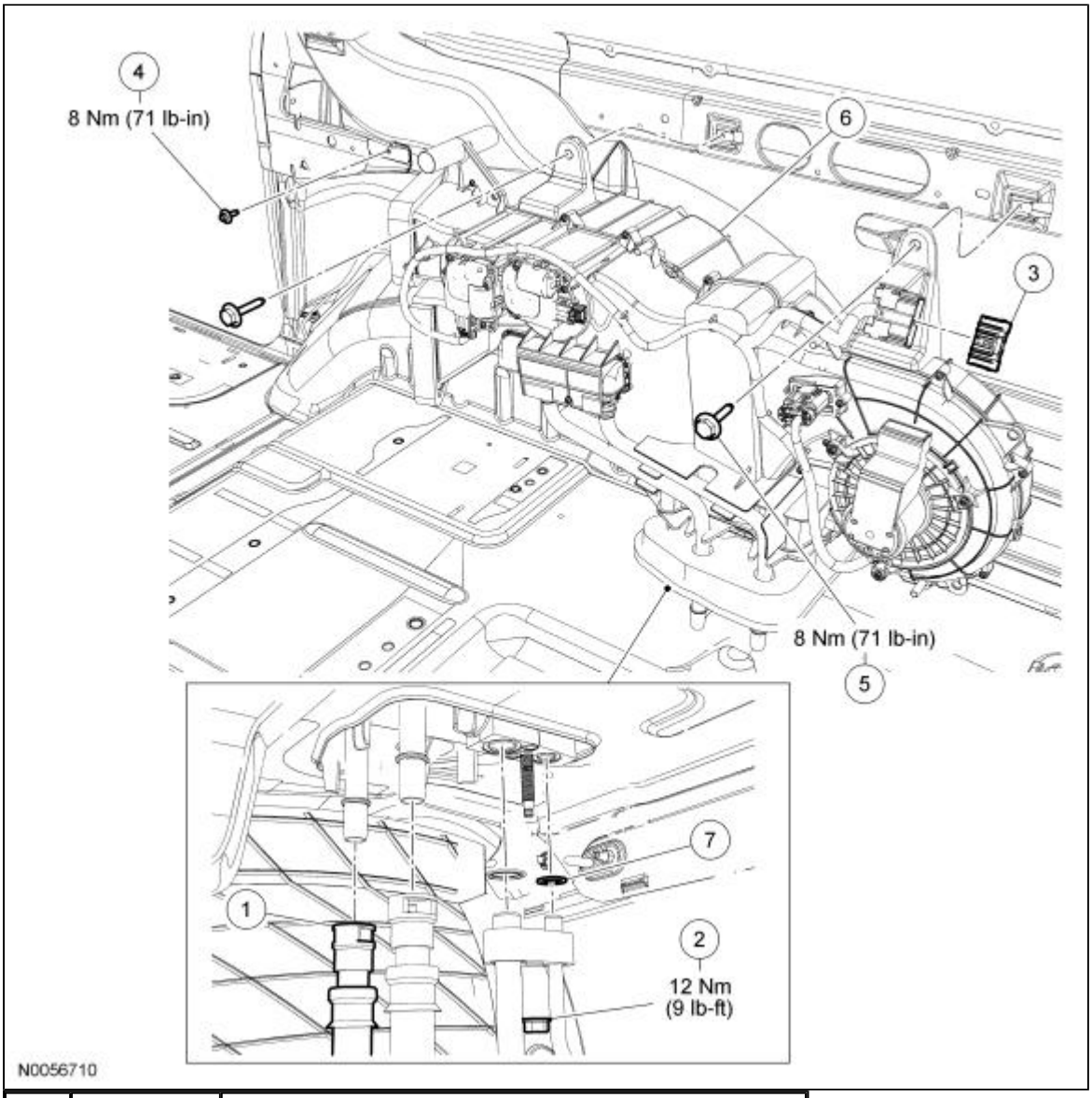
15. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Auxiliary Heater Core and Evaporator Core Housing — Expedition EL

Printable View (295 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	—	Auxiliary heater core quick disconnect fitting (2 required) (part of 18476)
2	W520413	Auxiliary evaporator outlet and inlet line rear fitting

		nut
3	19949	Auxiliary climate control harness electrical connector
4	W705132	Auxiliary airflow duct bolt
5	W707103	Auxiliary heater core and evaporator core housing bolt (2 required)
6	18D283	Auxiliary heater core and evaporator core housing
7	19B558	Gasket seal (2 required)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Drain the engine coolant. For additional information, refer to Section 303-03 .

4. Remove the RH rear quarter trim panel. For additional information, refer to Section 501-05 .

5. **NOTE:** Allow any residual coolant to drain from the auxiliary heater core after disconnecting the auxiliary heater core fittings.

   Position a suitable drain pan and disconnect the 2 auxiliary heater core quick disconnect fittings.

6. Remove the auxiliary evaporator outlet and inlet line rear fitting nut and disconnect the fitting.
   - Discard the gasket seals.
   - To install, tighten to 12 Nm (9 lb-ft).

7. Disconnect the auxiliary climate control harness electrical connector.

8. Remove the auxiliary airflow duct bolt.
   - To install, tighten to 8 Nm (71 lb-in).

9. Remove the 2 heater core and evaporator core housing bolts.
   - To install, tighten to 8 Nm (71 lb-in).

10. Remove the auxiliary heater core and evaporator core housing.

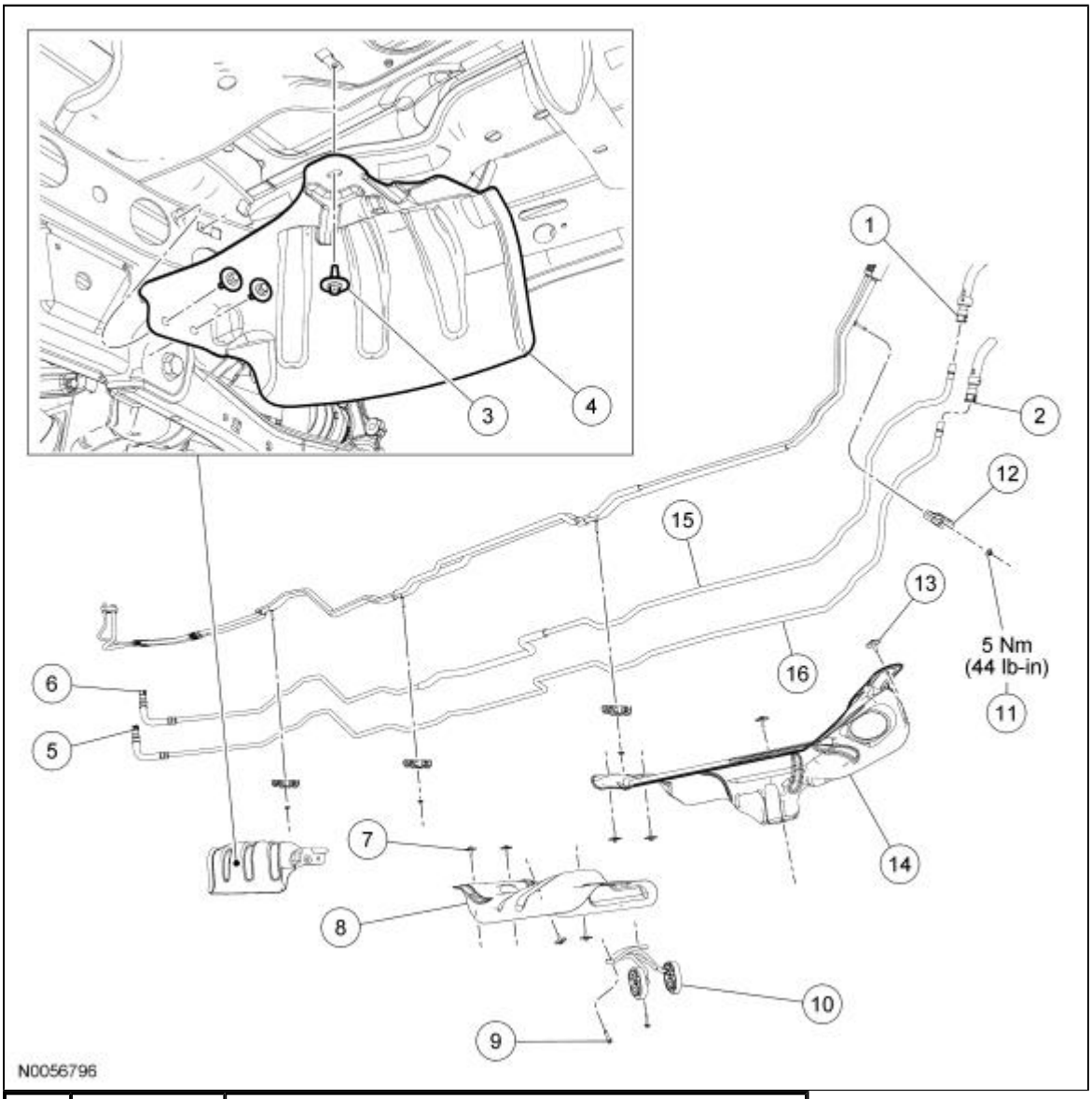
11. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

12. Fill the engine coolant level. For additional information, refer to Section 303-03 .

13. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Heater Outlet and Inlet Line

Printable View (266 KB)



Item	Part Number	Description
1	—	Auxiliary heater inlet line front quick disconnect (part of 18472)
2	—	Auxiliary heater outlet line front quick disconnect (part of 18472)
3	W707959	Spare tire carrier splash shield bolt (3 required)
4	1A484	Spare tire carrier splash shield
5	—	Auxiliary heater outlet line rear quick disconnect (part of 18696)
6	—	Auxiliary heater inlet line rear quick disconnect (part of 18663)
7	W707959	Muffler heat shield bolt (4 required)

8	5290	Muffler heat shield
9	W500225	Exhaust hanger bolt (2 required)
10	5B245	Exhaust hanger
11	W701694	Auxiliary line bracket nut (4 required)
12	18N332	Auxiliary line bracket (4 required)
13	W707959	Catalytic converter heat shield bolt (4 required)
14	5G221	Catalytic converter heat shield
15	18663	Auxiliary heater inlet line
16	18696	Auxiliary heater outlet line

Removal

NOTE: The auxiliary heater inlet and outlet lines are not supplied together as an assembly. The auxiliary heater inlet line and outlet line are each installed from the factory as one-piece assemblies. The replacement parts are supplied as separate kits containing multiple-piece lines for ease of installation.

NOTE: The following procedure can be used to remove and install one or both the auxiliary evaporator inlet and auxiliary evaporator outlet lines. If only one auxiliary evaporator line is to be removed and installed, cut or disconnect only the desired line at the specified points within the procedure.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the engine coolant. For additional information, refer to Section 303-03 .

3. Remove the spare tire.

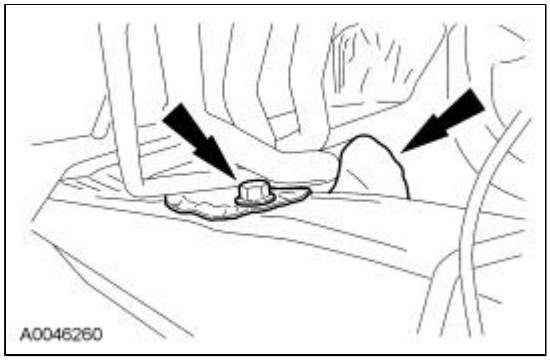
4. Remove the RH fender splash shield. For additional information, refer to Section 501-02 .

5. **NOTE:** If only one auxiliary heater line is to be removed, disconnect only the desired line.

   Disconnect the auxiliary heater outlet and/or inlet line front quick disconnect fitting(s).

6. Working through the RH fender well opening, remove the front auxiliary line bracket nut and the front auxiliary line bracket.

7. Working through the RH fender well opening, remove the RH catalytic converter heat shield front bolt.



Expedition EL only

8. Remove the RH rear wheel and tire assembly.

All vehicles

9. **NOTE:** If only one auxiliary heater line is to be removed, disconnect only the desired line.

   Disconnect the auxiliary heater outlet and inlet line rear quick disconnect fitting(s).

10. Remove the muffler. For additional information, refer to Section 309-00 .

11. Remove the 3 spare tire carrier splash shield bolts and the spare tire carrier splash shield.

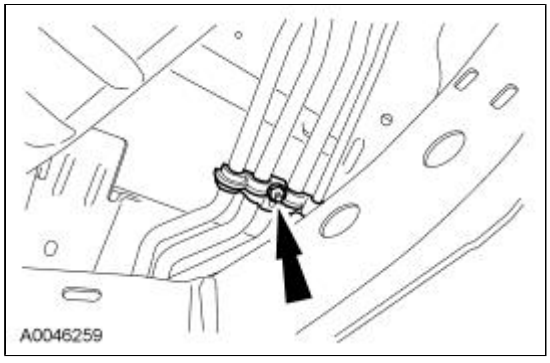
12. Remove the 3 muffler heat shield bolts and the muffler heat shield.

13. Remove the 2 exhaust hanger bolts and the exhaust hanger.

14. Remove the RH catalyst monitoring sensor. For additional information, refer to Section 303-14 .

15. Remove the 3 remaining RH catalytic converter heat shield bolts and the heat shield.

16. Remove the 3 remaining auxiliary line bracket nuts and the line brackets.



17. **NOTE:** If installing only one auxiliary heater line, cut only the desired line.

    Assemble and lay out the replacement line(s) in the same position as the existing line(s) and, using a suitable tool, cut the auxiliary heater line(s) in the same position as the fittings on the new line(s).

18. Remove the auxiliary heater line(s) in 3 separate pieces.

Installation

Expedition or Navigator only

1. Install the rear portion of the auxiliary heater outlet and inlet line(s) and connect the quick disconnect fittings.

All vehicles

2. Install the front auxiliary heater line(s) and connect the quick disconnect fittings.

3. **NOTE:** Loosely connect, but do not tighten, the fittings.

   Install the middle auxiliary heater line(s).

4. Starting from the rear of the vehicle, install the first 3 auxiliary line brackets and nuts.
    - Tighten to 5 Nm (44 lb-in).
5. Tighten the middle auxiliary heater line fittings.
6. Inspect the auxiliary heater lines for correct installation. Loosen, reposition and tighten as needed.
7. Install the RH catalytic converter heat shield and the 3 catalytic converter heat shield rear bolts.
8. Install the RH catalyst monitoring sensor. For additional information, refer to Section 303-14 .
9. Install the exhaust hanger and the 2 exhaust hanger bolts.
10. Install the muffler heat shield and the 3 muffler heat shield bolts.
11. Install the muffler. For additional information, refer to Section 309-00 .
12. Install the spare tire carrier splash shield and the 3 spare tire carrier splash shield bolts.
13. Working through the RH fender well opening, Install the RH catalytic converter heat shield front bolt.
14. Install the front auxiliary line bracket and the front auxiliary line bracket and nut.
    - Tighten to 5 Nm (44 lb-in).
15. Install the RH front fender splash shield.
16. Install the RH front wheel.

Expedition EL only

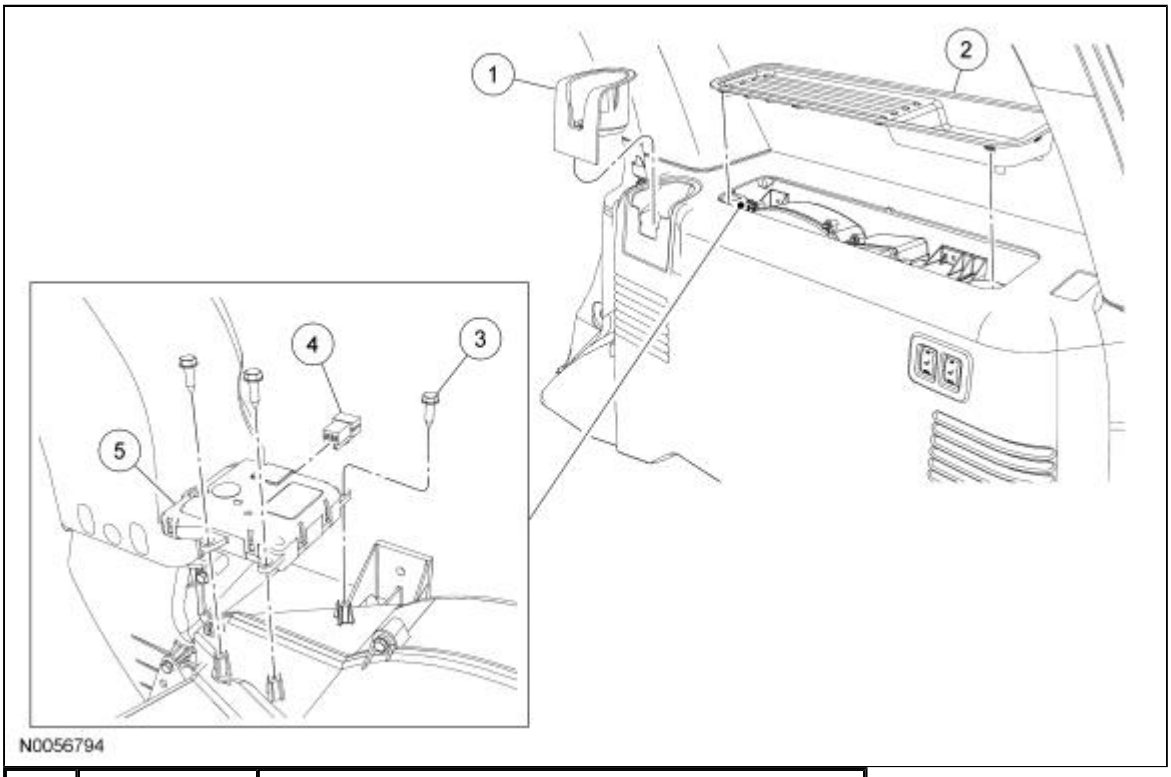
17. Install the RH rear wheel and tire assembly.

All vehicles

18. Install the spare tire.
19. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Auxiliary Mode Door Actuator — Expedition, Navigator

Printable View (142 KB)



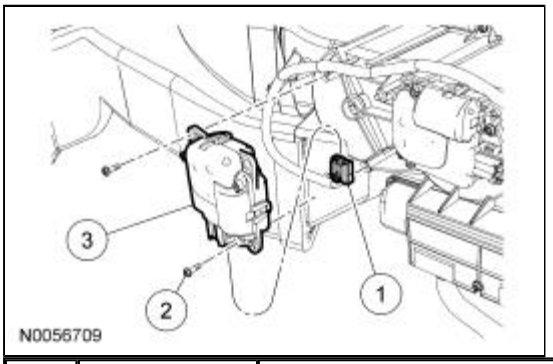
Item	Part Number	Description
1	13560	Quarter trim panel cup holder
2	13530	Quarter trim panel utility tray
3	W701696	Auxiliary mode door actuator screw (3 required)
4	13A409	Auxiliary mode door actuator electrical connector
5	19E616	Auxiliary mode door actuator

Removal and Installation

1. Remove the RH quarter trim panel cup holder.
2. Remove the RH quarter trim panel utility tray.
3. Remove the 3 auxiliary mode door actuator screws.
4. Disconnect the auxiliary mode door actuator electrical connector.
5. Remove the auxiliary mode door actuator.
6. To install, reverse the removal procedure.

Auxiliary Mode Door Actuator — Expedition EL

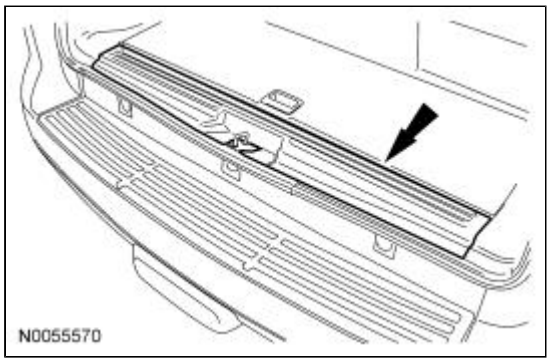
Printable View (224 KB)



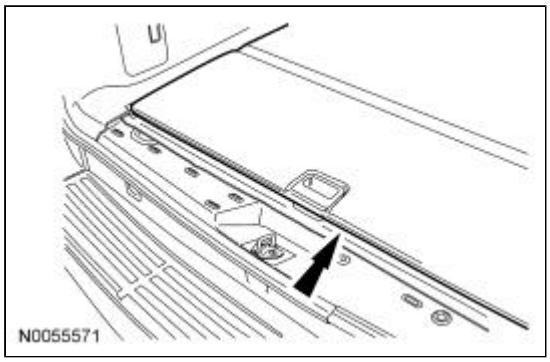
Item	Part Number	Description
1	19949	Auxiliary mode door actuator electrical connector
2	—	Auxiliary mode door actuator screw (2 required)
3	19E616	Auxiliary mode door actuator

Removal and Installation

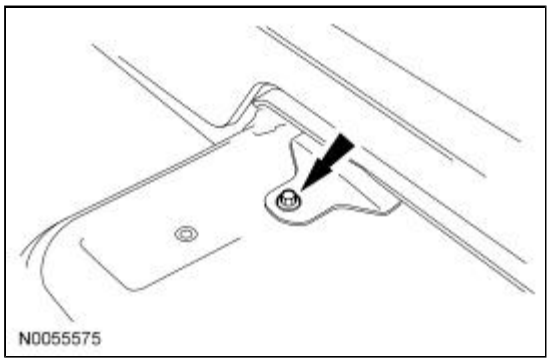
1. Fold the third row seats fully forward.
2. Remove the RH D-pillar trim panel. For additional information, refer to Section 501-05 .
3. Remove the liftgate sill plate.



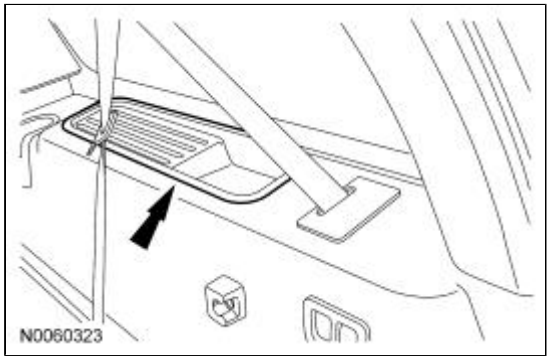
4. Remove the rear floor cargo space trim panel.



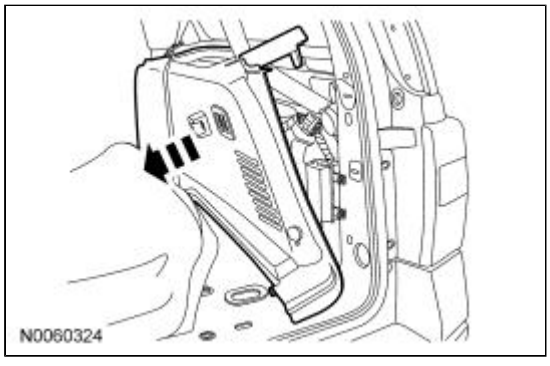
5. Position the rear floor cargo space floor trim aside and remove the RH rear quarter trim panel bolt.



6. Remove the RH quarter trim panel utility tray.



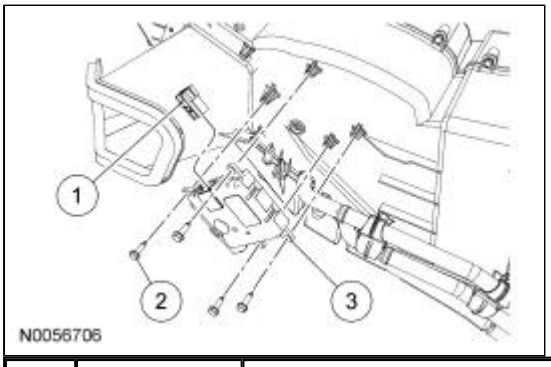
7. Detach the 3 rear and 5 upper RH quarter trim panel clips and position the quarter trim panel aside.



8. Disconnect the auxiliary mode door actuator electrical connector.
9. Remove the 2 auxiliary mode door actuator screws.
10. Remove the auxiliary mode door actuator.
11. To install, reverse the removal procedure.

Auxiliary Temperature Blend Door Actuator — Expedition, Navigator

Printable
View (96 KB)



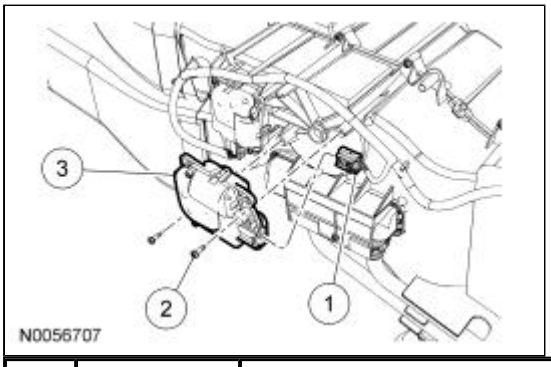
Item	Part Number	Description
1	13A409	Auxiliary temperature blend door actuator electrical connector
2	W701696	Auxiliary temperature blend door actuator screw (4 required)
3	19E616	Auxiliary temperature blend door actuator

Removal and Installation

1. Remove the RH quarter trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the auxiliary temperature blend door actuator electrical connector.
3. Remove the 4 auxiliary temperature blend door actuator screws.
4. Remove the auxiliary temperature blend door actuator.
5. To install, reverse the removal procedure.

Auxiliary Temperature Blend Door Actuator — Expedition EL

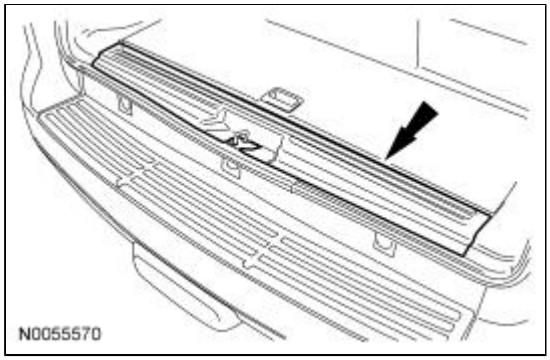
Printable View (228 KB)



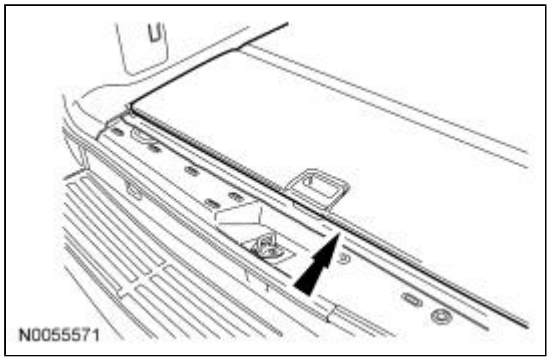
Item	Part Number	Description
1	19949	Auxiliary temperature blend door actuator electrical connector
2	—	Auxiliary temperature blend door actuator screw (2 required)
3	19E616	Auxiliary temperature blend door actuator

Removal and Installation

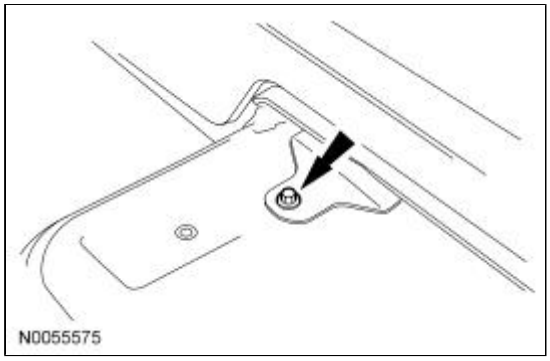
1. Fold the third row seats fully forward.
2. Remove the RH D-pillar trim panel. For additional information, refer to Section 501-05 .
3. Remove the liftgate sill plate.



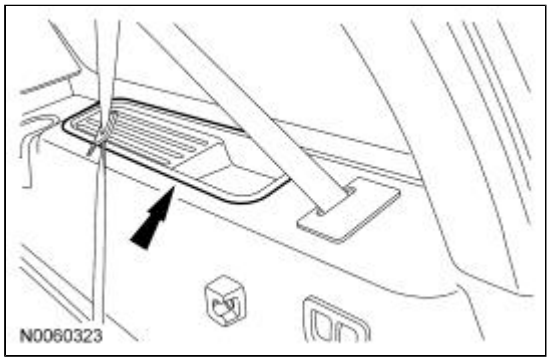
4. Remove the rear floor cargo space trim panel.



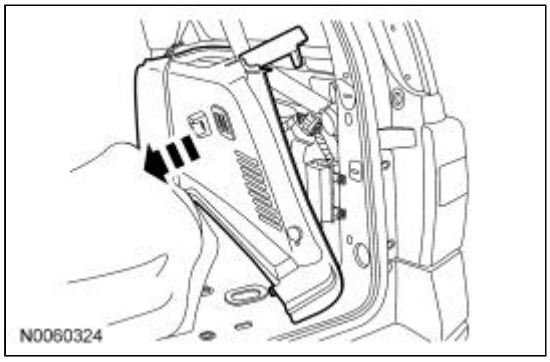
5. Position the rear floor cargo space floor trim aside and remove the RH rear quarter trim panel bolt.



6. Remove the RH quarter trim panel utility tray.



7. Detach the 3 rear and 5 upper RH quarter trim panel clips and position the quarter trim panel aside.



8. Disconnect the auxiliary temperature blend door actuator electrical connector.

9. Remove the 2 auxiliary temperature blend door actuator screws.

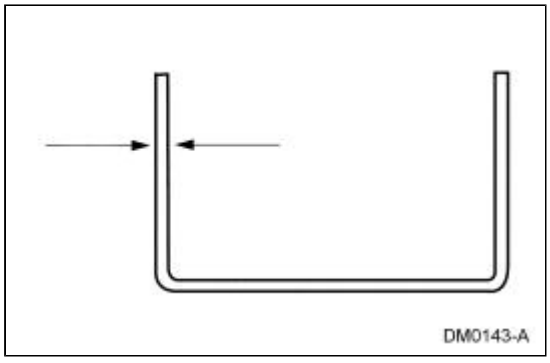
10. Remove the auxiliary temperature blend door actuator.
11. To install, reverse the removal procedure.

Register

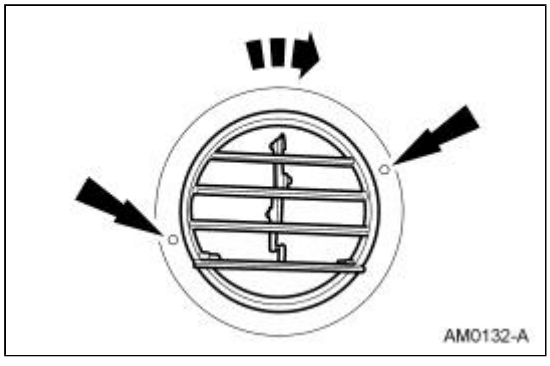
Printable View (81 KB)

Removal and Installation

1. Fabricate a removal tool from a 3.175 mm (0.12 in) diameter rod.



2. Rotate the register with the removal tool to align the retaining ears with the clearance openings and remove the register.



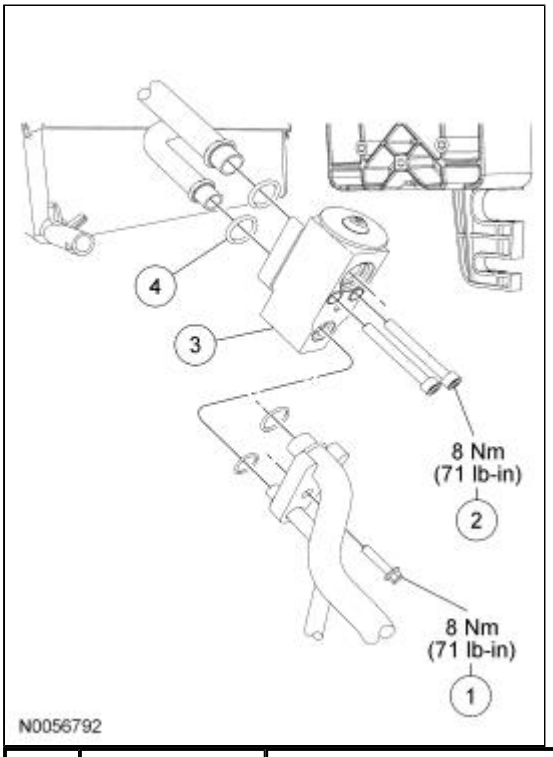
3. To install, reverse the removal procedure.

Thermostatic Expansion Valve — Expedition, Navigator

Printable View (100 KB)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	—	Thermostatic expansion valve (TXV) fitting bolt
2	7A771	TXV bolt (2 required)
3	19849	TXV
4	19E889	O-ring seal (4 required)

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Remove the RH quarter trim panel. For additional information, refer to Section 501-05 .
3. Remove the thermostatic expansion valve (TXV) fitting bolt and disconnect the fitting.
   - Discard the O-ring seals.
4. Remove the 2 TXV bolts.

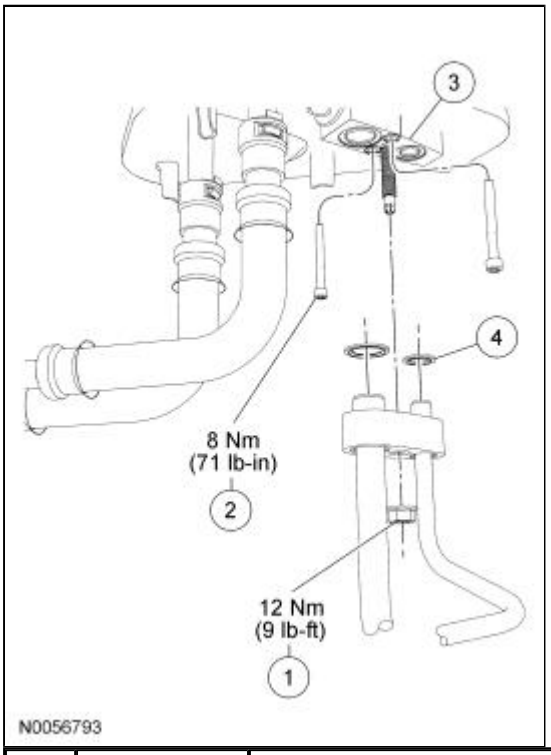
5. Remove the TXV.
    - Discard the O-ring seals.

6. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

7. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Thermostatic Expansion Valve — Expedition EL

Printable View (98 KB)



Item	Part Number	Description
1	W520413	Auxiliary evaporator outlet and inlet line rear fitting nut
2	—	Thermostatic expansion valve (TXV) bolt (2 required)
3	19849	TXV
4	19B558	Gasket seal (2 required)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the auxiliary evaporator outlet and inlet line rear fitting nut.
   - Discard the gasket seals.
   - To install, tighten to 12 Nm (9 lb-ft).

4. Remove the 2 thermostatic expansion valve (TXV) bolts and the TXV.
   - Discard the O-ring seals.
   - To install, tighten to 8 Nm (71 lb-in).

5. To install, reverse the removal procedure.
   - Install new O-ring seals and gasket seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

6. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Instrument Cluster and Panel Illumination

Printable View (63 KB)

The instrument cluster and panel illumination is used to provide backlighting to the instrument panel, switches, and control components when the headlamp switch is in either the PARKING LAMP or HEADLAMP ON position.

For Expedition, the level of intensity is adjustable by rotating the instrument panel dimmer switch either up to increase intensity or down to decrease intensity.

For Navigator, rotate the instrument panel dimmer switch to the right to increase intensity or to the left to decrease intensity.

The instrument cluster and panel lighting system illuminates the following components:

- Automatic four wheel drive (4WD) mode switch
- Adjustable pedal switch
- Ash receptacle
- Cigar lighter
- Manual A/C control assembly
- Electronic automatic temperature control (EATC)
- Auxiliary climate control (front, rear)
- Electric clock (Navigator only)
- Headlamp switch
- Heated back window switch and light
- Instrument cluster
- Message center switch
- Exterior rear view mirror control
- Power door lock switches (front left, front right)
- Power window switches
- Power rear quarter window switches
- Sliding roof panel switch
- Audio unit
- Steering wheel switches
- Floor shifter

Instrument Cluster and Panel Illumination

Printable View (198 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

Dimmable Backlighting

When the parking lamps or the headlamps are in the ON position the smart junction box (SJB) monitors the input from the instrument panel dimmer switch. The SJB sends a pulse-width modulated (PWM) voltage to the dimmable components and switches based on input received from the instrument panel dimmer switch.

The SJB also sends a message over the controller area network (CAN) to the audio unit, the DVD player, the electronic automatic temperature control (EATC) module, and the instrument cluster to indicate the backlighting intensity level.

Fixed Backlighting

When the accessory delay relay is energized, switched voltage is supplied to the non-dimmable components and switches.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Smart junction box (SJB) fuse 10 (15A) • Bulb(s) • Circuitry • Illumination source(s) • Auxiliary climate control switches (if equipped) • Door lock control switches • Window control switches • Headlamp switch • Electronic automatic temperature control (EATC) module • Audio unit • SJB • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool release software.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and the instrument cluster.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B2112	Panel Dim Switch Out of Range	Go To Pinpoint Test F .
B2A32	LED Backlighting Output Circuit Open	Go To Pinpoint Test D .
B2A33	LED Backlighting Output Circuit Short to Ground	Go To Pinpoint Test D .

B29B7	White lighting Output Circuit Open	Go To Pinpoint Test D .
B29B8	White lighting Output Circuit Short to Ground	Go To Pinpoint Test D .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the instrument cluster	• Fuse(s) • Circuitry • Instrument cluster	• REFER to Section 418-00 .
• No communication with the smart junction box (SJB)	• Fuse(s) • Circuitry • SJB	• REFER to Section 418-00 .
• The control illumination is inoperative	• Fuse • SJB	• Go To Pinpoint Test A .
• The control illumination is always on	• Circuitry • SJB	• Go To Pinpoint Test E .
• The instrument cluster illumination is inoperative	• Instrument cluster	• INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• The audio unit illumination is inoperative	• Audio unit	• REMOVE the audio unit. REFER to Section 415-01 . SEND it to an authorized repair facility. TEST the system for normal operation after the repair.
• The electronic automatic temperature control (EATC) unit illumination is inoperative	• EATC unit	• INSTALL a new EATC unit. REFER to Section 412-01 . TEST the system for normal operation.
• The digital versatile disc (DVD) player illumination is inoperative	• DVD player	• REMOVE the DVD player. REFER to Section 415-07 . SEND it to an authorized repair facility. TEST the system for normal operation after the repair.
• The auxiliary climate control illumination is inoperative	• Circuitry • Auxiliary climate control	• Go To Pinpoint Test B .
• The window control switch illumination is inoperative	• Window control switch	• CHECK the operation of the power windows. ▪ If the power windows operate correctly, INSTALL a new window control switch. REFER to Section 501-11 . TEST

		the system for normal operation. ■ If the power windows do not operate correctly, REFER to Section 501-11 .
• The steering wheel control illumination is inoperative	• Circuitry • Steering wheel control switch(es) • Steering wheel control switch harness • Clockspring	• Go To Pinpoint Test C .
• One or more module-controlled illumination source(s) is inoperative	• Circuitry • Illumination source • SJB	• Go To Pinpoint Test D .
• The instrument panel illumination does not dim	• Circuitry • Instrument panel dimmer switch • SJB	• Go To Pinpoint Test F .

Pinpoint Tests

Pinpoint Test A: The Control Illumination Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the dimmable illumination sources based on input received from the instrument panel dimmer switch.

The SJB also sends a message over the controller area network (CAN) to the audio unit, the DVD player, the electronic automatic temperature control (EATC) module, and the instrument cluster to indicate the backlighting intensity level.

Possible Causes

- Fuse
- SJB

PINPOINT TEST A: THE CONTROL ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take

A1 CHECK THE EXTERIOR LAMP OPERATION	
• Place the headlamp switch in the PARKING LAMPS ON position. • **Are the parking lamps illuminated?**	**Yes** VERIFY the SJB fuse 10 (15A) is OK. IF OK, GO to A2 . **No** REFER to Section 417-01 .
A2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Carry out the component test for the instrument panel dimmer switch. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the instrument panel dimmer switch OK?**	**Yes** GO to A3 . **No** INSTALL a new instrument panel dimmer switch. REFER to Instrument Panel Dimmer Switch in this section. CLEAR the DTCs. REPEAT the self-test.
A3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Auxiliary Climate Control Illumination Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

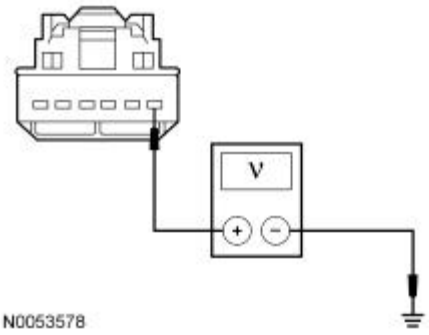
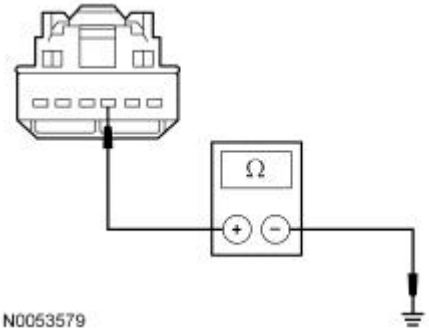
The smart junction box (SJB) supplies a pulse-width modulated (PWM) voltage to the auxiliary climate control illumination on circuit VLN18 (BU/WH). Ground is provided by circuit GD143 (BK/VT).

Possible Causes

- Circuit VLN18 (BU/WH) open
- Circuit GD143 (BK/VT) open
- Auxiliary climate control

PINPOINT TEST B: THE AUXILIARY CLIMATE CONTROL ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK CIRCUIT VLN18 (BU/WH) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Auxiliary Climate Control C3198. • Place the headlamp switch to the PARKING LAMPS ON position. • Rotate the instrument panel dimmer switch to the full illumination position. • Key in ON position. • Measure the voltage between the auxiliary climate control C3198-1, circuit VLN18 (BU/WH), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** REPAIR circuit VLN18 (BU/WH) for an open. TEST the system for normal operation.
B2 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the auxiliary climate control C3198-3, circuit GD143 (BK/VT), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new auxiliary climate control. REFER to Section 412-02 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: The Steering Wheel Control Illumination Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the steering wheel controls through circuit VLN04 (VT/GY) (Navigator) or VLN18 (BU/WH) (Expedition) to the clockspring. The voltage passes through the clockspring to the steering wheel control switch harness and on to the steering wheel controls. Ground is supplied through the clockspring and circuit GD133 (BK).

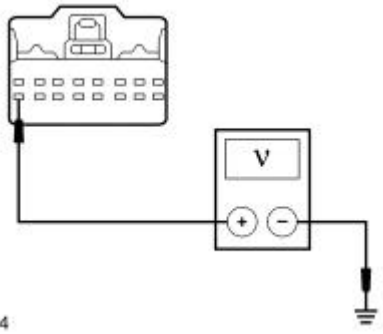
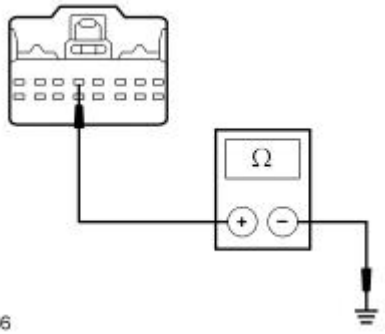
Possible Causes

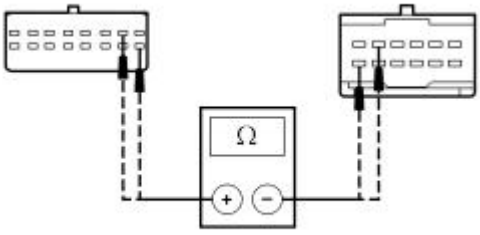
- Circuit VLN04 (VT/GY) open
- Circuit VLN18 (BU/WH) open
- Circuit GD133 (BK) open

- Steering wheel control switch harness
- Steering wheel control switch(es)
- Clockspring

PINPOINT TEST C: THE STEERING WHEEL CONTROL ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK CIRCUIT VLN04 (VT/GY) (NAVIGATOR) OR VLN18 (BU/WH) (EXPEDITION) FOR AN OPEN • Depower the supplemental restraint system (SRS). Refer to Section 501-20B . • Disconnect: Clockspring C218. • Key in ON position. • Place the headlamp switch in the PARKING LAMPS ON position. • Rotate the instrument panel dimmer switch to the full illumination position. • Measure the voltage between the clockspring C218-16, circuit VLN04 (VT/GY) (Navigator) or VLN18 (BU/WH) (Expedition), harness side and ground.  N0026444 • **Is the voltage greater than 10 volts?**	**Yes** TURN the headlamp switch off. GO to C2 . **No** REPAIR the circuit. REPOWER the SRS. REFER to Section 501-20B . TEST the system for normal operation.
C2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN • Measure the resistance between the clockspring C218-5, circuit GD133 (BK), harness side and ground.  N0026446 • **Is the resistance less than 5 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit. REPOWER the SRS. REFER to Section 501-20B . TEST the system for normal operation.
C3 CHECK THE CLOCKSPRING FOR AN OPEN • Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring Connector. • Measure the resistance between the clockspring C218 pin 16, component side and the upper clockspring connector pin 7,	**Yes** GO to C4 . **No**

component side; and between the clockspring C218 pin 7, component side and the upper clockspring connector pin 2, component side.  N0026971 • **Are the resistances less than 5 ohms?**	INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation.
C4 CHECK THE STEERING WHEEL CONTROL SWITCH HARNESS	
• Inspect the steering wheel control switch harness for shorts, opens, or any damage. • **Is the steering wheel control switch harness OK?**	**Yes** INSTALL new steering wheel controls. REFER to Section 310-03 or Section 415-01 as necessary. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR or INSTALL a new steering wheel control switch harness. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation.

Pinpoint Test D: One Or More Module-Controlled Illumination Source(s) Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the dimmable components through circuits VLN04 (VT/GY) (Navigator) and VLN18 (BU/WH) (Expedition). Ground is provided through circuits GD133 (BK), GD138 (BK/WH), GD143 (BK/VT) and GD150 (BK/WH).

DTC B2A32 — sets when the SJB detects an open, or short to voltage on the LED backlighting output circuit.

DTC B2A33 — sets when the SJB detects a short to ground on the LED backlighting output circuit.

DTC B29B7 — sets when the SJB detects an open on the white lighting output circuit.

DTC B29B8 — sets when the SJB detects a short to ground on the white lighting output circuit.

Possible Causes

- Circuit VLN04 (VT/GY) open, short to ground or voltage
- Circuit VLN18 (BU/WH) open, short to ground or voltage
- Circuit GD133 (BK) open
- Circuit GD138 (BK/WH) open
- Circuit GD143 (BK/VT) open
- Circuit GD150 (BK/WH) open
- Four wheel drive (4WD) switch
- Adjustable pedals switch
- Message center switch
- Headlamp switch
- LH door lock control switch
- RH door lock control switch
- Power liftgate/traction control/hazard switch
- Overhead console switch
- Clock (Navigator only)
- Floor shifter
- SJB

PINPOINT TEST D: ONE OR MORE MODULE-CONTROLLED ILLUMINATION SOURCE(S) IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>D1 CHECK THE VOLTAGE TO THE SINGLE ILLUMINATION SOURCE</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: Inoperative Illumination Source.
Place the headlamp switch to the PARKING LAMPS ON position.
Rotate the instrument panel dimmer switch to the full illumination position.
Measure the voltage between the inoperative illumination source, harness side and ground as follows:

Expedition
<table>
<tr><th>Component</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>Four wheel drive switch</td><td>C284-4</td><td>VLN18 (BU/WH)</td></tr>
<tr><td>Adjustable pedals switch</td><td>C2089-3</td><td>VLN18 (BU/WH)</td></tr>
<tr><td>Message center switch</td><td>C253-1</td><td>VLN18 (BU/WH)</td></tr>
<tr><td>Headlamp switch</td><td>C205-2</td><td>VLN18 (BU/WH)</td></tr>
<tr><td>LH door lock control switch</td><td>C505-2</td><td>VLN18 (BU/WH)</td></tr>
<tr><td>RH door lock control</td><td>C605-2</td><td>VLN18</td></tr>
</table>
</td><td>Yes
TURN headlamps off. GO to D2 .

No
RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation</td></tr>
</table>

switch		(BU/WH)
Power liftgate/traction control/hazard switch	C2361-1	VLN18 (BU/WH)
Overhead console	C930-2	VLN18 (BU/WH)
Floor shifter	C2096-3	VLN18 (BU/WH)

Navigator

Component	Connector-Pin	Circuit
Four wheel drive switch	C2071-1	VLN04 (VT/GY)
Adjustable pedals switch	C2089-3	VLN04 (VT/GY)
Ashtray receptacle	C2246-2	VLN04 (VT/GY)
Message center switch	C253-1	VLN04 (VT/GY)
Headlamp switch	C205-2	VLN04 (VT/GY)
LH door lock control switch	C505-2	VLN04 (VT/GY)
RH door lock control switch	C605-2	VLN04 (VT/GY)
Power liftgate/traction control/hazard switch	C2361-1	VLN04 (VT/GY)
Overhead console	C930-2	VLN04 (VT/GY)
Clock	C2016-2	VLN04 (VT/GY)
Floor shifter	C2096-3	VLN04 (VT/GY)

- **Is the voltage greater than 10 volts?**

D2 CHECK GROUND CIRCUIT TO THE SINGLE ILLUMINATION SOURCE FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the inoperative illumination source, harness side and ground as follows:

Expedition

Component	Connector-Pin	Circuit
Four wheel drive switch	C284-1	GD138 (BK/WH)
Adjustable pedals switch	C2089-4	GD138 (BK/WH)

Yes
INSTALL a new component in question. TEST the system for normal operation.

No
RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

Message center switch	C253-4	GD138 (BK/WH)
Headlamp switch	C205-1	GD138 (BK/WH)
LH door lock control switch	C505-4	GD143 (BK/VT)
RH door lock control switch	C605-4	GD138 (BK/WH)
Power liftgate/traction control/hazard switch	C2361-4	GD138 (BK/WH)
Overhead console	C930-1	GD150 (BK/WH)

Navigator

Component	Connector-Pin	Circuit
Four wheel drive switch	C2071-4	GD138 (BK/WH)
Adjustable pedals switch	C2089-4	GD138 (BK/WH)
Ashtray receptacle	C2246-1	GD138 (BK/WH)
Message center switch	C253-4	GD138 (BK/WH)
Headlamp switch	C205-1	GD138 (BK/WH)
LH door lock control switch	C505-4	GD143 (BK/VT)
RH door lock control switch	C605-4	GD138 (BK/WH)
Power liftgate/traction control/hazard switch	C2361-4	GD138 (BK/WH)
Overhead console	C930-1	GD150 (BK/WH)
Clock	C2016-5	GD138 (BK/WH)

- **Is the resistance less than 5 ohms?**

Pinpoint Test E: The Control Illumination Is Always On

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) then supplies a pulse-width modulated (PWM) voltage signal to the dimmable illumination sources on circuit VLN04 (VT/GY) (Navigator) and VLN18 (BU/WH) (Expedition).

DTC B2A32 — sets when the SJB detects an open, or short to voltage on the LED backlighting output circuit.

DTC B29B7 — sets when the SJB detects an open, or short to voltage on the white lighting output circuit.

Possible Causes

- Circuit VLN04 (VT/GY) short to voltage
- Circuit VLN18 (BU/WH) short to voltage
- SJB

PINPOINT TEST E: THE CONTROL ILLUMINATION IS ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
E1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded DTCs from the continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** If DTC B2A32 or B29B7 is retrieved, GO to E3 . **No** GO to E2 .
E2 CHECK THE EXTERIOR LIGHTING	
• Key in OFF position. • Observe the exterior lighting components. • **Are any exterior lighting components illuminated?**	**Yes** REFER to Section 417-01 . **No** GO to E3 .
E3 CHECK CIRCUITS VLN04 (VT/GY) (NAVIGATOR) AND VLN18 (BU/WH) (EXPEDITION) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280g. • **Do any dimmable backlighted components continue to illuminate?**	**Yes** RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation **No** GO to E4 .
E4 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The instrument panel Illumination Does Not Dim

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the input from the instrument panel dimmer switch by sending a voltage reference signal through circuit CLN27 (WH/BN) to the instrument panel dimmer switch. The return signal is sent through circuit RLN29 (WH/OG) back to the SJB. Based on the return signal intensity, the SJB sends a pulse-width modulated (PWM) voltage signal to the dimmable illumination sources. If the SJB detects a concern with the circuitry to the instrument panel dimmer switch, the SJB defaults the backlighting to a full intensity level.

DTC B2212 — sets when the SJB detects an out of range condition on the dimmer input switch circuit.

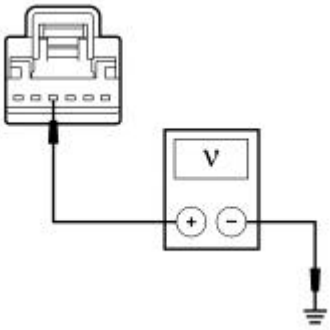
Possible Causes

- Circuit RLN29 (WH/OG) open, short to ground or voltage
- Circuit CLN27 (WH/BN) open, short to ground or voltage
- Instrument panel dimmer switch
- SJB

PINPOINT TEST F: THE INSTRUMENT PANEL ILLUMINATION DOES NOT DIM

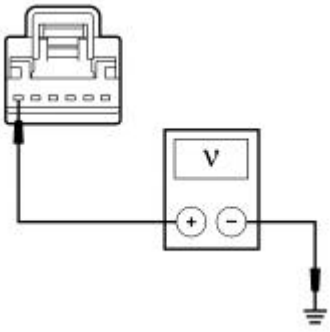
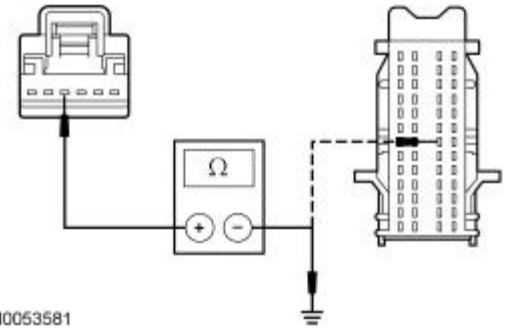
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

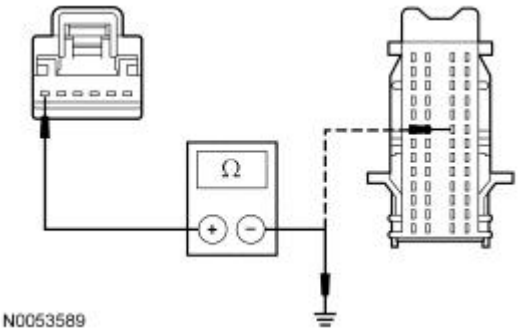
Test Step	Result / Action to Take
F1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded DTCs from the continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** If DTC B2212 is retrieved, GO to F3 . **No** GO to F2 .
F2 CHECK CIRCUIT RLN29 (WH/OG) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280e. • Disconnect: Instrument Panel Dimmer Switch C2065. • Key in ON position. • Measure the voltage between the instrument panel dimmer switch C2065-4, circuit RLN29 (WH/OG), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to F3 .



N0026447

- **Is any voltage indicated?**

F3 CHECK CIRCUIT CLN27 (WH/BN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the instrument panel dimmer switch C2065-6, circuit CLN27 (WH/BN), harness side and ground.  N0026448 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to F4 .
F4 CHECK CIRCUIT RLN29 (WH/OG) FOR AN OPEN OR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the instrument panel dimmer switch C2065-4, circuit RLN29 (WH/OG), harness side and the SJB C2280e-33, circuit RLN29 (WH/OG), harness side; and between the instrument panel dimmer switch C2065-4, circuit RLN29 (WH/OG), harness side and ground.  N0053581 • **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**	**Yes** GO to F5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F5 CHECK CIRCUIT CLN27 (WH/BN) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between the instrument panel dimmer switch C2065-6, circuit CLN27 (WH/BN), harness side and the SJB C2280e-34, circuit CLN27 (WH/BN), harness side; and between the instrument panel dimmer switch C2065-6, circuit CLN27 (WH/BN), harness side and ground.	**Yes** GO to F6 . **No** REPAIR the circuit. CLEAR the DTCs.

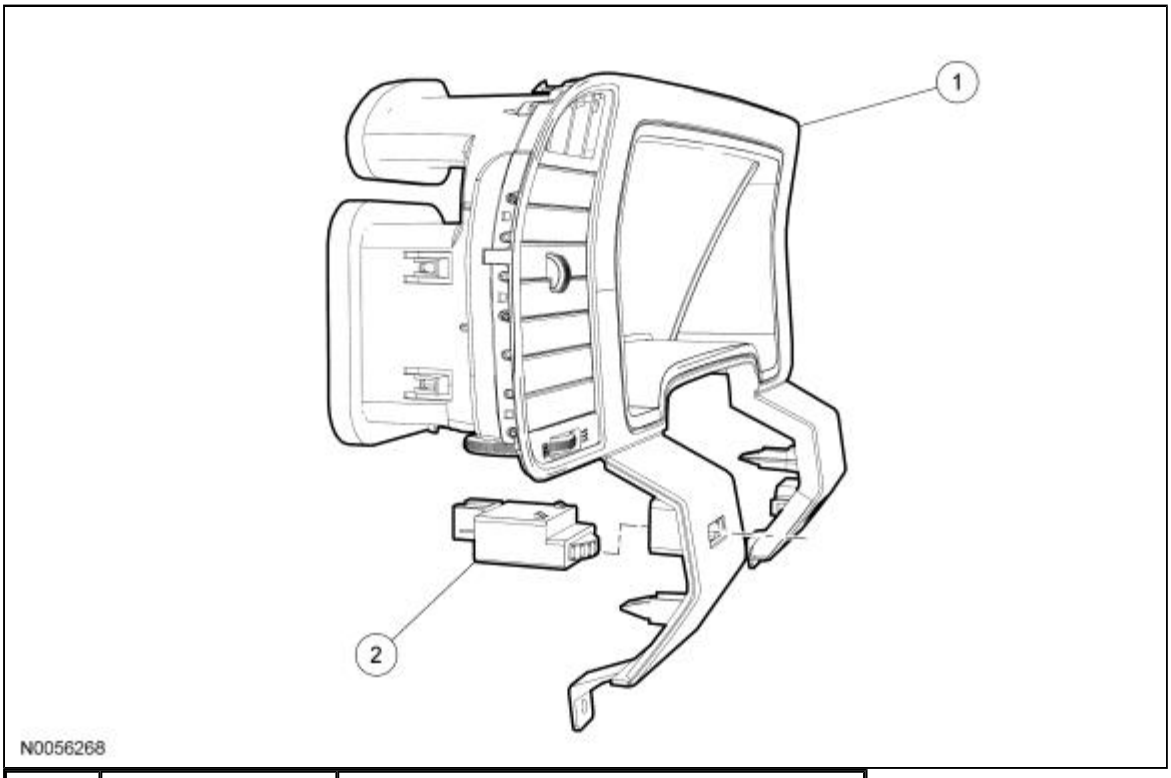
 • **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**	REPEAT the self-test.
F6 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Carry out the component test for the instrument panel dimmer switch. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the instrument panel dimmer switch OK?**	**Yes** GO to F7 . **No** INSTALL a new instrument panel dimmer switch. REFER to Instrument Panel Dimmer Switch in this section. TEST the system for normal operation.
F7 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Instrument Panel Dimmer Switch

Printable View (138 KB)

NOTE: Navigator shown, Expedition similar.



Item	Part Number	Description
1	011201	Instrument panel finish panel
2	11691	Instrument panel dimmer switch

Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
2. Press the tabs and remove the instrument panel dimmer switch.
3. To install, reverse the removal procedure.

Instrument Cluster

Printable View (69 KB)

The instrument cluster contains gauges, informational indicators, warning indicators and reconfigurable telltale indicators that are designed to provide the driver with system status and to alert the driver that certain conditions exist in the vehicle.

The instrument cluster uses a 2-line vacuum fluorescent display for display of basic informational items such as the odometer and trip odometer and for the message center display information.

All indicator lamps and warning indicator lamps are light-emitting diodes (LED), which are not replaceable.

Gauges

Gauges provide information to the driver indicating the status of systems. The systems that use gauges are as follows:

- Charging system
- Engine coolant temperature
- Engine oil pressure
- Engine rpm
- Fuel level
- Vehicle speed

Informational Indicators

Informational indicators provide information to the driver of conditions that exist in the vehicle. The indicators include:

- Turn signal
- High beam
- Speed control
- Transmission overdrive (O/D) off
- Anti-theft

Warning Indicators

Warning indicators provide information to the driver of conditions that could potentially cause personal injury or alter vehicle performance. The systems that use warning indicators include:

- Anti-lock brake system (ABS)
- Brake system (indicating low brake fluid, parking brake applied or other ABS brake system concerns)
- Safety belt buckle status
- Supplemental restraints system (SRS)
- Tire pressure monitoring system (TPMS)
- Powertrain

Reconfigurable Telltale Indicators

Reconfigurable telltale indicators illuminate in the message center and replace the typical indicator and

warning lamps and use the same iconic representation that were previously viewed as indicators or warning indicators in the instrument cluster. The systems that use reconfigurable telltale indicators include:

- Powertrain malfunction
  - Transmission (wrench)
  - Electronic throttle control (wrench)
  - 4x4 (wrench)
- Charging (battery)
- Engine oil pressure
- Engine over-temperature (failsafe)
- Low fuel
- Check fuel cap
- Low windshield washer fluid
- Traction control
- Four wheel drive (4WD)
  - 4x4 LOW
  - 4x4
  - 4x4 AUTO
- Door ajar

Hardwired Inputs

The hardwired inputs are provided from the following systems or components:

- Ambient temperature sensor (if equipped)
- Engine oil pressure switch
- Fuel level
- Low washer fluid switch
- Message center switch

Messaged Inputs

Module messaging has increased dramatically over time and is slowly becoming the standard for sending and receiving information required to operate the instrument cluster. For additional information and a complete list of module messages with the message origination sources, refer to Section 418-00 .

The status and information messages that the instrument cluster requires from other vehicle systems are as follows:

- Vehicle speed
- Engine temperature
- Engine rpm
- ABS
- 4WD
- Transmission range
- O/D status
- TPMS
- SRS
- Brake fluid level
- Parking brake status
- Engine emission system
- Electronic throttle control (ETC)

Instrument Cluster

Printable View (597 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST1473-A	Instrument Gauge System Tester 014-R1063 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: When installing a new instrument cluster, it is necessary to upload the module configuration to the scan tool. Following installation of the instrument cluster, download the module configuration from the scan tool into the new instrument cluster. Refer to Section 418-01 to carry out programmable module installation (PMI). It is also necessary to carry out a parameter reset procedure whenever a new instrument cluster or powertrain control module (PCM) is installed. Refer to Section 419-01 .

The instrument cluster is a hybrid electronic cluster (HEC) that utilizes a microprocessor to control the gauge and indicator functions. Data is sent to the instrument cluster over the high speed controller area network (HS-CAN) bus lines and through hardwired circuitry from individual components. The instrument cluster uses each input to output an action to the gauges or indicators.

It is very important to understand:

- where the input originates.
- all the information necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input control the output of the feature, or does it output a message over the communication network to another module.

- which module controls the output of the feature.

Instrument Cluster Gateway Function

The instrument cluster acts as a gateway module by receiving information in one format and transmitting it to other modules using another format. For example, the instrument cluster receives the vehicle speed data from the PCM over the high speed controller area network (HS-CAN), converts the data into a MS-CAN message and sends (gateways) the message to other network modules such as the electronic automatic temperature control (EATC), the tire pressure monitoring system (TPMS), the parking aid module, and the smart junction box (SJB). This enables network communication between modules that do not communicate using the same network (HS-CAN or the MS-CAN).

Instrument Cluster Messages

NOTE: Whenever a message is suspected as missing and confirmed by a missing message DTC (U-code), it is important to look for other symptoms that may also be present in the instrument cluster and throughout the vehicle. Once a DTC is set in the instrument cluster it may be helpful to review the complete message list available in Section 418-00 to see what other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same DTC may also be set in those modules. Confirmation of missing messages common to multiple modules may indicate that the originating module is the source of the concern or the communication network may be experiencing some problems.

The instrument cluster uses input messages from other modules to control the gauges, informational indicators, warning indicators and reconfigurable telltale indicators over the communication networks. If a required message is missing or invalid for less than 5 seconds, the gauge or indicator that requires the message remains at the last commanded state based upon the last known good message. For example, if the O/D off status message is missing the for less than 5 seconds and the O/D off indicator was ON (O/D cancelled), the indicator remains in the ON state until the next good message is received. If the message remains missing or invalid for greater than 5 seconds, the instrument cluster sets a U-code DTC and the output becomes a default action for the indicator or gauge. Each indicator or gauge utilizes a different default strategy depending on the nature of the indication. Refer to the normal operation descriptions located before each individual pinpoint test for further description of the default action specific to each indicator or gauge. If the messaged input to the cluster returns at any time, the normal function of the gauge or indicator resumes.

Instrument Cluster Configuration

The instrument cluster contains items that are configurable. While some configurable items are customer preference items, most items are configured at the end of the line production and only available for configuration using As-Built data. Refer to Section 418-01 for additional information on As-Built data and module configuration. The configurable instrument cluster customer preference items are as follows:

- Overspeed warning (gulf coast country [GCC] only)
- Reverse warning chime
- Outside air units
- Gallon display type
- Metric display type
- Language
- Oil life warning threshold
- Autolocks
- Easy entry/exit
- Safety belt timer (belt minder)

Instrument Cluster Prove-Out

The instrument cluster and other vehicle modules carry out a display prove-out to verify that all module controlled warning/indicator lamps and monitored systems are functioning correctly within the instrument cluster. When the ignition switch is cycled to the ON position with the engine off, the indicators illuminate

to prove-out according the following table:

Indicator	Controlling Module	Indicator Type	Prove-Out Duration
Air bag	Restraints control module (RCM)	Warning	6 seconds
Anti-lock brake system (ABS)	Instrument cluster	Warning	3 seconds
Anti-theft indicator	Instrument cluster	Indicator	3 seconds
Brake	Instrument cluster	Warning	3 seconds
Malfunction indicator lamp (MIL)	Powertrain control module (PCM)	Warning	Engine startup
Safety belt	RCM	Warning	65 seconds if the safety belt is unbuckled, turns off when the safety belt is buckled
Speed control	PCM	Indicator	No prove-out
Tire pressure monitoring system (TPMS)	Instrument cluster	Warning	3 seconds
High beam	Instrument cluster	Indicator	No prove-out
Overdrive off	Transmission control module (TCM)	Indicator	No prove-out
RH/LH turn signals	Instrument cluster	Indicator	No prove-out

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Accessory drive belt
• Correct tire size
• Washer fluid level
• Engine oil level
• Engine coolant level
• Door adjustment
• Brake fluid level
• Fuel tank
• Fuel evaporative system
	• Smart junction box (SJB) fuse(s):
	  ▪ 26 (10A)
	  ▪ 29 (5A)
	• Circuitry
	• Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** Make sure to use the latest scan tool software release.

If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster and the smart junction box (SJB).

9. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart or the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Instrument Cluster Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1202	Fuel Sender Circuit Open	Go To Pinpoint Test A .
B1204	Fuel Sender Circuit Short to Ground	Go To Pinpoint Test A .
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	REFER to Section 419-01 .
B1255	Air Temperature External Sensor Circuit Open	REFER to Section 413-08 .
B1257	Air Temperature External Sensor Circuit Short to Ground	REFER to Section 413-08 .
B1317	Battery Voltage High	REPEAT the self-test. CLEAR the DTC. If DTC B1317 is retrieved, REFER to Section 414-00 .
B1318	Battery Voltage Low	REPEAT the self-test. CLEAR the DTC. If DTC B1318 is retrieved, REFER to Section 414-00 .
B1342	ECU is Faulted	REPAIR all other DTCs first. REPEAT the self-test. CLEAR the DTC. If DTC B1342 is retrieved, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
B1868	Lamp Air Bag Warning	REPEAT the self-test. CLEAR the DTC. If DTC B1868 is

	Indicator Circuit Failure	retrieved, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
B1915	Air Bag Driver Circuit Failure	REPEAT the self-test. CLEAR the DTC. If DTC B1915 is retrieved, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
B2097	Compass Module Failure	REFER to Section 413-08 .
B2103	Antenna Not Connected	REFER to Section 419-01 .
B2141	NVM Configuration Failure	CARRY out a parameter reset. REFER to Section 419-01 . REPEAT the self-test. CLEAR the DTCs.
B2143	NVM Memory Failure	REPEAT the self-test. CLEAR the DTC. If DTC B2143 is retrieved, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
B2431	Transponder Programming Failed	REFER to Section 419-01 .
B2477	Module Configuration Failure	RECONFIGURE the instrument cluster. REFER to Section 418-01 . REPEAT the self-test. CLEAR the DTCs.
B2627	Fuel Sender Circuit Open #2	DISREGARD the DTC. Not applicable to this vehicle.
B2628	Fuel Sender Circuit Short to Ground #2	DISREGARD the DTC. Not applicable to this vehicle.
B2879	Fuel Tank Jet Pump Fault	DISREGARD the DTC. Not applicable to this vehicle.
C1945	Park Switch Indicates Park with Vehicle Moving	Go To Pinpoint Test V .
C2784	RAM Checksum Failure	REPEAT the self-test. CLEAR the DTC. If DTC C2784 is retrieved, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
U0100	Lost Communication With ECM/PCM	Go To Pinpoint Test AH .
U0101	Lost Communication With TCM	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0101 returns, REFER to Section 418-00 to diagnose no communication with the TCM.
U0102	Lost Communication With Transfer Case Control Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0102 returns, REFER to Section 418-00 to diagnose no communication with the four wheel drive (4WD) control module.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0121 returns, REFER to Section 418-00 to diagnose no communication with the ABS module.
U0122	Lost Communication With Vehicle Dynamics Control Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0122 returns, REFER to Section 418-00 to diagnose no communication with the air suspension module.
U0140	Lost Communication With Body Control Module (GEM)	Go To Pinpoint Test AI .

U0151	Lost Communication With Restraints Control Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0151 returns, REFER to Section 418-00 to diagnose no communication with the restraints control module (RCM).
U0159	Lost Communication With Parking Assist Control Module (PAM)	REFER to Section 413-13 .
U0164	Lost Communication With HVAC Control Module (EATC)	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0164 returns, REFER to Section 418-00 to diagnose no communication with the climate control module.
U0208	Lost Communication With Seat Control Module (DSM)	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0208 returns, REFER to Section 418-00 to diagnose no communication with the DSM.
U0230	Lost Communication With Rear Gate Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0230 returns, REFER to Section 418-00 to diagnose no communication with the rear liftgate module.
U0244	Lost Communication With Running Board Control Module	REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0244 returns, REFER to Section 418-00 to diagnose no communication with the running board control module.
U2013	Compass Module is Not Responding	REFER to Section 413-08 .
U2023	Fault Received From External Node	INSTALL a new smart junction box (SJB) for tire pressure monitoring system (TPMS) concern module. REFER to Section 419-10 . TEST the system for normal operation.
U2050	No Application Present	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	REFER to Section 418-01 .
U2199	Invalid Engine Coolant Temperature Data	For temperature gauge concerns, Go To Pinpoint Test D . For over engine temperature reconfigurable telltale concerns, Go To Pinpoint Test Z .
U2472	Unexpected Ignition State	Go To Pinpoint Test AJ .
U2510	CAN-Invalid Data for Vehicle Security	REFER to Section 419-01 .
U2511	CAN-Data Mis-Match (received data does not match expected)	REFER to Section 419-01 .
U261A	CAN Data/Configuration Setup Mismatch	REFER to Section 418-01 .
All other DTCs	—	REFER to Section 419-10 .

Smart Junction Box (SJB) Trouble Code (DTC) Chart

DTC	Description	Action
B2479	Park Brake Switch Circuit Short to Ground	Go To Pinpoint Test M .
C1125	Brake Fluid Level Sensor Input Circuit Failure	Go To Pinpoint Test M .
All other DTCs	—	REFER to Section 419-10 .

Powertrain Control Module (PCM) Trouble Code (DTC) Chart

DTC	Description	Action
P0457	Evaporative Emission System Leak Detected (fuel cap loose/off)	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
All other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Instrument Cluster Dealer Test Mode

To enter the instrument cluster dealer test mode with the engine off, press and hold the odometer reset button (base cluster) or the message center RESET button (message center cluster). Turn the ignition switch to the RUN position and hold until the display indicates ENGINEERING TEST MODE usually within 5-6 seconds. Press the reset button once to advance to each stage of the self-test.

To exit the instrument cluster dealer test mode, press and hold the odometer reset button (base cluster) or the message center RESET button (message center cluster) for approximately 5-8 seconds or turn the ignition to the OFF position.

Instrument Cluster Dealer Test Mode

Display-First Row	Display-Second Row	Description
GAUGE	TEST	Carries out gauge sweep of all gauges, then displays the present gauge values.
SEGMENTS	—	Illuminates all segments in the vacuum fluorescent (VF) display area.
TELLTALE	TEST	Illuminates all micro-controlled LEDs and automatically scrolls through the reconfigurable telltale indicators beginning with the highest priority telltale.
PART #	xxxx-xx	Returns all micro-controlled lamps and LEDs to normal operation. Displays alpha numeric part number.
ROM CHECKSUM	$xxxxx	Displays hexadecimal value for read-only memory (ROM) level (used when requesting assistance from the Hotline).
NVM LEVEL	$xxxxx	Displays hexadecimal ROM level and type as stored in non-volatile memory (NVM).
MANUFACTURE	xx-xx-xxxx	Displays final manufacturing test date.
B&A CONFIG	xx-xx-xx	Displays hexadecimal coding of second byte of module configuration (option content) settings
MANUF CONFIG	xxx-xxx-xxx	Displays hexadecimal coding of non-volatile memory (NVM) module configuration settings.
CONTINUOUS	$xxxx	Displays a 16-bit DTC in hexadecimal format. DTCs displayed are

DTC		those detected in continuous operation, not during self-test.
VEHICLE SPD	xxx.x MPH	Displays English speed value being input, speedometer indicates present filtered speed. VEHICLE SPD MIS MPH displayed if the input message is missing for greater than 5 seconds. VEHICLE SPD INV MPH displayed if the input message is invalid data.
VEHICLE SPD	xxx.x KM/H	Displays metric speed value being input, speedometer indicates present filtered speed. VEHICLE SPD MIS KMH displayed if the input message is missing for greater than 5 seconds. VEHICLE SPD INV KMH displayed if the input message is invalid data.
TACHOMETER	xxxx RPM	Displays the tachometer value being input to the instrument cluster. Tachometer indicates present rpm. TACHOMETER MIS RPM displayed if the input message is missing for greater than 5 seconds. TACHOMETER INV RPM displayed if the input message is invalid data.
FUEL LEVEL	xxx INST	Displays present fuel level analog/digital ratio input in decimal. 000-009 = short circuit. 10-254 = normal range. 255 = open circuit.
FUEL LVL %	STATUS xxx	Displays present weighted fuel level percent status in decimal. 000-254 = normal range. 255 = open/short detected for 33 seconds.
INSTANT DTE	xxx MILES	Displays instantaneous calculated distance to empty (DTE) in miles.
FUEL ON/OFF Z	xxx / xxx / xxx	Displays key-on, key-off, and zero speed fuel level values (average of instant).
F#S ON/OFF Z	xxx / xxx / xxx	Displays key-on, key-off, and zero speed fuel number of samples (average of instant).
COOLANT TEMP	xxx C	Displays last temperature gauge input value from high speed controller area network (HS-CAN), temperature gauge indicates present filtered temperature. COOLANT TEMP MIS C displayed if input message is missing for greater than 5 seconds.
ODOMETER	xxx COUNTS	Displays the odometer input received through HS-CAN in decimal. ODOMETER MIS COUNTS displayed if input message is missing for greater than 5 seconds.
TRIP A ODO	xxx.x MI	Displays the current mileage reading for the trip A odometer stored in random access memory (RAM).
TRIP B ODO	xxx.x MI	Displays the current mileage reading for the trip B odometer stored in RAM.
BATTERY	xx.x VOLTS	Displays current VBAT analog/digital reading in volts, compensated to yield voltage at the instrument cluster connector terminal pin.
PRKDETSW	x	Displays current state of the park detect switch position. G = ground O = open
DIMMING CMD	xx	Displays input status for smart junction box (SJB) dimming in decimal, 0-254. 0 = dimming off. 255 = invalid data.

		DIMMING CMD MIS = dimming command not received since MS-CAN initialization or dimming command missing for greater than 5 seconds.
DIMMING STEP	xx	Displays current dimming step in decimal. 0-21 for cluster with 21 step dimming or 0-25 for cluster with 25 step dimming. 0 = dimming off.
M/C SWITCH	xxx A/D CNTS	Displays current message center switch input analog/digital counts in decimal. Less than 20 = short to ground. 100-190 = INFO button pressed. 400-550 = move on to next. 600-750 = SETUP button pressed. Greater than 830 = no button pressed.
LWF OPS OAT	x / x / xxx	Displays the present low washer fluid, oil pressure switch and outside air temperature input analog/digital counts in decimal.
COMPASS	xx	Displays present compass input from the compass module in decimal.
LAST CHIME	SOUNDED xx	Displays either the last chime sounded by the cluster or the chime that is currently sounding, this excludes the trip reset button press chime.
GAUGE	TEST	Returns to the gauge sweep.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the instrument cluster	• Fuse(s) • Circuitry • Instrument cluster	• REFER to Section 418-00 .
• Incorrect fuel gauge indication	• Circuitry • Fuel level sensor • Fuel pump module • Fuel tank • Instrument cluster	• Go To Pinpoint Test A .
• Incorrect voltage gauge indication	• Charging system • Instrument cluster	• Go To Pinpoint Test B .
• Incorrect oil pressure gauge indication	• Circuitry • Engine oil pressure switch • Base engine concern • Instrument cluster	• Go To Pinpoint Test C .
• Incorrect temperature gauge	• Powertrain control module	• Go To Pinpoint Test D .

indication	(PCM) • Instrument cluster	
• The speedometer is inoperative	• Instrument cluster	• Go To Pinpoint Test E .
• The speedometer is inaccurate	• PCM • Instrument cluster	• Go To Pinpoint Test F .
• The odometer is inoperative	• Instrument cluster	• Go To Pinpoint Test G .
• The tachometer is inoperative	• Instrument cluster	• Go To Pinpoint Test H .
• Inaccurate tachometer indication	• PCM • Instrument cluster	• Go To Pinpoint Test I .
• The safety belt warning indicator is never/always on	• Restraints control module (RCM) • Instrument cluster	• Go To Pinpoint Test J .
• The anti-lock brake system (ABS) warning indicator is never/always on	• Instrument cluster • ABS module	• Go To Pinpoint Test K .
• The brake warning indicator is never on	• Circuitry • Master cylinder (brake fluid level switch) • Parking brake switch • Smart junction box (SJB) • Instrument cluster	• Go To Pinpoint Test L .
• The brake warning indicator is always on	• Circuitry • Brake fluid level switch • Parking brake switch • SJB • ABS module • Instrument cluster	• Go To Pinpoint Test M .
• Malfunction indicator lamp (MIL) is never/always on	• PCM • Instrument cluster	• Go To Pinpoint Test N .
• The air bag warning indicator is never/always on	• RCM • Instrument cluster	• Go To Pinpoint Test O .
• The high beam indicator is never/always on	• SJB • Instrument cluster	• Go To Pinpoint Test P .
• The LH/RH turn indicator is never/always on	• SJB • Instrument cluster	• Go To Pinpoint Test Q .
• The speed control	• PCM	• Go To Pinpoint Test R .

indicator is never/always on	• Instrument cluster	
• The tire pressure monitoring system (TPMS) warning indicator is never/always on	• TPMS concern • SJB • Instrument cluster	• Go To Pinpoint Test S .
• The O/D OFF indicator is never/always on	• Transmission control module (TCM) • Instrument cluster	• Go To Pinpoint Test T .
• The anti-theft indicator is never/always on	• Instrument cluster	• Go To Pinpoint Test U .
• The integrated circuit display is inoperative	• Instrument cluster	• VERIFY that the instrument cluster functions correctly and that the odometer, message center (if equipped), and reconfigurable telltale indicators are all inoperative and the display segments are all blank. ▪ If the instrument cluster is inoperative, Go To Pinpoint Test AG . ▪ If the odometer, message center, reconfigurable telltale indicators and the display segments are all blank, INSTALL a new instrument cluster. REFER to Instrument Cluster in this section.
• The PRNDL indicator is never/always on (if equipped)	• Circuitry • Brake shift interlock • Instrument cluster	• Go To Pinpoint Test V .
• The wrench reconfigurable telltale indicator is never/always on	• Electronic throttle concern • Transmission concern • Four wheel drive (4WD) concern (if equipped) • Instrument cluster	• Go To Pinpoint Test W .
• The charge reconfigurable telltale indicator is never/always on	• Charging system concern • Instrument cluster	• Go To Pinpoint Test X .
• The low oil pressure reconfigurable telltale indicator is never/always on	• Circuitry • Engine oil pressure switch • Base engine concern	• Go To Pinpoint Test Y .

	• Instrument cluster	
• The engine over temperature reconfigurable telltale indicator is never/always on	• PCM • Instrument cluster	• Go To Pinpoint Test Z .
• The low fuel reconfigurable telltale indicator is never/always on (if equipped)	• Instrument cluster	• Go To Pinpoint Test AA .
• The check fuel cap reconfigurable telltale indicator is never/always on	• PCM • Instrument cluster	• Go To Pinpoint Test AB .
• The low washer fluid reconfigurable telltale indicator is never/always on (if equipped)	• Circuitry • Washer fluid level switch • Instrument cluster	• Go To Pinpoint Test AC .
• The traction control reconfigurable telltale indicator is never/always on	• ABS module • Instrument cluster	• Go To Pinpoint Test AD .
• The 4x4, 4x4 LOW or 4x4 AUTO reconfigurable telltale indicator is never/always on	• 4WD control module • Instrument cluster	• Go To Pinpoint Test AE .
• The door ajar reconfigurable telltale indicator is never/always on	• SJB • Instrument cluster	• Go To Pinpoint Test AF .
• The instrument cluster is inoperative	• Fuse(s) • Circuitry • Instrument cluster	• Go To Pinpoint Test AG .

Pinpoint Tests

Pinpoint Test A: Incorrect Fuel Gauge Indication

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The fuel level sender receives a reference voltage signal from the instrument cluster through circuit VMC11 (YE/VT), and returns the fuel level signal to the instrument cluster through circuit RMC32 (GN/BU). As the fuel level changes, a float actuates a variable resistor that alters the fuel level signal voltage. The instrument cluster interprets this signal voltage and commands the fuel gauge to sweep to the correct level.

The instrument cluster uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sender readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The key must be in the OFF position throughout the entire refueling of the vehicle.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The instrument cluster must receive a valid key ON fuel sender reading within 1 second of the key being put into the RUN position. The key ON sample readings are considered valid if the fuel sender reading is between 15 ohms ± 2 ohms and 160 ohms ± 4 ohms. If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

The key ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The transmission is in PARK (P).
- The key is in the RUN position.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In key ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) position. When the 30 second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 90 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the key in the RUN position.

Recovery mode is incorporated into the instrument cluster strategy to recover from a missing fuel level input during a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sender or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The instrument cluster is in the anti-slosh (default) mode.
- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

DTC B1202 — is a continuous and on-demand DTC that sets if the instrument cluster detects an out of range input caused by an open or short to voltage on circuit VMC11 (YE/VT).

DTC B1204 — is a continuous and on-demand DTC that sets if the instrument cluster detects an out of range input caused by a short to ground on circuit VMC11 (YE/VT).

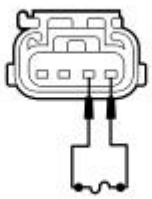
Possible Causes

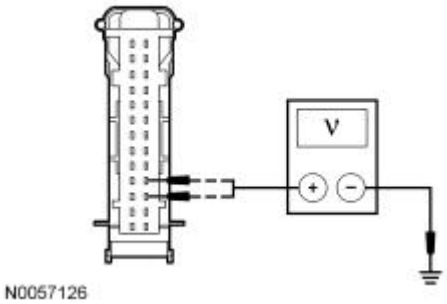
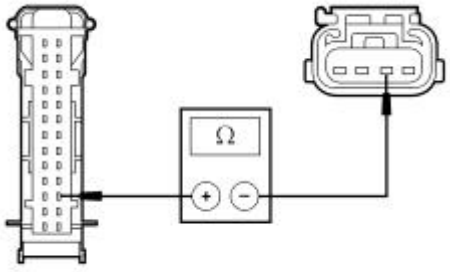
- Circuit VMC11 (YE/VT) open, short to ground or voltage
- Circuit RMC32 (GN/BU) open or short to voltage
- Fuel level sensor
- Fuel pump module
- Fuel tank
- Instrument cluster

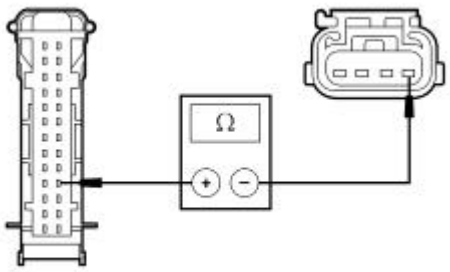
PINPOINT TEST A: INCORRECT FUEL GAUGE INDICATION

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The fuel pump module may also be called the fuel sender or fuel tank unit.

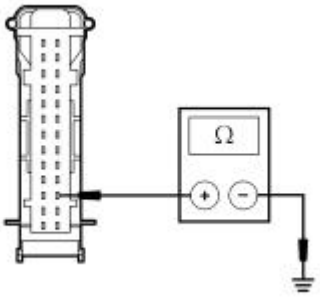
Test Step	Result / Action to Take
A1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Key in OFF position. • Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any instrument cluster DTCs recorded?**	**Yes** For DTC B1202, GO to A3 . For DTC B1204, GO to A7 . For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to A2 .
A2 CARRY OUT THE INSTRUMENT CLUSTER FUEL GAUGE ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster fuel gauge FUEL active command and scroll the fuel gauge level at 0%, 20%, 80% and 100%. • **Does the fuel gauge display empty (E) with 0%, approximately 1/4 tank with 20%, 3/4 tank with 80% and full (F) with 100%?**	**Yes** GO to A9 . **No** GO to A12 .
A3 CHECK THE FUEL PUMP MODULE FOR AN OPEN	
• Disconnect: Fuel Pump Module C433. • Connect a fused (5A) jumper wire between the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side and the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side.  N0057125 • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Self-Test. • Wait one minute.	**Yes** REMOVE the jumper wire. GO to A11 . **No** REMOVE the jumper wire. GO to A4 .

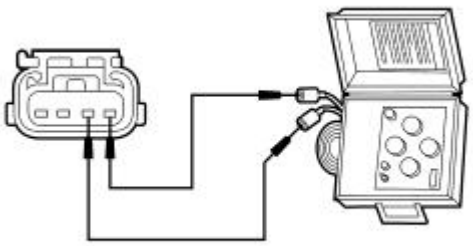
• **NOTE:** It may be normal for DTC B1202 to be present when carrying out this test step and should be ignored. • Clear the instrument cluster DTCs. Repeat the instrument cluster self-test • **Is DTC B1204 retrieved?**	
A4 CHECK CIRCUITS VMC11 (YE/VT) AND RMC32 (GN/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-16, circuit VMC11 (YE/VT), harness side and ground and between the instrument cluster C220-17, circuit RMC32 (GN/BU), harness side and ground.  N0057126 • **Is any voltage present?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. **No** GO to A5 .
A5 CHECK CIRCUIT VMC11 (YE/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the instrument cluster C220-16, circuit VMC11 (YE/VT), harness side and the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side.  N0057127 • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
A6 CHECK CIRCUIT RMC32 (GN/BU) FOR AN OPEN	
• Measure the resistance between the instrument cluster C220-17, circuit RMC32 (GN/BU), harness side and the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side.	**Yes** GO to A12 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



N0057128

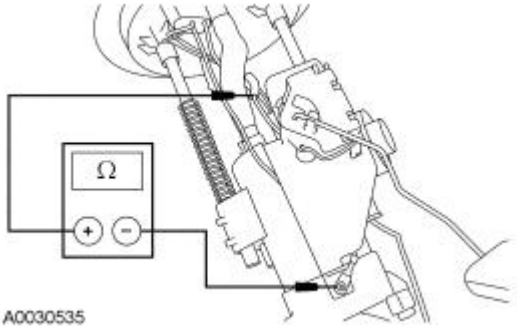
- **Is the resistance less than 5 ohms?**

A7 CHECK THE FUEL PUMP MODULE FOR A SHORT TO GROUND	
• Disconnect: Fuel Pump Module C433. • Wait one minute. • **NOTE:** It may be normal for DTC B1204 to be present when carrying out this test step and should be ignored. • Clear the instrument cluster DTCs. Repeat the instrument cluster self-test. • **Is DTC B1202 retrieved?**	**Yes** GO to A11 . **No** GO to A8 .
A8 CHECK CIRCUIT VMC11 (YE/VT) FOR A SHORT TO GROUND	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-16, circuit VMC11 (YE/VT), harness side and ground.  N0057129 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A12 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A9 CHECK THE FUEL GAUGE OPERATION	
NOTE: Since the instrument cluster may be in anti-slosh fuel indication mode, the PID values may not match the fuel gauge readings. The actual gauge indication should be disregarded during this test step. • Key in OFF position. • Disconnect: Fuel Pump Module C433. • Connect one lead of the instrument gauge tester to the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side and the other lead of the instrument gauge tester to the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side.	**Yes** DISCONNECT the instrument gauge tester. GO to A10 . **No** DISCONNECT the instrument gauge tester. GO to A12 .



N0057130

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PIDs.
- **NOTE:** It is extremely important to confirm the gauge tester settings with an ohmmeter to ensure that the gauge tester is in the correct position. Failure to follow this check may result in inaccurate test results.
- Monitor the fuel level PID Fuel with the gauge tester set at 180 ohms, 90 ohms, 55 ohms, 30 ohms and 0 ohms.
- **Does the PID begin at approximately 0%, move to 25%, 50%, 75% then 100%?**

A10 CHECK THE FUEL TANK	
• Check the fuel tank for any damage or deformation. • **Is the fuel tank OK?**	**Yes** GO to A11 . **No** VERIFY the fuel level sensor and the fuel pump module are OK. INSTALL a new fuel tank. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test.
A11 CHECK THE FUEL LEVEL SENSOR	
NOTE: The fuel level sensor resistance measures between 10 ohms ± 2 ohms at the upper stop position and 180 ohms ± 4 ohms at the lower stop position. • Remove the fuel pump module. Refer to Section 310-01 . • **NOTE:** Disconnect the fuel level sensor input wire from the fuel level sensor for this measurement. • Measure the resistance between the fuel level sensor input wire and the fuel level sensor ground while slowly moving the float arm between the upper and lower stop position.  A0030535 • **Does the resistance slowly increase from approximately 10 ohms at the upper stop to 180 ohms at the lower stop?**	**Yes** INSTALL a new fuel pump module. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new fuel level sensor. CLEAR the DTCs. REPEAT the self-test.
A12 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test B: Incorrect Voltage Gauge Indication

Normal Operation

The voltage gauge displays the system battery voltage as measured at the instrument cluster run input, circuit SBP26 (YE/RD). The voltage input is filtered within the instrument cluster to eliminate minor fluctuations in the voltage measurement due to minor variations in the input voltage.

Possible Causes

- Charging system
- Instrument cluster

PINPOINT TEST B: INCORRECT VOLTAGE GAUGE INDICATION

Test Step	Result / Action to Take
B1 CHECK THE CHARGING SYSTEM OPERATION	
• Key in START position. • Check the charging system. Refer to Section 414-00 . • **Does the charging system operate correctly?**	**Yes** GO to B2 . **No** REPAIR the charging system. REFER to Section 414-00 .
B2 CARRY OUT THE INSTRUMENT CLUSTER VOLTMETER ACTIVE COMMAND USING THE SCAN TOOL	
NOTE: The voltmeter should be register in the mid-range with approximately 12-14 volts. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster voltmeter active command VOLT_GAUGE and scroll the voltmeter beginning at 0 volts then approximately 12.8 volts, and approximately 20 volts. • **Does the voltmeter start at L (low) when at 0 volts, move to the mid-range at 12.8 volts, and H (high) at 20 volts?**	**Yes** GO to B3 . **No** GO to B4 .
B3 CARRY OUT THE INSTRUMENT CLUSTER DEALER	

TEST MODE	
• Key in ON position. • Enter the instrument cluster dealer test mode. Scroll through the displays until BATTERY is displayed and note the voltage value. • **Does the self-test input voltage match the voltmeter indication?**	**Yes** The system is operating correctly at this time. **No** GO to B4 .
B4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: Incorrect Oil Pressure Gauge Indication

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster is hardwired to the normally open engine oil pressure switch through circuit CMC24 (GY). The instrument cluster provides a reference voltage to the engine oil pressure switch when the ignition key is in the RUN position. When there is low or no oil pressure, the engine oil pressure switch remains open. The instrument cluster detects no change in the reference voltage and the oil pressure gauge remains in low oil pressure of the gauge. When the engine is running with sufficient oil pressure the engine oil pressure switch closes, providing a ground, which pulls the reference voltage from the instrument cluster low, the instrument cluster commands the oil pressure gauge to the normal oil pressure area of the gauge.

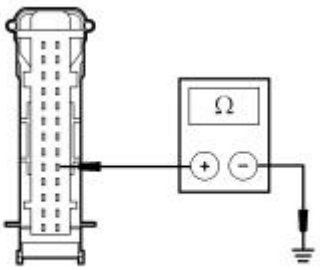
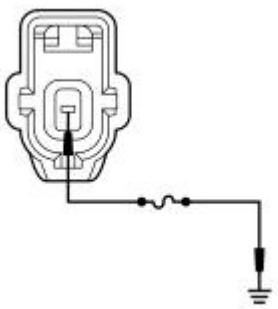
Possible Causes

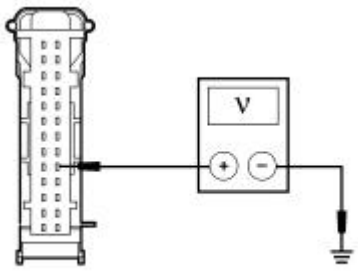
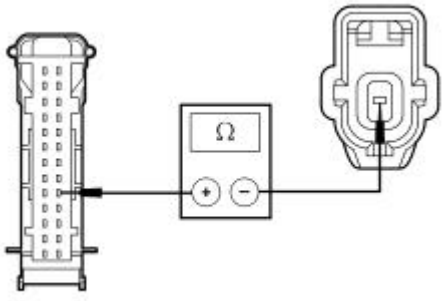
- Circuit CMC24 (GY) open, short to ground or voltage
- Engine oil pressure switch
- Base engine concern
- Instrument cluster

PINPOINT TEST C: INCORRECT OIL PRESSURE GAUGE INDICATION

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CARRY OUT THE INSTRUMENT CLUSTER OIL PRESSURE GAUGE ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command.	**Yes** If the oil pressure gauge always reads in the normal

• Select the instrument cluster oil pressure gauge active command OIL_POS on and off to sweep the gauge. • **Does the engine oil pressure gauge sweep to the high (H) when commanded on and return to low (L) when commanded off?**	range, GO to C2 . If the oil pressure gauge always reads low (L) and does not register any oil pressure, GO to C4 . **No** GO to C8 .
C2 CHECK FOR A STUCK CLOSED ENGINE OIL PRESSURE SWITCH	
• Key in OFF position. • Disconnect: Engine Oil Pressure Switch C103. • Key in ON position. • Observe the engine oil pressure gauge. • **Does the engine oil pressure gauge indicate low (L) oil pressure?**	**Yes** INSTALL a new engine oil pressure switch. REFER to Section 303-01 . TEST the system for normal operation. **No** GO to C3 .
C3 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-18, circuit CMC24 (GY), harness side and ground.  N0057131 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit. TEST the system for normal operation.
C4 CHECK FOR A STUCK OPEN ENGINE OIL PRESSURE SWITCH	
• Key in OFF position. • Disconnect: Engine Oil Pressure Switch C103. • Connect a fused (5A) jumper wire between the engine oil pressure switch, C103-1, circuit CMC24 (GY), harness side and ground.  N0002760 • Key in ON position. • Observe the engine oil pressure gauge. • **Does the engine oil pressure gauge indicate normal oil pressure?**	**Yes** REMOVE the jumper wire. GO to C7 . **No** REMOVE the jumper wire. GO to C5 .

C5 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-18, circuit CMC24 (GY), harness side and ground.  N0057217 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to C6 .
C6 CHECK CIRCUIT CMC24 (GY) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the instrument cluster C220-18, circuit CMC24 (GY), harness side and the engine oil pressure switch C103-1, circuit CMC24 (GY), harness side.  N0057132 • **Is the resistance less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit. TEST the system for normal operation.
C7 CHECK THE OIL PRESSURE	
• Carry out the engine oil pressure test. Refer to Section 303-00 . • **Is the oil pressure within specification?**	**Yes** INSTALL a new engine oil pressure switch. REFER to Section 303-01 . TEST the system for normal operation. **No** REFER to Section 303-00 to continue diagnosis of the engine oil pressure.
C8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating

	correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test D: Incorrect Temperature Gauge Indication

Normal Operation

The powertrain control module (PCM) receives the engine coolant temperature status through hardwired circuitry to the cylinder head temperature (CHT) sensor. The PCM sends the engine coolant temperature data to the instrument cluster over the high speed controller area network (HS-CAN) communication bus. The engine temperature data received from the PCM is filtered by the cluster to reduce gauge fluctuations. There are two separate strategies that the PCM and instrument cluster use to control the temperature gauge. The first strategy is basic engine temperature, which provides gradual changes in the temperature gauge based upon changing engine temperature. The second strategy is the failsafe cooling mode, which commands the gauge to the hot (H) stop position. If the instrument cluster does not receive the engine temperature status or if the temperature data is deemed invalid by the instrument cluster for more than 5 seconds, the message is considered missing and the instrument cluster sets DTC U0100 and defaults the temperature gauge to the cold (C) stop.

DTC U2199 — is a continuous DTC that sets if the instrument cluster receives invalid engine temperature data from the PCM. The instrument cluster defaults the temperature gauge to the cold (C) stop.

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST D: INCORRECT TEMPERATURE GAUGE INDICATION

Test Step	Result / Action to Take
D1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to D2 .
D2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to D3 .
D3 CARRY OUT THE INSTRUMENT CLUSTER TEMPERATURE GAUGE ACTIVE COMMAND USING THE SCAN TOOL	

• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster temperature gauge active command ENGCOOLNT and scroll in 3 increments 0°C (0° F), 105°C (221°F), and 134°C (273°F). • **Does the temperature gauge start at cold (C) when at 0° C (0°F), move to approximately half at 105°C (221°F), and full hot (H) at 134°C (273°F)?**	**Yes** GO to D4 . **No** GO to D5 .
D4 CARRY OUT THE INSTRUMENT CLUSTER DEALER TEST MODE	
• Key in START position. • Enter the instrument cluster dealer test mode with the key on and the engine running (KOER) by pressing and holding the odometer/trip odometer reset button (base cluster) or the message center switch RESET button (message center cluster) while starting the engine. Scroll through the displays until COOLANT TEMP is displayed and record the temperature value at different engine temperatures. • **Do the self-test temperature input values match the temperature gauge indication?**	**Yes** GO to D6 . **No** GO to D5 .
D5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

D6 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Speedometer Is Inoperative

Normal Operation

The instrument cluster receives the vehicle speed sensor (VSS) signal from the powertrain control module (PCM) over the controller area network (CAN) communication bus. The instrument cluster monitors the VSS input from the PCM and commands the speedometer with a corresponding movement of the pointer. If the instrument cluster does not receive the VSS data, or the data is deemed invalid by

the instrument cluster for more than 5 seconds, the message is considered missing and the instrument cluster sets DTC U0100 and defaults the speedometer to 0 km/h (0 mph).

Possible Causes

- Instrument cluster

PINPOINT TEST E: THE SPEEDOMETER IS INOPERATIVE

Test Step	Result / Action to Take
E1 CARRY OUT THE INSTRUMENT CLUSTER SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster speedometer active command SPD_IND and sweep the gauge in 10% increments. • **Does the speedometer start at 0 km/h (0 mph) and increase by 19.3 km/h (12 mph) for each 10% increase commanded?**	**Yes** GO to E2 . **No** GO to E3 .
E2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to E3 .
E3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Speedometer Is Inaccurate

Normal Operation

The instrument cluster receives the vehicle speed sensor (VSS) signal from the powertrain control module (PCM) over the controller area network (CAN) communication bus. The instrument cluster monitors the VSS input from the PCM and commands the speedometer with a corresponding movement of the pointer. If the instrument cluster does not receive the VSS data, or the data is deemed invalid by the instrument cluster for more than 5 seconds, the message is considered missing and the instrument cluster sets DTC U0100 and defaults the speedometer to 0 km/h (0 mph).

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST F: THE SPEEDOMETER IS INACCURATE

Test Step	Result / Action to Take
F1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to F2.
F2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH. **No** GO to F3.
F3 OBSERVE THE SPEEDOMETER POINTER POSITION	
• Key in START position. • Observe the speedometer while driving the vehicle at various speeds and stopping frequently. • **Does the speedometer begin at 0 km/h (0 mph) and fully return to the 0 km/h (0 mph) position when the vehicle is stopped?**	**Yes** GO to F4. **No** GO to F7.
F4 CARRY OUT THE INSTRUMENT CLUSTER SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster speedometer active command SPD_IND and scroll in 10% increments. • **Does the speedometer start at 0 km/h (0 mph) and increase by 19.3 km/h (12 mph) for each 10% increase commanded?**	**Yes** GO to F5. **No** GO to F7.
F5 CARRY OUT THE INSTRUMENT CLUSTER DEALER TEST MODE	
NOTE: This step may require the use of an assistant to monitor and record the instrument cluster self-test and the speedometer readings. • Key in START position. • Enter the instrument cluster dealer test mode with the key on and the engine running (KOER) by pressing and holding the odometer/trip odometer reset button (base cluster) or the message center switch RESET button (message center cluster) while starting the engine. Scroll through the displays until VEHICLE SPD is displayed.	**Yes** GO to F6. **No** GO to F7.

• Drive the vehicle at varying speeds. • Monitor the vehicle speed input with the speedometer reading. • **Do the self-test vehicle speed input values match the speedometer indication?**	
F6 CHECK THE PCM VSS SIGNAL INPUT	
NOTE: This step may require the use of an assistant to monitor and record the instrument cluster dealer test mode and the speedometer readings. • Key in START position. • Enter the following diagnostic mode on the diagnostic tool: PCM PIDs. • Monitor the PCM vehicle speed sensor PID VSS while driving the vehicle at varying speeds. • **Does the PCM PID match the speedometer indication?**	**Yes** The system is operating correctly at this time. VERIFY that the VSS signal to the PCM is correct by comparing vehicle speeds with a good known vehicle. **No** GO to F8 .
F7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

F8 CHECK FOR CORRECT PCM OPERATION	

• Disconnect the all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Odometer Is Inoperative

Normal Operation

The odometer is displayed in the message center vacuum fluorescent display. The instrument cluster receives the odometer rolling count data from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus and displays the data in the odometer display area of the message center. If the instrument cluster does not receive the vehicle rolling count message from the PCM or the rolling count data is deemed invalid by the instrument cluster, the instrument cluster sets DTC U0100.

NOTE: If DTC U0100 is set in the instrument cluster, other observable symptoms may be an inoperative speedometer, tachometer and temperature gauge.

Possible Causes

- Instrument cluster

PINPOINT TEST G: THE ODOMETER IS INOPERATIVE

Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to G2 .
G2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The Tachometer Is Inoperative

Normal Operation

The instrument cluster receives the tachometer data from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus and commands the tachometer according to the data. If the instrument cluster does not receive the engine rpm data or the data received is deemed invalid by the instrument cluster for more the 5 seconds, the instrument cluster sets DTC U0100.

NOTE: If DTC U0100 is set in the instrument cluster, other observable symptoms may be an inoperative speedometer, tachometer and temperature gauge.

Possible Causes

- Instrument cluster

PINPOINT TEST H: THE TACHOMETER IS INOPERATIVE

Test Step	Result / Action to Take
H1 CARRY OUT THE INSTRUMENT CLUSTER TACHOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the	**Yes** GO to H2 .

diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster tachometer active command TACH_IND and sweep the gauge in 10% increments. • **Does the tachometer start at 0 rpm and increase by 700 rpm for each 10% increase commanded?**	**No** GO to H3 .
H2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to H3 .
H3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: Inaccurate Tachometer Indication

Normal Operation

The instrument cluster receives the tachometer data from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus and commands the tachometer according to the data. If the instrument cluster does not receive the engine rpm data or the data received is deemed invalid by the instrument cluster for more the 5 seconds, the instrument cluster sets DTC U0100.

NOTE: If DTC U0100 is set in the instrument cluster, other observable symptoms may be an inoperative speedometer, tachometer and temperature gauge.

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST I: INACCURATE TACHOMETER INDICATION

Test Step	Result / Action to Take
I1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test.	**Yes** Go To Pinpoint Test AH .

• **Is DTC U0100 recorded?**	**No** GO to I2 .
I2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to I3 .
I3 OBSERVE THE TACHOMETER POINTER POSITION	
• Key in START position. • Observe the tachometer while increasing the engine speed between 0 and 2,000 rpm. • Key in OFF position. • **Does the tachometer begin at 0 rpm, increase with engine rpm then return to 0 rpm with the engine off?**	**Yes** GO to I4 . **No** GO to I7 .
I4 CARRY OUT THE INSTRUMENT CLUSTER TACHOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster tachometer active command TACH_IND and scroll in 10% increments. • **Does the tachometer start at 0 rpm and increase by 700 rpm for each 10% increase commanded?**	**Yes** GO to I5 . **No** GO to I7 .
I5 CARRY OUT THE INSTRUMENT CLUSTER DEALER TEST MODE	
• Key in START position. • Enter the instrument cluster dealer test mode with the key on and the engine running (KOER) by pressing and holding the odometer/trip odometer reset button (base cluster) or the message center switch RESET button (message center cluster) while starting the engine. Scroll through the displays until TACHOMETER is displayed. • Operate the engine at 1,000 rpm, 1,500 rpm and 2,000 rpm. • Monitor and compare the engine rpm input with the tachometer reading. • **Do the self-test engine rpm input values match the tachometer indication?**	**Yes** GO to I6 . **No** GO to I7 .
I6 CHECK THE PCM RPM SIGNAL INPUT	
• Key in START position. • Enter the following diagnostic mode on the diagnostic tool: PCM PIDs. • Monitor the PCM vehicle speed sensor PID RPM while operating the engine at 1,000 rpm, 1,500 rpm and 2,000 rpm. • **Does the PCM PID match the tachometer indication?**	**Yes** The system is operating correctly at this time. **No** GO to I8 .
I7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

I8 CHECK FOR CORRECT PCM OPERATION	

• Disconnect the all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Safety Belt Warning Indicator Is Never/Always On

Normal Operation

The restraints control module (RCM) monitors the safety belt position through the safety belt buckle switch. The RCM provides the safety belt buckle status to the instrument cluster over the high speed controller area network (HS-CAN) communication bus. If the instrument cluster does not receive the safety belt buckle switch status from the RCM or the message is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0151 and defaults the safety belt warning indicator off.

Possible Causes

- RCM
- Instrument cluster

PINPOINT TEST J: THE SAFETY BELT WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
J1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster safety belt warning indicator active command SBLT_LMP on and off. • **Does the safety belt warning indicator turn on when commanded on and turn**	**Yes** GO to J2 . **No** GO to J4 .

off when commanded off?	
J2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0151 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0151 returns, REFER to Section 418-00 to diagnose no communication with the RCM. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to J3 .
J3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND RCM SELF-TESTS	
• Check for recorded RCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 501-20B . **No** GO to J5 .
J4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

J5 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a RCM. REFER to Section 501-20B . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Anti-Lock Brake System (ABS) Warning Indicator Is Never/Always On

Normal Operation

The ABS module provides the ABS status to the instrument cluster over the high speed controller area network (HS-CAN) communication bus. If a fault condition exists in the ABS, the ABS module sends the instrument cluster a command to either flash the ABS warning indicator or to turn it on. If the instrument cluster does not receive the ABS status message from the ABS module or the message is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0121 and defaults the ABS warning indicator on.

Possible Causes

- ABS module
- Instrument cluster

PINPOINT TEST K: THE ANTI-LOCK BRAKE SYSTEM (ABS) WARNING INDICATOR IS ALWAYS ON

Test Step	Result / Action to Take
K1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster ABS warning indicator active command ABS on then off. Observe the ABS warning indicator. • **Does the ABS warning indicator turn off when commanded off?**	**Yes** GO to K2 . **No** GO to K4 .
K2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0121 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0121 returns, REFER to Section 418-00 to diagnose no communication with the ABS module. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to K3 .
K3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND ABS MODULE SELF-TESTS	
• Check for recorded ABS module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 206-09 . **No** GO to K5 .
K4 CHECK FOR CORRECT INSTRUMENT	

CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

K5 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect all the ABS module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the ABS module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a ABS module. REFER to Section 206-09 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: The Brake Warning Indicator Is Never On

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

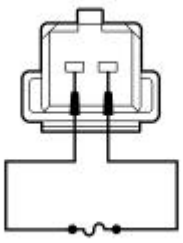
The instrument cluster uses 3 basic messaged inputs to control the brake warning indicator. The first 2 are the parking brake switch and brake fluid level switch. The third is for the electronic brake distribution, controlled by the anti-lock brake system (ABS). The parking brake switch and the brake fluid level switch status are sent from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. The electronic brake distribution message is sent from the ABS module over the HS-CAN communication bus lines. The parking brake switch is hardwired to the SJB through circuit CCB01 (VT/BN). The brake fluid level switch is hardwired to the SJB through signal circuit CMC19 (GY/VT) and return circuit RMC19 (YE/GY). When the parking brake is applied, the parking brake switch closes to ground through circuit GD143 (BK/VT), providing a ground to the SJB and pulling circuit CCB01 (VT/BN) low. When a low brake fluid level condition exists, the low brake fluid level switch closes to ground through circuit GD120 (BK/GN), pulling circuit CMC19 (GY/VT) low. The SJB monitors the parking brake and low brake fluid level inputs and sends the instrument cluster a message to turn on the brake warning indicator when the parking brake is applied or the brake fluid is low. When the ABS module detects a base brake system concern or other ABS related concerns that affect the electronic brake distribution function, the ABS module sends a message to the instrument cluster to illuminate both the ABS warning indicator and the brake warning indicator.

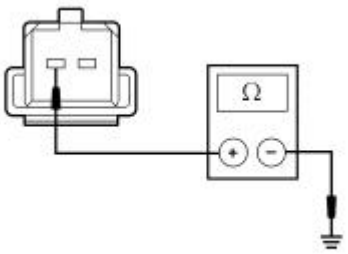
Possible Causes

- Circuit CCB01 (VT/OG) open
- Circuit GD120 (BK/GN) open
- Circuit GD143 (BK/VT) open
- Master cylinder (brake fluid level switch)
- Brake fluid level switch
- SJB
- Instrument cluster

PINPOINT TEST L: THE BRAKE WARNING INDICATOR IS NEVER ON

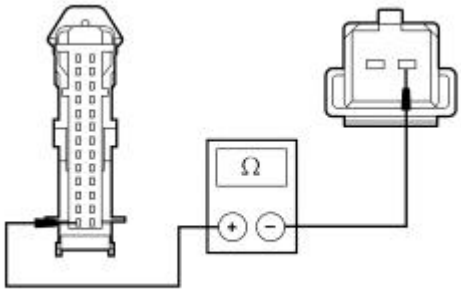
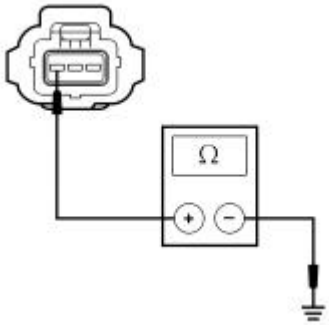
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

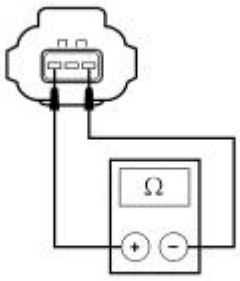
Test Step	Result / Action to Take
L1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster brake warning indicator active command BRK_LAMP on. Observe the brake warning indicator. • **Does the brake warning indicator illuminate when commanded on?**	**Yes** GO to L2 . **No** GO to L9 .
L2 CHECK THE PARKING BRAKE SWITCH PID	
• Enter the following diagnostic mode on the diagnostic tool: SJB PID. • Monitor the SJB PID PRK_BRAKE while applying the parking brake. • **Does the PID agree with the parking brake position?**	**Yes** GO to L6 . **No** GO to L3 .
L3 CHECK THE PARKING BRAKE SWITCH	
• Disconnect: Parking Brake Switch C2015. • Connect a fused (5A) jumper wire between the parking brake switch C2015-2, circuit GD143 (BK/VT), harness side and the parking brake switch C2015-1, circuit CCB01 (VT/BN), harness side.  N0002774 • **Does the brake warning indicator illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new parking brake switch. TEST the system for normal operation. **No** REMOVE the jumper wire. GO to L4 .
L4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the parking brake switch C2015-2, circuit GD143 (BK/VT), harness side and ground.	**Yes** GO to L5 . **No** REPAIR the circuit. TEST the system for normal operation.



N0057133

- **Is the resistance less than 5 ohms?**

L5 CHECK CIRCUIT CCB01 (VT/BN) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280D. • Measure the resistance between the SJB C2280D-1, circuit CCB01 (VT/BN), harness side and the parking brake switch C2015-1, circuit CCB01 (VT/BN), harness side and ground.  N0060120 • **Is the resistance less than 5 ohms?**	**Yes** GO to L10 . **No** REPAIR the circuit. TEST the system for normal operation.
L6 CHECK THE BRAKE FLUID LEVEL SWITCH OPERATION	
• Key in OFF position. • Disconnect: Brake Fluid Level Switch C124. • Key in ON position. • **Does the brake warning indicator illuminate?**	**Yes** GO to L7 . **No** GO to L10 .
L7 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the brake fluid level switch C124-1, circuit GD120 (BK/GN), harness side and ground.  N0027596 • **Is the resistance less than 5 ohms?**	**Yes** GO to L8 . **No** REPAIR the circuit. TEST the system for normal operation.
L8 CHECK THE BRAKE FLUID LEVEL SWITCH	
• Key in ON position. • **CAUTION: Do not spill brake fluid onto painted or plastic surfaces. If spilled, wipe up immediately before**	**Yes** GO to L10 . **No**

damage to the painted or plastic surface occurs. • Remove the brake fluid from the reservoir to allow the brake fluid level switch to fall to the bottom of the reservoir. • Measure the resistance between the brake fluid level switch C124 pin 3, component side and the brake fluid level switch C124 pin 1, component side.  N0057135 • **Does the resistance less than 5 ohms?**	INSTALL a new master cylinder. REFER to Section 206-06 . TEST the system for normal operation.
L9 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

L10 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: The Brake Warning Indicator Is Always On

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster uses 3 basic messaged inputs to control the brake warning indicator. The first 2

are the parking brake switch and brake fluid level switch. The third is for the electronic brake distribution, controlled by the anti-lock brake system (ABS). The parking brake switch and the brake fluid level switch status are sent from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. The electronic brake distribution message is sent from the ABS module over the HS-CAN communication bus lines. The parking brake switch is hardwired to the SJB through circuit CCB01 (VT/BN). The brake fluid level switch is hardwired to the SJB through signal circuit CMC19 (GY/VT) and return circuit RMC19 (YE/GY). When the parking brake is applied, the parking brake switch closes to ground through circuit GD143 (BK/VT), providing a ground to the SJB and pulling circuit CCB01 (VT/BN) low. When a low brake fluid level condition exists, the low brake fluid level switch closes to ground through circuit GD120 (BK/GN), pulling circuit CMC19 (GY/VT) low. The SJB monitors the parking brake and low brake fluid level inputs and sends the instrument cluster a message to turn on the brake warning indicator when the parking brake is applied or the brake fluid is low. When the ABS module detects a base brake system concern or other ABS related concerns that affect the electronic brake distribution function, the ABS module sends a message to the instrument cluster to illuminate both the ABS warning indicator and the brake warning indicator.

If the brake fluid level or parking brake status messages are missing or deemed invalid by the instrument cluster for more than 5 seconds, the instrument cluster sets DTC U0140 and defaults the brake warning indicator on. If the electronic brake distribution message is missing or invalid, the instrument cluster sets DTC U0121 and defaults the brake warning indicator on. If the instrument cluster does not receive the ABS status message from the ABS module or the message is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0121 and defaults the ABS warning indicator on.

DTC B2479 — sets on-demand if the SJB detects a short to ground on the parking brake input circuit CCB01 (VT/BN) during the module self-test.

DTC C1125 — is a continuous and on-demand DTC that sets in the SJB if an open is detected on the brake fluid level input circuit CMC19 (GY/VT) or return circuit RMC19 (YE/GY) or if a short to ground is detected on the input circuit CMC19 (GY/VT).

NOTE: If DTC U0140 is set in the instrument cluster, other symptoms may also be present such as tire pressure monitoring system (TPMS), instrument panel backlighting, and door ajar indication.

NOTE: Both the ABS warning indicator and the brake warning indicator illuminate if the input to turn on the brake warning indicator is received from the anti-lock brake system (ABS) module.

Possible Causes

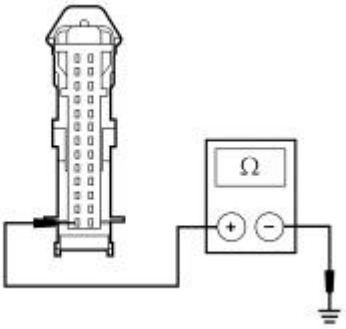
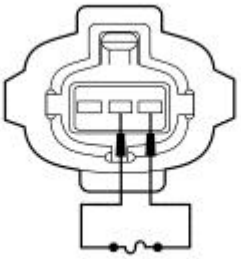
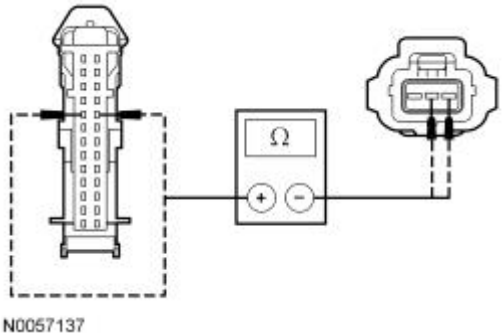
- Circuit CCB01 (VT/BN) open or short to ground
- Circuit CMC19 (GY/VT) open or short to ground
- Circuit RMC19 (YE/GY) open
- Parking brake switch
- Master cylinder (brake fluid level switch)
- ABS module
- SJB
- Instrument cluster

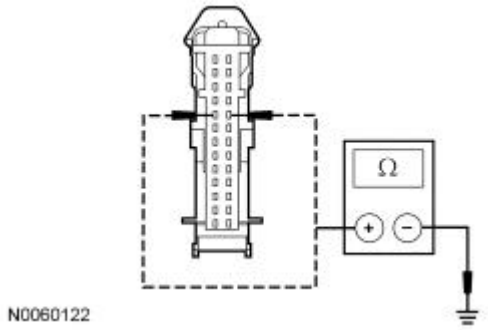
PINPOINT TEST M: THE BRAKE WARNING INDICATOR IS ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
M1 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER SELF-TEST	

• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0140 recorded?**	**Yes** Go To Pinpoint Test AI . **No** If DTC U0121 is recorded, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. GO to M2 .
M2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND ABS MODULE SELF-TESTS	
• Check for recorded ABS module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 206-09 . **No** GO to M3 .
M3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** If DTC B2479 is retrieved, GO to M5 . If DTC C1125 is retrieved, GO to M8 . **No** GO to M4 .
M4 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster brake warning lamp active command on and off. Observe the brake warning indicator. • **Does the brake warning indicator turn off when commanded off?**	**Yes** GO to M13 . **No** GO to M11 .
M5 CHECK THE PARKING BRAKE SWITCH PID	
• Enter the following diagnostic mode on the diagnostic tool: SJB PID. • Monitor the SJB PID PRK_BRAKE while applying and releasing the parking brake. • **Does the PID agree with the parking brake position?**	**Yes** GO to M12 . **No** GO to M6 .
M6 CHECK THE PARKING BRAKE SWITCH	
• Disconnect: Parking Brake Switch C2015. • Observe the brake warning indicator. • **Does the brake warning indicator continue to illuminate?**	**Yes** GO to M7 . **No** INSTALL a new parking brake switch. REPEAT the self-test. CLEAR

	the DTCs.
M7 CHECK CIRCUIT CCB01 (VT/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: SJB C2280D. • Measure the resistance between the SJB C2280D-1, circuit CCB01 (VT/BN), harness side and ground.  N0060121 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to M12 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.
M8 CHECK THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE OPERATION	
• Key in OFF position. • Disconnect: Brake Fluid Level Switch C124. • Connect a fused (5A) jumper wire between the brake fluid level switch C124-3, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-2, circuit RMC19 (YE/GY), harness side.  N0002771 • Key in ON position. • **Does the brake warning indicator turn off?**	**Yes** INSTALL a new master cylinder. REFER to Section 206-06 . REPEAT the self-test. CLEAR the DTCs. **No** REMOVE the jumper wire. GO to M9 .
M9 CHECK CIRCUITS CMC19 (GY/VT) AND RMC19 (YE/GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280B. • Measure the resistance between the SJB C2280B-9, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-3, circuit CMC19 (GY/VT), harness side; and between the SJB C2280B-22, circuit RMC19 (YE/GY), harness side and the brake fluid level switch C124-2, circuit RMC19 (YE/GY), harness side.  N0057137	**Yes** GO to M10 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• **Are the resistances less than 5 ohms?**	
M10 CHECK CIRCUITS CMC19 (GY/VT) AND RMC19 (YE/GY) FOR A SHORT TO GROUND	
• Measure the resistance between the SJB C2280B-9, circuit CMC19 (GY/VT), harness side and ground; and between the SJB C2280B-22, circuit RMC19 (YE/GY), harness side and ground.  N0060122 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to M12 . **No** REPAIR the circuit in question. TEST the system for normal operation.
M11 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

M12 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

M13 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect the ABS module connector. • Check for: ▪ corrosion	**Yes** INSTALL a new ABS module.

▪ damaged pins ▪ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	REFER to Section 206-09 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Malfunction Indicator Lamp (MIL) Is Never/Always On

Normal Operation

The malfunction indicator lamp (MIL) is illuminated when a mis-fire condition exists or an emission-related concern is detected by the powertrain control module (PCM). The instrument cluster receives the MIL data from the PCM over the high speed controller area network (HS-CAN) communication bus. If an emissions concern exists, the PCM sets a DTC and sends a message to the instrument cluster to illuminate the MIL. If a mis-fire condition exists, the PCM sets a DTC and sends the instrument cluster a message to flash the MIL. If the MIL message is missing or if the data is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0100 and defaults the MIL on.

NOTE: If U0100 is set in the instrument cluster other symptoms may also be present such as an inoperative speedometer, tachometer or temperature gauge.

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST N: THE MALFUNCTION INDICATOR LAMP (MIL) IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
N1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to N2 .
N2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to N3 .
N3 CARRY OUT THE INSTRUMENT CLUSTER	

INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster MIL active command MIL_IC on and off. Observe the MIL. • **Does the MIL illuminate when commanded on and turn off when commanded off?**	**Yes** GO to N5 . **No** GO to N4 .
N4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

N5 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Air Bag Warning Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the supplemental restraint system (SRS) status from the restraints control module (RCM) over the high speed controller area network (HS-CAN) communication bus. If an air SRS concern is detected, the RCM sets a DTC and sends a message to the instrument cluster to turn on the air bag warning indicator. If the SRS status message is missing or is deemed invalid for greater than 5 seconds, the instrument cluster sets DTC U0151 and defaults the air bag warning indicator on.

Possible Causes

- RCM
- Instrument cluster

PINPOINT TEST O: THE AIR BAG WARNING INDICATOR IS NEVER/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
O1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0151 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0151 returns, REFER to Section 418-00 to diagnose no communication with the RCM. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to O2 .
O2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND RESTRAINT CONTROL MODULE (RCM) SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B to continue diagnosis of the restraint system. **No** GO to O3 .
O3 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster air bag warning indicator active command AIRBAG on and off. Observe the air bag warning indicator. • **Does the air bag warning indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to O5 . **No** GO to O4 .
O4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. ACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ACTIVATE the air bag system. REFER to Section 501-20B .

O5 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new RCM. REFER to Section 501-20B . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ACTIVATE the air bag system. REFER to Section 501-20B .

Pinpoint Test P: The High Beam Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the high beam status from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. When the high beams have been selected, the SJB sends a message to the instrument cluster to turn on the high beam indicator. If the high beam status message is missing for more than 5 seconds, the instrument cluster sets DTC U0140 and defaults the high beam indicator off.

NOTE: Navigators equipped with high intensity discharge (HID) headlamps do not illuminate the high beam indicator when in flash-to-pass mode.

NOTE: If DTC U0140 is set in the SJB, other symptoms may also be present such as tire pressure monitoring system (TPMS), instrument panel backlighting, and door ajar indication.

Possible Causes

- SJB
- Instrument cluster

PINPOINT TEST P: THE HIGH BEAM INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
P1 VERIFY THE HIGH BEAM OPERATION	
• Verify the high beam headlamps operation. • **Do the high beam headlamps operate correctly?**	**Yes** GO to P2 . **No** REFER to Section 417-01 .
P2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0140 recorded?**	**Yes** Go To Pinpoint Test AI . **No** GO to P3 .
P3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS	

• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 419-10 , Diagnostic Trouble Code (DTC) Chart for correct navigation of the DTC. **No** GO to P4 .
P4 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster high beam indicator active command HIGH_BEAM on and off. Observe the high beam indicator. • **Does the high beam indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to P6 . **No** GO to P5 .
P5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

P6 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The LH/RH Turn Indicator Is Never On

Normal Operation

The instrument cluster receives the LH and RH turn signal/hazard status from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. When the LH or RH turn signal or hazards have been selected, the SJB sends a message to the instrument cluster to turn on the LH or RH turn indicator. If the LH or RH turn status message is missing for more than 5 seconds, the instrument cluster sets DTC U0140 and defaults the turn indicators off.

NOTE: If DTC U0140 is set in the SJB, other symptoms may also be present such as tire pressure monitoring system (TPMS), instrument panel backlighting, and door ajar indication.

Possible Causes

- SJB
- Instrument cluster

PINPOINT TEST Q: THE LH/RH TURN INDICATOR IS NEVER ON

Test Step	Result / Action to Take
Q1 CHECK THE TURN SIGNAL OPERATION	
• Verify the turn signal operation. • **Does the LH and RH turn signals operate correctly?**	**Yes** GO to Q2 . **No** REFER to Section 417-01 .
Q2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0140 recorded?**	**Yes** Go To Pinpoint Test AI . **No** GO to Q3 .
Q3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 419-10 , Diagnostic Trouble Code (DTC) Chart for correct navigation of the DTC. **No** GO to Q4 .
Q4 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster all lamps active command ALL_LAMP on and off. Observe the LH and RH turn indicators. • **Do the LH and RH turn indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to Q6 . **No** GO to Q5 .
Q5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded

	connector.
Q6 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: The Speed Control Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the speed control signal from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus. When the speed control is engaged, the PCM sends a message to the instrument cluster to illuminate the speed control indicator. If the speed control message is missing or if the data is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0100 and defaults the speed control off.

NOTE: If U0100 is set in the instrument cluster other symptoms may also be present such as an inoperative speedometer, tachometer or temperature gauge.

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST R: THE SPEED CONTROL INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
R1 CHECK SPEED CONTROL OPERATION	
• Test drive the vehicle and operate the speed control. • **Does the speed control operate correctly?**	**Yes** GO to R2 . **No** REFER to Section 310-03 .
R2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to R3 .
R3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

	No GO to R4 .
R4 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster speed control active command CRUISE on and off. Observe the speed control indicator. • **Does the speed control indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to R6 . **No** GO to R5 .

R5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

R6 CHECK FOR CORRECT PCM OPERATION
• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test S: The Tire Pressure Monitoring System (TPMS) Warning Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the TPMS messages from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. If the SJB determines that the tire pressure has exceeded the limits, a message is sent to the instrument cluster to turn on the TPMS warning indicator. If a TPMS fault condition exists, the SJB sends a message to the instrument cluster to flash the TPMS warning indicator. If the TPMS status message is missing or deemed invalid by the instrument cluster for more than 5 seconds, the instrument cluster sets DTC U0140 and flashes the TPMS indicator for 60 seconds then turns the indicator on.

NOTE: If DTC U0140 is set in the SJB, other symptoms may also be present such as high beam indicator, RH/LH turn indicators, instrument panel backlighting, and door ajar indication.

Possible Causes

- TPMS concern
- SJB
- Instrument cluster

PINPOINT TEST S: THE TIRE PRESSURE MONITORING SYSTEM (TPMS) WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
S1 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER SELF-TEST	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0140 recorded?**	**Yes** Go To Pinpoint Test AI . **No** GO to S2 .
S2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are any SJB DTCs recorded?**	**Yes** REFER to Section 419-10 , Diagnostic Trouble Code (DTC) Chart for correct navigation of the DTC. **No** GO to S3 .
S3 CARRY OUT THE INSTRUMENT INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster TPMS active command TIRE_PRES on and off. Observe the TPMS warning indicator. • **Does the TPMS warning indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to S5 . **No** GO to S4 .
S4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

S5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for:	**Yes** INSTALL a new SJB. REFER to Section

■ corrosion ■ damaged pins ■ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: The O/D Off Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the overdrive (O/D) off signal from the transmission control module (TCM) over the high speed controller area network (HS-CAN) communication bus. The O/D off switch is hardwired to the TCM. When the transmission O/D is selected off, the O/D off switch provides a ground signal to the TCM. The TCM upon receipt of the O/D off ground signal, provides an O/D off message to the instrument cluster and the instrument cluster illuminates the O/D off indicator. If the O/D off message is missing or invalid for greater than 5 seconds, the instrument cluster sets DTC U0101 and defaults the O/D off indicator off.

Possible Causes

- TCM
- Instrument cluster

PINPOINT TEST T: THE O/D OFF INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
T1 CHECK O/D OPERATION	
• Test drive the vehicle and turn the O/D function off and on again. • **Does the O/D function operate correctly?**	**Yes** GO to T2 . **No** REFER to Section 307-05 .
T2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0101 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0101 returns, REFER to Section 418-00 to diagnose no communication with the TCM. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to T3 .
T3 RETRIEVE THE RECORDED DTCs FROM	

BOTH THE CONTINUOUS AND ON-DEMAND TCM SELF-TESTS	
• Check for recorded TCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 307-01A or Section 307-01B . **No** GO to T4 .
T4 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster O/D active command OVERDRV on and off. Observe the O/D off indicator. • **Does the O/D off indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to T6 . **No** GO to T5 .
T5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

T6 CHECK FOR CORRECT TCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new TCM. REFER to Section 307-01A , Main Control Valve Body or Section 307-01B , Mechatronic Assembly. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: The Anti-Theft Indicator Is Never/Always On

Normal Operation

The instrument cluster controls the passive anti-theft system (PATS) with the powertrain control module (PCM) and receives the anti-theft key status from the hardwired PATS module. If there is a PATS concern, the instrument cluster anti-theft indicator glows steadily for one minute then flashes a 4-digit fault code 10 times when the ignition switch is turned to the ON position. The PATS also flashes the theft indicator approximately every 2 seconds at ignition OFF to act as a visual theft deterrent. Refer to Section 419-01 for addition PATS information.

Possible Causes

- Instrument cluster

PINPOINT TEST U: THE THEFT INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
U1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster anti-theft indicator active command THEFT_LMP on and off. Observe the anti-theft indicator. • **Does the anti-theft off indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to U2 . **No** GO to U3 .
U2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Are any DTCs recorded?**	**Yes** For all PATS related DTCs, REFER to Section 419-01 . For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to U3 .
U3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: The PRNDL Indicator is Never/Always On (If Equipped)

Normal Operation

The instrument cluster receives the transmission range status from the transmission control module (TCM) over the high speed controller area network (HS-CAN) communication bus. Column shift vehicles use a park detect switch (part of the brake shift interlock) to signal the instrument cluster that the shift lever is fully seated in the park position. The instrument cluster compares the park detect switch input with the transmission range status sent from the TCM. The instrument cluster provides a reference voltage to the brake shift interlock on circuit CET53 (BU/OG). When the gearshift is in PARK (P), the

brake shift indicator routes the reference voltage to ground, pulling the circuit low to the instrument cluster. When the gearshift is moved out of PARK (P), the brake shift interlock opens the ground sending the reference voltage high. If the PRNDL information is missing from the TCM, the instrument cluster sets DTC U0101 or if the instrument cluster sees a signal from the park detect switch indicating the shifter is in PARK (P) with a conflicting PRNDL input, the instrument cluster defaults the PRNDL display to blank (no PRNDL display).

NOTE: If U0101 is set, other symptoms may include the O/D off indicator or the wrench reconfigurable telltale indicator ON.

NOTE: The PRNDL is only available on column shift vehicles.

DTC C1945 — is a continuous memory DTC that sets if the instrument cluster detects a short to ground on the park detect switch input, circuit CET53 (BU/OG), pulling the circuit low with a vehicle speed sensor (VSS) input over 16 km/h (10 mph), indicating that the vehicle is in motion.

Possible Causes

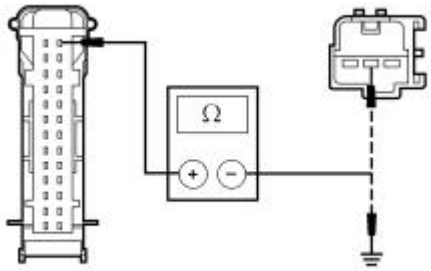
- Circuit CET53 (BU/OG) open or short to ground
- Brakeshift interlock
- Instrument cluster

PINPOINT TEST V: THE PRNDL INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
V1 CHECK THE PRNDL DISPLAY PARK OPERATION	
• Key in ON position. • Shift the selector lever through the different gear positions while observing the PRNDL display. • Place the selector lever in the PARK (P) position. • Key in OFF position. • Observe the PRNDL display immediately after turning the key off. • **Does the PRNDL display the different ranges according to the selector lever position then display P for approximately 5 seconds when the key is turned off?**	**Yes** The system is functioning correctly at this time. **No** GO to V2 .
V2 RETRIEVE AND RECORD THE INSTRUMENT CLUSTER DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** For all DTCs, REPEAT the self-test. CLEAR the DTCs. DRIVE the vehicle above 16 km/h (10 mph) for more than 5 seconds. If DTC C1945 returns, GO to V6 . If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system.

	If DTC U0101 returns, REFER to Section 418-00 to diagnose no communication with the TCM module. **No** GO to V3.
V3 RETRIEVE AND RECORD THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to V4.
V4 RETRIEVE AND RECORD THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND TCM SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any TCM DTCs recorded?**	**Yes** REFER to Section 307-01A or Section 307-01B. **No** GO to V5.
V5 CARRY OUT THE INSTRUMENT CLUSTER DEALER TEST MODE	
• Key in ON position. • Verify that the transmission selector lever is fully seated in the PARK (P) position. • Enter the instrument cluster dealer test mode. Scroll through the displays until PRKDETSW is displayed and note the park detect switch status. • **Does the self-test indicate G?**	**Yes** GO to V6. **No** GO to V8.
V6 CHECK THE BRAKE SHIFT INTERLOCK OPERATION	
• Key in OFF position. • Disconnect: Brake Shift Interlock C2008. • Clear the DTCs. DRIVE the vehicle above 16 km/h (10 mph) for more than 5 seconds. Retrieve the instrument cluster continuous memory DTCs. • **Is DTC C1945 still present?**	**Yes** GO to V7. **No** INSTALL a new brake shift interlock. TEST the system for normal operation.
V7 CHECK CIRCUIT CET53 (BU/OG) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Disconnect: Brake Shift Interlock C2008. • Measure the resistance between the instrument cluster C220-26, circuit CET53 (BU/OG), harness side and the brake shift interlock C2008-2, circuit CET53 (BU/OG), harness side; and between the instrument cluster C220-26, circuit CET53 (BU/OG), harness side and ground.	**Yes** GO to V8. **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

 N0057139 • **Is the resistance less than 5 ohms between the instrument cluster and the brake shift interlock, and greater than 10,000 ohms between the instrument cluster and ground?**	
V8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test W: The Wrench Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

The wrench reconfigurable telltale can be turned on by any one of three modules. The powertrain control module (PCM) provides the electronic throttle control status, the transmission control module (TCM) provides transmission status and the four wheel drive (4WD) control module (if equipped) provides a status of the 4WD system to the instrument cluster. Each module monitors the powertrain for their respective function and provides the instrument cluster with the operating status over the high speed controller area network (HS-CAN) communication bus. When a fault condition exists in any of the monitored systems, the PCM, TCM or 4WD (if equipped) control modules provide the instrument cluster with a message to turn on the wrench warning indicator.

If the electronic throttle control message is missing or if the data is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0100 and defaults the wrench reconfigurable telltale ON. If the O/D off message is missing or invalid for greater than 5 seconds, the instrument cluster sets DTC U0101 and defaults the wrench reconfigurable telltale ON. If equipped with 4WD and the 4WD status message is missing or invalid for more than 5 seconds, the instrument cluster sets DTC U0102 and defaults the wrench reconfigurable telltale ON.

NOTE: If U0100 is set in the instrument cluster other symptoms may also be present such as an inoperative speedometer, tachometer or temperature gauge. If U0101 is set, other symptoms may include the O/D off indicator ON. If DTC U0102 is set, other symptoms may include the 4x4, 4x4 LOW or 4x4 AUTO reconfigurable telltales may be inoperative.

Possible Causes

- Electronic throttle control concern
- Transmission concern
- 4WD concern (if equipped)
- Instrument cluster

PINPOINT TEST W: THE WRENCH RECONFIGURABLE TELLTALE IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
W1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Are any DTCs recorded?**	**Yes** For all DTCs, REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0101 returns, REFER to Section 418-00 to diagnose no communication with the TCM module. If DTC U0100 returns, Go To Pinpoint Test AH . If DTC U0102 returns, REFER to Section 418-00 to diagnose no communication with the 4WD control module. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to W2 .
W2 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster wrench indicator reconfigurable telltale active command WR_LMP on and off. • **Does the wrench indicator reconfigurable telltale turn on when commanded on and turn off when commanded off?**	**Yes** GO to W3 . **No** GO to W6 .
W3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND TCM SELF-TESTS	
• Check for recorded TCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 307-01A or Section 307-01B . **No**

	GO to W4 .
W4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** If equipped with 4WD, GO to W5 . If not equipped with 4WD, GO to W6 .
W5 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND 4WD CONTROL MODULE SELF-TESTS	
• Check for recorded 4WD control module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 308-07A . **No** GO to W6 .
W6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test X: The Charge Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the charging system signal from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus. If the charging system is functioning correctly once the engine is started, the PCM sends the instrument cluster a message to turn off the charge indicator. When a charging system concern is detected, the PCM sends a message to the instrument cluster to turn on the charge reconfigurable telltale indicator. If the charging system message is missing or if the data is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0100 and defaults the charge reconfigurable telltale ON.

NOTE: If U0100 is set in the instrument cluster other symptoms may also be present such as an inoperative speedometer, tachometer or temperature gauge.

Possible Causes

- Charging system concern
- Instrument cluster

PINPOINT TEST X: THE CHARGE RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
X1 CHECK THE CHARGING SYSTEM • Check the charging system operation. Refer to Section 414-00 . • **Is the charging system operating correctly?**	**Yes** GO to X2 . **No** REFER to Section 414-00 .
X2 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster charging system reconfigurable telltale active command CHARGE_LMP on and off. • **Does the charging system reconfigurable telltale turn on when commanded on and turn off when commanded off?**	**Yes** GO to X3 . **No** GO to X5 .
X3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS • Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to X4 .
X4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS • Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to X5 .

X5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Y: The Low Oil Pressure Reconfigurable Telltale Indicator Is Never/Always On

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster uses engine rpm data, sent from the powertrain control module (PCM) over the high speed controller area network (HS-CAN) communication bus, to determine whether the engine is running. The normally open engine oil pressure switch is hardwired to the instrument cluster through circuit CMC24 (GY). The instrument cluster provides a reference voltage to the engine oil pressure switch when the ignition key is in the RUN position. When there is low or no oil pressure, the engine oil pressure switch remains open, the instrument cluster detects no change in the reference voltage, and the low oil pressure reconfigurable telltale is turned on. When the engine is running with sufficient oil pressure, the PCM sends an rpm status message to the cluster and the engine oil pressure switch closes, providing a ground, which pulls the reference voltage from the instrument cluster low, turning on the low oil pressure reconfigurable telltale. If the engine rpm status message is missing or if the data is deemed invalid by the instrument cluster for greater than 5 seconds, the instrument cluster sets DTC U0100 and defaults the low oil pressure reconfigurable telltale on.

NOTE: If U0100 is set in the instrument cluster other symptoms may also be present such as an inoperative speedometer, tachometer or temperature gauge.

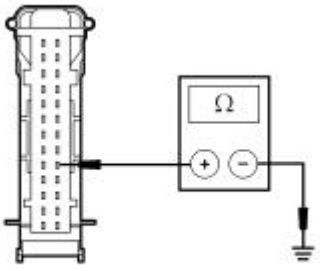
Possible Causes

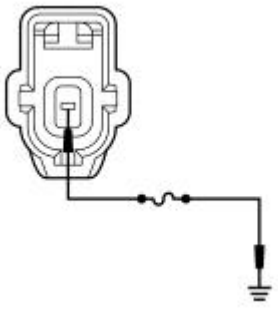
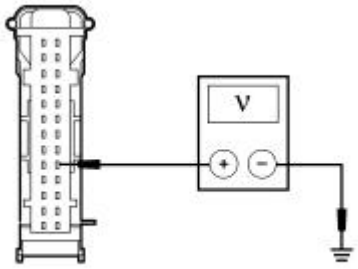
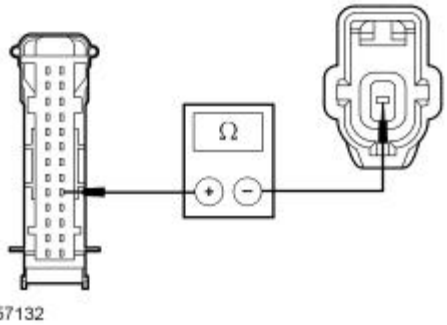
- Circuit CMC24 (GY) open, short to ground or voltage
- Engine oil pressure switch
- Base engine concern
- Instrument cluster

PINPOINT TEST Y: THE LOW OIL PRESSURE RECONFIGURABLE TELLTALE IS NEVER/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
Y1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster low oil pressure reconfigurable telltale active command OIL_P_L on and off . • **Does the low oil pressure reconfigurable telltale turn on when commanded on and turn off when commanded off?**	**Yes** GO to Y2 . **No** GO to Y10 .
Y2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to Y3 .

Y3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** If the low oil pressure reconfigurable telltale indicator is always on, GO to Y4 . If the low oil pressure reconfigurable telltale indicator is never on, GO to Y6 .
Y4 CHECK FOR A STUCK CLOSED ENGINE OIL PRESSURE SWITCH	
• Key in OFF position. • Disconnect: Engine Oil Pressure Switch C103. • Key in ON position. • Observe the engine oil pressure gauge. • **Does the engine oil pressure gauge indicate low (L) oil pressure?**	**Yes** INSTALL a new engine oil pressure switch. REFER to Section 303-01 . TEST the system for normal operation. **No** GO to Y5 .
Y5 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-18, circuit CMC24 (GY), harness side and ground.  N0057131 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Y10 . **No** REPAIR the circuit. TEST the system for normal operation.
Y6 CHECK FOR A STUCK OPEN ENGINE OIL PRESSURE SWITCH	
• Key in OFF position. • Disconnect: Engine Oil Pressure Switch C103. • Connect a fused (5A) jumper wire between the engine oil pressure switch, C103-1, circuit CMC24 (GY), harness side and ground.	**Yes** REMOVE the jumper wire. GO to Y9 . **No** REMOVE the jumper wire. GO to Y7 .

 N0002760 • Key in START position. • Observe the low oil pressure reconfigurable telltale. • **Does the low oil pressure reconfigurable telltale turn off?**	
Y7 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-18, circuit CMC24 (GY), harness side and ground.  N0057217 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to Y8 .
Y8 CHECK CIRCUIT CMC24 (GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-18, circuit CMC24 (GY), harness side and the engine oil pressure switch C103-1, circuit CMC24 (GY), harness side.  N0057132 • **Is the resistance less than 5 ohms?**	**Yes** GO to Y10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Y9 CHECK THE OIL PRESSURE	
• Carry out the engine oil pressure test. Refer to Section 303-00 . • **Is the oil pressure within specification?**	**Yes** INSTALL a new engine oil pressure switch. REFER to Section 303-01 . TEST the

	system for normal operation. **No** REFER to Section 303-00 to continue diagnosis of the engine oil pressure.
Y10 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Z: The Engine Over Temperature Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

There are basically 3 separate situations when the instrument cluster receives a message to turn on the engine over temperature reconfigurable telltale indicator; a high engine temperature condition, failsafe cooling 1 or failsafe cooling 2 state. The powertrain control module (PCM) sends the applicable message to the instrument cluster over the high speed controller area network (HS-CAN) communication bus whenever any of the 3 conditions exist. The PCM receives the engine coolant temperature status through hardwired circuitry to the cylinder head temperature (CHT) sensor. If a high engine temperature condition exists, the PCM sends a message to the instrument cluster to turn on the engine over temperature reconfigurable telltale indicator. If a failsafe warning condition exists, the PCM sends a message to the instrument cluster to flash the engine over temperature reconfigurable telltale indicator.

If the instrument cluster does not receive the engine temperature or failsafe cooling status or if the data is deemed invalid by the instrument cluster for more than 5 seconds, the message is considered missing and the instrument cluster sets DTC U0100 and defaults the temperature gauge to the cold (C) stop and the engine over temperature reconfigurable indicator on.

DTC U2199 — is a continuous DTC that sets if the instrument cluster receives invalid engine temperature data from the PCM. The instrument cluster defaults the temperature gauge to the cold (C) stop and turns on the engine over temperature reconfigurable telltale.

Possible Causes

- PCM
- Instrument cluster

PINPOINT TEST Z: THE ENGINE OVER TEMPERATURE RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take

Z1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . If both U0100 and U2199 are recorded, REFER to Section 418-00 to diagnose the communication network. **No** If DTC U2199 is recorded, GO to Z2 .
Z2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to Z3 .
Z3 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster engine over temperature reconfigurable telltale active command OVTEMP_LMP on and off. • **Does the engine over temperature reconfigurable telltale turn on when commanded on and turn off when commanded off?**	**Yes** GO to Z5 . **No** GO to Z4 .
Z4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Z5 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AA: The Low Fuel Reconfigurable Telltale Indicator Is Never/Always On (If Equipped)

Normal Operation

The low fuel reconfigurable telltale illuminates when the distance to empty (DTE) calculation reaches 80 km (50 miles) or less. The DTE is calculated internally by the instrument cluster from data received from the powertrain control module and fuel gauge. When the instrument cluster receives the data, the fuel gauge indicates low fuel and the instrument cluster turns on the low fuel reconfigurable telltale.

Possible Causes

- Instrument cluster

PINPOINT TEST AA: THE LOW FUEL RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

Test Step	Result / Action to Take
AA1 CHECK THE FUEL GAUGE OPERATION • Key in ON position. • Access and observe the informational display or message center display distance to empty (DTE) displayed mileage. • **Does the DTE display indicate 80 km (50 miles) or less until empty?**	**Yes** GO to AA2 . **No** The system is operating correctly at this time. The low fuel warning message does not appear until the DTE is 80 km (50 miles) or less.

AA2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AB: The Check Fuel Cap Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

The powertrain control module (PCM) monitors the fuel tank evaporative emission system for significant leaks that occur following refueling of the vehicle. Once the PCM detects a fuel vapor leak, the PCM sends the instrument cluster a message over the communication network to turn on the check fuel cap reconfigurable telltale indicator. DTC P0457 sets in the PCM following a successful cruise test, which is initiated when the vehicle is driven at a steady speed above 64 km/h (40 mph) for a duration of approximately 4-5 minutes. If the PCM is unable to successfully run the cruise test, the instrument cluster does not receive the check fuel cap message and the check fuel cap reconfigurable telltale indicator remains off.

DTC P0457 — sets in the PCM if a fuel tank pressure change greater than -23.7 kPa (-7 in-Hg) of vacuum within 30 seconds after refueling occurs, or there is an excessive purge (fuel vapor) flow of greater than 454 g (1.0 lb) per minute.

Possible Causes

- Instrument cluster

PINPOINT TEST AB: THE CHECK FUEL CAP RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
AB1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster indicator lamp control active command FUEL_CAP. Command the check fuel cap reconfigurable telltale indicator on and off. Observe the check fuel cap reconfigurable telltale indicator. • **Does the check fuel cap reconfigurable telltale indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** GO to AB2 . **No** GO to AB5 .
AB2 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Is PCM DTC P0457 recorded?**	**Yes** If the check fuel cap warning indicator is illuminated, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the check fuel cap warning indicator is not illuminated, GO to AB4 . **No** GO to AB3 .
AB3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0100 recorded?**	**Yes** Go To Pinpoint Test AH . **No** GO to AB4 .
AB4 CHECK THE INSTRUMENT CLUSTER OPERATION	
• Monitor the instrument cluster check fuel cap reconfigurable telltale indicator. • **Is the instrument cluster check fuel cap reconfigurable telltale indicator always on?**	**Yes** GO to AB5 . **No** The system is operating normally at this time. If the fuel cap was left off and the check fuel cap

	warning indicator did not turn on, driving conditions may not have allowed for the PCM to run the cruise test and message the instrument cluster to turn on the check fuel cap warning indicator.

AB5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AC: The Low Washer Fluid Reconfigurable Telltale Indicator Is Never/Always On (If Equipped)

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster provides a reference voltage to the washer fluid switch through circuit CMC20 (VT). The washer fluid switch is grounded through circuit GD123 (BK/GY). When the washer fluid is low, the washer fluid switch closes to ground, pulling the reference voltage low. When the instrument cluster detects the washer fluid input pulled low, it turns on the low washer fluid reconfigurable telltale indicator.

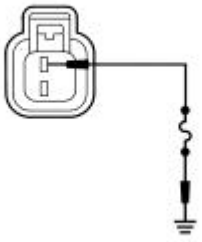
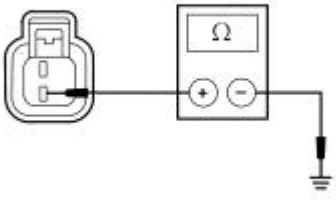
Possible Causes

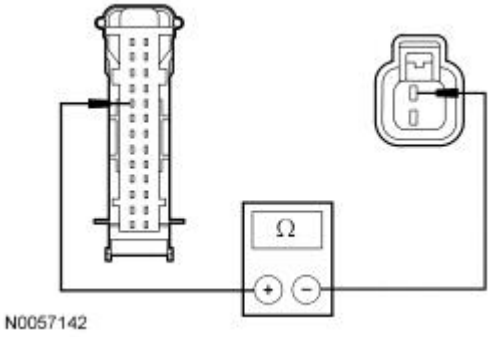
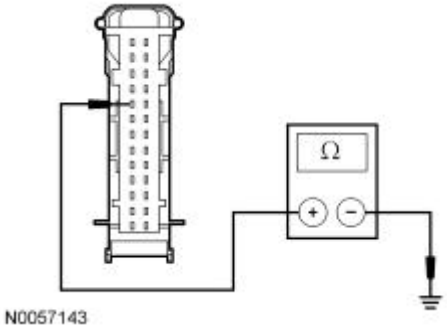
- Circuit CMC20 (VT) open or short to ground
- Circuit GD123 (BK/GY) open
- Washer fluid level switch
- Instrument cluster

PINPOINT TEST AC: THE LOW WASHER FLUID RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
AC1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster indicator lamp control active command WASHFLLMP. Command the low washer fluid reconfigurable telltale indicator on and off. Observe the low washer fluid reconfigurable telltale indicator.	**Yes** GO to AC2 . **No** GO to AC8 .

• **Does the low washer fluid reconfigurable telltale indicator illuminate when commanded on, and turn off when commanded off?**	
AC2 CHECK THE LOW WASHER FLUID RECONFIGURABLE TELLTALE INDICATOR OPERATION	
• Make sure that the washer fluid level is full. • Key in ON position. • Observe the low washer fluid reconfigurable telltale indicator. • **Is the low washer fluid reconfigurable telltale on?**	**Yes** If the low washer fluid reconfigurable telltale indicator is always on, GO to AC6 . **No** If the low washer fluid reconfigurable telltale indicator is never on, GO to AC3 .
AC3 CHECK THE LOW WASHER FLUID RECONFIGURABLE TELLTALE	
• Key in OFF position. • Disconnect: Washer Fluid Level Switch C138. • Connect a fused (5A) jumper wire between the washer fluid level switch C138-1, circuit CMC20 (VT), harness side and ground.  N0057140 • Key in ON position. • Wait one minute. • Observe the low washer fluid reconfigurable telltale indicator. • **Is the low washer fluid reconfigurable telltale on?**	**Yes** REMOVE the jumper wire. GO to AC4 . **No** REMOVE the jumper wire. GO to AC5 .
AC4 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the washer fluid level switch C138-2, circuit GD123 (BK/GY), harness side and ground.  N0057141 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new washer fluid level switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
AC5 CHECK CIRCUIT CMC20 (VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: Instrument Cluster C220.	**Yes** GO to AC8 .

• Measure the resistance between the instrument cluster C220-9, circuit CMC20 (VT), harness side and the washer fluid level switch C138-1, circuit CMC20 (VT), harness side.  N0057142 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. TEST the system for normal operation.
AC6 CHECK THE WASHER FLUID SWITCH	
• Key in OFF position. • Disconnect: Washer Fluid Level Switch C138. • Key in ON position. • Wait one minute. • Observe the low washer fluid reconfigurable telltale indicator. • **Did the low washer fluid reconfigurable telltale turn off?**	**Yes** INSTALL a new washer fluid level switch. TEST the system for normal operation. **No** GO to AC7 .
AC7 CHECK CIRCUIT CMC20 (GY/BK) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-9, circuit CMC20 (GY/BK), harness side and ground.  N0057143 • **Is the resistance less than 5 ohms?**	**Yes** GO to AC8 . **No** REPAIR the circuit. TEST the system for normal operation.
AC8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AD: The Traction Control Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

The traction control reconfigurable telltale indicator flashes when the vehicle traction control is in active mode or is being controlled by the anti-lock brake system (ABS) module. The instrument cluster receives the traction control data from the ABS module over the high speed controller area network (HS-CAN) communication bus. The instrument cluster monitors the traction control message and when the ABS module detects a traction control concern, the instrument cluster illuminates the traction control reconfigurable telltale indicator. If the traction control message is missing for greater than 5 seconds, the instrument cluster sets DTC U0121 and defaults the traction control reconfigurable telltale indicator on.

Possible Causes

- ABS module
- Instrument cluster

PINPOINT TEST AD: THE TRACTION CONTROL RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
AD1 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster traction control reconfigurable telltale indicator active command TC_IVD_RSC_LMP on and off. Observe the traction control reconfigurable telltale indicator. • **Does the traction control reconfigurable telltale indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to AD2 . **No** GO to AD3 .
AD2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0121 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0121 returns, REFER to Section 418-00 to diagnose no communication with the ABS module. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No**

	GO to AD4 .
AD3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Make sure all other system connectors are fully seated.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AD4 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Correct the ABS module connector and make sure it seats correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AE: The 4x4, 4x4 LOW Or 4x4 AUTO Reconfigurable Telltale Indicator Is Never/Always On (If Equipped)

Normal Operation

The instrument cluster receives the 4x4, 4x4 LOW and 4x4 AUTO reconfigurable telltale indicator status from the four wheel drive (4WD) control module over the high speed controller area network (HS-CAN) communication bus. If the instrument cluster receives a message that the 4WD system in the process of shifting from two wheel drive (2WD) to either 4WD high or 4WD low, the message center displays the message 4x4 SHIFT IN PROGRESS and the appropriate 4x4, 4x4 LOW or 4x4 AUTO reconfigurable telltale indicator is turned off. If the instrument cluster receives a message that the 4WD system in not in the process of completing a 4WD shift or the shift event has ended, the message center cancels the displayed message and the 4x4, 4x4 LOW or 4x4 AUTO reconfigurable telltale indicator is turned on. If the 4x4 status message is missing for greater than 5 seconds, the instrument cluster sets DTC U0102 and defaults the 4x4 AUTO reconfigurable telltale indicator off.

Possible Causes

- 4WD control module
- Instrument cluster

PINPOINT TEST AE: THE 4X4, 4X4 LOW OR 4X4 AUTO RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

Test Step	Result / Action to Take
AE1 CHECK 4WD SYSTEM OPERATION	
• Test drive the vehicle and operate the 4WD system.	**Yes**

• **Does the 4WD system operate correctly?**	GO to AE2 . **No** REFER to Section 308-07A .
AE2 CARRY OUT THE INSTRUMENT CLUSTER INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the inoperative instrument cluster 4x4 reconfigurable telltale indicator active command 4X4_AUTO_LMP, 4X4_LOW_LMP or 4X4_HIGH_LMP on and off. Observe the applicable 4x4 reconfigurable telltale indicator. • **Does the 4x4 reconfigurable telltale indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to AE3 . **No** GO to AE4 .
AE3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0102 recorded?**	**Yes** REPEAT the self-test. CLEAR the DTCs. If DTC B1317 or B1318 returns, REFER to Section 414-00 to diagnose the charging system. If DTC U0102 returns, REFER to Section 418-00 to diagnose no communication with the ABS module. For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to AE5 .
AE4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Make sure all other system connectors are fully seated.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AE5 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION	
• Disconnect the 4WD control module connector. • Check for: ▪ corrosion	**Yes** INSTALL a new 4WD control module. REFER to Section 308-

■ damaged pins ■ pushed-out pins • Correct the 4WD control module connector and make sure it seats correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	07A . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AF: The Door Ajar Reconfigurable Telltale Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the door ajar status for the LH front door, RH front door, LH rear door, RH rear door, liftgate, and liftgate glass ajar switch status from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. When the instrument cluster receives a message from the SJB that one or more doors are open or ajar, the instrument cluster turns on the door ajar reconfigurable telltale indicator. If the door ajar status message is missing for greater than 5 seconds, the instrument cluster sets DTC U0140 and defaults the door ajar reconfigurable telltale indicator on.

NOTE: If DTC U0140 is set in the SJB, other symptoms may also be present such as high beam indicator, RH/LH turn indicators, instrument panel backlighting and tire pressure monitoring system (TPMS).

Possible Causes

- SJB
- Instrument cluster

PINPOINT TEST AF: THE DOOR AJAR RECONFIGURABLE TELLTALE INDICATOR IS NEVER/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
AF1 CHECK THE INTERIOR LIGHTING OPERATION	
• **NOTE:** The interior lamp switch must not be in the dome defeat position. • Open and close each door, liftgate and liftgate glass while monitoring the interior lamps. • **Do the interior lamps operate correctly with each door, liftgate and liftgate glass?**	**Yes** GO to AF2 . **No** REFER to Section 417-02 .
AF2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER SELF-TEST	
• Check for recorded instrument cluster DTCs from the continuous self-test. • **Is DTC U0140 recorded?**	**Yes** Go To Pinpoint Test AI . **No** GO to AF3 .
AF3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB	

SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are any SJB DTCs recorded?**	**Yes** REFER to Section 419-10 , Diagnostic Trouble Code (DTC) Chart for correct navigation of the DTC. **No** GO to AF4 .
AF4 CARRY OUT THE INSTRUMENT INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Command. • Select the instrument cluster door ajar active command DRAJLMP on and off. Observe the door ajar reconfigurable telltale indicator. • **Does the door ajar reconfigurable telltale indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to AF6 . **No** GO to AF5 .
AF5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AF6 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AG: The Instrument Cluster Is Inoperative

Normal Operation

With the ignition switch in the START or RUN position, the instrument cluster receives voltage from the smart junction box (SJB) through circuit CBP29 (WH/VT). With the ignition switch in the OFF position, the instrument cluster receives its keep-alive voltage from the SJB through circuit SBP26 (YE/RD). The instrument cluster grounding is through circuit GD133 (BK).

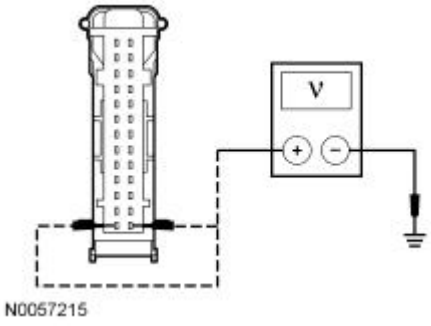
Possible Causes

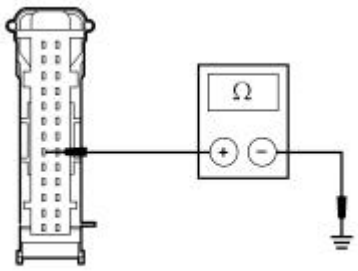
- Fuse(s)

- Circuit CBP29 (WH/VT) open or short to ground
- Circuit SBP26 (YE/RD) open or short to ground
- Circuit GD133 (BK) open
- Instrument cluster

PINPOINT TEST AG: THE INSTRUMENT CLUSTER IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
AG1 CARRY OUT THE NETWORK TEST	
NOTE: If the medium speed controller area network (MS-CAN) is damaged or disconnected, the instrument cluster may appear inoperative, the vehicle may not start and the theft indicator will appear to be functioning correctly. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Network Test. • Carry out the vehicle network test. • **Do all modules communicate on the MS-CAN network?**	**Yes** GO to AG2 . **No** REFER to Section 418-00 to diagnose the communication network.
AG2 CHECK THE INSTRUMENT CLUSTER VOLTAGE SUPPLY	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-1, circuit SBP26 (YE/RD), harness side and ground; and between the instrument cluster C220-14, circuit CBP29 (WH/VT), harness side and ground.  N0057215 • **Are the voltages greater than 10 volts?**	**Yes** GO to AG3 . **No** VERIFY SJB fuse 26 (10A) and fuse 29 (5A) are OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.
AG3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the instrument cluster C220-6, circuit GD133 (BK), harness side and ground.	**Yes** GO to AG4 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0057216 • **Is the resistance less than 5 ohms?**	

AG4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AH: DTC U0100 — Lost Communication With ECM/PCM

Normal Operation

The instrument cluster sets DTC U0100 if data messages for following systems or data types are missing:

- Passive anti-theft system (PATS)
- Speed control
- Accelerator pedal position
- Transmission type
- Engine coolant temperature
- Odometer rolling count
- Fuel flow
- Malfunction indicator lamp (MIL)
- Fail safe cooling mode
- Electronic throttle control
- Charging system
- Check fuel cap
- AC clutch engaged
- Engine rpm
- Vehicle identification number (VIN)

Once the instrument cluster sets DTC U0100, multiple gauges or indicators are likely to be inoperative in the cluster. Other modules that require data from the instrument cluster all set communication DTCs and may also exhibit system function concerns.

Possible Causes

- Low battery voltage
- Communication network
- PCM

PINPOINT TEST AH: DTC U0100 — LOST COMMUNICATION WITH ECM/PCM

Test Step	Result / Action to Take
AH1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Is DTC B1318 recorded?**	**Yes** REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to AH2 .
AH2 RECHECK THE INSTRUMENT CLUSTER DTCs	
• Repeat the instrument cluster self-test. • Clear the DTCs. • **Is DTC U0100 still present?**	**Yes** GO to AH3 . For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
AH3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND TCM AND ABS MODULE SELF-TESTS	
• Check for recorded TCM and ABS module DTCs from the continuous and on-demand self-tests. • **Is DTC U0100 recorded?**	**Yes** REFER to Section 418-00 to diagnose no communication with the PCM. **No** GO to AH4 .
AH4 CHECK THE NETWORK OPERATION	
• Carry out the network test. • **Does the PCM pass the network test?**	**Yes** GO to AH5 . **No** REFER to Section 418-00 to diagnose no communication with the PCM.
AH5 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this

• Operate the system and verify the concern is still present. • **Is the concern still present?**	time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AI: DTC U0140 — Lost Communication With Body Control Module (GEM)

Normal Operation

The instrument cluster sets DTC U0140 if data messages for following systems or data types are missing:

- Ignition switch position
- Key-in-ignition switch
- Tire pressure system
- Backlighting dimmer
- Door ajar status
- Headlamp on warning command
- Key-in-ignition warning command
- Parking brake status
- Parking brake chime request
- Brake warning indicator request
- High beam indicator request
- Daytime running lamps
- Brake fluid level low
- RF low beam circuit
- LF low beam circuit
- Fog lamp relay circuit
- Autolamp switch status
- Parking lamps circuit
- Brake lamp on status

Once the instrument cluster sets DTC U0140, multiple indicators are likely to be inoperative in the cluster. Other modules that require data from the instrument cluster will all set communication DTCs and may also exhibit system function concerns.

Possible Causes

- Low battery voltage
- Communication network
- SJB

PINPOINT TEST AI: DTC U0140 — LOST COMMUNICATION WITH BODY CONTROL MODULE (GEM)

Test Step	Result / Action to Take
AI1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Is DTC B1318 recorded?**	**Yes** REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section.

	No GO to AI2 .
AI2 RECHECK THE INSTRUMENT CLUSTER DTCs	
• Repeat the instrument cluster self-test. • Clear the DTCs. • **Is DTC U0140 still present?**	**Yes** GO to AI3 . For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
AI3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND AUDIO UNIT AND CLIMATE CONTROL UNIT SELF-TESTS	
• Check for recorded audio unit and climate control unit DTCs from the continuous and on-demand self-tests. • **Is DTC U0140 recorded?**	**Yes** REFER to Section 418-00 to diagnose no communication with the SJB. **No** GO to AI4 .
AI4 CHECK THE NETWORK OPERATION	
• Carry out the network test. • **Does the SJB pass the network test?**	**Yes** GO to AI5 . **No** REFER to Section 418-00 to diagnose no communication with the PCM.
AI5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AJ: DTC U2472 — Unexpected Ignition State

Normal Operation

The instrument cluster sets DTC U2472 when it detects a descrepancy between the hardwired voltage input and the messaged ignition state inputs from the smart junction box (SJB). With the ignition switch in the START or RUN position, the instrument cluster receives voltage from the SJB through circuit CBP29 (WH/VT). With the ignition switch in the OFF position, the instrument cluster receives its keep-alive voltage from the SJB through circuit SBP26 (YE/RD).

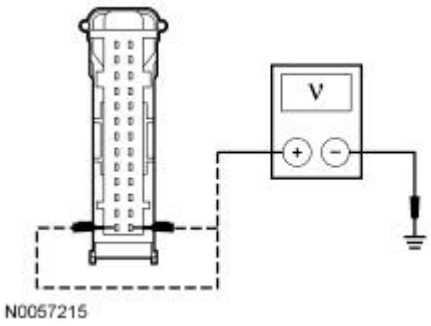
Possible Causes

- Fuse(s)
- Circuit CBP29 (WH/VT) open or short to ground
- Circuit SBP26 (YE/RD) open or short to ground

- Instrument cluster

PINPOINT TEST AJ: DTC U2472 — UNEXPECTED IGNITION STATE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
AJ1 CHECK THE INSTRUMENT CLUSTER VOLTAGE SUPPLY • Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-1, circuit SBP26 (YE/RD), harness side and ground; and between the instrument cluster C220-14, circuit CBP29 (WH/VT), harness side and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to AJ2 . **No** VERIFY the SJB fuse 26 (10A) and fuse 29 (5A) are OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.
AJ2 CHECK THE INSTRUMENT CLUSTER DTCs • Repeat the instrument cluster self-test. • Clear the DTCs. • **Is DTC U2472 still present?**	**Yes** GO to AJ3 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
AJ3 CHECK THE SJB INPUT PIDs FROM THE IGNITION SWITCH • Enter the following diagnostic mode on the diagnostic tool: SJB PIDs. • Monitor the SJB PIDs IGN_A_ECU, IGN_O_ECU, IGN_R_ECU, and IGN_S_ECU while cycling the ignition switch from ACC, OFF, RUN and START. • **Do the SJB PIDs match the ignition switch position?**	**Yes** GO to AJ4 . **No** REFER to Section 211-05 to diagnose the ignition switch outputs to the SJB.

AJ4 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

correctly. ● Operate the system and verify that the concern is still present. ● **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Instrument Cluster

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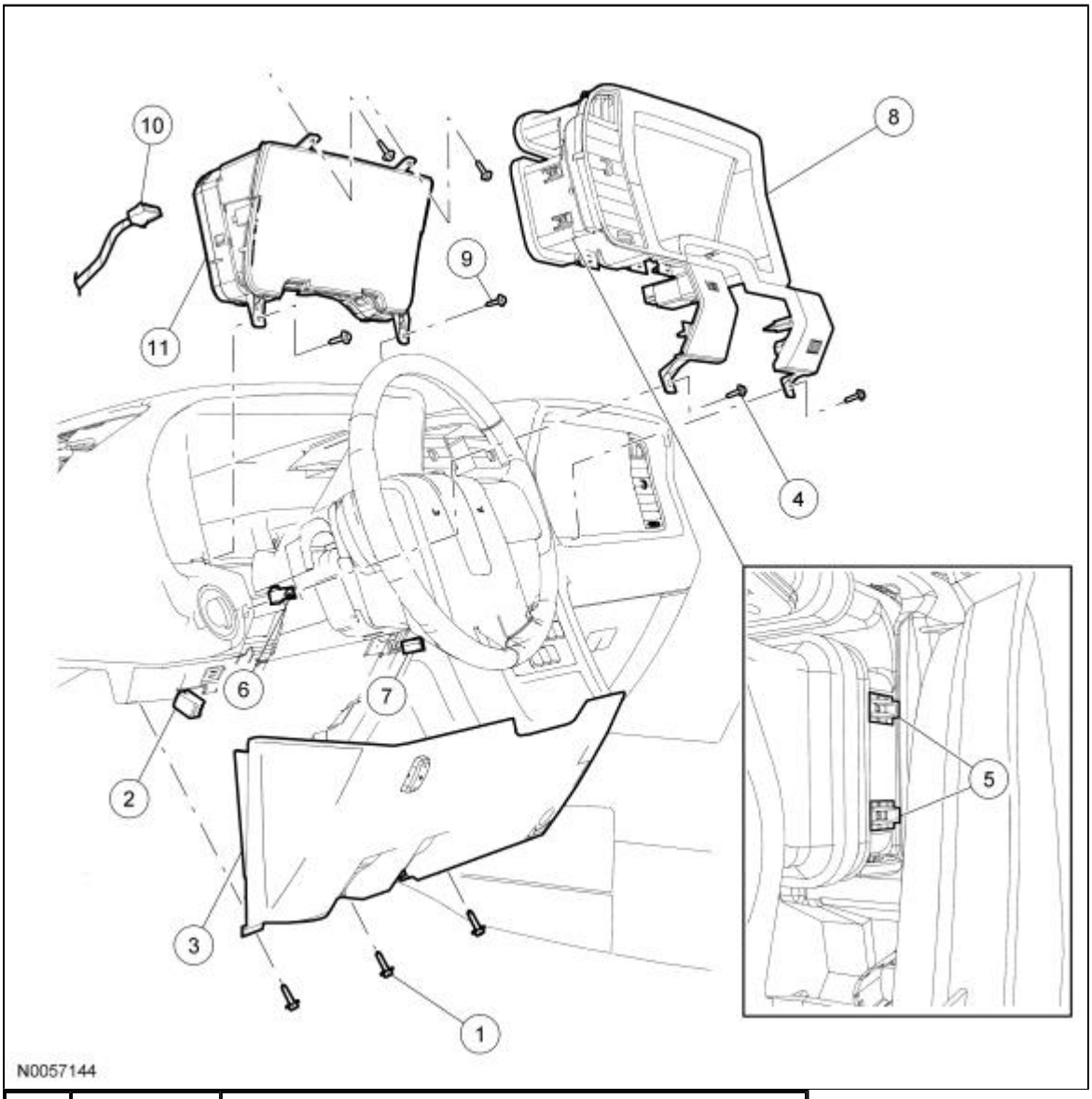
NOTE: Navigator shown, Expedition similar.



Item	Part Number	Description
1	W707628	Lower steering column cover screws (3 required)
2	—	Adjustable pedal switch electrical connector (if equipped) (part of 14401)
3	78044F08	Lower steering column cover
4	W707628	Instrument cluster finish panel screws (2 required)
5	—	A/C register release tabs (part of 78044D70)
6	—	Dimmer switch electrical connector (part of 14401)
7	—	Ambient air temperature sensor electrical connector

		(if equipped) (part of 14401)
8	78044D70	Instrument cluster finish panel
9	W707628	Instrument cluster screws (4 required)
10	—	Electrical connector (part of 14401)
11	10849	Instrument cluster

Removal

All vehicles

1. If installing a new instrument cluster, upload the instrument cluster configuration information to the scan tool. For additional information, refer to Section 418-01 , Programmable Module Installation (PMI).

2. Lower the steering column to the lowest position.

3. Remove the 3 screws and the lower steering column cover.
   - Disconnect the electrical connector for the brake pedal switch (if equipped).

Navigator

4. Remove the 2 center instrument cluster finish panel screws.

5. **CAUTION: The 2 tabs on the LH A/C register must be pressed to release the LH side of the A/C register from the instrument panel or damage to the center instrument cluster finish panel will occur.**

   NOTE: The 2 tabs that retain the LH A/C register can be accessed from the backside of the instrument panel with the lower steering column cover removed.

   Press the 2 tabs on the outer edge of the LH A/C register while pulling the instrument cluster finish panel out from the instrument panel.

Expedition

6. Remove the 2 screws and pull the center instrument cluster finish panel straight out to release the retainers.

All vehicles

7. Disconnect the dimmer switch electrical connector.

8. If equipped, disconnect the ambient air temperature sensor electrical connector and air tube from the instrument cluster finish panel and remove the finish panel.

9. Remove the 4 screws and the instrument cluster.
   - Disconnect the electrical connector.

Installation

1. Position the instrument cluster and install the 4 screws.
   - Connect the electrical connector.

2. Position the instrument cluster finish panel and install the ambient air temperature sensor electrical connector and air tube.

3. Connect the dimmer switch electrical connector.

4. Install the instrument cluster finish panel and the 2 screws.

5. Position the lower steering column cover and install the 3 screws.
   - Connect the electrical connector for the brake pedal switch (if equipped).

6. If installing a new instrument cluster, upload the instrument cluster configuration information to the scan tool. For additional information, refer to Section 418-01 , PMI.

7. **NOTE:** If a new instrument cluster is installed, the instrument cluster and the powertrain control module (PCM) require a parameter reset to allow the instrument cluster and the PCM to recognize each other. Failure to carry out the parameter reset to the instrument cluster and the PCM may result in a no start condition.

   NOTE: If equipped, the vehicles passive anti-theft system (PATS) keys must be programmed to the new instrument cluster.

   Carry out the parameter reset and key programming procedure. For additional information, refer to Section 419-01 .

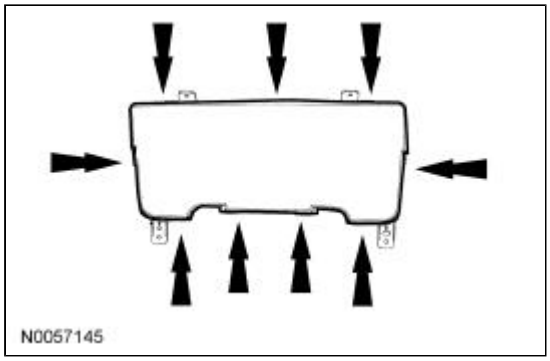
Instrument Cluster Lens

Printable View (88 KB)

Removal and Installation

1. Remove the instrument cluster. For additional information, refer to Instrument Cluster in this section.

2. Release the 9 retaining tabs and remove the instrument cluster lens.



3. **CAUTION: Be sure that all the tabs are correctly located to avoid damage to the new lens and fully locked in place to reduce the potential for noise.**

   To install, reverse the removal procedure.

Horn

Printable View (63 KB)

The horn system consists of the following components:

- Horn switch (part of the driver air bag module)
- Clockspring
- Horn relay (part of the smart junction box [SJB])
- Horn

For removal and installation of the driver air bag module, refer to Section 501-20B .

Horn

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Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) supplies the switched and control voltage to the horn relay (part of the SJB). When the horn switch (part of the steering wheel) is pressed, ground is supplied to the SJB through the clockspring. The SJB then energizes the horn relay sending voltage to the horn, enabling the horn to sound.

The SJB provides a momentary ground to the horn relay when the anti-theft system is armed, and an on then off ground when an intrusion is detected or the panic button is pressed on the remote keyless entry (RKE) key fob.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Horn • Horn switch (part of the steering wheel)	• Smart junction box (SJB) fuse 24 (20A) • Circuitry

	• Clockspring • SJB

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The horn is inoperative	• Fuse • Circuitry • Steering wheel switch harness • Horn • Clockspring • Horn switch (part of the steering wheel) • Smart junction box (SJB)	• Go To Pinpoint Test A .
• The horn is always on	• Circuitry • Steering wheel switch harness • Clockspring • Horn switch (part of the steering wheel) • SJB	• Go To Pinpoint Test B .

Pinpoint Tests

Pinpoint Test A: The Horn Is Inoperative

Refer to Wiring Diagrams Cell 44 , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

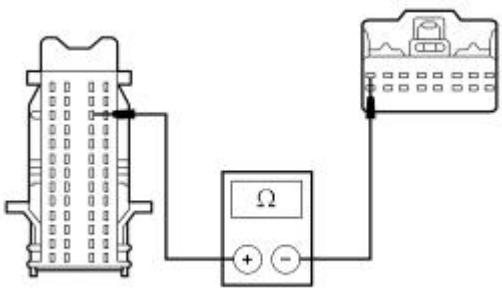
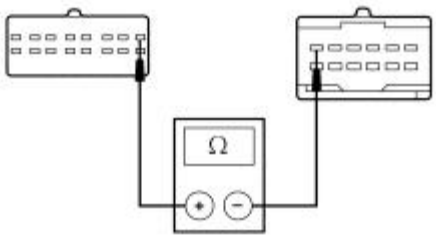
The smart junction box (SJB) supplies the switched and control voltage to the horn relay (part of the SJB). When the horn switch (part of the steering wheel) is pressed, the switch closes and ground is applied from the steering wheel switch harness through the clockspring to the horn relay through circuit SRH01 (YE/RD). The horn relay is then energized, applying voltage to the horn through circuit CRH02 (BU/WH), enabling the horn to sound. Ground for the horn is supplied through circuit GD120 (BK/GN).

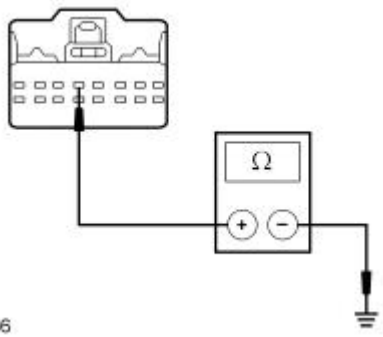
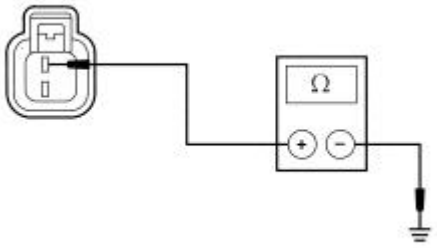
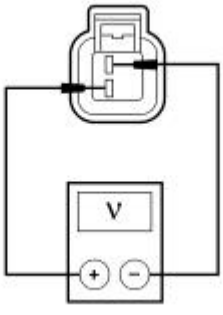
Possible Causes

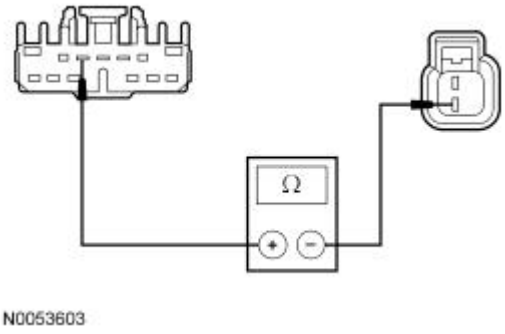
- Fuse
- Circuit CRH02 (BU/WH) open
- Circuit GD120 (BK/GN) open
- Circuit GD133 (BK) open
- Circuit SRH01 (YE/RD) open
- Steering wheel switch harness
- Horn
- Clockspring
- Horn switch (part of the steering wheel)
- SJB

PINPOINT TEST A: THE HORN IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE SJB OUTPUT	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: SJB Active Commands. • Select the SJB horn active command. Command the horn active command on and then off. • **Does the horn sound when commanded on?**	**Yes** GO to A2. **No** GO to A6.
A2 CHECK CIRCUIT SRH01 (YE/RD) FOR AN OPEN	
• Depower the supplemental restraint system (SRS). Refer to Section 501-20B. • Disconnect: SJB C2280g. • Disconnect: Clockspring C218. • Measure the resistance between the clockspring C218-8, circuit SRH01 (YE/RD), harness side and the SJB C2280g-41, circuit SRH01 (YE/RD), harness side.  N0053601 • **Is the resistance less than 5 ohms?**	**Yes** GO to A3. **No** REPAIR the circuit. REPOWER the SRS. REFER to Section 501-20B. CLEAR the DTCs. REPEAT the self-test.
A3 CHECK THE CLOCKSPRING FOR AN OPEN	
• Remove the driver air bag module. Refer to Section 501-20B. • Disconnect: Upper Clockspring Connector. • Measure the resistance between the clockspring C218 pin 8, component side and the upper clockspring connector pin 1, component side.  N0053602 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4. **No** INSTALL a new clockspring. INSTALL the driver air bag module. REFER to Section 501-20B. CLEAR the DTCs. REPEAT the self-test.
A4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between the clockspring C218A-5, circuit GD133 (BK), harness side and ground.	**Yes** GO to A5.

 N0026446 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. REPOWER the SRS. REFER to Section 501-20B . TEST the system for normal operation.
A5 CHECK THE STEERING WHEEL SWITCH HARNESS FOR DAMAGE OR OPENS • Inspect the steering wheel switch harness for damage or opens. • **Is the steering wheel switch harness OK?**	**Yes** INSTALL a new steering wheel. REFER to Section 211-04 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR or INSTALL a new steering wheel switch harness. CLEAR the DTCs. REPEAT the self-test.
A6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN • Key in OFF position. • Disconnect: Horn C131. • Measure the resistance between the horn C131-1, circuit GD120 (BK/GN), harness side and ground.  A0032815 • **Is the resistance less than 5 ohms?**	**Yes** GO to A7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A7 CHECK CIRCUIT CRH02 (BU/WH) FOR VOLTAGE • Measure the voltage between the horn C131-2, circuit CRH02 (BU/WH), harness side, and the horn C131-1, circuit GD120 (BK/GN), harness side, while pressing the horn switch.  N0013171	**Yes** INSTALL a new horn. CLEAR the DTCs. REPEAT the self-test. **No** VERIFY the SJB fuse 24 (20A) is OK. If OK, GO to A8 .

• **Is the voltage greater than 10 volts?**	
A8 CHECK CIRCUIT CRH02 (BU/WH) FOR AN OPEN	
• Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-5, circuit CRH02 (BU/WH), harness side, and the horn C131-2, circuit CRH02 (BU/WH), harness side.  N0053603 • **Is the resistance less than 5 ohms?**	**Yes** GO to A9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A9 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Horn Is Always On

Refer to Wiring Diagrams Cell 44 , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

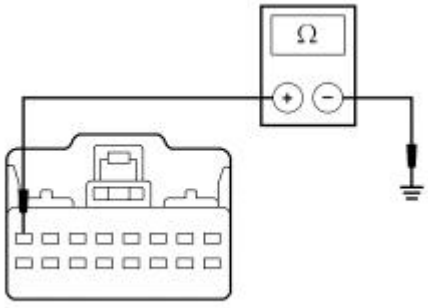
The smart junction box (SJB) supplies the switched and control voltage to the horn relay (part of the SJB). When the horn switch (part of the steering wheel) is pressed, the switch closes and ground is applied from the steering wheel switch harness through the clockspring to the horn relay through circuit SRH01 (YE/RD). The horn relay is then energized, applying voltage to the horn through circuit CRH02 (BU/WH), enabling the horn to sound.

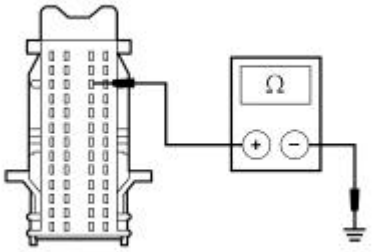
Possible Causes

- Circuit CRH02 (BU/WH) short to voltage
- Circuit SRH01 (YE/RD) short to ground
- Steering wheel switch harness
- Clockspring
- Horn switch (part of the steering wheel)
- SJB

PINPOINT TEST B: THE HORN IS ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK CIRCUIT CRH02 (BU/WH) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: SJB C2280a. • **Does the horn continue to sound?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B2 .
B2 CHECK THE HORN SWITCH INPUT • Disconnect: SJB C2280g. • Connect: SJB C2280a. • **Does the horn continue to sound?**	**Yes** GO to B6 . **No** GO to B3 .
B3 CHECK CIRCUIT SRH01 (YE/RD) FOR A SHORT TO GROUND • Depower the supplemental restraint system (SRS). Refer to Section 501-20B . • Disconnect: Clockspring C218. • Measure the resistance between the clockspring C218-8, circuit SRH01 (YE/RD), harness side and ground.  N0026775 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. REPOWER the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
B4 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND • Remove the driver air bag module. Refer to Section 501-20B . • Connect: Clockspring C218. • Measure the resistance between the SJB C2280g-41, circuit SRH01 (YE/RD), harness side and ground.	**Yes** GO to B5 . **No** INSTALL a new clockspring. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

 N0053604 • **Is the resistance greater than 10,000 ohms?**	
B5 CHECK THE STEERING WHEEL SWITCH HARNESS FOR DAMAGE OR SHORTS • Inspect the steering wheel switch harness for damage or shorts. • **Is the steering wheel switch harness OK?**	**Yes** INSTALL a new steering wheel. REFER to Section 211-04 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new steering wheel switch harness. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
B6 CHECK FOR CORRECT SJB OPERATION • Disconnect all the SJB connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Clock

Printable View (62 KB)

The stand-alone electric analog clock, available in the Navigator only, is centrally located on the instrument panel and displays time in a 12-hour format. The clock is backlit when the headlamps and parking lamps are on. The Expedition clock is integrated into the radio.

Clock

Printable View (119 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Clock	• Smart junction box (SJB) fuse 14 (10A) • Circuitry • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, verify the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The clock operation is inoperative	• Fuse • Circuitry • Clock • Smart junction box (SJB)	• Go To Pinpoint Test A .

• The clock operation is erratic	• Clock	• INSTALL a new clock. REFER to Clock in this section.

Pinpoint Tests

Pinpoint Tests A: The Clock Operation Is Inoperative

Refer to Wiring Diagrams Cell 44 , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

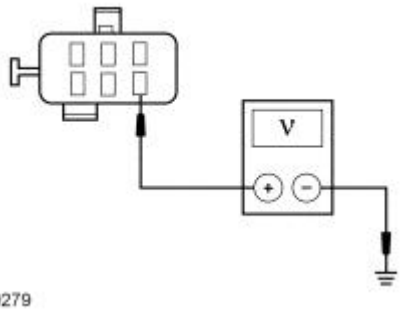
The clock receives battery voltage from the smart junction box (SJB) through circuit SBP14 (BN/RD). Ground for the clock is supplied through circuit GD138 (BK/WH).

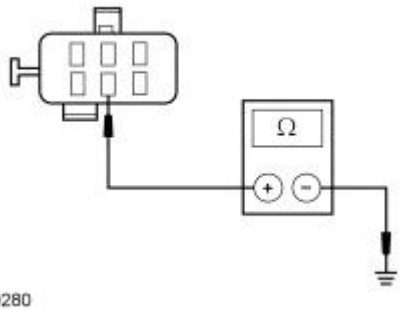
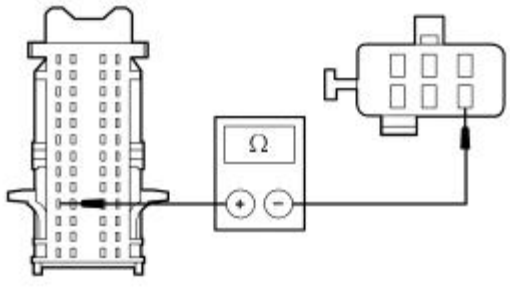
Possible Causes

- Fuse
- Circuit SBP14 (BN/RD) open
- Circuit GD138 (BK/WH) open
- Clock
- SJB

PINPOINT TEST A: THE CLOCK OPERATION IS INOPERATIVE

CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

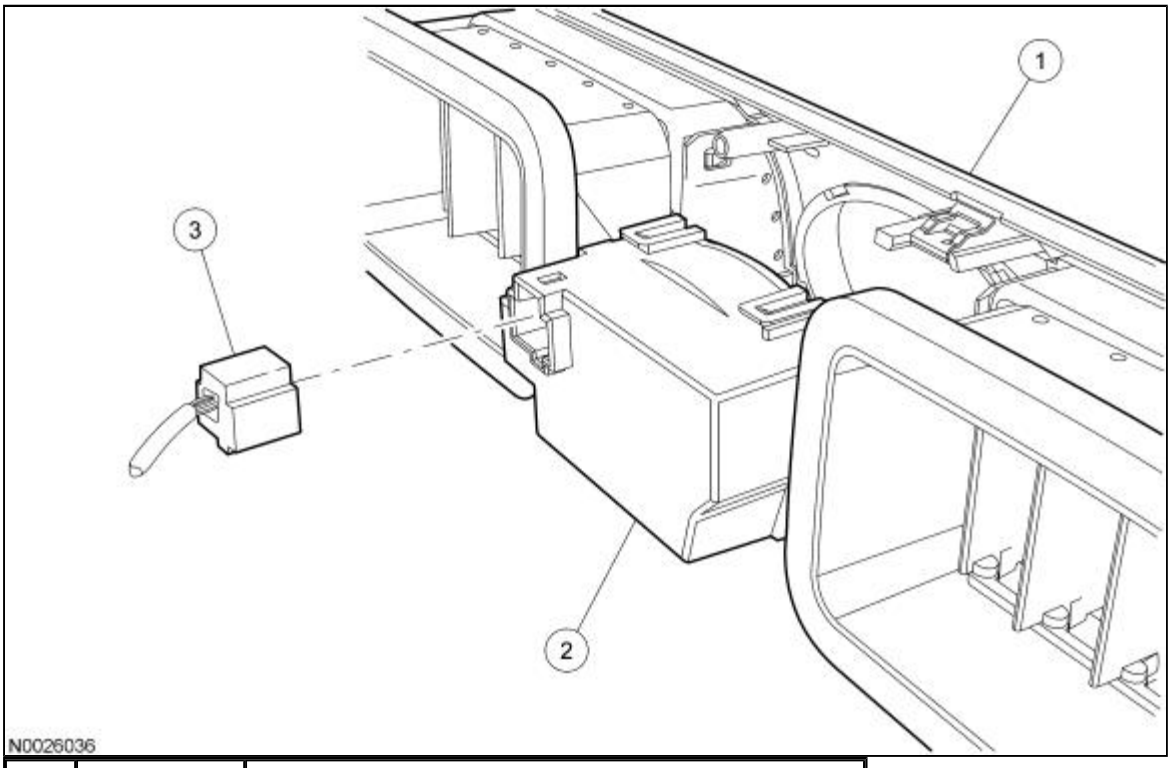
Test Step	Result / Action to Take
A1 CHECK CIRCUIT SBP14 (BN/RD) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Clock C2016. • Measure the voltage between the clock C2016-6, circuit SBP14 (BN/RD), harness side and ground.  A0039279 • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY that SJB fuse 14 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If the system is still inoperative, GO to A3 .
A2 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between the clock C2016-5, circuit GD138 (BK/WH), harness side and ground.	**Yes** INSTALL a new clock. REFER to Clock in this section. TEST the system for normal operation.

 A0039280 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT SBP14 (BN/RD) FOR AN OPEN	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
• Disconnect: SJB C2280g. • Measure the resistance between the SJB C2280g-4, circuit SBP14 (BN/RD), harness side and the clock C2016-6, circuit SBP14 (BN/RD), harness side.  N0057152 • **Is the resistance less than 5 ohms?**	
A4 CHECK FOR CORRECT SJB OPERATION	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**	

Clock

Printable View (131 KB)



Item	Part Number	Description
1	04320	Instrument cluster center finish panel
2	15000	Clock
3	—	Clock electrical connector (part of 14401 wiring harness)

Removal and Installation

1. Remove the instrument cluster center finish panel. For additional information, refer to Section 501-12 .
2. Disconnect the electrical connector.
3. Release the retaining clips and remove the clock from the instrument cluster center finish panel.
4. To install, reverse the removal procedure.

Information And Message Center

Printable View (72 KB)

The message center display is a green (Expedition) or white (Navigator) vacuum fluorescent, fixed format, 2-line display integrated into the center of the instrument cluster and is controlled by the message center switches. Refer to the Owner's Literature for operating instructions.

The message center provides the following features:

- Information displays
- Setup displays
- System check messages
- System warning messages

The message center information can be selected through a set of 3 buttons:

- INFO
- SETUP
- RESET

Message Center Configuration

The message center has the capability to configure items such as oil life, language, units (English or metric), autolamp delay, to enable/disable a variety of options such as easy entry/easy exit (if equipped) and air suspension (if equipped), or to carry out calibrations/settings on items such as the compass. The oil life is displayed in percent and is preset to a maximum of approximately 8,000 km (5,000 miles) or 180 days. For additional information on configuration of the oil life, refer to Message Center Configuration in this section. For additional information on other configurable items, refer to the Owner's Literature.

On configurable items such as parking aid on/off and air suspension on/off (if equipped) the message center indicates the appropriate selection (ON/OFF) by bracketing the selection. An example is as follows: PARKING AID <ON> OFF. The parking aid is enabled or on in the previous example. If the driver selects the parking aid off, the display would be: PARKING AID ON <OFF>.

Reconfigurable Telltale Indicators

The message center displays reconfigurable telltale indicators in the RH side of the display area. Reconfigurable telltale indicators replace indicators that have been typically displayed in the instrument cluster and use the same iconic representation. For additional information, refer to Section 413-01 .

Compass and Outside Air Temperature Displays

The message center provides a compass display and uses directional information sent from a compass module, located on the underside of the inside rear view mirror.

The message center provides an outside air temperature display on vehicles that are not equipped with electronic automatic temperature control (EATC). For additional information, refer to Section 412-00 .

Information Displays

The information displays are non-timed modes. The selected mode remains on until the driver presses a message center button to change the mode or it is overridden by another mode.

The information display modes are:

- Odometer
- Trip odometer
- Outside air temperature display (if equipped)
- Compass
- Distance to empty (DTE)
- Average fuel economy
- Instantaneous fuel economy
- Blank display

For additional information on the odometer and trip odometer, refer to Section 413-01 .

Setup Displays

The setup displays are timed modes and terminate after a finite interval. The setup display modes are:

- System check
- Oil life
- Units English/metric
- Autolamp delay in seconds (if equipped)
- Easy entry/easy exit seat on/off (if equipped)
- Air suspension on/off (if equipped)
- Autolocks on/off (if equipped)
- Power liftgate on/off (if equipped)
- Power running boards auto/off/out (if equipped)
- Compass zone
- Compass calibration
- Language

System Check

The system check provides a check of all the monitored systems on the vehicle. The system check scrolls through each of the monitored systems and provides a visual indication to report out the status of each system. The message center displays OK for approximately 2 seconds if the system check does not detect a fault in the system and displays a warning message for approximately 2 seconds if the system check detects a fault in the system. Press the RESET button to scroll through the system check messages.

The system check messages are:

- OIL LIFE
- CHARGING SYSTEM
- WASHER FLUID LOW
- DOOR STATUS
- LIFTGATE/GLASS
- BRAKE FLUID LEVEL
- TIRE PRESSURE SYSTEM (if equipped)
- AIR SUSPENSION SYSTEM (if equipped)
- FUEL LEVEL

System Warning Messages

The system warning messages alert the operator to possible problems or malfunctions in the vehicle operating systems. The message center displays the last selected feature if there are no additional

warning messages. Once a warning message has been displayed, the message must be acknowledged to allow full functionality of the message center. Press the RESET to acknowledge and clear the warning message. The warning messages are divided into 4 categories:

- Cannot be cleared until the condition is corrected.
- Reappear on the display 10 minutes from the reset if the condition has not been corrected.
- Do not reappear until an ignition OFF-ON cycle has been completed.
- Reappear if the condition clears then reoccurs within the same ignition cycle ON-OFF cycle.

The warning display that cannot be reset is:

- PARK AID ON/OFF

The warning messages that reoccur after 10 minutes are:

- CHECK BRAKE SYSTEM
- XXX MILES (km) TO E FUEL LOW
- PARK BRAKE ENGAGED

The warning messages that display whenever the ignition switch is turned from the OFF position to the ON position are:

- BRAKE FLUID LEVEL LOW
- CHECK PARK BRAKE
- WASHER FLUID LEVEL LOW
- OIL CHANGE REQUIRED
- XXX% OIL LIFE CHANGE SOON
- CHECK AIR SUSPENSION SYSTEM (if equipped)

The warning messages that return after a condition has cleared then reoccurs within the same ignition ON-OFF cycle are:

- DRIVER DOOR AJAR
- PASSENGER DOOR AJAR
- REAR LEFT DOOR AJAR
- REAR RIGHT DOOR AJAR
- LIFTGATE/GLASS AJAR
- CHECK CHARGING SYSTEM
- TIRE PRESSURE SENSOR FAULT (if equipped)
- LOW TIRE PRESSURE (if equipped)
- TIRE PRESSURE MONITOR FAULT (if equipped)
- 4X4 SHIFT IN PROGRESS (if equipped)
- AIR SUSPENSION OFF (if equipped)

The message center displays warning messages that indicate a system state during the operation of the four wheel drive (4WD) system (late build only). The displayed warning messages are as follows:

- FOR 4X4 STOP VEHICLE (if equipped)
- FOR 4X4 LOW APPLY BRAKE (if equipped)
- FOR 4X4 LOW SHIFT TO N (if equipped)
- TO EXIT 4X4 LOW STOP VEHICLE (if equipped)
- TO EXIT 4X4 LOW APPLY BRAKE (if equipped)
- TO EXIT 4X4 LOW SHIFT TO N (if equipped)

The message center displays warning messages that indicate a system state during repair procedures

related to the tire pressure monitoring system (TPMS). The displayed warning messages are as follows:

- TRAIN LEFT TIRE (if equipped)
- TRAIN LEFT REAR TIRE (if equipped)
- TRAIN RIGHT FRONT TIRE (if equipped)
- TRAIN RIGHT REAR TIRE (if equipped)
- TRAIN SPARE TIRE (if equipped)
- TRAINING COMPLETE (if equipped)
- TIRES NOT TRAINED-REPEAT (if equipped)

The message center displays warning messages that indicate a system state during repair procedures related to the compass display. The displayed warning messages are as follows:

- RESET FOR ZONE SETTING
- ZONE XX RESET = CHANGE
- RESET FOR CALIBRATION
- CIRCLE SLOWLY TO CALIBRATE
- CALIBRATION COMPLETED
- COMPASS DATA ERROR

The message center displays warning messages that indicate a system state during repair procedures related to the oil life and oil life start value. The displayed warning messages are as follows:

- OIL LIFE XXX% HOLD RESET = NEW
- OIL LIFE SET TO XXX%

Information And Message Center

Printable View (215 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The message center is an integral part of the instrument cluster that receives and acts upon much of the same information that is input and used to operate the instrument cluster gauges, indicators, warning indicators and reconfigurable telltale indicators. The message center, located in the center of the instrument cluster is a vacuum fluorescent 2-line display. The message center electronic functions use both hardwired, and the controller area network (CAN) circuitry to transmit and receive information.

Whenever conditions are present that require a warning message, the message center replaces the last selected display with the new warning display. Once the message is reset or cleared, the message center returns to the last selected display. If multiple warnings are present, the message center displays each warning for approximately 4 seconds. Warning messages are also generally associated with other observable instrument cluster indications. For example, when the LH front door is opened, the message center displays the message DRIVER DOOR AJAR along with the door ajar reconfigurable telltale indicator. This allows the message center to be a more informative supplement to the instrument cluster gauges and indicators.

It is very important to understand:

- where the input (command) originates.
- all the information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- if the module that received the input (message) controls the output of the feature, or if it outputs a message over the CAN to another module.
- which module controls the output of the feature.

Instrument Cluster Messages

NOTE: Whenever a message is suspected as missing, confirmed by a missing message DTC, it is important to look for other symptoms that may also be present in the instrument cluster and throughout the vehicle. Once a DTC is set in the instrument cluster it may be helpful to review the complete message list available in Section 418-00 to see what other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same DTC may also be set in those modules. Confirmation of missing messages common to multiple modules may

indicate that the originating module is the source of the concern or the communication network may be experiencing some problems.

The instrument cluster uses input messages from other modules to control the gauges, informational indicators, warning indicators and reconfigurable telltale indicators over the communication networks. If a required message is missing or invalid for less than 5 seconds, the gauge or indicator that requires the message remains at the last commanded state based upon the last known good message. For example, if the message is missing the O/D off status for less than 5 seconds and the O/D off indicator was ON (O/D cancelled), the indicator remains in the ON state until the next good message is received. If the message remains missing or invalid for greater than 5 seconds, the instrument cluster sets a U-code DTC and the output becomes a default action for the indicator or gauge. Each indicator or gauge utilizes a different default strategy depending on the nature of the indication. Refer Section 413-01 for further descriptions of the default action specific to each indicator or gauge. If the messaged input to the cluster returns at any time, the normal function of the gauge or indicator resumes.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Brake fluid level
• Engine coolant level
• Engine oil level
• Fuel level
• Washer fluid level
• Fuel tank
• Accessory drive belt
• Tire pressure
	• Smart junction box (SJB) fuse(s):
	  ▪ 26 (10A)
	  ▪ 29 (5A)
	  ▪ 31 (10A)
	• Circuitry
	• Compass module
	• Message center switch
	• Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test:
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.

9. If the DTCs retrieved are related to the concern, refer to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Instrument Cluster Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1255	Air Temperature External Sensor Circuit Open	Go To Pinpoint Test E .
B1257	Air Temperature External Sensor Circuit Short to Ground	Go To Pinpoint Test E .
B2097	Compass Module Failure	Go To Pinpoint Test C .
U2013	Compass Module Is Not Responding	Go To Pinpoint Test C .
All other DTCs	—	REFER to Section 413-01 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The message center is not operating correctly	• Message center switches • Instrument cluster	• If equipped with a message center cluster, Go To Pinpoint Test A . • If equipped with a base instrument cluster, VERIFY that the instrument cluster is operating correctly. ▪ If the instrument cluster operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ▪ If the instrument cluster is not operating correctly, REFER to Section 413-01 .
• The message center display is blank	• Message center	• PRESS the INFO button on the message center

	• display setting • Instrument cluster	to make sure the display is not set to a blank display. ▪ If the message center display turns on, the system is operating normally at this time. The message center display was set to a blank display. ▪ If the message center display is still blank, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• Not all segments of the display illuminate	• Instrument cluster	• INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• The message center switch does not operate correctly	• Circuitry • Message center switch • Instrument cluster	• Go To Pinpoint Test B .
• The compass is inoperative	• Fuse • Circuitry • Compass sensor module	• Go To Pinpoint Test C .
• The compass is inaccurate	• Zone setting • Calibration • Compass sensor module	• Go To Pinpoint Test D .
• The outside air temperature sensor does not operate correctly	• Circuitry • Outside air temperature sensor • Instrument cluster	• Go To Pinpoint Test E .
• The distance to empty (DTE)/average/instantaneous fuel economy display is inoperative	• Instrument cluster	• CHECK the operation of the speedometer, the fuel gauge and the odometer. ▪ If the speedometer, the fuel gauge and the odometer do not operate correctly, REFER to Section 413-

		01 . ■ If the speedometer, the fuel gauge and the odometer operate correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• The PARKING AID ON/OFF warning is inoperative	• Instrument cluster configuration • Parking aid system • Instrument cluster	• Go To Pinpoint Test F .
• The XXX MILES/KM TO E FUEL LOW warning is inoperative	• Fuel gauge • Instrument cluster	• VERIFY that the fuel gauge operates correctly and that there is less than approximately 3 gallons of fuel in the tank. ■ **NOTE:** The miles to empty warning only displays at 80 km (50 miles) to empty which is equal to approximately 3-5 gallons of fuel remaining. This is a learned strategy based on fuel economy and changes from its default setting. If the fuel gauge operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the fuel gauge does not operate correctly, REFER to Section 413-01 .
• The CHECK BRAKE SYSTEM, CHECK PARK BRAKE, PARK BRAKE ENGAGED, or BRAKE	• Parking brake switch • Brake fluid	• OBSERVE the brake warning indicator. ■ If the brake

FLUID LEVEL LOW warning is inoperative	level switch • Smart junction box (SJB) • Instrument cluster	warning indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the brake warning indicator does not operate correctly, REFER to Section 413-01 .
• The WASHER FLUID LEVEL LOW warning is inoperative	• Circuitry • Washer fluid level switch • Instrument cluster	• OBSERVE the low washer fluid level reconfigurable telltale indicator. ■ If the low washer fluid level reconfigurable telltale indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the low washer fluid level reconfigurable telltale indicator does not operate correctly, REFER to Section 413-01 .
• The XXX% OIL LIFE CHANGE OIL SOON or OIL CHANGE REQUIRED warning is inoperative	• Instrument cluster	• INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• The CHECK AIR SUSPENSION SYSTEM or AIR SUSPENSION OFF warning is inoperative (if equipped)	• Instrument cluster configuration • Air suspension system • Air suspension module • Instrument cluster	• Go To Pinpoint Test G .
• The DRIVER DOOR, PASSENGER DOOR, REAR LEFT DOOR, REAR RIGHT DOOR or LIFTGATE/GLASS	• Interior lamps • SJB	• OPEN and CLOSE each door, liftgate and liftgate glass and VERIFY that the interior lamps

AJAR warning is inoperative		operate correctly. ■ If the interior lamps do not operate correctly from each door, liftgate and liftgate glass, REFER to Section 417-02 .
	• Instrument cluster	• VERIFY that the door ajar reconfigurable telltale indicator operates correctly. ■ If the door ajar reconfigurable telltale indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the door ajar reconfigurable telltale indicator does not operate correctly, REFER to Section 413-01 .
• The CHECK CHARGING SYSTEM warning is inoperative	• Instrument cluster	• VERIFY that the charge reconfigurable telltale indicator operates correctly. ■ If the charge reconfigurable telltale indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the charge reconfigurable telltale indicator does not operate correctly, REFER to Section 413-01 .
• The TIRE PRESSURE SENSOR FAULT, LOW TIRE PRESSURE or TIRE PRESSURE MONITOR FAULT warning is inoperative (if equipped)	• Instrument cluster	• VERIFY that the tire pressure monitoring system (TPMS) warning indicator operates correctly. ■ If the TPMS

		reconfigurable telltale indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the TPMS reconfigurable telltale indicator does not operate correctly, REFER to Section 413-01 .
• The 4X4 SHIFT IN PROGRESS warning is inoperative	• Instrument cluster configuration • Four wheel drive (4WD) system • 4WD control module • Instrument cluster	• Go To Pinpoint Test H .

Pinpoint Tests

Pinpoint Test A: The Message Center Is Not Operating Correctly

Normal Operation

The message center is located in the center of the instrument cluster between the tachometer and the speedometer in the vacuum fluorescent display area. The message center is integral to the instrument cluster and uses the same voltage supply as the instrument cluster. The RUN/START voltage is supplied to the instrument cluster on circuit CBP29 (WH/VT) and the keep alive B+ voltage is received on circuit SBP26 (YE/RD). The instrument cluster ground is received through circuit GD133 (BK). The message center functionality is controlled through the message center switches, which are hardwired to the instrument cluster through the input circuit CMC29 (GN/VT) and the return circuit VMC29 (YE).

Possible Causes

- Message center switches
- Instrument cluster

PINPOINT TEST A: THE MESSAGE CENTER IS NOT OPERATING CORRECTLY

Test Step	Result / Action to Take
A1 CHECK THE INSTRUMENT CLUSTER ODOMETER OPERATION	

• Key in ON position. • Observe the odometer display in the message center. • **Is the odometer displayed?**	**Yes** If the display is blank, PRESS the INFO button to see if the message center was previously set to the blank display. If the display remains blank, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. If individual messages are inoperative, GO to Symptom Chart . If the INFO, SETUP or RESET buttons are inoperative, Go To Pinpoint Test B . **No** REFER to Section 413-01 .

Pinpoint Test B: The Message Center Switch Does Not Operate Correctly

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The message center functionality is controlled through the message center switch, which is hardwired to the instrument cluster through the input circuit CMC29 (GN/VT) and the return circuit VMC29 (YE). There are 3 message center switch buttons with each button operating a switch that uses different resistance values. The instrument cluster sends out a reference voltage to the message center switch on the input circuit and monitors the input voltage when a message center switch button is pressed. The input voltage will vary depending upon the resistance of each button, providing a specific indication to the instrument cluster which switch is pressed.

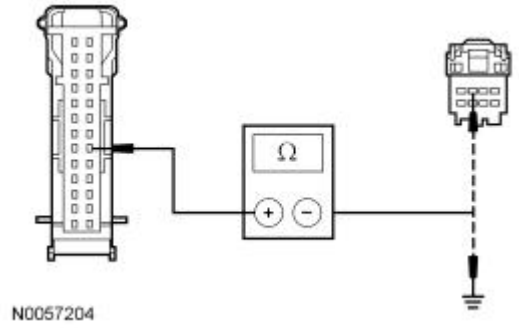
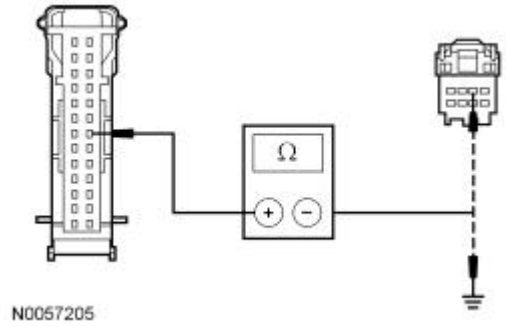
Possible Causes

- Circuit CMC29 (GN/VT) open or short to ground
- Circuit VMC29 (YE) open or short to ground
- Message center switch
- Instrument cluster

PINPOINT TEST B: THE MESSAGE CENTER SWITCH DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK THE MESSAGE CENTER SWITCH PIDs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PID. • Select and monitor the instrument cluster PID INFOSW, SETUPSW, and RES_SW, while pressing each message center switch button (INFO, SETUP and RESET). • **Does the PID agree with the button position?**	**Yes** GO to B4 . **No** GO to B2 .
B2 CHECK CIRCUIT CMC29 (GN/VT) FOR AN OPEN AND SHORT TO GROUND	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Disconnect: Message Center Switch C253. • Measure the resistance between the instrument cluster C220-	**Yes** GO to B3 . **No**

19, circuit CMC29 (GN/VT), harness side and the message center switch C253-3, circuit CMC29 (GN/VT), harness side; and between the instrument cluster C220-19, circuit CMC29 (GN/VT), harness side and ground.  N0057204 • **Is the resistance less than 5 ohms between the instrument cluster and the message center switch, and greater than 10,000 ohms between the instrument cluster and ground?**	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B3 CHECK CIRCUIT VMC29 (YE) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between the instrument cluster C220-20, circuit VMC29 (YE), harness side and the message center switch C253-2, circuit VMC29 (YE), harness side; and between the instrument cluster C220-20, circuit VMC29 (YE), harness side and ground.  N0057205 • **Is the resistance less than 5 ohms between the instrument cluster and the message center switch, and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** INSTALL a new message center switch. REFER to Message Center Switch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test C: The Compass Is Inoperative

Normal Operation

The compass sensor module receives voltage from the smart junction box (SJB) through circuit CBP31 (BU/OG) and is grounded through circuit GD133 (BK). The compass sensor module communicates the vehicle direction to the instrument cluster through the compass communication data plus circuit VMC31 (YE/GN) and compass communication data minus circuit VMC30 (BU/GY).

DTC B2097 — sets in continuous memory if the instrument cluster detects invalid data sent from the compass module.

DTC U2013 — is a continuous memory and on-demand DTC that sets if the instrument cluster is missing the compass data from the compass module. If the instrument cluster fails to receive the compass data, the instrument cluster sets DTC U2013 and defaults the compass display to (----).

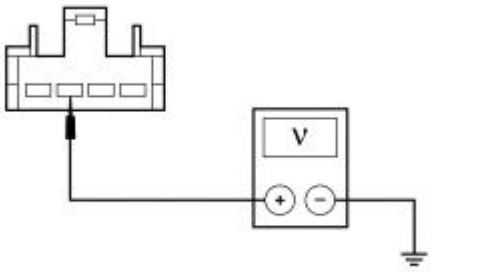
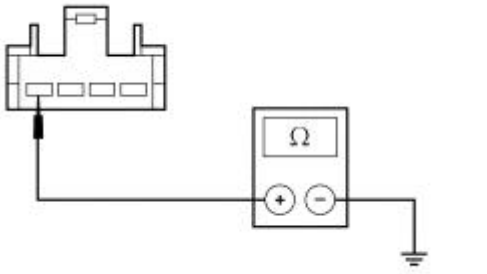
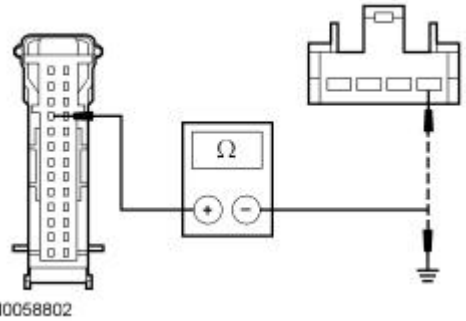
Possible Causes

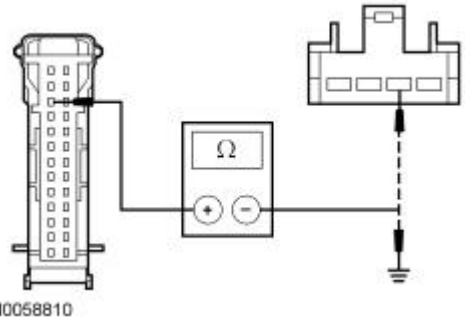
- Fuse
- Circuit CBP31 (BU/OG) open
- Circuit GD133 (BK) open
- Circuit VMC30 (BU/GY) open or short to ground
- Circuit VMC31 (YE/GN) open or short to ground
- Compass sensor module

PINPOINT TEST C: THE COMPASS IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 RETRIEVE THE RECORDED DTCs FROM THE INSTRUMENT CLUSTER CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for instrument cluster DTCs from the continuous and on-demand self-tests. • **Is DTC B2097 recorded?**	**Yes** INSTALL a new compass module. REPEAT the self-test. CLEAR the DTCs. **No** If DTC U2013 is recorded, GO to C2 . For all other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section.
C2 CHECK CIRCUIT CBP31 (BU/OG) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Compass Sensor Module C909. • Key in ON position. • Measure the voltage between the compass sensor module C909-3, circuit CBP31 (BU/OG), harness side and ground.	**Yes** GO to C3 . **No** VERIFY the SJB fuse 31 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 GK9616-A • **Is the voltage greater than 10 volts?**	
C3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the compass sensor module C909-4, circuit GD133 (BK), harness side and ground.  GK9617-A • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C4 CHECK CIRCUIT VMC31 (YE/GN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-10, circuit VMC31 (YE/GN), harness side and the compass sensor module C909-1, circuit VMC31 (YE/GN), harness side; and between the instrument cluster C220-10, circuit VMC31 (YE/GN), harness side and ground.  N0058802 • **Is the resistance less than 5 ohms between the instrument cluster and the compass sensor module, and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** GO to C5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK CIRCUIT VMC30 (BU/GY) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between the instrument cluster C220-11, circuit VMC30 (BU/GY), harness side and the compass sensor module C909-2, circuit VMC30 (BU/GY), harness side; and between the instrument cluster C220-11, circuit VMC30 (BU/GY), harness side and ground.	**Yes** INSTALL a new compass sensor module. SET the zone. REFER to Compass Zone Adjustment — With Message

 • **Is the resistance less than 5 ohms between the instrument cluster and the compass sensor module, and greater than 10,000 ohms between the instrument cluster and ground?**	Center or Compass Zone Adjustment — Without Message Center in this section. CALIBRATE the compass. REFER to Compass Calibration — With Message Center or Compass Calibration — Without Message Center in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Compass Is Inaccurate

Normal Operation

The compass sensor module communicates the vehicle direction to the instrument cluster through the compass communication data plus circuit VMC31 (YE/GN) and compass communication data minus circuit VMC30 (BU/GY). The magnetic fields generated by the earths north and south poles are divided into zones that differ from each other with respect to how the magnetic fields appear. The magnetic north can change by up to 4 degrees between zones and become noticeable across multiple zones. The compass zone must be set to the correct zone for the compass to read accurately. Factors within the vehicle may affect the ability of the compass module to accurately read the magnetic north. Calibrating the compass allows the compass module to compensate for vehicle factors that influence the accuracy of the compass.

NOTE: Outside factors such as bridges, steel structures, tall buildings and power lines also affect compass accuracy.

Possible Causes

- Compass sensor module
- Zone setting
- Calibration

PINPOINT TEST D: THE COMPASS IS INACCURATE

Test Step	Result / Action to Take
D1 CHECK THE COMPASS ZONE SETTING AND CALIBRATION	
• Set the zone. Refer to Compass Zone Adjustment — With Message Center or Compass Zone Adjustment — Without Message Center in this section. • Calibrate the compass. Refer to Compass Calibration — With Message Center or Compass Calibration — Without	**Yes** The compass is OK. **No** INSTALL a new compass sensor module. SET the zone. REFER to Compass Zone Adjustment — With Message Center or Compass Zone Adjustment — Without Message Center in this section. CALIBRATE the compass. REFER to Compass Calibration — With Message Center or Compass Calibration — Without Message Center in this section. TEST the system for normal operation.

Message Center in this section. • **Does the compass calibrate correctly?**	

Pinpoint Test E: The Outside Air Temperature Sensor Does Not Operate Correctly

Normal Operation

The outside air temperature sensor is mounted on the radiator core support in front of the radiator and A/C condenser and is hardwired to the instrument cluster through input circuit VH407 (YE/GN) and return circuit VMC29 (YE). The instrument cluster provides a reference voltage to the ambient air temperature sensor and monitors the change in voltage resulting from changes in resistance as determined by outside air temperature. When the engine has been off for 2 hours, or the engine temperature is cold, the instrument cluster displays the current outside air temperature as measured by the ambient air temperature sensor. When the time is less than 2 hours, or if the engine is not cold, the instrument cluster takes a reading of the current temperature and compares the current reading against the last reading at key off. If the temperature is less than the last key off temperature reading, the instrument cluster displays the current temperature. If the temperature is greater than the last key off temperature reading, the instrument cluster displays the last key off temperature reading until the ambient air temperature has had time to stabilize with vehicle movement.

DTC B1255 — is a continuous and on-demand DTC that sets if the instrument cluster detects an open on the outside air temperature sensor input, circuit VH407 (YE/GN). If the instrument cluster detects an open on the outside air temperature input, the instrument cluster defaults the display to 23.89°C (75°F).

DTC B1257 — is a continuous and on-demand DTC that sets if the instrument cluster detects a short to ground on the outside air temperature sensor input, circuit VH407 (YE/GN). If the instrument cluster detects a short to ground on the outside air temperature input, the instrument cluster defaults the display to 23.89°C (75°F).

Possible Causes

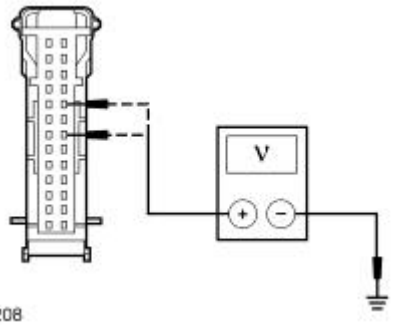
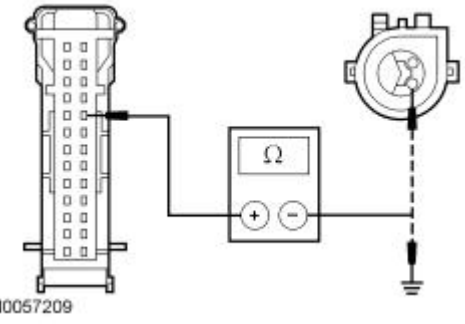
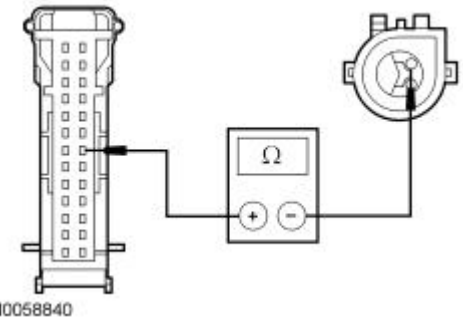
- Circuit RH111 (GY/BU) open
- Circuit VH407 (YE/GN) open, short to voltage or ground
- Circuit VMC29 (YE) open or short to voltage
- Outside air temperature sensor
- Instrument cluster

PINPOINT TEST E: THE OUTSIDE AIR TEMPERATURE SENSOR DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
E1 MONITOR THE OUTSIDE AIR TEMPERATURE DISPLAY	
NOTE: If equipped with electronic automatic temperature control (EATC), the outside air temperature display is located in the EATC display. • Observe the instrument cluster integrated circuit display and monitor the outside air temperature display. • **Does the integrated display show the outside air temperature as 23.89°C (75°F)?**	**Yes** GO to E2 . **No** If the outside air temperature display does not display, VERIFY that the vehicle is not

	equipped with EATC and that the instrument cluster is configured for the outside air temperature display. REFER to Section 418-01 . If the outside air temperature display is inaccurate, INSTALL a new ambient air temperature sensor. REFER to Section 412-01 . TEST the system for normal operation. If the integrated circuit display is inoperative, INSTALL a new instrument cluster. REFER to Section 413-01 .
E2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Is instrument cluster DTC B1255 or B1257 recorded?**	**Yes** GO to E3 . **No** VERIFY that the vehicle has been driven to eliminate any potential heat soak condition and cool off the sensor. If the outside air temperature display is still inaccurate, INSTALL a new ambient air temperature sensor. REFER to Section 412-01 . TEST the system for normal operation.
E3 CLEAR THE DTCs AND RECHECK THE SYSTEM	
• Clear the DTCs and repeat the instrument cluster self-test. • **Is instrument cluster DTC B1255 or B1257 recorded?**	**Yes** GO to E4 . **No** The system is operating normally at this time.
E4 CHECK CIRCUIT VH407 (YE/GN) AND VMC29 (YE) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Key in ON position. • Measure the voltage between the instrument cluster C220-22, circuit VH407 (YE/GN), harness side and ground; and between the instrument cluster C220-20, circuit VMC29 (YE), harness side and ground.	**Yes** REPAIR the circuit in question. REPEAT the self-test. CLEAR the DTCs. **No** GO to E5 .

 N0057208 • **Is any voltage present?**	
E5 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN AND SHORT TO GROUND	
• Key in OFF position. • Disconnect: Ambient Air Temperature Sensor C132. • Measure the resistance between the instrument cluster instrument cluster C220-22, circuit VH407 (YE/GN), harness side and the ambient air temperature sensor C132-2, circuit VH407 (YE/GN), harness side; and between the instrument cluster instrument cluster C220-22, circuit VH407 (YE/GN), harness side and ground.  N0057209 • **Is the resistance less than 5 ohms between the instrument cluster and the ambient air temperature sensor, and greater than 10,000 ohm between the instrument cluster and ground?**	**Yes** GO to E6 . **No** REPAIR the circuit. TEST the system for normal operation.
E6 CHECK CIRCUIT VMC29 (YE) AND RH111 (GY/BU) FOR AN OPEN	
• Measure the resistance between the instrument cluster instrument cluster C220-20, circuit VMC29 (YE), harness side and the ambient air temperature sensor C132-1, circuit RH111 (GY/BU), harness side.  N0058840 • **Is the resistance less than 5 ohms?**	**Yes** GO to E7 . **No** REPAIR the circuit in question. REPEAT the self-test. CLEAR the DTCs.
E7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for:	**Yes** INSTALL a new

■ corrosion ■ damaged pins ■ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The PARKING AID ON/OFF Warning Is Inoperative

Normal Operation

The parking aid on/off status is sent from the parking aid module to the instrument cluster over the medium speed controller area network (MS-CAN) communication bus lines. When the RESET button is pressed, the instrument cluster sends a query to the parking aid module, requesting a system status. The parking aid module responds to the instrument cluster with the status of the system, either on or off. If the return status message is missing or corrupted, the instrument cluster does not display the brackets around either the ON or OFF selection.

Possible Causes

- Instrument cluster configuration
- Parking aid system
- Instrument cluster

PINPOINT TEST F: THE PARKING AID ON/OFF WARNING IS INOPERATIVE

Test Step	Result / Action to Take
F1 VERIFY THE INSTRUMENT CLUSTER CONFIGURATION	
NOTE: Parking aid configuration in the instrument cluster is not a customer preference item that is configurable and must be configured using As-Built data. When the instrument cluster is configured for the parking aid system, the instrument cluster begins to query the parking aid module for parking aid status. Do not confuse the customer preference ON/OFF configuration with the instrument cluster parking aid system present configuration. • Key in ON position. • Verify that the vehicle is equipped with parking aid and the instrument cluster is configured for parking aid. Refer to Section 418-01 for additional information on using As-Built data. • **Is the vehicle equipped with parking aid and is the instrument cluster configured for parking aid?**	**Yes** GO to F2 . **No** CONFIGURE the instrument cluster. REFER to Section 418-01 .
F2 CHECK THE PARKING AID SYSTEM OPERATION	
• Operate the parking aid system and check for correct operation when the feature is selected on and off. Refer to the Owner's Literature for additional information on selecting the parking aid system on or off. • **Does the parking aid system operate correctly when the feature is selected on then off?**	**Yes** GO to F3 . **No** REFER to Section 413-13 .
F3 CHECK THE PARKING AID DISPLAY IN THE MESSAGE	

CENTER	
• Press the SETUP button repeatedly and verify that the instrument cluster displays PARKING AID ON OFF. • **Does the message center display PARKING AID ON OFF?**	**Yes** GO to F4 . **No** GO to F5 .
F4 CHECK THE MESSAGE CENTER ON/OFF DISPLAY	
• Press the SETUP button until PARKING AID ON OFF is displayed. • **Does the ON or OFF have the < > brackets around it indicating the desired selection?**	**Yes** PRESS the RESET button to allow the instrument cluster to query the parking aid module again. If the display is still incorrect, REFER to Section 418-00 to diagnose no communication with the parking aid module. **No** The system is operating normally at this time. The problem may have been caused by a momentary loss of communication with the parking aid module.
F5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The CHECK AIR SUSPENSION or AIR SUSPENSION OFF Warning Is Inoperative

Normal Operation

The air suspension on/off status is sent from the air suspension module to the instrument cluster over the high speed controller area network (HS-CAN) communication bus lines. When the RESET button is pressed, the instrument cluster sends a query to the air suspension module, requesting a system status. The air suspension module responds to the instrument cluster with the status of the system, either on or off. If the return status message is missing or corrupted, the instrument cluster does not display the brackets around either the ON or OFF selection.

Possible Causes

- Instrument cluster configuration
- Air suspension system
- Air suspension module
- Instrument cluster

PINPOINT TEST G: THE CHECK AIR SUSPENSION OR AIR SUSPENSION OFF WARNING IS INOPERATIVE

Test Step	Result / Action to Take
G1 VERIFY THE INSTRUMENT CLUSTER CONFIGURATION	
NOTE: Air suspension system configuration in the instrument cluster is not a customer preference item that is configurable and must be configured using As-Built data. When the instrument cluster is configured for the parking aid system, the instrument cluster begins to query the parking aid module for parking aid status. Do not confuse the customer preference ON/OFF configuration with the instrument cluster parking aid system present configuration. • Key in ON position. • Verify that the vehicle is equipped with air suspension and that the instrument cluster is configured for air suspension. Refer to Section 418-01 for additional information on using As-Built data. • **Is the vehicle equipped with air suspension and is the instrument cluster configured for air suspension?**	**Yes** GO to G2 . **No** CONFIGURE the instrument cluster. REFER to Section 418-01 .
G2 CHECK THE AIR SUSPENSION SYSTEM OPERATION	
• Operate the air suspension system and check for correct operation when the feature is selected on and off. Refer to the Owner's Literature for additional information on selecting the parking aid system on or off. • **Does the air suspension system operate correctly when the feature is selected on then off?**	**Yes** If the AIR SUSPENSION OFF warning is inoperative, GO to G3 . If the CHECK SUSPENSION SYSTEM warning is inoperative, GO to G5 . **No** REFER to Section 204-05 .
G3 CHECK THE AIR SUSPENSION DISPLAY IN THE MESSAGE CENTER	
• Press the SETUP button repeatedly and verify that the instrument cluster displays AIR SUSPENSION ON OFF. • **Does the message center display AIR SUSPENSION ON OFF?**	**Yes** GO to G4 . **No** GO to G6 .
G4 CHECK THE MESSAGE CENTER ON/OFF DISPLAY	
• Press the SETUP button until AIR SUSPENSION ON OFF is displayed. • **Does the ON or OFF have the < > brackets around it indicating the desired selection?**	**Yes** PRESS the RESET button to allow the instrument cluster to query the air suspension module again. If the display is still incorrect, REFER to Section 418-00 to diagnose no communication with the parking aid module. **No** The system is operating normally at this time. The problem may have been caused by a momentary loss of communication with the parking aid module.
G5 CHECK FOR CORRECT AIR SUSPENSION MODULE	

OPERATION	

• Disconnect all the air suspension module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the air suspension connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new air suspension module. REFER to Section 204-05 . TEST the system for normal operation.
	
	If the CHECK AIR SUSPENSION or AIR SUSPENSION OFF warning indicator is still inoperative, GO to G6 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The 4X4 SHIFT IN PROGRESS Warning Is Inoperative

Normal Operation

The four wheel drive (4WD) control module sends the instrument cluster a message over the high speed controller area network (HS-CAN) communication bus lines when the 4WD system is in the process of shifting out of two wheel drive (2WD) and has not yet fully shifted into 4x4 high, 4x4 low or 4x4 auto. Once the shift is completed, the 4WD control module removes the 4x4 shift in progress message and sends a new message to turn on the applicable reconfigurable telltale indicator.

Possible Causes

- Instrument cluster configuration
- 4WD system
- 4WD control module
- Instrument cluster

PINPOINT TEST H: THE 4X4 SHIFT IN PROGRESS WARNING IS INOPERATIVE

Test Step	Result / Action to Take
H1 VERIFY THE INSTRUMENT CLUSTER	

CONFIGURATION	
NOTE: 4WD configuration in the instrument cluster is not a customer preference item that is configurable and must be configured using As-Built data. • Key in ON position. • Verify that the vehicle is equipped with 4WD and the instrument cluster is configured for 4WD. Refer to Section 418-01 for additional information on using As-Built data. • **Is the vehicle equipped with 4WD and is the instrument cluster configured for 4WD?**	**Yes** GO to H2 . **No** CONFIGURE the instrument cluster. REFER to Section 418-01 .
H2 CHECK THE 4WD SYSTEM	
• Operate the vehicle in 4WD and verify that the vehicle shifts from 2WD to 4WD correctly. • **Does the 4WD system shift correctly from 2WD to 4WD?**	**Yes** GO to H3 . **No** REFER to Section 308-07A .
H3 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION	

• Disconnect the 4WD control module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the 4WD control module and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a 4WD control module. REFER to Section 308-07A . TEST the system for normal operation.
	
	If the 4X4 SHIFT IN PROGRESS warning message still does not operate, GO to H4 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

H4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Message Center Configuration

Printable View (78 KB)

Oil Life Reset

1. **NOTE:** The oil life calculation is set at a maximum of approximately 8,000 km (5,000 miles) or 180 days.

   Press and release the SETUP button until the message center displays OIL LIFE = XXX% HOLD RESET = NEW.

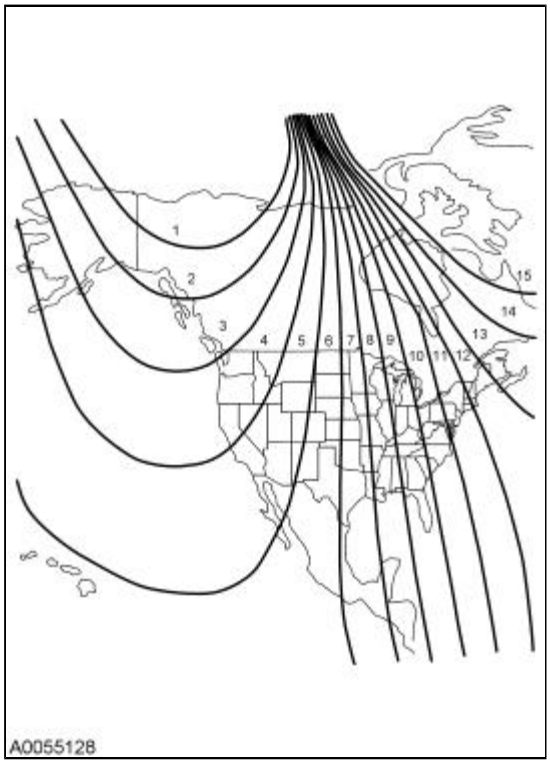
2. Press and hold the RESET button for 2 seconds and release when the message center displays OIL LIFE SET TO 100%.

3. Press and release the SETUP button to exit the procedure.

Compass Zone Adjustment — With Message Center

Printable View (122 KB)

1. Determine which magnetic zone you are in for your geographic location.



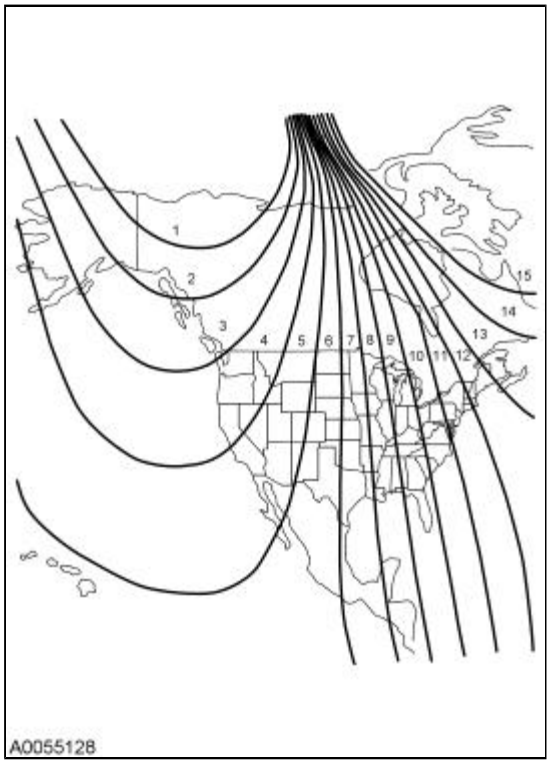
2. Start the engine.
3. Press the message center SETUP button until RESET FOR ZONE SETTING is displayed.
4. Press and release the RESET button until ZONE XX RESET = CHANGE is displayed.
5. **NOTE:** The zone selection increases with each subsequent button press with a range of zones from 1 to 15 scrolling back to the beginning.

   Press and release the RESET button until the desired zone appears in the message center display.
6. To exit the zone setting mode and lock in the changes, press and release either the RESET or SETUP button or simply wait 4 seconds and the message center locks in the zone.

Compass Zone Adjustment — Without Message Center

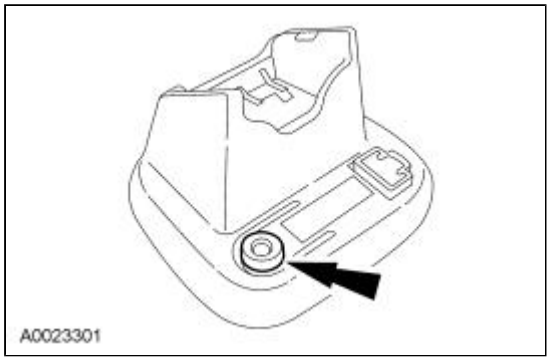
Printable View (136 KB)

1. Determine which magnetic zone you are in for your geographic location.



2. Start the engine.

3. Locate the reset button on the top of the compass module at the base of the interior rear view mirror.



4. Press and hold the reset button for 6 seconds and release when ZONE appears in the instrument cluster display.

5. **NOTE:** The zone selection increases with each subsequent button press with a range of zones from 1 to 15 scrolling back to the beginning.

   Press and release the reset button until the desired zone number appears.

6. When the desired zone number appears in the instrument cluster display, do not press the reset button. The instrument cluster locks in the zone setting and returns to normal operation when the reset button is not pressed for approximately 4 seconds.

Compass Calibration — With Message Center

Printable View (79 KB)

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (heated rear window, heater, A/C, map lamps, wiper, etc.) and make sure all the doors are closed.

   Start the vehicle.

2. Press the message center SETUP button until RESET FOR CALIBRATION is displayed.

3. **NOTE:** The message center displays CIRCLE SLOWLY TO CALIBRATE in the calibration function.

   Press the RESET control button to start the compass calibration function.

4. **NOTE:** This step may require up to 5 circles to complete the calibration.

   NOTE: If the RESET button is pressed during the calibration or 3 minutes has elapsed since the beginning of the calibration without driving the vehicle, the message center reverts back to normal operation and the INFO displays CAL until a successful calibration is carried out.

   Slowly drive the vehicle in a circle less than 5 km/h (3 mph) until the CIRCLE SLOWLY TO CALIBRATE display changes to CALIBRATION COMPLETED.

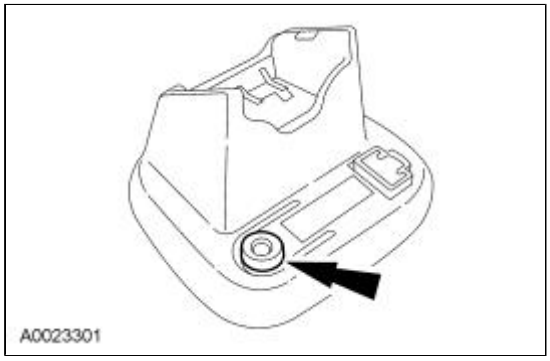
Compass Calibration — Without Message Center

Printable View (93 KB)

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (heated rear window, heater, A/C, map lamps, wiper, etc.) and make sure all the doors are closed.

   Start the vehicle.

2. Locate the reset button on the top of the compass module at the base of the interior rear view mirror.



3. Press and hold the reset button for 8 seconds and release when CAL appears in the instrument cluster display.

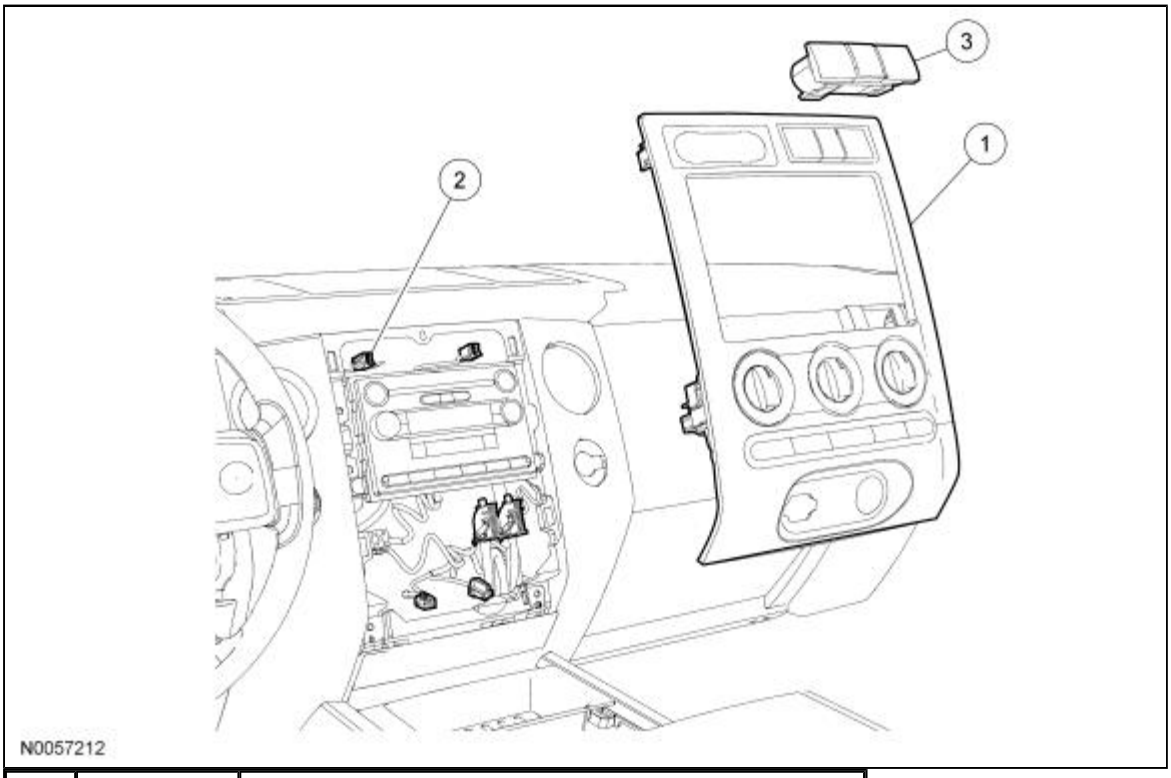
4. **NOTE:** This step may require up to 5 circles to complete the calibration.

   Slowly drive the vehicle in a circle at no more than 5 km/h (3 mph) until CAL turns off in the instrument cluster display.

Message Center Switch

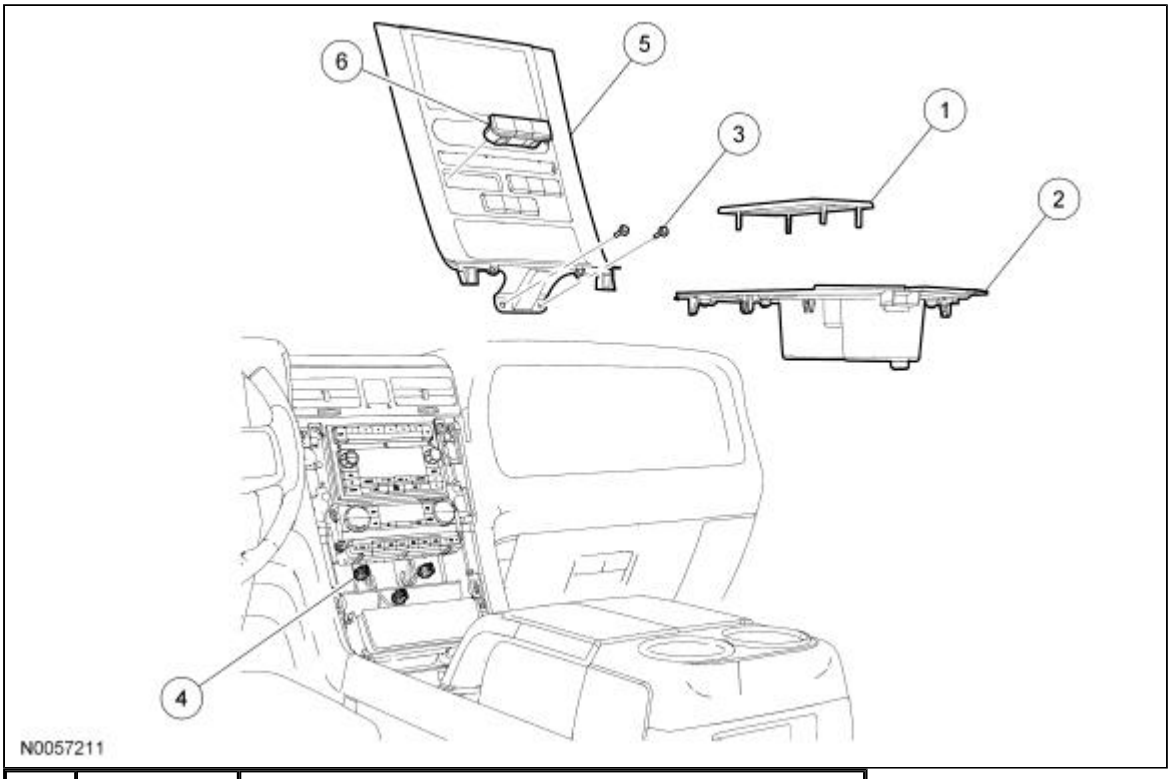
Printable View (233 KB)

Expedition



Item	Part Number	Description
1	78044D70	Instrument panel center finish panel
2	—	Instrument panel center finish panel electrical connectors (part of 14401)
3	10D889	Message center switch

Navigator



Item	Part Number	Description
1	7E391	Transmission range selector bezel
2	78044J76	Floor console finish panel
3	W707628	Instrument panel center finish panel screws (2 required)
4	—	Instrument panel center finish panel electrical connectors (part of 14401)
5	78044D70	Instrument panel center finish panel
6	10D889	Message center switch

Removal and Installation

Expedition

1. Pull the instrument panel center finish panel straight out to release the retaining clips.

Navigator

2. **NOTE:** The transmission selector lever bezel is held in place by 4 tabs that are located in the shifter assembly.

   Remove the transmission selector lever bezel.

3. Open the floor console compartment door and pull the floor console finish panel straight up to release the retainer clips.

4. Remove the 2 screws and pull the instrument panel center finish panel straight out to release the retainer clips.
   - Position the instrument panel center finish panel aside.

All vehicles

5. Disconnect the electrical connectors.

6. Press the 4 retaining tabs and remove the message center switch from the center instrument panel finish panel.

7. To install, reverse the removal procedure.

Warning Devices

Printable View (63 KB)

The warning chimes are designed to provide the driver with an audible warning that acts as a supplemental alert. The only deviation from this strategy is the air bag chime which is used to alert the driver that the primary alerting system does not operate. The instrument cluster controls all warning chimes based on messages received from external modules.

The warning device system consists of the following:

- Instrument cluster
- Safety belt warning indicator switch (part of the safety belt buckle)
- Door ajar switch
- Liftgate ajar switch
- Liftgate glass ajar switch
- Key-in-ignition warning switch (part of the ignition switch)
- Smart junction box (SJB)

The following chimes are controlled by the instrument cluster:

- Safety belt warning
- Air bag warning
- Key-in-ignition
- Turn signal left on
- Door ajar
- Turn signal indicator
- Headlamps on
- Message center
- Parking brake applied
- Belt minder

Warning Devices

Printable View (137 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The instrument cluster uses inputs that are both hardwired to individual components and messages that are sent from the other modules over the high speed or medium speed controller area networks (HS-CAN or MS-CAN) to control the warning chime functions.

It is very important to understand:

- where the input (command) originates.
- all the information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- if the module that received the input (message) controls the output of the feature, or if it outputs a message over the CAN to another module.
- which module controls the output of the feature.

Instrument Cluster Messages

NOTE: Whenever a message is suspected as missing, confirmed by a missing message DTC, it is important to look for other symptoms that may also be present in the instrument cluster and throughout the vehicle. Once a DTC is set in the instrument cluster it may be helpful to review the complete message list available in Section 418-00 to see what other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same DTC may also be set in those modules. Confirmation of missing messages common to multiple modules may indicate that the originating module is the source of the concern or the communication network may be experiencing some problems.

The instrument cluster uses input messages from other modules to control the gauges, informational indicators, warning indicators and reconfigurable telltale indicators over the communication networks. If a required message is missing or invalid for less than 5 seconds, the gauge or indicator that requires the message remains at the last commanded state based upon the last known good message. For example, if the O/D off status message is missing for less than 5 seconds and the O/D off indicator was ON (O/D cancelled), the indicator remains in the ON state until the next good message is received. If the message remains missing or invalid for greater than 5 seconds, the instrument cluster sets a U-code DTC and the output becomes a default action for the indicator or gauge. Each indicator or gauge utilizes

a different default strategy depending on the nature of the indication. Refer to the normal operation descriptions located before each individual pinpoint test for further description of the default action specific to each indicator or gauge. If the messaged input to the cluster returns at any time, the normal function of the gauge or indicator resumes.

Warning Chime Characteristics

Each warning chime has unique characteristics that help to identify and differentiate each warning chime. The warning chimes use volume, chime frequency, length of time the chime sounds and the number of chime tones to identify which chime is sounding. The instrument cluster prioritizes the chimes according to a preset hierarchy programmed into the instrument cluster software. When more than one chime request is received by the instrument cluster, the most important chime sounds. If a lower priority chime is currently sounding, the higher priority request takes over and replaces the lower priority chime.

There are 3 different chimes as listed below:

- Repetitive
- Single tone
- Tic-toc

The following table provides a summary of the chime characteristics including the chime priority.

Instrument Cluster Chime Characteristics/Priority

Chime Name	Priority	Number of Chime Tones	Condition Description
Safety belt	1	6	On for as long as the safety belt is unbuckled and the instrument cluster receives the chime on command.
Air bag	2	5	Five sequences of 1 second ON and 1 second OFF (10 seconds total)
Key-in-ignition	3	Repetitive	On for as long as the key is in the ignition with the door ajar and the instrument cluster receives the chime on command.
Turn signal left on	4	Repetitive	On for as long as the RH or LH turn signal is on and the instrument cluster receives the chime on command.
Door ajar	5	Single tone (1)	This is a single tone chime that sounds when the key is in the RUN position and a door changes from closed to ajar.
Turn signal	6	Repetitive tic-toc	On for as long as the RH or LH turn signal or hazards are on and the instrument cluster receives the chime on command.
Headlamps on	7	Repetitive	On for as long as the headlamps are on and the instrument cluster receives the chime on command.
Message center (if equipped)	8	Single tone (1)	This is a single tone chime that sounds once per ignition cycle whenever the instrument cluster receives a new message commanding on one of the message center warnings.
Parking brake on	9	Repetitive	On for as long as the parking brake is applied and the instrument cluster receives the chime on command.
Belt minder	10	6	This chime provides 4 series of 6 one-quarter second tone bursts (total of 24 one-quarter second tones).

Safety Belt Warning Chime

The safety belt warning chime warns that the driver safety belt is not fastened. The safety belt warning chime sounds when the driver safety belt is not fastened and the ignition switch is turned to the RUN or START position.

The safety belt warning chime stops sounding when the:

- driver safety belt is fastened.
- ignition switch is turned to the OFF/LOCK or ACC position.
- chime has sounded 6 times.

The safety belt warning chime inputs are the:

- Ignition switch RUN/START position
- Ignition switch RUN/ACC position
- Driver safety belt switch message from the restraints control module (RCM)

Air Bag Warning Chime

The air bag warning chime warns that a fault is present within the air bag warning indicator circuit. The RCM provides the air bag warning indicator message to the instrument cluster. The instrument cluster monitors the internal air bag warning indicator circuitry and turns on the air bag warning chime if a fault is present.

The air bag warning chime input is the air bag warning indicator request from the RCM.

Key-In-Ignition Warning Chime

The key-in-ignition warning chime warns that the key is in the ignition when the LH front door is ajar. The key-in-ignition warning chime sounds when all the following conditions are met:

- The LH front door is ajar
- The key is in the ignition lock cylinder
- The ignition switch is in the OFF/LOCK or ACC position

The key-in-ignition warning chime will stop sounding when the:

- LH front door is closed.
- key is removed from the ignition lock cylinder.
- ignition switch is turned to the RUN position.

The key-in-ignition warning chime inputs are the:

- Ignition switch RUN/START position
- Ignition switch RUN/ACC position
- Key-in-ignition warning switch message from the smart junction box (SJB)
- LH front door ajar switch

Turn Signal Left On Warning Chime

The turn signal left on warning chime warns that the turn signals have been left on. The turns signals must have been on continuously for more than 3.2 km (2.0 miles).

The turn signal left on warning chime inputs are the:

- Odometer rolling count message from the powertrain control module (PCM)
- RH or LH turn signal message from the SJB

Door Ajar Warning Chime

The door ajar warning chime warns that a door is ajar. The door ajar warning chime is a single chime with a 1 second duration. The door ajar chime sounds when the driver or passenger door, liftgate or liftgate glass becomes ajar while the ignition switch is in the RUN position.

The door ajar warning chime inputs are the:

- Ignition switch RUN position
- Door ajar, liftgate or liftgate glass message from the SJB

Turn Signal Chime

Since the turn and hazard flasher is an electronic function of the SJB, the on/off sound that used to be present with standard bi-metal flashers is no longer present. To provide an audible sound and indicate that the RH/LH TURN or HAZARD indicators are on, the instrument cluster provides an tic-toc tone along with the visual turn signal indicators.

The turn signal on warning chime inputs are the:

- RH/LH TURN or HAZARD signal messages from the SJB

Headlamps On Warning Chime

The headlamp on warning chime warns that the headlamps are on while the driver door is ajar. The headlamp on warning chime sounds when all the following conditions are met:

- The driver door is ajar
- The headlamp switch is in the PARK or HEADLAMPS position
- The ignition switch is in the OFF/LOCK position
- The key is out of the ignition lock cylinder

The headlamp on warning chime stops sounding when any one of the conditions are met:

- The driver door is closed
- The headlamp switch is turned off
- The ignition switch is placed in the RUN position

The headlamp on warning chime inputs are the:

- Ignition switch voltage
- Headlamp switch status message from the SJB
- LH front door ajar switch message from the SJB
- Key-in-ignition switch status message from the SJB

Message Center Warning Chime (If Equipped)

The message center warning chime sounds when the instrument cluster receives a new message to be displayed in the message center. The chime tone sounds once per ignition cycle for each message that is received. If there are multiple messages present upon key on, the instrument cluster provides a single, 1.0 second tone, for each message that displays. The message may remain visible, but the chime only sounds once.

The message center warning chime inputs are the message center warning messages received from external sensors and other modules. For additional information on the message center message displays and the associated inputs, refer to Section 413-08 .

Parking Brake On Warning Chime

The parking brake warning chime is controlled by the SJB and warns that the parking brake is applied with the vehicle in motion.

The parking brake warning chime input is the parking brake chime request from the SJB.

Belt Minder Warning Chime

The safety belt minder feature is configurable. For additional information, refer to Section 418-01 . To configure without using a scan tool, refer to Safety Belt Minder Deactivating/Activating in this section.

The safety belt minder feature is controlled by a message sent to the instrument cluster from the RCM and supplements the safety belt warning chime and the safety belt warning indicator functions. The safety belt minder reminds the driver that his/her safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster. The safety belt minder feature is enabled after the safety belt warning chime is complete and the vehicle speed has exceeded 4.8 km/h (3 mph). While activated, the safety belt minder alternates the chime and safety belt warning indicator from ON for 6 seconds to OFF for 30 seconds then the sequence repeats. If the belt minder remains active after 3 repetitions, the sound level and the speed of the chimes increase.

The safety belt minder warning chime inputs are the:

- Ignition switch RUN/START position
- Ignition switch RUN/ACC position
- Driver safety belt switch message from the RCM

The safety belt minder reminder stops when:

- the driver safety belt is buckled.
- the ignition switch is turned to the OFF or ACC position.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Circuitry • Key-in-ignition switch (part of the ignition switch) • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground

from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1352	Ignition Key-In Circuit Failure	If the chime sounds with the door ajar and no key in the ignition, Go To Pinpoint Test A . If the key-in-ignition chime is inoperative, Go To Pinpoint Test B .
All other DTCs	—	REFER to Section 413-01 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• All chimes are inoperative	• Instrument cluster	• INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
• The chime sounds when the driver door is ajar (no key in ignition and headlamps off)	• Circuitry • Ignition switch • Smart junction box (SJB)	• Go To Pinpoint Test A .
• The safety belt	• Instrument	• VERIFY the safety belt warning

warning chime is inoperative	cluster	indicator operates correctly. ■ If the safety belt warning indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the safety belt warning indicator does not operate correctly, REFER to Section 413-01 .
• The air bag warning chime is inoperative	• Instrument cluster • Restraints control module (RCM)	• VERIFY DTC B1868 is present in the instrument cluster. ■ If DTC B1868 is present, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If DTC B1868 is not present, the system is operating normally.
• The key-in-ignition warning chime is inoperative	• Circuitry • Key-in-ignition switch (part of the ignition switch) • SJB	• Go To Pinpoint Test B .
• The turn signal left on warning chime is inoperative	• Instrument cluster	• VERIFY the turn signal indicators and speedometer operate correctly. ■ If the turn signal indicators and speedometer operate correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the turn signal indicators or speedometer do not operate correctly, REFER to Section 413-01 .
• The door ajar warning chime is inoperative	• Instrument cluster	• VERIFY the door ajar indicator operates correctly. ■ If the door ajar indicator operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the door ajar indicator does not operate correctly, REFER to Section 413-01 .
• The turn signal chime is inoperative	• Instrument cluster	• VERIFY the turn signal indicators operate correctly. ■ If the turn signal indicators operate correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ■ If the turn signal indicators do not operate correctly, REFER to Section 413-01 .

• The headlamps on warning chime is inoperative	• Door ajar indication • SJB	• Go To Pinpoint Test C .
• The message center warning chime is inoperative	• Instrument cluster	• VERIFY the message center operates correctly. ▪ If the message center operates correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ▪ If the message center does not operate correctly, REFER to Section 413-08 .
• The parking brake on warning chime is inoperative	• Instrument cluster	• VERIFY the brake warning indicator and the speedometer operate correctly. ▪ If the brake warning indicator and the speedometer operate correctly, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. ▪ If the brake warning indicator and the speedometer do not operate correctly, REFER to Section 413-01 .
• The safety belt minder feature is not operating correctly	• Safety belt minder deactivated • RCM	• ACTIVATE the safety belt minder. ▪ To activate using a scan tool, REFER to Section 418-01 . ▪ To activate without using a scan tool, REFER to Safety Belt Minder Deactivating/Activating in this section. • INSTALL a new RCM. REFER to Section 501-20B . TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: The Chime Sounds When The Driver Door Is Ajar (No Key In Ignition And Headlamps Off)

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

When the key is inserted into the ignition lock cylinder, the key-in-ignition switch (part of the ignition switch) closes, providing a voltage signal to the smart junction box (SJB) through circuit CDC30 (BU/GY). The key-in-ignition and door ajar status is communicated to the instrument cluster from the SJB over the medium speed communication area network (MS-CAN). If the instrument cluster detects that the ignition switch is in the OFF or ACC position and the SJB communicates to the instrument cluster that the driver door is ajar and the key is in the ignition, the key-in-ignition warning chime sounds. The SJB also communicates to the instrument cluster that the headlamps or parking lamps are on and the driver door is opened for the headlamps on warning chime. The headlamps on warning chime sounds when the driver door is opened with the ignition switch in the OFF position, the key is not in the ignition lock cylinder, and the headlamp switch is in the PARK or HEADLAMP ON position.

DTC B1352 — is an on-demand DTC that sets if the SJB detects an open or short to ground on the key-in-ignition switch input, circuit CDC30 (BU/GY) or if the SJB detects ignition START, RUN/START or RUN/ACC inputs without the key-in-ignition input.

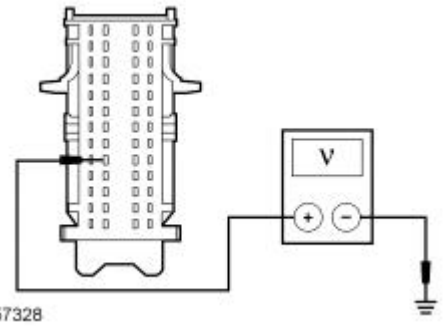
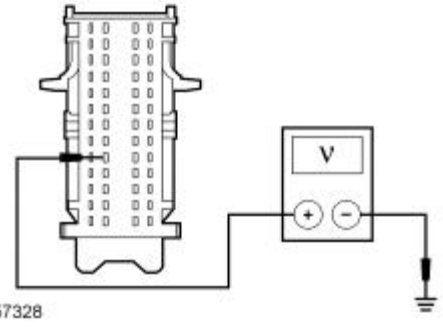
Possible Causes

- Circuit CDC30 (BU/GY) short to voltage
- Ignition switch
- SJB

PINPOINT TEST A: THE CHIME SOUNDS WHEN THE DRIVER DOOR IS AJAR (NO KEY IN IGNITION AND HEADLAMPS OFF)

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE INSTRUMENT CLUSTER ILLUMINATION	
• Verify the instrument cluster is not illuminated with the headlamp switch off. • **Does the instrument cluster illumination operate correctly?**	**Yes** GO to A2 . **No** REFER to Section 413-00 .
A2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS	
• Check the recorded DTCs from the SJB self-tests. • **Are any DTCs present?**	**Yes** For DTC B1352, GO to A3 . For all other DTCs, REFER to Section 419-10 . **No** GO to A4 .
A3 CHECK THE SJB INPUT PIDs FROM THE IGNITION SWITCH	
• Enter the following diagnostic mode on the diagnostic tool: SJB PIDs. • Monitor the SJB PIDs IGN_A_ECU, IGN_O_ECU, IGN_R_ECU, and IGN_S_ECU while cycling the ignition switch from ACC, OFF, RUN and START. • **Do the SJB PIDs match the ignition switch position?**	**Yes** GO to A6 . **No** REFER to Section 211-05 to diagnose the ignition switch outputs to the SJB.
A4 CHECK CIRCUIT CDC30 (BU/GY) FOR VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280H. • Measure the voltage between the SJB C2280H-35, circuit CDC30 (BU/GY), harness side and ground.	**Yes** GO to A5 . **No** GO to A6 .

 N0057328 • **Is any voltage present?**	
A5 CHECK CIRCUIT CDC30 (BU/GY) FOR A SHORT TO VOLTAGE	
• Disconnect: Ignition Switch C250. • Measure the voltage between the SJB C2280H-35, circuit CDC30 (BU/GY), harness side and ground.  N0057328 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new ignition switch. REFER to Section 211-05 . TEST the system for normal operation.
A6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Key-In-Ignition Warning Chime Is Inoperative

Normal Operation

The instrument cluster receives the key-in-ignition warning status from the smart junction box (SJB) over the medium speed controller area network (MS-CAN). The key-in-ignition warning switch (part of the ignition switch) is hardwired to the SJB through circuit CDC30 (BU/GY). When the key is inserted into the ignition lock cylinder, the key-in-ignition switch closes and supplies voltage to the SJB. The SJB monitors the door ajar input from the LH front door and the key-in-ignition switch status. When the key is inserted into the ignition lock cylinder and the driver door is open or ajar, the SJB sends the instrument cluster a chime request message to sound the key-in-ignition warning chime.

DTC B1352 — is an on-demand DTC that sets if the SJB detects an open or short to ground on the key-in-ignition switch input, circuit CDC30 (BU/GY) or if the SJB detects ignition START, RUN/START or

RUN/ACC inputs without the key-in-ignition input.

Possible Causes

- Circuit CDC30 (BU/GY) open or short to ground
- Key-in-ignition switch (part of the ignition switch)
- SJB

PINPOINT TEST B: THE KEY-IN-IGNITION WARNING CHIME IS INOPERATIVE

Test Step	Result / Action to Take
B1 CHECK THE INTERIOR LIGHTS OPERATION • Key in OFF position. • Open then close the driver door while observing the interior lights. • **Do the interior lights operate correctly?**	**Yes** GO to B2. **No** REFER to Section 417-02.
B2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS • Check the recorded DTCs from the SJB self-tests. • **Is DTC B1352 present?**	**Yes** GO to B3. **No** GO to B4.
B3 CHECK THE IGNITION SWITCH • Disconnect: Ignition Switch C250. • Carry out the ignition switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the ignition switch OK?**	**Yes** REPAIR circuit CDC30 (BU/GY) for an open or short to ground. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new ignition switch. REFER to Section 211-05. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Headlamps On Warning Chime Is Inoperative

Normal Operation

The smart junction box (SJB) receives the headlamp switch status from the headlamp switch and the LH front door ajar status from the LH door ajar switch through hardwired circuitry. The headlamps on warning chime sounds when the LH front door is opened with the ignition switch in the OFF position, the

key is not in the ignition lock cylinder, and the headlamp switch is in the PARK or HEADLAMP ON position. The SJB communicates to the instrument cluster when the headlamps or parking lamps are on and the driver door is opened. The autolamps feature must not be selected for the headlamps on warning chime to operate.

Possible Causes

- Door ajar indication
- SJB

PINPOINT TEST C: THE HEADLAMPS ON WARNING CHIME IS INOPERATIVE

Test Step	Result / Action to Take
C1 CHECK THE EXTERIOR LAMPS OPERATION • Key in OFF position. • Place the headlamp switch in the PARK or HEADLAMP ON position. • **Do the headlamps or parking lamps operate?**	**Yes** GO to C2 . **No** REFER to Section 417-01 .
C2 CHECK THE DOOR AJAR RECONFIGURABLE INDICATOR OPERATION • Key in ON position. • Open then close the LH front door while observing the door ajar reconfigurable indicator in the instrument cluster message center or the integrated display. • **Does the door ajar reconfigurable indicator operate correctly?**	**Yes** GO to C3 . **No** REFER to Section 413-01 .

C3 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	If the concern remains, REINSTALL the original SJB and GO to C4 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

C4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Safety Belt Minder Deactivating/Activating

Printable View (79 KB)

Preparation

1. Set the parking brake.
2. Place the transmission in PARK (P).
3. Turn the ignition switch to the OFF position.
4. Close all the vehicle doors.
5. Unbuckle the driver and passenger safety belts.

Deactivating/Activating

1. Turn the ignition switch to the RUN position (do not start the engine).
2. Wait until the safety belt warning indicator turns off (approximately 1 minute).
3. **NOTE:** Step 3 must be completed within 50 seconds after the safety belt warning indicator turns off or the procedure must be repeated.

   Buckle then unbuckle the safety belt 9 times, ending with the safety belt unbuckled.
4. **NOTE:** After Step 3, the air bag warning indicator lamp illuminates for 3 seconds.

   Within 10 seconds of the air bag warning indicator turning on, buckle then unbuckle the safety belt.
   - This disables the safety belt minder feature if it is currently enabled. As confirmation, the air bag warning indicator flashes 4 times per second for 3 seconds.
   - This enables the safety belt minder feature if it is currently disabled. As confirmation, the air bag warning indicator flashes 4 times per second for 3 seconds followed by a second series of 4 flashes per second for 3 seconds.
5. After confirmation, the deactivation/activation procedure is complete.

Printable View (62 KB)

General Specifications

Item	Specification
Azimuth system check object position 1 (P1) and position 5 (P5), distance from sensor	46 cm (18 in) rear 50 cm (20 in) side
Azimuth system check object position 2 (P2), 3 (P3) and 4 (P4), distance from sensor	274 cm (9 ft)

Parking Aid

Printable View (62 KB)

The parking aid radar sensor is integral to the parking aid module and no additional sensors are used. The parking aid module is located in the center of the rear bumper between the bumper isolator and the bumper cover. The parking aid speaker is located in the LH C-pillar area.

The parking aid system consists of the following:

- Radar sensor and module assembly
- Parking aid speaker (audible warning tone)
- Parking aid disable feature (integral to the instrument cluster message center)

Parking Aid

Printable View (191 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The liftgate must be closed for correct operation of the parking aid system.

The parking aid radar sensor is integral to the parking aid module and no additional sensors are used. The parking aid module is located in the center of the rear bumper between the bumper isolator and the bumper cover. The parking aid speaker is located in the LH C-pillar area.

With the ignition switch in the RUN position, the parking aid module detects objects behind the vehicle when the vehicle is in REVERSE (R). The parking aid module does this by calculating the distance to an object within the azimuth field by the use of a radar sensor mounted in the rear bumper. The azimuth field is a 170 degree semicircular area emitted around the rear of the vehicle.

- At speeds under 4 km/h (2.5 mph), the system reports multiple beeps at ranges of up to 2.6 m (9 ft) A solid tone will be reported if an object is within approximately 0.5 m (1.5 ft).
- At speeds 4-8 km/h (2.5-5 mph), the system reports objects up to 5 m (16 ft).
- At speeds above 8 km/h (5 mph), the system reports objects up to 5 m (16 ft) and reports a fast beep alarm indicating time to collision is less than 1.5 seconds.
- The system is not effective at speeds greater than 10 km/h (6 mph) and may not detect certain angular or moving objects.

The parking aid system is disabled if any fault is detected, and the message center indicates the parking aid is disabled. The parking aid system is also disabled when the operator selects parking aid disable through the message center. The parking aid system remains disabled until either the ignition key is cycled from OFF to RUN, or parking aid enable is selected through the message center.

The parking aid module communicates with the scan tool, the smart junction box (SJB) and the

instrument cluster. The following chart describes network messages used by the parking aid module:

Parking Aid Module Network Communication Messages

NOTE: Both medium speed controller area network (MS-CAN) and high speed controller area network (HS-CAN) are used for intermodule communication. A gateway message is transferred from one network to another through the instrument cluster. Refer to Section 418-00 for further explanation.

Broadcast Message	Originating Module	Network Type	Receiving Module
Ignition switch position	Smart junction box (SJB)	MS-CAN	Parking aid module
Parking aid disable switch status	Instrument cluster	MS-CAN	Parking aid module
Parking aid system status	Parking aid module	MS-CAN	Instrument cluster
Transmission selector range (PRNDL)	Transmission control module (TCM)	HS-CAN	Instrument cluster
Transmission selector range (PRNDL) (gateway)	Instrument cluster	MS-CAN	Parking aid module
Vehicle speed	PCM	HS-CAN	Instrument cluster
Vehicle speed (gateway)	Instrument cluster	MS-CAN	Parking aid module

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical and electrical damage.

   Visual Inspection Chart

Mechanical	Electrical
• Rear bumper height and alignment	• Smart junction box (SJB) fuse 35 (10A) • Circuitry • Parking aid module and sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Carry out the Azimuth System Check and Elevation System Check. Refer to Azimuth System Check and Elevation System Check in this section.
5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).
6. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

8. Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

9. Clear the continuous DTCs and carry out the self-test diagnostics for the parking aid module.

10. If the DTCs retrieved are related to the concern, go to the Parking Aid Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Parking Aid Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1317	Battery Voltage High	CLEAR the DTCs. REPEAT the parking aid module self-test. If DTC B1317 is retrieved again, REFER to Section 414-00 .
B1318	Battery Voltage Low	Go To Pinpoint Test B .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the parking aid module self-test. If DTC B1342 is retrieved again, INSTALL a new parking aid module. REFER to Parking Aid Module in this section. CLEAR all DTCs. REPEAT the self-test.
B2477	Module Communication Failure	REFER to Section 418-01 .
C1742	Rear Sounder Circuit Failure	Go To Pinpoint Test C .
C1743	Rear Sounder Circuit Short To Vbatt	Go To Pinpoint Test C .
U0140	Lost Communication with Body Control Module (GEM)	CARRY OUT the network test. REFER to Section 418-00 .
U0155	Lost Communication with Instrument Cluster	CARRY OUT the network test. REFER to Section 418-00 .
U2023	Fault Received From External Node	DISREGARD this DTC. RETRIEVE and FOLLOW the other parking aid module DTCs.
U2471	Unexpected PRNDL State	Go To Pinpoint Test D .
U2472	Unexpected Ignition State	Go To Pinpoint Test E .
U2473	Unexpected Vehicle Speed (VSS)	Go To Pinpoint Test F .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the parking aid module	• Fuse • Circuitry • Parking aid module	• REFER to Section 418-00 .
• The parking aid is inoperative	• Circuitry • Parking aid module	• Go To Pinpoint Test A .
• Continuous or intermittent tone when no obstacles or fault codes are present	• Dirty or iced over rear bumper cover	• CLEAN the rear bumper with high-pressure water.
	• Aftermarket add-ons located on the rear bumper cover including but not limited to trailer hitches, emblems, and metallic stickers • Rear bumper cover impact damage, alignment or obstruction concerns	• REMOVE the aftermarket equipment or REPAIR the rear bumper cover damage as necessary.
	• Parking aid module	• Go To Pinpoint Test G .

Pinpoint Tests

Pinpoint Test A: The Parking Aid Is Inoperative

Normal Operation

The parking aid system is disabled if any fault is detected, and the message center indicates the parking aid is disabled. The parking aid system is also disabled when the operator selects parking aid disable through the message center. The parking aid system remains disabled until either the ignition key is cycled from OFF to RUN, or parking aid enable is selected through the message center. The parking aid module communicates with the scan tool, the smart junction box (SJB) and the instrument cluster on the medium speed controller area network (MS-CAN).

Possible Causes

- Circuit GD133 (BK) open
- Circuit CBP35 (YE/GY) open
- Parking aid module

PINPOINT TEST A: THE PARKING AID IS INOPERATIVE

Test Step	Result / Action to Take

A1 VERIFY THE PARKING AID MODULE COMMUNICATES WITH THE SCAN TOOL	
• Key in ON position. • Carry out the network test. • **Does the parking aid module communicate with the scan tool?**	**Yes** GO to A2 . **No** REFER to Section 418-00 .
A2 CHECK THE DTCs FROM THE PARKING AID MODULE ON-DEMAND SELF-TEST	
• Retrieve the DTCs from the parking aid module on-demand self-test. • **Are any DTCs recorded?**	**Yes** REFER to the Parking Aid Module Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to A3 .
A3 CHECK THE MESSAGE CENTER DISPLAY	
• Observe the message center. • **Does the message center display PARK AID OFF?**	**Yes** ENABLE parking aid in the message center. REPEAT the on-demand self test. **No** GO to A4 .
A4 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC B1318 — Battery Voltage Low

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid module on circuit CBP35 (YE/GY). Circuit GD133 (BK) provides ground.

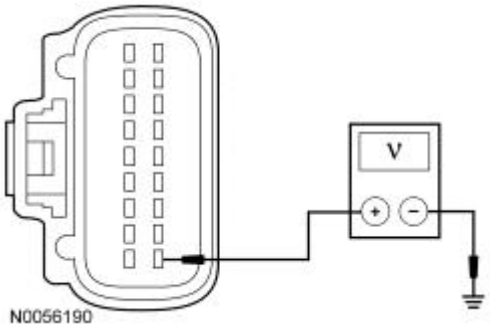
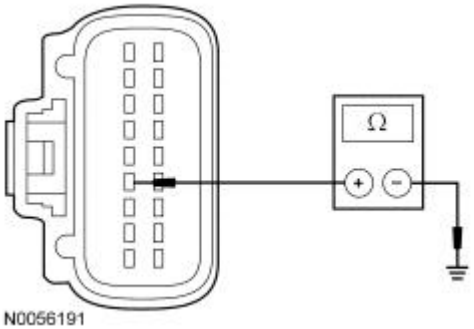
DTC B1318 — is a continuous and on-demand DTC that sets if available voltage to the parking aid module drops below 8 volts for 3 or more seconds.

Possible Causes

- Circuit GD133 (BK) high resistance
- Circuit CBP35 (YE/GY) high resistance
- Charging system concern

PINPOINT TEST B: DTC B1318 — BATTERY VOLTAGE LOW

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK THE PARKING AID MODULE VOLTAGE SUPPLY CIRCUIT	
• Key in OFF position. • Disconnect: Parking Aid Module C4226. • Key in ON position. • Measure the voltage between the parking aid module C4226-18, circuit CBP35 (YE/GY), harness side and ground.  N0056190 • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B2 CHECK THE PARKING AID MODULE GROUND CIRCUIT	
• Key in OFF position. • Measure the resistance between the parking aid module C4226-6, circuit GD133 (BK), harness side and ground.  N0056191 • **Is resistance less than 5 ohms?**	**Yes** REFER to Section 414-00 to diagnose the low battery voltage concern. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC C1742 — Rear Sounder Circuit Failure and DTC C1743 — Rear Sounder Circuit Short To Vbatt

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

With the ignition switch in the RUN position and the gear selector in REVERSE (R), the parking aid system calculates the distance to an object by the use of a radar sensor. A 750 Hz variable warning tone is generated by the parking aid sounder.

The parking aid speaker tone is controlled by the parking aid module through circuit CLS03 (GN/WH). Circuit GD149 (BK/GY) provides ground. The parking aid sounder is located in the LH C-pillar area.

DTC C1742 — is a continuous and on-demand DTC that sets if the parking aid module detects a short to ground or open on the rear speaker circuit CLS03 (GN/WH) when the vehicle is in REVERSE (R) and a detectable object is within the azimuth field.

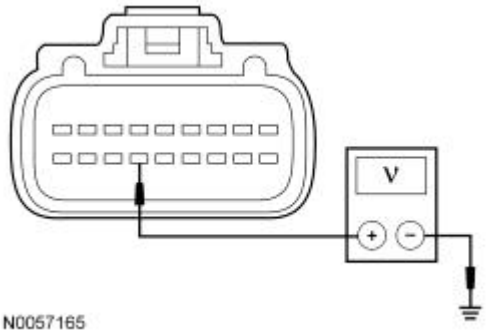
DTC C1743 — is a continuous and on-demand DTC that sets if the parking aid module detects a short to voltage on the rear speaker circuit CLS03 (GN/WH) when the vehicle is in REVERSE (R) and a detectable object is within the azimuth field.

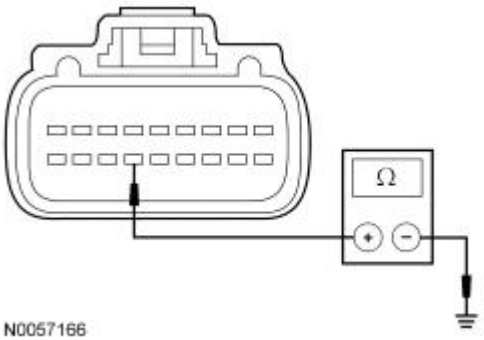
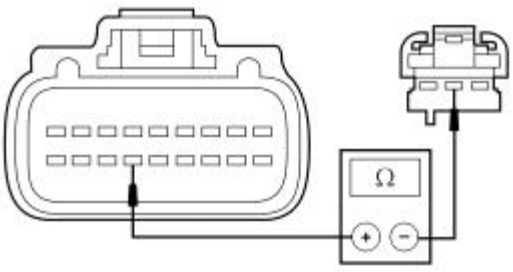
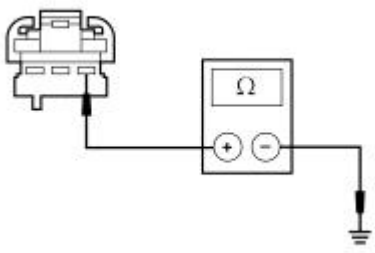
Possible Causes

- Circuit CLS03 (GN/WH) open, short to voltage or ground
- Circuit GD149 (BK/GY) open
- Parking aid speaker
- Parking aid module

PINPOINT TEST C: DTC C1742 — REAR SOUNDER CIRCUIT FAILURE AND DTC C1743 — REAR SOUNDER CIRCUIT SHORT TO VBATT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK CIRCUIT CLS03 (GN/WH) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Parking Aid Module C4226. • Key in ON position. • Measure the voltage between the parking module C4226-15, circuit CLS03 (GN/WH), harness side and ground.  N0057165 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C2 .
C2 CHECK CIRCUIT CLS03 (GN/WH) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the parking aid module C4226-15, circuit CLS03 (GN/WH), harness side and ground.	**Yes** GO to C3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0057166 • **Is the resistance greater than 10,000 ohms?**	
C3 CHECK CIRCUIT CLS03 (GN/WH) FOR AN OPEN	
• Measure the resistance between the parking aid module, C4226-15, circuit CLS03 (GN/WH), harness side and the parking aid speaker C4015-2, circuit CLS03 (GN/WH), harness side.  N0057167 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C4 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the parking aid speaker C4015-1, circuit GD149 (BK/GY), harness side and chassis ground.  N0058854 • **Is the resistance less than 5 ohms?**	**Yes** GO to C5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK THE PARKING AID SPEAKER	
• Connect: Parking Aid Module C4226. • Install a known good parking aid speaker and repeat the on-demand self-test. • **Is DTC C1742 or C1743 still present?**	**Yes** INSTALL the original parking aid speaker. GO to C6 . **No** INSTALL a new parking aid speaker. REFER to Parking Aid Speaker in this section. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC U2471 — Unexpected PRNDL State

Normal Operation

The parking aid module receives the PRNDL state from the instrument cluster as a gateway message from the transmission control module (TCM).

DTC U2471 — is a continuous and on-demand DTC that sets when the parking aid module receives an unknown PRNDL state message from the instrument cluster.

Possible Causes

- Instrument cluster
- Networked data fault

PINPOINT TEST D: DTC U2471 — UNEXPECTED PRNDL STATE

Test Step	Result / Action to Take
D1 CHECK THE DTCs FROM THE ON-DEMAND SELF-TEST	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Parking Aid Module Self-Test. • Clear the DTCs. Repeat the parking aid module on-demand self-test. • **Are any DTCs present?**	**Yes** If DTCs U2471 and U0155 are both present, REFER to Section 418-00 to diagnose no communication with the instrument cluster. For DTC U2471 only, GO to D2 . **No** System is operating normally at this time.
D2 VERIFY THE INSTRUMENT CLUSTER PRNDL DISPLAY FUNCTIONS PROPERLY	
• Monitor the instrument cluster PRNDL display while moving the gearshift lever through the range of positions. • **Does the PRNDL match all range positions?**	**Yes** GO to D3 . **No** REFER to Section 413-01 to diagnose the PRNDL.
D3 CHECK FOR CORRECT INSTRUMENT	

CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTC U2472 — Unexpected Ignition State

Normal Operation

The parking aid module receives the ignition switch state from the smart junction box (SJB) as a network message.

DTC U2472 — is a continuous and on-demand DTC that sets when the parking aid module receives an unknown ignition switch state message.

Possible Causes

- SJB
- Networked data fault

PINPOINT TEST E: DTC U2472 — UNEXPECTED IGNITION STATE

Test Step	Result / Action to Take
E1 CHECK THE DTCs FROM THE ON-DEMAND SELF-TEST	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Parking Aid Module Self-Test. • Clear the DTCs. Repeat the parking aid module on-demand self-test. • **Is DTC U2472 present?**	**Yes** GO to E2 . **No** System is operating normally at this time.
E2 CHECK THE DTCs FROM THE ON-DEMAND SELF-TEST	
• Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test. • Carry out the SJB self-test. • **Is DTC B1359, B1363 and/or B1555 present?**	**Yes** REFER to Section 211-05 . **No** GO to E3 .
E3 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
	Yes
	INSTALL a new SJB. REFER to Section 419-10 .
	TEST the system for normal operation.

■ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC U2473 — Unexpected Vehicle Speed

Normal Operation

The parking aid module receives the vehicle speed from the instrument cluster as a gateway message from the powertrain control module (PCM).

DTC U2473 — is a continuous and on-demand DTC that sets when the parking aid module receives an unknown vehicle speed message.

Possible Causes

- Instrument cluster fault
- Networked data fault

PINPOINT TEST F: U2473 — UNEXPECTED VEHICLE SPEED

Test Step	Result / Action to Take
F1 CHECK THE DTCs FROM THE PARKING AID MODULE ON-DEMAND SELF-TEST	
• Key in ON position. • Clear the DTCs. Repeat the parking aid module on-demand self-test. • **Are any DTCs present?**	**Yes** GO to F2 . **No** System is operating normally at this time.
F2 CHECK FOR MULTIPLE DTCs FROM THE PARKING AID MODULE ON-DEMAND SELF-TEST	
• Record the DTCs from the parking aid module self-test. • **Are both DTCs U2473 and U0155 recorded?**	**Yes** REFER to Section 418-00 . **No** GO to F3 .
F3 CHECK THE DTCs FROM THE PCM ON-DEMAND SELF-TEST	
• Record the DTCs from the PCM self-test. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to F4 .
F4 CHECK THE DTCs FROM THE INSTRUMENT CLUSTER ON-DEMAND SELF-TEST	
• Record DTCs from the instrument cluster self-test.	**Yes** REFER to Section 413-01 .

• **Are any DTCs recorded?**	**No** GO to F5 .
F5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: Continuous or Intermittent Tone When No Obstacles or Fault Codes Are Present

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

With the ignition switch in the RUN position and the gear selector in REVERSE (R), the parking aid system calculates the distance to an object by the use of a radar sensor. A 750 Hz variable warning tone is generated by the parking aid sounder. The sounder increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 46 cm (18 in) of the vehicle, the warning tone becomes continuous.

Possible Causes

- Rear bumper cover impact damage, alignment or obstruction concerns
- Parking aid module

PINPOINT TEST G: CONTINUOUS OR INTERMITTENT TONE WHEN NO OBSTACLES OR FAULT CODES ARE PRESENT

Test Step	Result / Action to Take
G1 CARRY OUT THE REAR BUMPER COVER VISUAL INSPECTION	

• Visually inspect the rear bumper cover for any of the following conditions:
  ▪ Dirty or iced over rear bumper cover
  ▪ Rear bumper cover impact damage
  ▪ Rear bumper height or alignment incorrect
  ▪ Rear bumper cover aftermarket add-ons present including but not limited to trailer hitches, emblems, and metallic stickers
• **Are any of the above conditions present?**
	Yes
	REMOVE the aftermarket equipment or REPAIR the rear bumper cover damage as necessary.
	
	No
	GO to G2 .

G2 CARRY OUT THE AZIMUTH AND ELEVATION SYSTEM CHECKS	
• Carry out the Azimuth System Check and the Elevation System Check in this section.	**Yes** The system is operating correctly at this

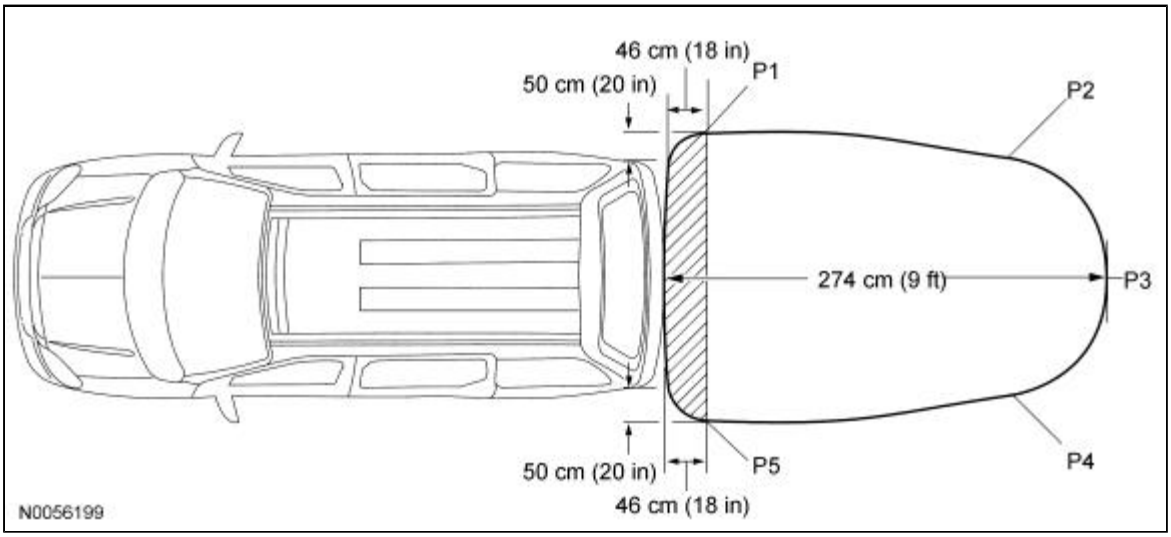
• **Does the parking aid system pass both system checks?**	time. **No** GO to G3 .
G3 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Azimuth System Check

Printable View (116 KB)

Minimum Detectable Object Locations



1. **NOTE:** The object used in this system check can be fabricated from 9 cm O.D. (3 in I.D.) plastic pipe 100 cm (39 in) length (available as PVC pipe, or similar from a hardware or plumbing supply).

   NOTE: The following system check should be carried out with the vehicle on a level surface.

   NOTE: The parking aid system will default to on when the ignition key is cycled from OFF to ON.

   Turn the ignition to the ON position, engine off.

2. Set the parking brake on.

3. Place the gearshift in REVERSE (R).

4. Verify that the parking aid system detects the specified object when placed within the 5 specified locations (P1, P2, P3, P4, P5). These zones are shown ideally and are not absolute. Pipe should be inside of the locations.
   - The sounder should beep slowly when objects are detected on the outer edges of the detection zone, and increase as the object is moved closer to the vehicle. When the object is within 46 cm (18 in) of the rear bumper, the sounder should be on continuously.

5. Using the scan tool, monitor the parking aid distance PID. The distance PID reads between 0 and 274 cm (0 and 9 ft) on a properly functioning system.

Elevation System Check

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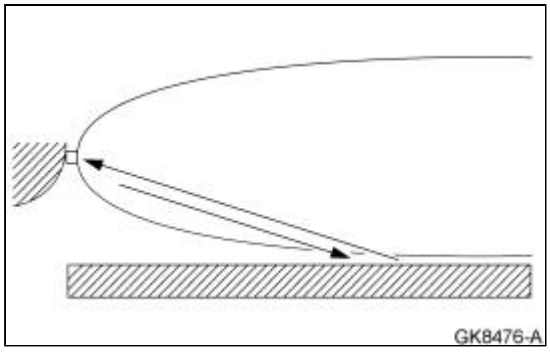
NOTE: The following system check should be carried out with the vehicle on a 3.0 m wide by 4.5 m deep (10 ft wide by 15 ft deep) smooth concrete surface, free of all obstacles and noise from fan and pneumatic tools.

1. Turn the ignition to the ON position, engine off.



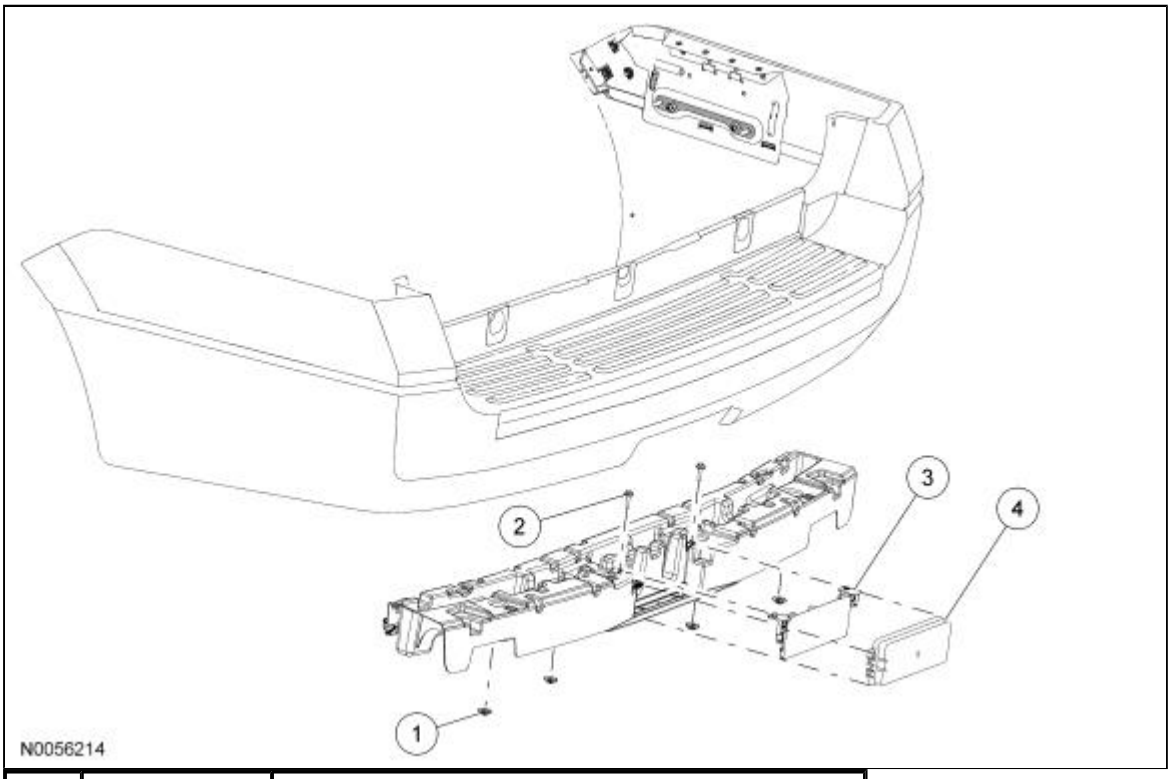
2. Set the parking brake.

3. Place the gearshift in REVERSE (R).

4. Verify that no audible alerts are heard. If audible alerts are heard, check to make sure the bumper is correctly installed and is not tilted downward so that the sensor is pointing at the ground.

Parking Aid Module

Printable View (133 KB)



Item	Part Number	Description
1	—	Insulator-to-bumper cover nuts (4 required)
2	W505425-S	Parking aid module bracket bolts (2 required)
3	—	Parking aid module bracket
4	15K859	Parking aid module

Removal and Installation

1. Disconnect the parking aid module sub-harness from the body harness.
2. Remove the rear bumper cover. For additional information, refer to Section 501-19 .
3. Remove the 4 insulator-to-bumper cover nuts and the insulator from the bumper cover.
4. Disconnect the parking aid module sub-harness from the parking aid module.
5. Remove the 2 parking aid module bracket bolts.
6. Remove the parking aid module bracket assembly.
7. Release the module tabs from the bracket and remove the module from the bracket.
8. To install, reverse the removal procedure.

Parking Aid Speaker

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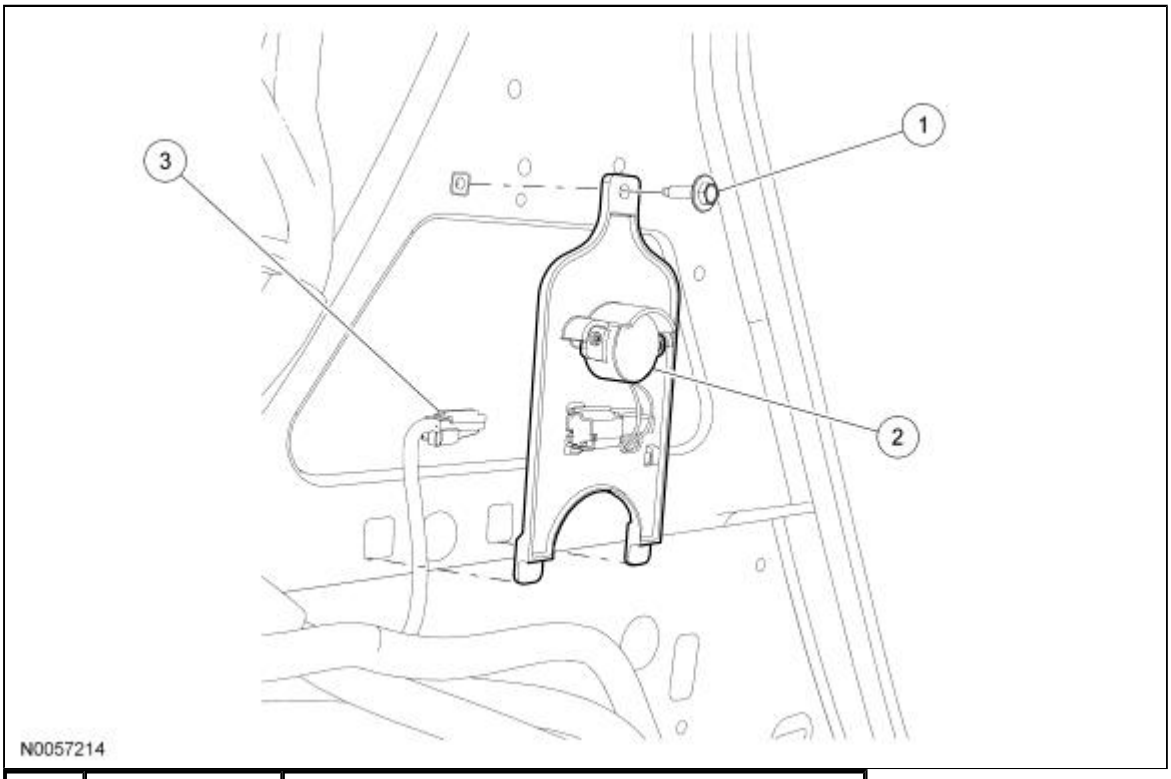

Item	Part Number	Description
1	—	Parking aid speaker bracket bolt
2	—	Parking aid speaker and bracket assembly
3	—	Parking aid speaker electrical connector

Removal and Installation

1. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .
2. Remove the bolt and the speaker and bracket assembly.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

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General Specifications

Item	Specification
Voltage	12 volts
Generator amps	89/157 amp (max) @ 1,800-6,000 generator rpm, approximately 500-2,000 engine rpm

Charging System

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The charging system is a negative ground system. The generator (including an internal voltage regulator) is belt-driven by the engine accessory drive system. When the engine is started, the generator begins to generate alternating current (AC), which is internally converted to direct current (DC). This current is then supplied to the vehicle electrical system through the output (B+) terminal of the generator.

Battery

The battery is a 12-volt DC source connected in a negative ground system. The battery case is sealed with 2 vent holes to release gases. The battery has 3 major functions:

- Engine cranking power source
- Voltage stabilizer for the electrical system
- Temporary power source when electrical loads exceed the generator output current

Charging System

Printable View (373 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2173-A	SABRE Premium Battery & Electrical System Tester 010-00736 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

The powertrain control module (PCM) controlled charging system determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator. This system is unique in that it has 2 unidirectional communication lines between the PCM and the generator/regulator. Both of these communication lines are pulse-width modulated (PWM). The generator communication (GEN COM) line communicates the desired setpoint from the PCM to the voltage regulator. The generator monitor (GEN MON) line communicates the generator load and error conditions to the PCM. The third pin on the voltage regulator, the A circuit pin, is a dedicated battery voltage sense line.

The charging system voltage is controlled by the PCM. The generator charges the battery, and at the same time supplies power for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm. The PCM is able to adjust the charging voltage according to the battery temperature by using a signal from the intake air temperature (IAT) sensor. This means the voltage setpoint is calculated by the PCM and communicated to the regulator by a communication link.

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged, the system is able to increase the idle speed.

To minimize drag when starting the engine, the PCM controls the generator. The generator does not produce any output until the engine has started. The PCM then progressively increases the generator output.

The PCM controls the charging system warning indicator in the instrument cluster. The PCM turns the charging system warning indicator off after the engine is started and illuminates it under fault conditions (when the generator is not generating the correct amount of current with the engine running). The charging system warning indicator is also illuminated by the PCM at key ON engine OFF (KOEO), and stall condition.

This is a System 4 charging system, which uses the GEN MON and GEN COM lines to control and monitor the charging system through the PCM. System 4 charging systems are identical and share the same diagnostics. The circuit numbers and colors may be different, but the functions are the same. System 4 charging systems may use any type of generator, as the generator type usually depends on the engine packaging and/or output requirements versus cost.

Circuit Description

Positive Battery Output (B+) Terminal Circuit SDC02 (RD)

The generator output voltage is supplied to the battery and electrical system through the positive battery output (B+) terminal circuit SDC02 (RD) on the rear of the generator.

A Circuit SDC02 (RD)

This is the A terminal battery voltage sense circuit and is used to sense battery voltage.

Circuit CDC15 (VT)

The generator monitor (GEN MON) circuit communicates the generator load and error conditions to the PCM.

Circuit CDC10 (BU/OG)

This is the generator communication (GEN COM) circuit. The PCM determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator on the GEN COM circuit.

Inspection and Verification

WARNING: Batteries contain sulfuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury, damage to the vehicle or battery. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

CAUTION: Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses, or fusible links.

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

NOTE: While carrying out any pinpoint test, disregard any diagnostic trouble codes (DTCs) set while following a specific pinpoint test. After the completion of a test, be sure to clear all codes in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Battery • Generator drive belt • Generator pulley	• Circuitry • Cables • Generator • PCM • Charging system warning indicator • Fusible links

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Verify the battery condition. Refer to Section 414-01 .

5. Check the operation of the charging system warning indicator (instrument cluster). Normal operation is as follows:
   - With the key OFF, the charging system warning indicator should be off.
   - With the key ON and the engine OFF, the charging system warning indicator should be on.
   - With the engine running, the charging system warning indicator should be off.

6. Turn off the headlamps and the A/C system (if equipped). Turn the climate control blower to low/off. Check the battery voltage before and after starting the engine to determine if the battery voltage increases.

7. **NOTE:** Make sure to use the latest scan tool software release.

   If the concern is not visually evident, connect the scan tool to the data link connector (DLC).

8. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

9. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

11. If the DTCs retrieved are related to the concern, go to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Chart.

12. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

NOTE: DTC P0622 may be set by the loss of the communication lines between the generator and the PCM. The charging system warning indicator then illuminates until the engine is operated at greater than 4,500 rpm (approximately wide open throttle [WOT]) for a minimum of 3 seconds. At this time, the generator self-excites. The charging system warning indicator remains illuminated, and the generator operates in a default mode (approximately 13.5 volts) until the engine is turned off.

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
P0622	Generator Field Term Cir	PCM	GO to Symptom Chart .
All Other DTCs	—	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Instrument Cluster Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B1317	Battery Voltage High	—	Go To Pinpoint Test C .
B1318	Battery Voltage Low	—	Go To Pinpoint Test A .
All Other DTCs	—	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The battery is discharged or battery voltage is low	• Circuitry • High key-off current drain(s) • Battery • Generator	• Go To Pinpoint Test A .
• The charging system warning	• Circuitry	• Go To Pinpoint

indicator is on with the engine running (the charging system voltage does not increase)	• Generator • Powertrain control module (PCM)	Test B .
• The charging system overcharges (battery voltage is greater than 15.5 volts)	• Circuitry • Generator • PCM	• Go To Pinpoint Test C .
• The charging system warning indicator is on with the engine running (the battery increases voltage)	• Generator • PCM	• Go To Pinpoint Test D .
• The charging system warning indicator is off with the ignition switch in the RUN position and the engine off	• Instrument cluster • PCM	• Go To Pinpoint Test E .
• The charging system warning indicator flickers or is intermittent	• Instrument cluster	• INSTALL a new instrument cluster. REFER to Section 413-01 .
• The generator is noisy	• Loose bolts/brackets • Drive belt • Generator/pulley	• Go To Pinpoint Test F .
• Radio interference	• Generator • Wiring/routing • In-vehicle entertainment system	• Go To Pinpoint Test G .

Pinpoint Tests

Pinpoint Test A: The Battery is Discharged or Battery Voltage is Low

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

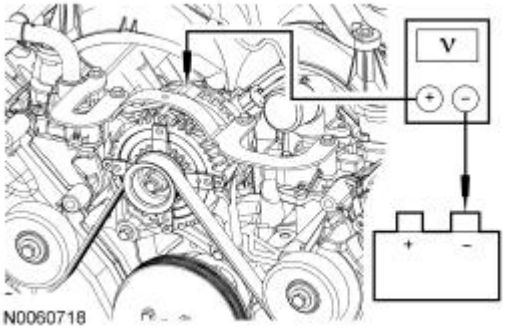
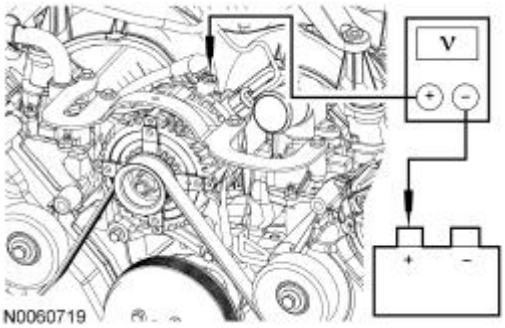
The generator output is supplied through the positive battery output (B+) circuit SDC02 (RD) terminal on the rear of the generator to the battery and electrical system. During normal operation the charging system warning indicator is off with the key in the ON position and the engine running. The charging system warning indicator is on with the key in the ON position and the engine off.

Possible Causes

- Circuitry
- High key-off current drain(s)
- Battery
- Generator

PINPOINT TEST A: THE BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

Test Step	Result / Action to Take

A1 CHECK THE BATTERY CONDITION	
• Carry out the Battery — Condition Test to determine if the battery can hold a charge and is OK for use. Refer to Section 414-01 . • **Does the battery pass the condition test?**	**Yes** GO to A2 . **No** INSTALL a new battery. REFER to Section 414-01 . TEST the system for normal operation.
A2 CHECK THE GENERATOR OUTPUT	
• Carry out the Generator On-Vehicle Load Test and No Load Test. Refer to Component Tests in this section. • **Does the generator pass the component tests?**	**Yes** GO to A3 . **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.
A3 CHECK FOR CURRENT DRAINS	
• Carry out the Battery — Drain Testing. Refer to Component Tests in this section. • **Are any circuits causing excessive current drains?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK THE VEHICLE GROUNDS	
• Key in START position. • Measure the voltage drop between the generator housing and the negative battery terminal.  • **Is the voltage drop less than 0.1 volt?**	**Yes** GO to A5 . **No** CHECK the engine ground, generator ground, and the battery ground for corrosion. TEST the system for normal operation.
A5 CHECK THE VOLTAGE DROP IN B+ CIRCUIT SDC02 (RD)	
• Measure the voltage drop between the generator B+ C102b, circuit SDC02 (RD) and the positive battery terminal.  • **Is the voltage drop less than 0.1 volt?**	**Yes** DETERMINE if the customer left any component(s) on or if there is an intermittent excessive battery draw. TEST the system for normal operation. **No** CHECK for any corrosion in the B+ circuit SDC02 (RD) positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test B: The Charging System Warning Indicator is On With the Engine Running (the Charging System Voltage Does Not Increase)

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The sense A circuit to the generator field coil is 13-15 volts. The S (stator) circuit (internal to the generator) is used to feed back a voltage signal from the generator to the voltage regulator. This voltage is used by the powertrain control module (PCM) to turn off the charging system warning indicator. The positive battery output (B+) circuit SDC02 (RD) is the generator output supplied to the battery and electrical system.

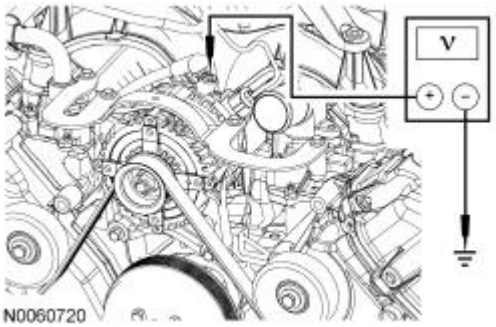
Possible Causes

- Circuitry
- Generator
- PCM

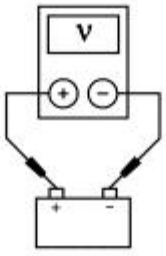
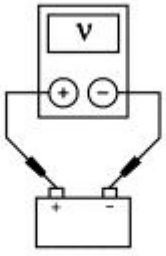
PINPOINT TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE CHARGING SYSTEM VOLTAGE DOES NOT INCREASE)

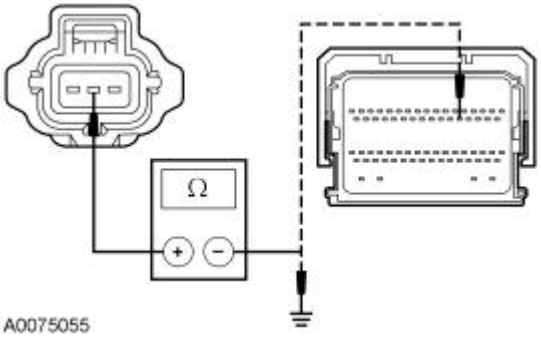
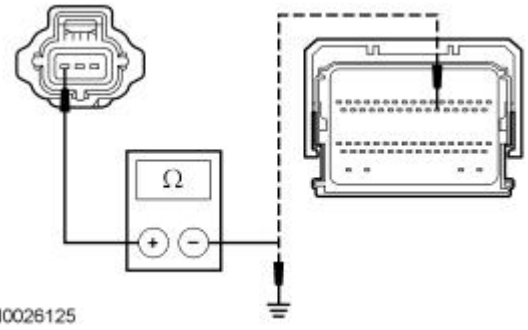
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK THE FAULT CODES IN THE POWERTRAIN CONTROL MODULE (PCM)	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs. • Check the recorded PCM DTCs from the continuous and on-demand self tests. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If referred here by the Powertrain Control/Emissions Diagnosis (PC/ED) manual, GO to B2 . **No** GO to B2 .
B2 CHECK THE GENERATOR B+ CIRCUIT SDC02 (RD) FOR VOLTAGE	
• Key in OFF position. • Measure the voltage between generator C102b, circuit SDC02 (RD), and ground.	**Yes** GO to B3 . **No** REPAIR the circuit. TEST the system for normal operation.



- **Is the voltage approximately equal to positive battery voltage?**

B3 CHECK THE GENERATOR INTEGRITY	
• Disconnect: Generator C102a. • Key in ON position, engine OFF. • Measure and record the battery voltage.  AJ0210-A • Key in START position. • **NOTE:** If the generator communication lines are disconnected (DTC P0622 may set), the generator self-excites if it is operated at greater than 4,500 rpm (approximately wide open throttle [WOT]) for a minimum of 3 seconds. It then operates in a default mode at approximately 13.5 volts until the engine is turned off. • With the engine running (after the brief WOT has been carried out), measure the battery voltage.  AJ0210-A • **Does the battery voltage increase a minimum of 0.5 volt from the key ON, engine OFF measurement to the key ON, engine running measurement (after the brief WOT or snap acceleration has been carried out)?**	**Yes** GO to B4 . **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.
B4 CHECK CIRCUIT CDC10 (BU/OG) FOR AN OPEN OR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: PCM C175b. • Measure the resistance between the generator C102a-2, circuit CDC10 (BU/OG), harness side and the PCM C175b-22, circuit CDC10 (BU/OG), harness side; and between the	**Yes** GO to B5 . **No** REPAIR the circuit. TEST

generator C102a-2, circuit CDC10 (BU/OG), harness side and ground.  A0075055 • **Is the resistance less than 5 ohms between the generator and the PCM, and greater than 10,000 ohms between the generator and ground?**	the system for normal operation.
B5 CHECK CIRCUIT CDC15 (VT) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between the generator C102a-1, circuit CDC15 (VT), harness side and the PCM C175b-23, circuit CDC15 (VT), harness side; and between the generator C102a-1, circuit CDC15 (VT), harness side and ground.  N0026125 • **Is the resistance less than 5 ohms between the generator and the PCM, and greater than 10,000 ohms between the generator and ground?**	**Yes** GO to B6 . **No** REPAIR the circuit. TEST the system for normal operation.
B6 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . REPEAT the self-test. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test C: The Charging System Overcharges (Battery Voltage is Greater Than 15.5 Volts)

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

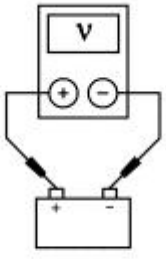
Normal Operation

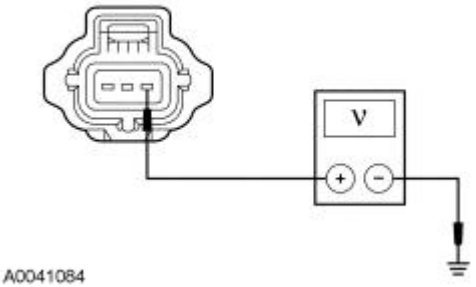
The generator output is determined by the voltage of the A circuit SDC02 (RD). The A circuit voltage is compared to a set voltage internal to the regulator, and the regulator controls the generator field current to maintain the correct generator output. The set voltage varies with temperature and is typically higher in cold temperatures and lower in warm temperatures.

Possible Causes

- A circuit SDC02 (RD) open or high resistance
- Generator
- Powertrain control module (PCM)

PINPOINT TEST C: THE CHARGING SYSTEM OVERCHARGES (BATTERY VOLTAGE IS GREATER THAN 15.5 VOLTS)

Test Step	Result / Action to Take
C1 CHECK THE FAULT CODES IN THE POWERTRAIN CONTROL MODULE (PCM)	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs. • Check for recorded PCM DTCs from the continuous and on-demand self tests. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If referred here by the Powertrain Control/Emissions Diagnosis (PC/ED) manual, GO to C2 . **No** GO to C2 .
C2 CHECK THE BATTERY VOLTAGE	
• Key in START position. • With the engine running and all the accessories turned off, measure the voltage at the battery while varying the engine rpm.  AJ0210-A • **Is the voltage greater than 15.5 volts?**	**Yes** GO to C3 . **No** GO to C4 .
C3 CHECK FOR A VOLTAGE DROP IN CIRCUIT SDC02 (RD)	
• Key in OFF position. • Disconnect: Generator C102a. • Measure the voltage between the generator C102a-3, circuit SDC02 (RD), harness side and ground.	**Yes** CONNECT the generator C102a. GO to C4 . **No** REPAIR the circuit for high resistance. TEST the system for normal operation.



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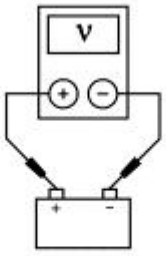
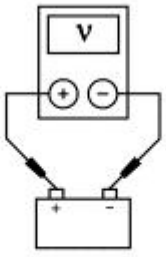
- **Is the voltage within 0.5 volt of the battery voltage?**

C4 CHECK THE GENERATOR PIDS	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Monitor PCM PIDs. • Monitor the PID GEN_COM in the PCM. • **Does the GEN_COM PID read YES?**	**Yes** GO to C5 . **No** GO to C6 .
C5 CHECK THE GENERATOR INTEGRITY	
• Key in OFF position. • Disconnect: Generator C102a. • Key in ON position, engine OFF. • Measure and record the battery voltage.  AJ0210-A • Key in START position. • **NOTE:** If the generator communication lines are disconnected (DTC P0622 may be set), the generator self-excites if it is operated at greater than 4,500 rpm (approximately wide open throttle [WOT]) for a minimum of 3 seconds. It then operates in a default mode at approximately 13.5 volts until the engine is turned off. • With the engine running (after the brief WOT has been carried out), measure the battery voltage.  AJ0210-A • **Does the battery voltage increase a minimum of 0.5 volt from the key ON, engine OFF measurement to the key ON, engine running measurement (after the brief WOT or snap acceleration has been carried out)?**	**Yes** GO to C6 . **No** INSTALL a new generator. REFER to Section 414-02 . TEST for normal operation.

C6 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: The Charging System Warning Indicator is On With the Engine Running (the Battery Increases Voltage)

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

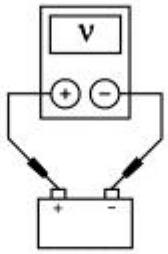
With the engine running, the charging system warning indicator is off. The sense A circuit SDC02 (RD) to the generator field coil is 13-15 volts. The S (stator) circuit (internal to the generator) is used to feed back a voltage signal from the generator to the voltage regulator. This voltage is monitored by the powertrain control module (PCM) to turn off the charging system warning indicator. The positive battery output (B+) circuit SDC02 (RD) is the generator output supplied to the battery and electrical system.

Possible Causes

- Generator
- PCM

PINPOINT TEST D: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND THE BATTERY INCREASES VOLTAGE

Test Step	Result / Action to Take
D1 CHECK THE FAULT CODES IN THE POWERTRAIN CONTROL MODULE (PCM)	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs. • Check the recorded PCM DTCs from the continuous and on-demand self tests. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If referred here by the Powertrain Control/Emissions Diagnosis (PC/ED) manual, GO to D2 . **No** GO to D2 .
D2 CHECK THE SYSTEM FOR OVERCHARGING	
• Key in START position. • With the engine running and all accessories off, measure the voltage at the battery terminals while varying the engine rpm.	**Yes** Go To Pinpoint Test C . **No**

 AJ0210-A • **Is the voltage greater than 15.5 volts?**	GO to D3 .
D3 CHECK THE PCM PIDS	
• Enter the following diagnostic mode on the diagnostic tool: Monitor PCM PIDs. • With the engine running, monitor the generator output fault PID in the PCM. • **Does the PID read YES?**	**Yes** GO to D4 . **No** REFER to Section 413-01 to diagnose the charging system warning indicator.
D4 CHECK THE GENERATOR OUTPUT	
• Verify the generator output. Refer to Component Tests, Generator On-Vehicle Tests in this section. • **Did the generator pass the component tests?**	**Yes** GO to D5 . **No** INSTALL a new generator. REFER to Section 414-02 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D5 CHECK FOR CORRECT PCM OPERATION	

• Key in OFF position.
• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . REPEAT the self-test. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: The Charging System Warning Indicator is Off With the Ignition Switch in the RUN Position and the Engine Off

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

Under normal operation, the charging system warning indicator is on with the key ON and the engine off.

Possible Causes

- Powertrain control module (PCM)

PINPOINT TEST E: THE CHARGING SYSTEM WARNING INDICATOR IS OFF WITH THE IGNITION SWITCH IN THE RUN POSITION AND THE ENGINE OFF

Test Step	Result / Action to Take
E1 CHECK THE CHARGING SYSTEM WARNING INDICATOR OPERATION	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Active Commands. • Using Active Commands, turn on the charging system warning indicator in the instrument cluster. • **Is the charging system warning indicator on?**	**Yes** GO to E2 . **No** REFER to Section 413-01 to diagnose the charging system warning indicator.
E2 CHECK FOR CORRECT PCM OPERATION	

• Key in OFF position.
• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . REPEAT the self-test. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: The Generator is Noisy

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The generator is belt-driven by the engine accessory drive system.

Possible Causes

- Accessory drive belt
- Loose bolts/brackets
- Generator/pulley

PINPOINT TEST F: THE GENERATOR IS NOISY

Test Step	Result / Action to Take
F1 CHECK FOR ACCESSORY DRIVE NOISE AND MOUNTING BRACKETS	
• Key in OFF position. • Check the accessory drive belt for damage and correct installation. Refer to Section 303-05 . • Check the accessory mounting brackets and generator pulley for looseness or misalignment.	**Yes** GO to F2 . **No** REPAIR as necessary. TEST the system for normal operation.

• **Is the accessory drive OK?**	
F2 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE	
• Disconnect: Generator C102b. • Key in START position. • With the engine running, determine if the generator is still noisy. • **Is the noise still present?**	**Yes** GO to F3 . **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.
F3 CHECK THE GENERATOR FOR MECHANICAL NOISE	
• Turn all the accessories off. With the engine running, use a stethoscope or equivalent listening device to probe the generator for unusual mechanical noise. • **Is the generator the noise source?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REFER to Section 303-00 to diagnose the source of the engine noise.

Pinpoint Test G: Radio Interference

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

Possible Causes

- Generator
- Wiring/routing
- In-vehicle entertainment system

PINPOINT TEST G: RADIO INTERFERENCE

Test Step	Result / Action to Take
G1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE	
NOTE: If the original equipment manufactured (OEM) audio unit has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to OEM condition before following this pinpoint test. • Key in START position. • Start and run the engine. • Tune the radio to a station where the interference is present. • Key in OFF position. • Disconnect: Generator C102b. • Key in START position. • With the engine running, determine if the interference is still present. • **Is the interference present with the generator**	**Yes** REFER to Section 415-00 for diagnosis and testing of the in-vehicle entertainment system. **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.

disconnected?	

Component Tests

Battery — Drain Testing

WARNING: Do not attempt this test on a lead-acid battery that has recently been recharged. Explosive gases may cause personal injury. Failure to follow these instructions may result in personal injury.

CAUTION: To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10 amps.

CAUTION: If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted during the first 30 seconds, permanent damage to the CD6 audio unit will result.

NOTE: No factory-equipped vehicle should have more than a 50 milliamps (mA) (0.050) amp draw.

NOTE: Many electronic modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Use an in-line ammeter between the negative battery post and its respective cable.

NOTE: Typically, a drain of approximately one amp is attributed to an engine compartment lamp, glove compartment lamp, or interior lamp staying on continually. Other component failures or wiring shorts are located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all the fuses, it is due to the generator.

NOTE: To accurately test the drain on a battery, an in-line ammeter must be used. Use of a test lamp or voltmeter is not an accurate method due to the number of electronic modules.

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure:

1. Make sure the battery junction box (BJB) and the auxiliary relay box(es) are accessible without turning on the interior lights or the underhood lights.

2. Drive the vehicle for at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.

3. Allow the vehicle to sit with the key OFF for at least 40 minutes to allow modules to time out/power down.

4. Connect a fused (30A) jumper wire between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.

5. Disconnect the negative battery cable from the negative battery post without breaking the connection of the jumper wire.

6. **NOTE:** It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated.

Connect the battery tester between the negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10-amp capability.

7. **NOTE:** If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

   NOTE: Amperage draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.

   NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

   Remove the jumper wire.

8. Note the amperage draw. Draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference. No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

9. If the draw is found to be excessive, remove the fuses from the CJB one at a time and note the current reading. Do not reinstall fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed. Then install one fuse, note the amperage draw, remove the fuse and install the next fuse, etc.

10. If the current draw is still excessive, remove the fuses from the auxiliary relay box one at a time and note the current drop. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed. Then install one fuse, note the amperage draw, remove the fuse and install the next fuse. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.

11. Check the wiring diagrams for any circuits that run from the battery without passing through the auxiliary relay box or the BJB. If the current draw is still excessive, disconnect these circuits until the draw is found. Also disconnect the generator electrical connections if the draw can not be located. The generator may be internally shorted, causing the current drain.

Generator On-Vehicle Tests

CAUTION: To prevent damage to the generator, do not make jumper wire connections except as directed.

CAUTION: Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with the key in the ON or OFF positions. A short circuit may result and burn out the diodes.

NOTE: Battery posts and cable clamps must be clean and tight for accurate meter indications.

NOTE: Refer to the battery tester manual for complete directions for testing the charging system.

1. Turn off all lamps and electrical components.

2. Place the transmission in NEUTRAL and apply the parking brake.

3. Carry out the Load Test and No Load Test according to the following component tests:

Generator On-Vehicle Tests — Load Test

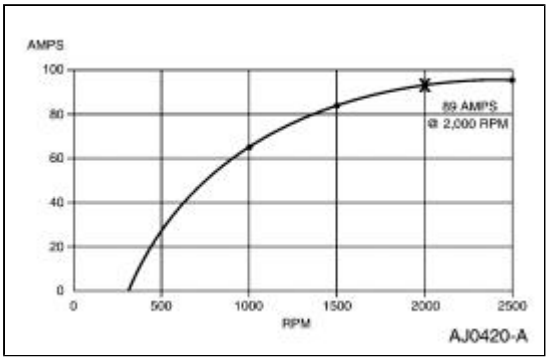
1. Switch the tester to the ammeter function.

2. Connect the positive and negative leads of the tester to the corresponding battery terminals.

3. Connect the current probe to the generator B+ output terminal, circuit SDC02 (RD).

4. With the engine running at approximately 2,000 rpm, adjust the tester load bank to determine the output of the generator. Generator output should be greater than the graph shown below. If not, refer to the pinpoint test or GO to Symptom Chart .

Expedition And Navigator



Generator On-Vehicle Tests — No Load Test

1. Switch the tester to the voltmeter function.

2. Connect the voltmeter positive lead to the generator B+ terminal, circuit SDC02 (RD) and the negative lead to ground.

3. Turn all of the electrical accessories off.

4. With the engine running at approximately 2,000 rpm, check the generator output voltage. The voltage should be between 13.2 and 15.5 volts. If not, refer to the pinpoint test or GO to Symptom Chart .

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery cable harness bracket nuts	10	—	89
Battery ground cable nut	25	18	—
Battery ground cable-to-cowl panel bolt	12	9	—
Battery ground cable-to-frame bolt	15	11	—
Battery hold-down bolt	10	—	89
Battery negative terminal bolt	5	—	44
Battery tray bolts	17	13	—
Generator harness terminal/central junction box (CJB) cable nut	9	—	80
Positive battery terminal nut	9	—	80
Starter solenoid positive cable nut	12	9	—
Starter solenoid wire nut	5	—	44

Battery and Cables

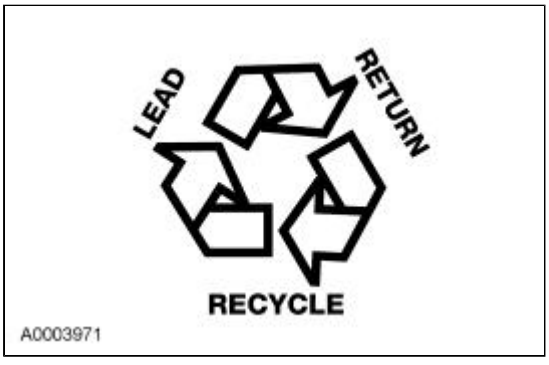
Printable View (73 KB)

Vehicles are equipped with a 12-volt maintenance-free battery.

The battery and cable system consists of the following components:

- Battery
- Battery cable assembly
- Battery tray

Ford Motor Company strongly recommends that lead-acid batteries be returned to an authorized recycling facility for disposal.



Battery

Printable View (91 KB)

Special Tool(s)

ST2442-A	Micro 490 Digital Battery Analyzer 162-00004 or equivalent

Principles of Operation

Battery Eye Operation

The purpose of the battery eye is to indicate the state of charge of the battery in the assembly plant and while on the dealership lot. The battery eye can also indicate the state-of-charge when the vehicle is delivered to the dealership and during the pre-delivery inspection process. The battery eye is made up of a viewing plate, 2 balls and a small passage. The balls indicate the specific gravity of the electrolyte by floating higher or lower in the passageway. It is important to note that the battery eye checks the specific gravity on only a single battery cell.

The color of the battery eye indicates the approximate state of charge.

- Red usually indicates the battery state-of-charge is at 40% or less.
- Yellow indicates the battery state-of-charge is between 40% and 57%.
- Green indicates the battery state-of-charge is above 57%.
- No color/black can occur after the battery has been in service for several years and some of the plate material has coated the balls.
- A clear battery eye can occur if the battery case becomes damaged and the electrolyte has fallen below the plates.

NOTE: The battery eye may remain red for a period of time (up to several days), even after the battery is fully charged, because the acid is not yet fully mixed.

Do not replace a battery based solely on the indication of the battery eye. The battery eye color simply indicates the battery state-of-charge, not its condition. For example, a red or yellow battery eye usually indicates the battery is discharged, not defective. If the battery eye indicates the battery may be discharged, it is necessary to recharge the battery before testing its condition.

Charging a Battery

Batteries discharge while the vehicle is on the dealer lot or parked by the customer for an extended period of time due to normal parasitic key-off loads. Also, vehicles still in dealer inventory or in long-term storage may be driven short distances with heavy electrical loads. Over a period of time (30 days or more), this could result in vehicles having shallow or deeply discharged batteries.

- Deeply discharged — A battery that is drained over a prolonged period of time, such as an unsold vehicle or a vehicle in storage, to the point the battery is dead.
- Shallow discharge — A battery that is drained by leaving an accessory on for several hours or a few days and has a very low charge.

The vehicle's charging system is designed to supply the electrical power needed to maintain the battery near full charge during normal vehicle use. The charging system is not capable of bringing a deeply discharged battery back near full charge in a short amount of time such as allowing the vehicle to idle for 15 minutes to "recharge the battery." Discharged batteries should be charged using an external charger.

NOTE: Battery chargers have improved greatly with the addition of the new generation pulse chargers. These chargers pulse current into the battery, breaking down the sulfation layer on the battery plates and generally reduce charging times to less than an hour.

NOTE: Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature.

The following chart summarizes 2 recommended methods of charging.

Type of Battery Discharge	Pulse Charger	Standard Charger
Deeply discharged	Follow directions supplied with the pulse charger	2 to 8 hours and may take up to an hour to accept initial charge
Shallow discharge	45 minutes to an hour charge	2 hours (40A) on manual setting or medium automatic setting

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

   Visual Inspection Chart

Mechanical	Electrical
• Battery • Battery mounting	• Battery cables • Battery posts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, Go To Pinpoint Test A .

Pinpoint Tests

Pinpoint Test A: Battery Condition Test

Normal Operation

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

Possible Causes

- Battery charge
- Battery

PINPOINT TEST A: BATTERY CONDITION TEST

Test Step	Result / Action to Take
A1 TEST THE BATTERY CONDITION	
NOTE: No battery with a red test-eye should be replaced. The red eye only means the battery is discharged, not necessarily defective. **NOTE:** Failure to fully charge the battery before retesting may cause false readings. ● Verify the battery condition using the battery analyzer. ● **Is the battery OK?**	**Yes** If the meter reads GOOD BATTERY, RETURN the battery to service. If the meter reads GOOD-RECHARGE, CHARGE the battery and RETURN it to service. If the meter reads CHARGE & RETEST, fully CHARGE and RETEST the battery. **No** If the meter reads REPLACE BATTERY, INSTALL a new battery. If the meter reads BAD CELL-REPLACE, INSTALL a new battery.

Battery Disconnect

Printable View (81 KB)

WARNING: Batteries normally produce explosive gases. Therefore, do not allow flames, sparks, or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: To avoid accidental deployment and possible injury, the backup power supply must be depleted before repairing or installing any front air bag or side air curtain supplemental restraint system (SRS) components and before repairing, installing, adjusting or striking components near the front air bag or side air curtain sensors, such as the doors, instrument panel, console, door latches, strikers, seats and hood latches. To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect the auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may result in personal injury.

WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

WARNING: Keep batteries out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted during the first 30 seconds, permanent damage to the CD6 audio unit will result.

NOTE: When the battery (or powertrain control module [PCM]) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system setpoint may also vary. The vehicle may need to be driven to relearn its strategy.

1. **CAUTION: Do not lift the battery ground terminal by grabbing onto the wire.**

   Disconnect the battery negative cable.
   - To connect, tighten to 5 Nm (44 lb-in).

2. **CAUTION: Do not lift the positive battery terminal by grabbing onto the wire or lifting underneath the terminal cover.**

   Disconnect the positive battery cable.
   - To connect, tighten to 9 Nm (80 lb-in).

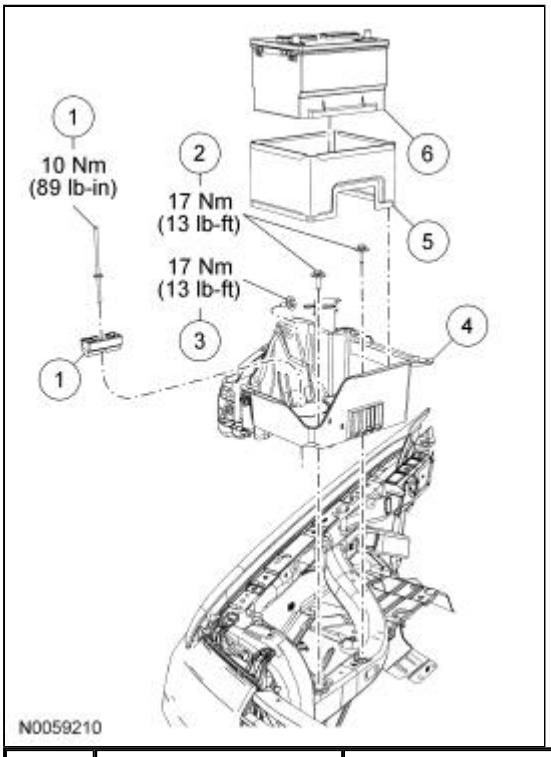
3. **CAUTION: Do not tap, press or excessively push on the battery terminals.**

NOTE: Make sure the battery terminals slide all of the way down the battery post and is not tilted.

To connect, reverse the disconnect procedure.

Battery and Battery Tray — Exploded View

Printable View (122 KB)



Item	Part Number	Description
1	10747	Battery hold-down clamp and bolt
2	N811866-S100	Battery tray bolts
3	N811866-S439	Battery tray bolts
4	10732	Battery tray
5	10A687	Battery heat shield
6	10655	Battery

1. For additional information, refer to the procedures in this section.

Battery

Printable View (79 KB)

Removal and Installation

1. Disconnect the battery cables. For additional information, refer to Battery Disconnect in this section.

2. Loosen and remove the battery hold-down bolt and clamp.
   - To install, tighten to 10 Nm (89 lb-in).

3. **WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to leak out through the vent caps, resulting in personal injury, or damage to the vehicle or battery. Lift with a battery carrier. Failure to follow these instructions may result in personal injury.**

   Remove the battery and the heat shield.

4. To install, reverse the removal procedure.

Battery Tray

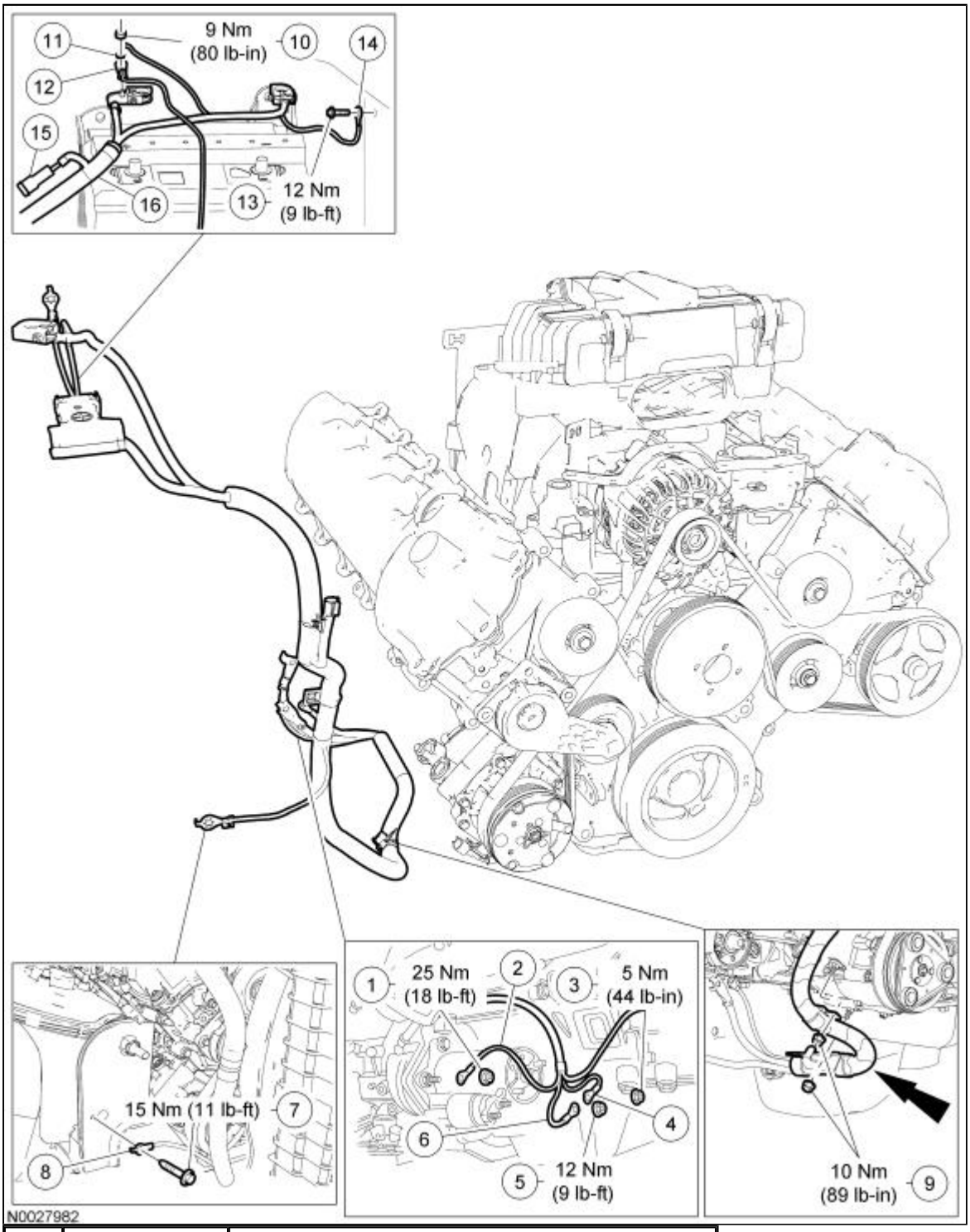
Printable View (63 KB)

Removal and Installation

1. Remove the battery. For additional information, refer to Battery in this section.
2. Remove the battery tray. For additional information refer to Section 501-16 .

Battery Cables

Printable View (306 KB)



Item	Part Number	Description
1	N805024-S901	Battery ground cable nut
2	—	Battery ground cable terminal (part of 14B060)
3	N805320-S100	Starter solenoid wire nut

4	—	Starter solenoid wire terminal (part of 14B060)
5	W706414-S413	Starter solenoid positive cable nut
6	—	Starter solenoid positive cable terminal (part of 14B060)
7	—	Battery ground cable-to-frame bolt (part of 14B060)
8	—	Battery ground cable frame terminal (part of 14B060)
9	N621906-S438	Battery cable harness bracket nuts (2 required)
10	W520101-S437M	Generator harness terminal/central junction box (CJB) cable nut
11	—	CJB cable terminal (part of 14300)
12	—	Generator harness terminal (part of 14305)
13	N806925-S437M	Battery ground cable-to-cowl panel bolt
14	—	Battery ground cable-to-body terminal (part of 14B060)
15	—	Battery cable harness in-line electrical connector (part of 14B060)
16	14B060	Battery cable harness assembly

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.

3. Remove the nut and position the battery ground cable terminal aside at the starter.
   - To install, tighten to 25 Nm (18 lb-ft).

4. Remove the nut and position the starter solenoid positive cable terminal aside.
   - To install, tighten to 12 Nm (9 lb-ft).

5. Remove the nut and position the starter solenoid wire terminal aside.
   - To install, tighten to 5 Nm (44 lb-in).

6. Remove the 2 nuts and position the 2 battery cable harness brackets from the A/C compressor mounting bolts.
   - To install, tighten to 10 Nm (89 lb-in).

7. Remove the bolt and position the battery ground cable-to-frame terminal aside.
   - To install, tighten to 15 Nm (11 lb-ft).

8. Remove the nut and position the generator harness terminal and the CJB cable terminal aside.
   - To install, tighten to 9 Nm (80 lb-in).

9. Remove the bolt and position the battery ground cable-to-cowl panel terminal aside.
   - To install, tighten to 12 Nm (9 lb-ft).

10. Disconnect the battery cable harness in-line electrical connector, release the harness locator and remove the battery cable harness assembly.

11. To install, reverse the removal procedure.

Printable View (78 KB)

General Specifications

Item	Specification
Generator	
Rating	89/157 amp (max) @ 1,800-6,000 generator rpm, approximately 500-2,000 engine rpm
Generator pulley ratio	2.96:1
Voltage regulator type	Electronic internal with generator

Torque Specifications

Description	Nm	lb-ft	lb-in
Generator B+ terminal nut	8	—	71
Generator bolts	25	18	—
Generator bracket bolts	10	—	89

Generator

Printable View (62 KB)

The generator is belt-driven by the engine accessory drive system. The generator has an internal voltage regulator that is not replaced separately. The generator and voltage regulator are repaired as an assembly.

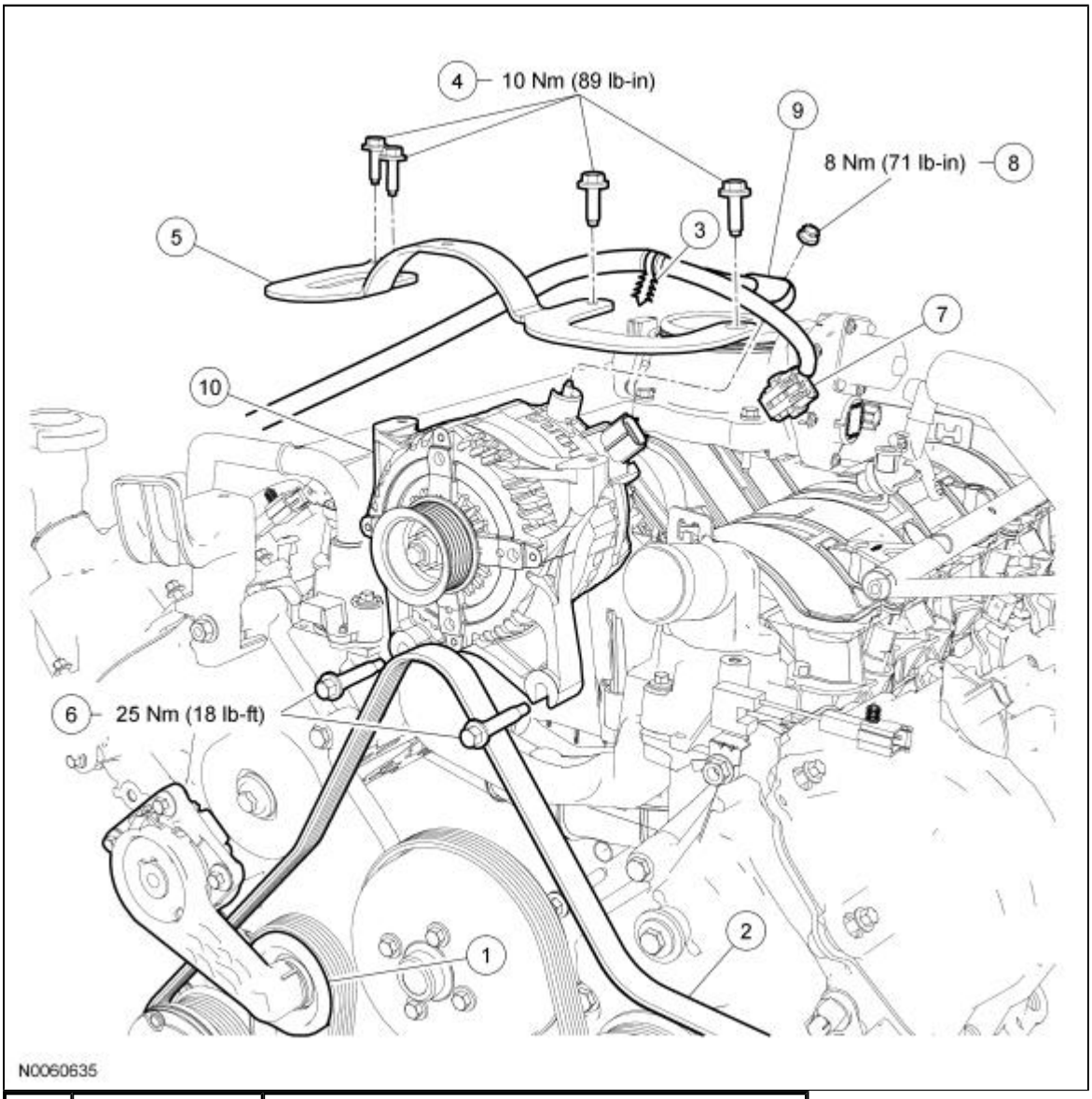
Generator

Printable View (62 KB)

Refer to Section 414-00 .

Generator

Printable View (305 KB)



Item	Part Number	Description
1	6B209	Front end accessory drive belt tensioner
2	8620	Front end accessory drive belt
3	—	Generator harness locator
4	N807309	Generator bracket bolts (4 required)
5	10153	Generator bracket
6	N811334	Generator bolts (2 required)
7	—	Generator electrical connector (part of 12B637)
8	W705790-S901	Generator B+ terminal nut
9	—	Generator B+ terminal (part of 12B637)
10	10300	Generator

Removal and Installation

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. For Navigator, release the 2 retainers and remove the engine cover.
3. Remove the air cleaner intake pipe. For additional information, refer to Section 303-12 .
4. Rotate the front end accessory drive belt tensioner counterclockwise and position the accessory drive belt aside.
5. Remove the harness locator from the generator bracket.
6. Remove the 4 bolts and the generator bracket.
   - To install, tighten to 10 Nm (89 lb-in).
7. Remove the 2 bolts and position the generator aside.
   - Tighten to 25 Nm (18 lb-ft).
8. Disconnect the generator electrical connector.
9. Position the generator B+ protective cover aside, remove and discard the nut, then position the generator B+ terminal aside.
   - Install a new B+ terminal nut; tighten to 8 Nm (71 lb-in).
10. Remove the generator.
11. To install, reverse the removal procedure.

Audio System

Printable View (430 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

Audio Unit

The audio unit can be operated while the key is in RUN or ACC. The accessory delay feature allows the audio unit to be operated for a preset period of time after the key is moved to OFF and a front door has not been opened. The audio unit sends AC voltage audio signals to the speakers or to the amplifier, depending on vehicle configuration. The audio unit can produce its own DTCs, which can be communicated to the scan tool through the medium speed controller area network (MS-CAN), or can be retrieved through the audio unit self-test by simultaneously pressing presets 3 and 6. The audio unit communicates via the MS-CAN.

Satellite Audio

The satellite audio system consists of a satellite radio receiver, a satellite radio antenna, and an antenna cable. The satellite radio antenna receives digital audio signals and sends them to the satellite radio receiver, where the signals are converted and sent to the auxiliary audio module (or the DVD player, if equipped). The satellite radio receiver communicates via the MS-CAN.

Antenna — AM/FM

The combination AM/FM antenna is located on the right rear quarter-glass. An antenna amplifier is used to amplify the signals to the audio unit. The AM/FM antenna cannot be replaced separately from the quarter glass.

Subwoofer

The Audiophile subwoofer and amplifier are integral. The subwoofer in the THX® audio system is powered by the THX® amplifier. The enable/clip detection circuit carries out 2 functions: to turn the amplifier on, and to indicate to the audio unit when the subwoofer output distortion signal reaches a damaging level. The audio unit then clips the audio output signal to prevent damage to the subwoofer.

Auxiliary Audio Module

The auxiliary audio module allows rear-seat users to select audio functions. It allows for single/dual-play mode. The auxiliary audio module communicates via the MS-CAN.

Digital Versatile Disc (DVD) Player

When a video disc is inserted into the DVD player and the PLAY button is pressed, an image is displayed on the screen and a stereo signal is transmitted to the audio unit. The DVD player allows for single/dual-play mode. The DVD player communicates via the MS-CAN.

Single-Play Mode

In single-play mode, any audio input routed through the auxiliary audio module (or DVD player) is broadcast through all of the vehicle speakers. These audio inputs include the DVD player and peripheral gaming devices plugged into the auxiliary audio module (or DVD player).

Dual-Play Mode (All Audio Systems Except THX®)

In dual-play mode, the audio unit continues to control the output to the front speakers, while the auxiliary audio module (or DVD player) controls the audio to the rear speakers and headphones.

Dual-Play Mode (THX®)

In dual-play mode, the audio unit continues to control all of the vehicle speakers. The auxiliary audio module (or DVD player) controls the audio output to the headphones only.

THX® Audio System

The THX® audio system provides theatre quality sound in the vehicle. Audio signals are sent to the THX® amplifier, which processes the audio signals and sends them to the 12 speakers: 4 door speakers, 2 tweeter speakers, 3 front/center speakers, 2 D-pillar tweeters, and a subwoofer. The THX® amplifier communicates via the MS-CAN.

Navigation

The navigation audio unit generates a display on a video screen. When an on-screen menu key is pressed, a new screen is displayed corresponding to the key that was pressed. The navigation audio unit is available with the THX® or Audiophile sound systems. For additional information on the navigation system, refer to Section 419-07 .

Steering Wheel Controls

The steering wheel controls consist of a series of resistors. Each steering wheel control switch function corresponds with a specific resistance value within the switch. When a switch is pressed, the audio unit monitors the change in reference voltage to determine the requested function.

Audio Input Jack

The audio input jack allows for a portable MP3 player to be connected to the vehicle audio system. When a portable MP3 player is connected, audio from the MP3 player can be played through the vehicle speakers.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine ignition and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections.

Network Communication

The following audio system components communicate via the MS-CAN:

- Audio unit
- Navigation audio unit
- Satellite radio receiver
- Auxiliary audio module
- DVD player
- THX® amplifier

The following messages are utilized by the audio system:

Message	Transmitting Module	Receiving Module(s)	Audio System Function
Ignition Switch Position	Instrument Cluster	Audio Unit Satellite Radio Receiver Digital Versatile Disc (DVD) Player THX® Amplifier	Indicates ignition switch position for power-up/shut-down.
Backlight Dimmer	Smart Junction Box (SJB)	Audio Unit DVD Player Auxiliary Audio Module	Controls the backlight intensity, based on the position of the dimmer switch.
Transmission Gear Selected	Instrument Cluster	Audio Unit	With the vehicle in REVERSE (R), the audio unit mutes the speaker output when a reverse parking aid tone is sounded (if equipped). For navigation system, this signal is used for more accurate navigation tracking.
Delayed Accessory Status	SJB	Audio Unit DVD Player Auxiliary Audio Module	When active, this signal allows the audio component to be operated after the vehicle is shut off.
Engine RPM Data	Instrument Cluster	Audio Unit THX® Amplifier	Used by the audio unit (or THX® amplifier) for the speed-compensated volume function.
Steering Wheel Position	Instrument Cluster	Audio Unit	For navigation system, this signal is used for more accurate navigation tracking.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Audio unit
• Antenna
• Digital versatile disc (DVD) player
• Auxiliary audio module
• Steering wheel controls
• Audio input jack
• Speaker(s)
• Noise suppression equipment
	• Smart junction box fuse(s):
	  ▪ 3 (15A) (satellite radio receiver/DVD player power)
	  ▪ 28 (5A) (audio unit hot in START)
	  ▪ 38 (20A) (subwoofer power) (Audiophile only)
	  ▪ 38 (20A) (amplifier power) (THX® only)
	  ▪ 39 (20A) (audio unit hot at all times)
	  ▪ 40 (20A) (amplifier power) (THX® only)
	• Circuitry

3. If the fault is visually evident, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. **NOTE:** Do not press any buttons on the audio unit while the audio unit is carrying out the self-test.

   Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the audio unit.

9. If the DTCs retrieved are related to the concern, go to the Audio Unit Diagnostic Trouble Code (DTC) Chart, the THX® Amplifier Diagnostic Trouble Code (DTC) Chart, the Digital Versatile Disc (DVD) Player Diagnostic Trouble Code (DTC) Chart, the Auxiliary Audio Module Diagnostic Trouble Code (DTC) Chart or the Satellite Radio Receiver Diagnostic Trouble Code (DTC) Chart.

10. If no DTCs related to the concern are retrieved, go to the Speaker Walk-Around Test, the Audio Unit Self-Diagnostic Mode, or the Satellite Audio Bezel Diagnostic Test.

Speaker Walk-Around Test

NOTE: To enter the speaker walk-around test or audio unit self-diagnostic mode, the audio unit must be turned on and in radio tuner mode (AM/FM).

1. To enter the speaker walk-around test, simultaneously press the audio unit preset buttons 3 and 6.

2. The speaker walk-around test stops at each speaker and applies sound to each speaker for about 1 to 2 seconds. Each speaker is tested and displayed on the audio unit in the following sequence:
    - Except THX®: RF, LF, LR, RR, SUBWOOFER
    - THX®: CSA FRONT, TWEETER LF, TWEETER RF, CENTER REAR, SPEAKER LF, SPEAKER RF, SPEAKER LR, SUBWOOFER, SPEAKER RR

3. To exit the speaker walk-around test, turn the key to OFF, turn the audio unit off, or press preset button 1 for diagnostics.

Audio Unit Self-Diagnostic Mode

NOTE: To enter the audio unit self-diagnostic mode, the audio unit must be turned on and in radio tuner mode (AM/FM).

1. To enter the following tests, press the desired preset button while in the speaker walk-around test or while in the audio unit self-diagnostic mode.

2. The self-diagnostic mode has the following functions available:
    - Preset button 1 = On-Demand Self-Test. This button runs the on-demand self-test.
        - Pressing the MENU DOWN button allows scrolling of any DTCs found during the test while in this menu.
    - Preset button 2 = Display Continuous DTCs. This button enables viewing of any continuous DTCs that have been logged.
        - Pressing the MENU UP button allows scrolling of any DTCs while in this menu.
        - While continuous DTCs are being displayed, pressing the EJECT button will clear all present DTCs.
    - Preset button 3 = Signal Strength Test. This button displays the signal strength.
    - Preset button 4 = Software Version Display. This button displays the audio unit software version.
        - Pressing the MENU UP button allows scrolling of all audio subsystem software versions while in this menu.
    - Preset button 5 = Display Test. This test illuminates all the display segments for 5 seconds, then turns all segments off.
    - Preset button 6 = Configuration Status. This button enables audio unit configuration status.
        - Pressing the MENU button displays the audio unit part number while in this menu.

3. To exit the self-diagnostic mode, turn the audio unit off or turn the key to OFF.

4. If the concern remains and the fault is not detected, GO to Symptom Chart to continue diagnostics.

Satellite Audio Bezel Diagnostic Test

NOTE: To enter the satellite audio bezel diagnostic test, the audio unit must be on and in SAT mode.

1. To enter the satellite audio bezel diagnostic test, simultaneously press and hold the AUX button and preset button 2 (except navigation), or press SOUND and preset button 1 (navigation).

2. Upon entering the self-test, the audio unit produces 2 continuously alternating tones of different pitch, one for the right channel, then one for the left.

3. The test continues by displaying any DTCs currently present. If no DTCs are present, NO DTCS will be displayed. If there are DTCs present, the audio unit will auto-scroll through the list of active DTCs.

4. Historical DTCs can be viewed by pressing the AUX button and preset button 2 simultaneously while in the active DTC mode.
    - If any DTCs are present, pressing the AUX button and preset button 2 will prompt CLEAR DTCS? on the audio unit.
    - To clear historical DTCs, press preset buttons 1, 2, and 3 consecutively within 4 seconds.
    - To exit historical DTCs (with or without clearing DTCs), press the AUX button and preset button 2 simultaneously.

5. If no historical DTCs are present, pressing the AUX button and preset button 2 simultaneously while in active DTC mode will display the DLP software version.

6. To exit the satellite audio bezel diagnostic test, press the AUX button and preset button 2 simultaneously while the DLP software version is displayed, or turn the audio unit off.

7. If the concern remains and the fault is not detected, GO to Symptom Chart .

Audio Unit Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1117	Audio Steering Wheel Button Stuck	VERIFY no steering wheel control buttons are stuck and that no steering wheel control buttons are pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B1117 is retrieved again, Go To Pinpoint Test J .
B1119	Audio Disc DVD Player Thermal Shutdown	ALLOW the audio unit to cool. DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B1136	Audio Steering Wheel Switch #2 Circuit Failure	Go To Pinpoint Test J .
B1140	Map Disk Invalid	REFER to Section 419-07 to continue diagnosis of the navigation system.
B1154	Subwoofer #1 Short to Ground	Go To Pinpoint Test F .
B1155	Subwoofer #1 Short to Battery	Go To Pinpoint Test F .
B1318	Battery Voltage Low	CLEAR the DTCs. REPEAT the self-test. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2103	Antenna Not Connected	Go To Pinpoint Test A .
B2204	GPS Antenna Connection Open or Short	REFER to Section 419-07 to continue diagnosis of the navigation system.
B2274	Phone Transceiver Active Circuit Failure	DTC is not applicable. The vehicle is not equipped with cellular phone functionality. DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B2384	Audio Reverse Park Aid Mute Ckt Failure	VERIFY the audio unit is configured to receive the vehicle speed signal through the medium speed controller area network (MS-CAN).

		REFER to Section 418-01 .
B2404	Audio Steering Wheel Switch Circuit Fault	Go To Pinpoint Test J .
B2405	Audio Disc CD Player Thermal Shutdown Fault	ALLOW the audio unit to cool. DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B2406	Audio Disc CD Player Internal Fault	CLEAR the DTCs. REPEAT the self-test. If DTC B2406 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
B2633	Driver-Front Microphone Circuit Failure	Go To Pinpoint Test N .
B2656	DVD (Digital Versatile Disk) Error	INSERT a known good navigation map DVD. CLEAR the DTCs. REPEAT the self-test. If DTC B2656 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2913	Audio Subwoofer Not Connected	Go To Pinpoint Test F .
B2924	Audio Button Stuck	VERIFY no audio unit buttons are stuck and that no audio unit button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2965	Audio System Speaker Circuit Fault	For vehicles with bench seat, Go To Pinpoint Test B . For vehicles without bench seat or THX® audio system, Go To Pinpoint Test C . For vehicles with THX® audio system, Go To Pinpoint Test D .
C1992	Vehicle Speed Circuit Failure	VERIFY the audio unit is configured to receive the vehicle speed signal through the MS-CAN. REFER to Section 418-01 .
P0812	Reverse Input Circuit	VERIFY the audio unit is configured to receive the reverse input signal through the MS-CAN. REFER to Section 418-01 .
U0140	Lost Communication With Body Control Module (GEM)	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. VERIFY the operation of the illumination system and the accessory delay. ■ If the illumination system or the accessory delay does not operate correctly, REFER to Section 413-00 (illumination) or Section 501-11 (accessory delay). ■ If the illumination system and the accessory delay operate correctly, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. CARRY OUT the smart junction box (SJB) self-test. ■ If DTC U0155 is present in both the audio unit and the SJB, INSTALL a new instrument cluster. REFER to Section 413-

		01 . CLEAR the DTCs. REPEAT the self-test. ■ If DTC U0155 is only present in the audio unit, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U0159	Lost Communication With Parking Assist Control Module (PAM)	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go To Pinpoint Test K .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Go To Pinpoint Test G .
U0197	Lost Communication With Telephone Control Module	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	Go To Pinpoint Test E .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	GO to Symptom Chart .
U2050	No Application Present	CONFIGURE the audio unit. REFER to Section 418-01 . REPEAT the self-test. If DTC U2050 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U2051	One or More Calibration Files Missing/Corrupt	CONFIGURE the audio unit. REFER to Section 418-01 . REPEAT the self-test. If DTC U2051 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U2473	Unexpected Vehicle Speed (VSS)	REFER to Section 419-07 to continue diagnosis of the navigation system.

THX® Amplifier Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1158	Subwoofer #2 Open	Go To Pinpoint Test D .
B1317	Battery Voltage High	CLEAR the DTCs. REPEAT the self-test. If DTC B1317 is retrieved again, REFER to Section 414-00 to diagnose the over-charging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. REPEAT the self-test. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.

B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
B2913	Audio Subwoofer Not Connected	Go To Pinpoint Test D .
B2925	Subwoofer Speaker Short Circuit	Go To Pinpoint Test D .
B292A	Subwoofer #2 Speaker Short Circuit	Go To Pinpoint Test D .
B2965	Audio System Speaker Circuit Fault	Go To Pinpoint Test D .
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. CARRY OUT the smart junction box (SJB) self-test. ■ If DTC U0155 is present in both the THX® amplifier and the SJB, INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. ■ If DTC U0155 is only present in the THX® amplifier, INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.
U0184	Lost Communication With Radio (ACM)	GO to Symptom Chart
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Go To Pinpoint Test G .
U2050	No Application Present	CONFIGURE the THX® amplifier. REFER to Section 418-01 . REPEAT the self-test. If DTC U2050 is retrieved again, INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.
U2051	One or More Calibration Files Missing/Corrupt	CONFIGURE the THX® amplifier. REFER to Section 418-01 . REPEAT the self-test. If DTC U2051 is retrieved again, INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.

Digital Versatile Disc (DVD) Player Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1119	Audio Disc DVD Player Thermal Shutdown	ALLOW the DVD player to cool. DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B111F	LCD Thermal Shutdown	ALLOW the DVD player to cool. DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B1317	Battery Voltage High	CLEAR the DTCs. REPEAT the self-test. If DTC B1317 is retrieved again, REFER to Section 414-00 to diagnose the over-charging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. REPEAT the self-test. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved

		again, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
B2656	DVD (Digital Versatile Disk) Error	INSTALL a known good DVD into the DVD player. CLEAR the DTCs. REPEAT the self-test. If DTC B2656 is still present, REMOVE the DVD player and SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.
B2924	Audio Button Stuck	VERIFY no DVD player buttons are stuck and that no DVD player button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
U0140	Lost Communication With Body Control Module (GEM)	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. VERIFY the operation of the illumination system and the accessory delay. ■ If the illumination system or the accessory delay does not operate correctly, REFER to Section 413-00 (illumination) or Section 501-11 (accessory delay). ■ If the illumination system and the accessory delay operate correctly, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
U0184	Lost Communication With Radio (ACM)	GO to Symptom Chart .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go To Pinpoint Test K .
U2050	No Application Present	CONFIGURE the DVD player. REFER to Section 418-01 . REPEAT the self-test. If DTC U2050 is retrieved again, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.

Auxiliary Audio Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1318	Battery Voltage Low	CLEAR the DTCs. REPEAT the self-test. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
B2924	Audio Button Stuck	VERIFY no rear audio controls button is stuck and that no rear audio controls button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the

		system for normal operation.
U0140	Lost Communication With Body Control Module (GEM)	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. VERIFY the operation of the illumination system and the accessory delay. ■ If the illumination system or the accessory delay does not operate correctly, REFER to Section 413-00 (illumination) or Section 501-11 (accessory delay). ■ If the illumination system and the accessory delay operate correctly, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation.
U0184	Lost Communication With Radio (ACM)	GO to Symptom Chart .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go To Pinpoint Test K .
U2050	No Application Present	CONFIGURE the auxiliary audio module. REFER to Section 418-01 . REPEAT the self-test. If DTC U2050 is retrieved again, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation after the repair.

Satellite Radio Receiver Diagnostic Trouble Code (DTC) Chart

NOTE: While running the satellite audio bezel diagnostic test, DTCs contain the characters "SAT" after the 5-digit DTC.

DTC	Description	Action
B1031	SDARS Satellite Antenna Open	Go To Pinpoint Test L .
B1032	SDARS Satellite Antenna Short	Go To Pinpoint Test L .
B1318	Battery Voltage Low	CLEAR the DTCs. REPEAT the self-test. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, REMOVE the satellite radio receiver and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
U0184	Lost Communication With Radio (ACM)	GO to Symptom Chart .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Go To Pinpoint Test G .
U0197	Lost Communication With Telephone Control Module	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0249	Lost Communication With Entertainment Control	GO to Symptom Chart .

	Module - Rear "B" (RCU)	
U0255	Lost Communication With Front Controls Interface Module	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0256	Lost Communication With Front Display Interface Module	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U2050	No Application Present	CONFIGURE the satellite radio receiver. REFER to Section 418-01 . REPEAT the self-test. If DTC U2050 is retrieved again, REMOVE the satellite radio receiver and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the audio unit	• Fuse • Circuitry • Audio unit	• REFER to Section 418-00 .
• No communication with the satellite radio receiver	• Fuse • Circuitry • Satellite radio receiver	• REFER to Section 418-00 .
• No communication with the THX® amplifier	• Fuse • Circuitry • THX® amplifier	• REFER to Section 418-00 .
• No communication with the digital versatile disc (DVD) player	• Fuse • Circuitry • DVD player	• REFER to Section 418-00 .
• No communication with the auxiliary audio module	• Fuse • Circuitry • Auxiliary audio module	• REFER to Section 418-00 .
• The satellite audio is inoperative/does not operate correctly	• Circuitry • Auxiliary audio module (if equipped) • DVD player (if equipped) • Satellite radio receiver • Audio unit	• Go To Pinpoint Test K .
• The navigation audio unit is inoperative/does not operate correctly	• Circuitry • Audio unit	• REFER to Section 419-07 .
• The video system is inoperative/does not operate correctly — no video	• Damaged DVD • DVD player	• VERIFY a good DVD is inserted into the DVD player. TEST the system for normal operation. If the concern is still present, REMOVE the DVD player and SEND it to an

		authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
• The video system does not operate correctly — no audio	• Circuitry • DVD player • Audio unit	• Go To Pinpoint Test G .
• The audio unit display is blank, but the audio unit operates	• Audio unit	• REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• The audio unit backlighting does not operate correctly	• Circuitry • Module configuration • Audio unit	• VERIFY the audio unit is configured for network-based illumination. ▪ If the audio unit is configured correctly, REFER to Section 413-00 , to continue diagnosis of a single illumination source inoperative. ▪ If the audio unit is not configured correctly, CONFIGURE the audio unit. REFER to Section 418-01 . TEST the system for normal operation.
• During CD mode, the audio unit displays: NO CD	• Damaged CD • Audio unit	• INSERT a known good CD. If the concern is still present, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• Poor reception — AM/FM	• Circuitry • Antenna • Antenna cable • Charging system • Ignition system • Noise suppression equipment • Antenna module • Audio unit	• Go To Pinpoint Test A .
• Poor reception — satellite audio	• Obstructions to the line of sight	• DRIVE the vehicle to an open area and TEST the reception. ▪ If the reception is OK, INFORM the customer that the satellite signal can be affected by obstructions to the

	• Satellite antenna • Satellite antenna cable • Satellite radio receiver	satellite antenna line of sight. ▪ If the reception is not OK, Go To Pinpoint Test L . • Go To Pinpoint Test L .
• Continuous seek/scan in AM/FM	• RDS function setting • Antenna cable • Noise suppression equipment • Antenna • Audio unit	• VERIFY the RDS is set to ALL. SCAN for a good channel. ▪ If a good channel is found, the cause of the concern was that no RDS channel in the selected category was found. The system is OK. ▪ If no good channel is found, Go To Pinpoint Test A . • Go To Pinpoint Test A .
• Poor quality/distorted/no sound from one or more speakers (not all speakers) — vehicles with bench seat	• Circuitry • Speaker • Audio unit	• Go To Pinpoint Test B .
• Poor quality/distorted/no sound from one or more speakers (not all speakers) — vehicles without bench seat or THX® audio system	• Circuitry • Speaker • Auxiliary audio module (if equipped) • DVD player (if equipped) • Audio unit	• Go To Pinpoint Test C .
• Poor quality/distorted/no sound from one or more speakers (not all speakers) — THX®	• Fuse • Circuitry • Speaker • Subwoofer • THX® amplifier • Audio unit	• Go To Pinpoint Test D .
• Poor quality/distorted/no sound from all speakers — except THX® audio system	• Circuitry • Audio unit	• With the key in RUN, MEASURE the voltage between the audio unit C240a-15, circuit CBP28 (GY/VT), harness side and ground. ▪ If voltage is present, REPAIR the circuit. TEST the system for

		normal operation. ■ If no voltage is present, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• No sound from all speakers — THX® audio system	• Fuse • Circuitry • THX® amplifier • Audio unit	• Go To Pinpoint Test E .
• The subwoofer is inoperative/does not operate correctly — except THX®	• Fuse • Circuitry • Subwoofer • Audio unit	• Go To Pinpoint Test F .
• The subwoofer is inoperative/does not operate correctly — THX®	• Fuse • Circuitry • Speaker • Subwoofer • THX® amplifier • Audio unit	• Go To Pinpoint Test D .
• No auxiliary headphones audio — all audio systems except THX®	• Headphones • Auxiliary audio module • DVD player	• INSTALL a set of known good headphones and OPERATE the audio system in radio tuner mode. ■ If the system operates correctly, the concern was caused by inoperative headphones. ■ If the system does not operate correctly and the vehicle has a DVD player, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 419-07 . TEST the system for normal operation after the repair. ■ If the system does not operate correctly and the vehicle does not have a DVD player, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation.
• No auxiliary headphone audio — THX®	• Circuitry • Headphones • Auxiliary audio module • DVD player	• Go To Pinpoint Test H .

• Loud popping sound when cycling the ignition	• Fuse • Circuitry • Subwoofer (Audiophile) • THX® amplifier • Audio unit	• Go To Pinpoint Test I .
• The steering wheel controls are inoperative/do not operate correctly	• Circuitry • Clockspring • Steering wheel controls • Audio unit	• Go To Pinpoint Test J .
• Voice recognition is inoperative/does not operate correctly	• Fuse • Circuitry • Steering wheel controls • Microphone (part of the interior rear view mirror) • Audio unit	• Go To Pinpoint Test N .
• The speed sensitive volume does not operate correctly.	• Instrument cluster • Audio unit	• CHECK for audio unit DTCs. ▪ If DTC U0155 is present, REFER to the Audio Unit Diagnostic Trouble Code (DTC) Chart in this section. ▪ If no DTCs related to the concern are present, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• The audio input jack is inoperative/does not operate correctly	• Circuitry • Audio input jack • Audio unit	• Go To Pinpoint Test M .

Pinpoint Tests

Pinpoint Test A: Poor Reception — AM/FM

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The radio antenna, integral to the right quarter glass, receives AM and FM radio waves. The antenna module, which receives voltage from the audio unit through circuit CME13 (YE/OG), sends the radio waves to the audio unit through the antenna cable.

The noise suppression equipment reduces engine ignition and electrical systems interference transmitted through the speakers.

DTC B2103 — sets when an open is detected in the antenna circuit.

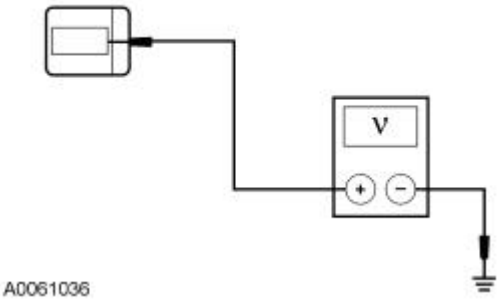
Possible Causes

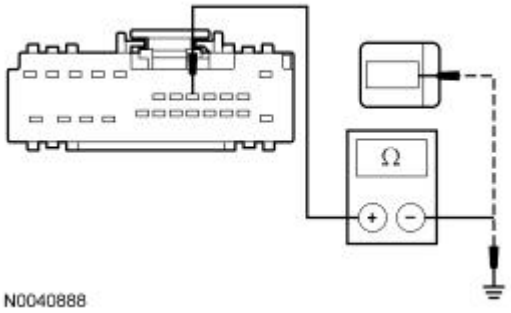
- Circuit CME13 (YE/OG) open or short to ground
- Antenna
- Antenna cable
- Charging system
- Ignition system
- Antenna module
- Noise suppression equipment
- Audio unit

PINPOINT TEST A: POOR RECEPTION — AM/FM

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE DTCs	
• Review the audio unit DTCs from the self-test. • **Is DTC B2103 present?**	**Yes** GO to A8 . **No** GO to A2 .
A2 CHECK THE AUDIO UNIT RECEPTION	
• Check the audio unit reception with the engine running, and with the engine off. • **Does the poor reception only occur with the engine running?**	**Yes** GO to A3 . **No** GO to A8 .
A3 CHECK THE NOISE SUPPRESSION EQUIPMENT	
• Check all required noise suppression equipment and the radio frequency interference suppression bond for security, cleanliness, and metal-to-metal contact. • **Are the connections clean, secure, and in metal-to-metal contact?**	**Yes** GO to A4 . **No** CLEAN and SECURE the antenna connections, or INSTALL new noise suppression equipment as needed. TEST the system for normal operation.
A4 CHECK THE CAPACITOR MOUNTING AND CONNECTING CIRCUITS	
• **NOTE:** The capacitor mounting points are used to complete the electrical circuit and must be mounted securely to clean surfaces. • Check the mounting and connecting circuits of the radio ignition interference capacitor for security, cleanliness, and metal-to-metal contact. • **Are the contacts clean, secure, and in metal-to-metal**	**Yes** GO to A5 . **No** CLEAN and SECURE the connections, or INSTALL a new radio ignition interference

contact?	capacitor as necessary. TEST the system for normal operation.
A5 CHECK THE RADIO INTERFERENCE CAPACITOR	
• Check the operation of the radio interference capacitor by installing a known good component. • Start the vehicle. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** INSTALL a new radio interference capacitor. TEST the system for normal operation. **No** INSTALL the original radio interference capacitor. GO to A6 .
A6 CHECK THE GENERATOR	
• Key in OFF position. • Check the generator by disconnecting the wiring harness from the voltage regulator. • Start the engine. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** GO to A7 .
A7 CHECK THE IGNITION CIRCUITS	
• Key in OFF position. • Connect the wiring harness to the voltage regulator. • Check the ignition circuits for correct routing, grounding, and integrity of the connections. • **Are the ignition components OK?**	**Yes** USE a jumper cable to ground various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation. **No** REPAIR the ignition system as necessary. TEST the system for normal operation.
A8 CHECK CIRCUIT CME13 (YE/OG) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Antenna Module C9021a. • Operate the audio unit in radio tuner mode. • Measure the voltage between the antenna module C9021a-1, circuit CME13 (YE/OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A10 . **No** GO to A9 .

A9 CHECK CIRCUIT CME13 (YE/OG) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Disconnect: Audio Unit C240a. • Measure the resistance between the audio unit C240a-5, circuit CME13 (YE/OG), harness side and the antenna module C9021a-1, circuit CME13 (YE/OG), harness side; and between the audio unit C240a-5, circuit CME13 (YE/OG), harness side and ground.  N0040888 • **Is the resistance less than 5 ohms between the audio unit and the antenna module, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** GO to A15 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A10 CHECK THE ANTENNA GRID	
• Key in OFF position. • Inspect the antenna grid closely for signs of damage. • **Is the antenna grid OK?**	**Yes** GO to A11 . **No** REPAIR the antenna grid as necessary. REFER to Section 501-11 . TEST the system for normal operation.
A11 ISOLATE THE ANTENNA MODULE	
• Key in OFF position. • Substitute the antenna module for a known good antenna module. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** INSTALL a new antenna module. REFER to Section 415-02 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL the original antenna module. GO to A12 .
A12 SUBSTITUTE THE ANTENNA LEAD-IN CABLE	
• Key in OFF position. • Substitute a known good antenna lead-in cable. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** INSTALL a new antenna lead-in cable. REFER to Section 415-02 . CLEAR the DTCs. REPEAT the self-test. **No** GO to A13 .
A13 SUBSTITUTE THE AUDIO UNIT	
• Key in OFF position. • Substitute a known good audio unit. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** SEND the original audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair.

	No INSTALL the original audio unit. GO to A14 .
A14 REPOSITION THE COMPONENTS	
• Key in OFF position. • Determine if the noise can be eliminated by repositioning the antenna extension cable, audio speaker circuits, or audio unit power feed circuits away from other circuits and/or brackets. • Start the vehicle. • Operate the audio unit in radio tuner mode. • **Is the reception OK?**	**Yes** Permanently REPOSITION the components as needed. TEST the system for normal operation. **No** GROUND various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, body sheet metal) using a jumper cable. When the reception is OK, PROVIDE a permanent ground where necessary. TEST the system for normal operation.
A15 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) — Vehicles With Bench Seat

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The audio unit directs the audio signals to the speakers through separate positive and negative circuits for each of the 4 audio channels: LH front, RH front, LH rear, and RH rear. The audio unit provides internal circuit protection for shorts to ground or shorts to voltage. The tweeter speakers are wired in series with the door speakers.

DTC B2965 — sets when an open, a short to ground, or a short to voltage is detected on the front door or rear door speaker circuits. The DTC may not set due to a circuit fault in the tweeter speaker circuits.

Possible Causes

- Circuit RME07 (WH/BN) open, short to ground or voltage
- Circuit RME08 (GY/OG) open, short to ground or voltage
- Circuit RME09 (BN/YE) open, short to ground or voltage

- Circuit RME10 (WH/OG) open, short to ground or voltage
- Circuit RME11 (YE/OG) open, short to ground or voltage
- Circuit RME12 (BN/BU) open, short to ground or voltage
- Circuit VME07 (WH) open, short to ground or voltage
- Circuit VME08 (GN/OG) open, short to ground or voltage
- Circuit VME09 (BN/GN) open, short to ground or voltage
- Circuit VME10 (WH/VT) open, short to ground or voltage
- Circuit VME11 (VT/OG) open, short to ground or voltage
- Circuit VME12 (BN/WH) open, short to ground or voltage
- Speaker
- Audio unit

PINPOINT TEST B: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) — VEHICLES WITH BENCH SEAT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>B1 ISOLATE THE SUSPECT SPEAKER</td><td rowspan="2">Yes
GO to B5 .

No
GO to B2 .</td></tr>
<tr><td>• Key in ON position.
• Carry out the speaker walk-around test.
• Is the concern with a tweeter speaker?</td></tr>
<tr><td>B2 CHECK THE SPEAKER CIRCUITS FOR VOLTAGE</td><td rowspan="2">Yes
INSTALL a new speaker for the suspect speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

No
GO to B3 .</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Suspect Speaker.
• Operate the audio unit in radio tuner mode.
• Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows:
<table><tr><th>Suspect Speaker</th><th>Connector-Pin/ Circuit</th><th>Connector-Pin/ Circuit</th></tr><tr><td>LH front</td><td>C523a-1
VME07 (WH)</td><td>C523a-2
RME07 (WH/BN)</td></tr><tr><td>RH front</td><td>C612a-1
VME10 (WH/VT)</td><td>C612a-2
RME10 (WH/OG)</td></tr><tr><td>LH rear</td><td>C702-1
VME12 (BN/WH)</td><td>C702-2
RME12 (BN/BU)</td></tr><tr><td>RH rear</td><td>C802-1
VME12 (BN/WH)</td><td>C802-2
RME12 (BN/BU)</td></tr></table>• Is a fluctuating AC voltage present?</td></tr>
<tr><td>B3 CHECK THE SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE</td><td rowspan="2">Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Audio Unit C240a.
• Key in ON position.
• Measure the voltage between the suspect speaker, harness side and ground as follows:</td></tr>
</table>

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C523a-1 VME07 (WH)	C523a-2 RME07 (WH/BN)
RH front	C612a-1 VME10 (WH/VT)	C612a-2 RME10 (WH/OG)
LH rear	C702-1 VME12 (BN/WH)	C702-2 RME12 (BN/BU)
RH rear	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)

- **Is any voltage present?**

No
GO to B4 .

B4 CHECK THE SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio unit, harness side and the suspect speaker, harness side; and between the audio unit, harness side and ground as follows:

Suspect Speaker	Audio Unit Connector-Pin	Speaker Connector-Pin	Circuit
LH front	C240a-8	C523a-1	VME07 (WH)
	C240a-21	C523a-2	RME07 (WH/BN)
RH front	C240a-11	C612a-1	VME10 (WH/VT)
	C240a-12	C612a-2	RME10 (WH/OG)
LH rear	C240a-9	C702-1	VME09 (BN/GN)/ VME12 (BN/WH)
	C240a-22	C702-2	RME09 (BN/YE)/ RME12 (BN/BU)
RH rear	C240a-10	C802-1	VME12 (BN/WH)
	C240a-23	C802-2	RME12 (BN/BU)

- **Are the resistances less than 5 ohms between the audio unit and the speaker, and greater than 10,000 ohms between the audio unit and ground?**

Yes
GO to B9 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK FOR VOLTAGE TO THE SUSPECT TWEETER SPEAKER

- Key in OFF position.
- Disconnect: Suspect Tweeter Speaker.
- Operate the audio unit in radio tuner mode.
- Measure the AC voltage between the suspect tweeter speaker pin 1 and pin 2, harness side as follows:

Yes
INSTALL a new speaker for the suspect tweeter speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH tweeter	C513-1 VME08 (GN/OG)	C513-2 RME08 (GY/OG)
RH tweeter	C613-1 VME11 (VT/OG)	C613-2 RME11 (YE/OG)

- **Is a fluctuating AC voltage present?**

self-test.

No
GO to B6 .

B6 CHECK THE TWEETER SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LF Speaker C523b or RF Speaker C612b.
- Key in ON position.
- Measure the voltage between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Circuit
LH tweeter	C513-1	VME08 (GN/OG)
	C513-2	RME08 (GY/OG)
RH tweeter	C613-1	VME11 (VT/OG)
	C613-2	RME11 (YE/OG)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to B7 .

B7 CHECK THE TWEETER SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect tweeter speaker, harness side and the respective door speaker, harness side; and between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector- Pin	Door Speaker Connector- Pin	Circuit
LH tweeter	C513-1	C523b-1	VME08 (GN/OG)
	C513-2	C523b-2	RME08 (GY/OG)
RH tweeter	C613-1	C612b-1	VME11 (VT/OG)
	C613-2	C612b-2	RME11 (YE/OG)

- **Is the resistance less than 5 ohms between the suspect tweeter speaker and the door speaker, and greater than 10,000 ohms between the suspect tweeter speaker and ground?**

Yes
GO to B8 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B8 ISOLATE THE DOOR SPEAKER

• Connect: Suspect Tweeter Speaker. • Install a known good door speaker for the door with the suspect tweeter speaker. • Operate the audio unit in radio tuner mode. • **Does the tweeter speaker operate correctly?**	**Yes** INSTALL a new door speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new tweeter speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.
B9 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) — Vehicles Without Bench Seat or THX® Audio System

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The audio unit directs audio signals to the front door speakers and to the auxiliary audio module or digital versatile disc (DVD) player (if equipped). The tweeter speakers are wired in series with the front door speakers. The rear door speakers receive audio signals through the auxiliary audio module (or DVD player).

DTC B2965 — sets when an open, a short to ground, or a short to voltage is detected on the front door or rear door speaker circuits. The DTC may not set due to a circuit fault in the tweeter speaker circuits.

Possible Causes

- Circuit RME07 (WH/BN) open, short to ground or voltage
- Circuit RME08 (GY/OG) open, short to ground or voltage
- Circuit RME09 (BN/YE) open, short to ground or voltage
- Circuit RME10 (WH/OG) open, short to ground or voltage
- Circuit RME11 (YE/OG) open, short to ground or voltage
- Circuit RME12 (BN/BU) open, short to ground or voltage
- Circuit VME07 (WH) open, short to ground or voltage
- Circuit VME08 (GN/OG) open, short to ground or voltage
- Circuit VME09 (BN/GN) open, short to ground or voltage
- Circuit VME10 (WH/VT) open, short to ground or voltage

- Circuit VME11 (VT/OG) open, short to ground or voltage
- Circuit VME12 (BN/WH) open, short to ground or voltage
- Speaker
- Auxiliary audio module
- DVD player
- Audio unit

PINPOINT TEST C: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) — VEHICLES WITHOUT BENCH SEAT OR THX® AUDIO SYSTEM

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>C1 ISOLATE THE SUSPECT SPEAKER
• Key in ON position.
• Carry out the speaker walk-around test.
• Is the concern with a tweeter speaker?</td><td>Yes
GO to C10 .

No
GO to C2 .</td></tr>
<tr><td>C2 CHECK THE SPEAKER CIRCUITS FOR VOLTAGE
• Key in OFF position.
• Disconnect: Suspect Speaker.
• Operate the audio unit in radio tuner mode.
• Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows:
<table><tr><th>Suspect Speaker</th><th>Connector-Pin/ Circuit</th><th>Connector-Pin/ Circuit</th></tr><tr><td>LH front</td><td>C523a-1
VME07 (WH)</td><td>C523a-2
RME07 (WH/BN)</td></tr><tr><td>RH front</td><td>C612a-1
VME10 (WH/VT)</td><td>C612a-2
RME10 (WH/OG)</td></tr><tr><td>LH rear</td><td>C702-1
VME12 (BN/WH)</td><td>C702-2
RME12 (BN/BU)</td></tr><tr><td>RH rear</td><td>C802-1
VME12 (BN/WH)</td><td>C802-2
RME12 (BN/BU)</td></tr></table>• Is a fluctuating AC voltage present?</td><td>Yes
INSTALL a new speaker for the suspect speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

No
For a front speaker concern, GO to C8 .

For a rear speaker concern, GO to C3 .</td></tr>
<tr><td>C3 CHECK THE AUDIO UNIT OUTPUT SIGNALS
• Key in OFF position.
• Disconnect: Auxiliary Audio Module C3077 or DVD Player C949.
• Operate the audio unit in radio tuner mode.
• Measure the AC voltage between the auxiliary audio module (or DVD player) pins, harness side as follows:
<table><tr><th>Suspect Speaker</th><th>Connector-Pin/ Circuit</th><th>Connector-Pin/ Circuit</th></tr><tr><td>LH rear</td><td>C3077-27 or C949-27</td><td>C3077-28 or C949-28</td></tr></table></td><td>Yes
GO to C6 .

No
GO to C4 .</td></tr>
</table>

	VME09 (BN/GN)	RME09 (BN/YE)
RH rear	C3077-11 or C949-11 VME12 (BN/WH)	C3077-12 or C949-12 RME12 (BN/BU)

- **Is a fluctuating AC voltage present?**

C4 CHECK THE AUDIO UNIT OUTPUT CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Audio Unit C240a.
- Key in ON position.
- Measure the voltage between the auxiliary audio module (or DVD player), harness side as follows:

Suspect Speaker	Connector-Pin	Circuit
LH rear	C3077-27 or C949-27	VME09 (BN/GN)
	C3077-28 or C949-28	RME09 (BN/YE)
RH rear	C3077-11 or C949-11	VME12 (BN/WH)
	C3077-12 or C949-12	RME12 (BN/BU)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to C5 .

C5 CHECK THE AUDIO UNIT OUTPUT CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio unit and the auxiliary audio module (or DVD player), harness side; and between the audio unit, harness side and ground as follows:

Suspect Speaker	Audio Unit Connector-Pin	Auxiliary Audio Module (or DVD Player) Connector-Pin	Circuit
LH rear	C240a-9	C3077-27 or C949-27	VME09 (BN/GN)
	C240a-22	C3077-28 or C949-28	RME09 (BN/YE)
RH rear	C240a-10	C3077-11 or C949-11	VME12 (BN/WH)
	C240a-23	C3077-12 or C949-12	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the audio unit and the auxiliary audio module (or DVD player), and greater than 10,000 ohms between the audio unit and ground?**

Yes
GO to C14 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE REAR SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Speaker.
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin	Circuit

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to C7 .

LH rear	C702-1 C702-2	VME12 (BN/WH) RME12 (BN/BU)
RH rear	C802-1 C802-2	VME12 (BN/WH) RME12 (BN/BU)

- **Is any voltage present?**

C7 CHECK THE REAR SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect speaker, harness side and the auxiliary audio module (or DVD player), harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	Auxiliary Audio Module (or DVD Player) Connector- Pin	Circuit
LH rear	C3077-30 or C949-30	C702-1	VME09 (BN/GN)/ VME12 (BN/WH)
	C3077-29 or C949-29	C702-2	RME09 (BN/YE)/ RME12 (BN/BU)
RH rear	C3077-14 or C949-14	C802-1	VME12 (BN/WH)
	C3077-13 or C949-13	C802-2	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the suspect speaker and the auxiliary audio module (or DVD player), and greater than 10,000 ohms between the suspect speaker and ground?**

Yes
If equipped with an auxiliary audio module, GO to C15 .

If equipped with a DVD player, GO to C16 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE FRONT SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Audio Unit C240a.
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C523a-1 C523a-2	VME07 (WH) RME07 (WH/BN)
RH front	C612a-1 C612a-2	VME10 (WH/VT) RME10 (WH/OG)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to C9 .

C9 CHECK THE FRONT SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio unit, harness side and the suspect speaker, harness side; and between the audio unit, harness side and ground as follows:

Suspect Speaker	Audio Unit Connector- Pin	Speaker Connector- Pin	Circuit
LH front	C240a-8	C523a-1	VME07 (WH)
	C240a-21	C523a-2	RME07 (WH/BN)
RH front	C240a-11	C612a-1	VME10 (WH/VT)
	C240a-12	C612a-2	RME10 (WH/OG)

- **Is the resistance less than 5 ohms between the audio unit and the suspect speaker, and greater than 10,000 ohms between the audio unit and ground?**

Yes
GO to C14 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C10 CHECK FOR VOLTAGE TO THE SUSPECT TWEETER SPEAKER

- Key in OFF position.
- Disconnect: Suspect Tweeter Speaker.
- Operate the audio unit in radio tuner mode.
- Measure the AC voltage between the suspect tweeter speaker pin 1 and pin 2, harness side as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH tweeter	C513-1 VME08 (GN/OG)	C513-2 RME08 (GY/OG)
RH tweeter	C613-1 VME11 (VT/OG)	C613-2 RME11 (YE/OG)

- **Is a fluctuating AC voltage present?**

Yes
INSTALL a new speaker for the suspect tweeter speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

No
GO to C11 .

C11 CHECK THE TWEETER SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LF Speaker C523b or RF Speaker C612b.
- Key in ON position.
- Measure the voltage between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Circuit
LH tweeter	C513-1	VME08 (GN/OG)
	C513-2	RME08 (GY/OG)
RH tweeter	C613-1	VME11 (VT/OG)
	C613-2	RME11 (YE/OG)

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to C12 .

- **Is any voltage present?**

C12 CHECK THE TWEETER SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect tweeter speaker, harness side and the respective door speaker, harness side; and between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector- Pin	Door Speaker Connector- Pin	Circuit
LH tweeter	C513-1	C523b-1	VME08 (GN/OG)
	C513-2	C523b-2	RME08 (GY/OG)
RH tweeter	C613-1	C612b-1	VME11 (VT/OG)
	C613-2	C612b-2	RME11 (YE/OG)

- **Is the resistance less than 5 ohms between the suspect tweeter speaker and the door speaker, and greater than 10,000 ohms between the suspect tweeter speaker and ground?**

Yes
GO to C13 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C13 ISOLATE THE DOOR SPEAKER

- Connect: Suspect Tweeter Speaker.
- Install a known good door speaker for the door with the suspect tweeter speaker.
- Operate the audio unit in radio tuner mode.
- **Does the tweeter speaker operate correctly?**

Yes
INSTALL a new door speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

No
INSTALL a new tweeter speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

C14 CHECK FOR CORRECT AUDIO UNIT OPERATION

- Key in OFF position.
- Disconnect all the audio unit connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the audio unit connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

Yes
REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

C15 CHECK FOR CORRECT AUXILIARY AUDIO MODULE OPERATION	

• Key in OFF position.
• Disconnect the auxiliary audio module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the auxiliary audio module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

C16 CHECK FOR CORRECT DVD PLAYER OPERATION	

• Key in OFF position.
• Disconnect the DVD player connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the DVD player connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) — THX®

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The audio unit directs the audio signals to the THX® amplifier, which processes the audio signals and sends them to the speakers. Each speaker has a signal and return circuit.

NOTE: The rear tweeters are wired in series with each other. A concern in circuits RME30 (VT/BN), VME30 (GN/BN) or VME47 (BN/VT), or a concern in either speaker, may cause poor/distorted/no sound in both speakers.

DTC B1158 — sets when an open is detected in the RH subwoofer circuit.

DTC B2913 — sets when an open is detected in the LH subwoofer circuit.

DTC B2925 — sets when a short to ground or voltage is detected in the LH subwoofer circuit.

DTC B292A — sets when a short to ground or voltage is detected in the RH subwoofer circuit.

DTC B2965 — sets when an open, short to ground, or short to voltage is detected on any of the speaker circuits.

Possible Causes

- Fuse
- Circuit GD114 (BK/BU) open
- Circuit RME01 (GY) open, short to ground or voltage
- Circuit RME02 (YE) open, short to ground or voltage
- Circuit RME07 (WH/BN) open, short to ground or voltage
- Circuit RME08 (GY/OG) open, short to ground or voltage
- Circuit RME10 (WH/OG) open, short to ground or voltage
- Circuit RME11 (YE/OG) open, short to ground or voltage
- Circuit RME12 (BN/BU) open, short to ground or voltage
- Circuit RME15 (GY/BU) open, short to ground or voltage
- Circuit RME28 (BN/GN) open, short to ground or voltage
- Circuit RME29 (BU/WH) open, short to ground or voltage
- Circuit RME30 (VT/BN) open, short to ground or voltage
- Circuit RME39 (GY/BN) open, short to ground or voltage
- Circuit RME40 (VT/WH) open, short to ground or voltage
- Circuit SBP38 (BN/RD) open
- Circuit SBP40 (VT/RD) open
- Circuit VME01 (GN) open, short to ground or voltage
- Circuit VME02 (VT) open, short to ground or voltage
- Circuit VME07 (WH) open, short to ground or voltage
- Circuit VME08 (GN/OG) open, short to ground or voltage
- Circuit VME10 (WH/VT) open, short to ground or voltage
- Circuit VME11 (VT/OG) open, short to ground or voltage
- Circuit VME12 (BN/WH) open, short to ground or voltage
- Circuit VME15 (GN/BU) open, short to ground or voltage
- Circuit VME28 (BN/VT) open, short to ground or voltage
- Circuit VME29 (GN/WH) open, short to ground or voltage
- Circuit VME30 (GN/BN) open, short to ground or voltage
- Circuit VME39 (GN/BN) open, short to ground or voltage
- Circuit VME40 (BU/WH) open, short to ground or voltage
- Speaker
- Subwoofer
- THX® amplifier
- Audio unit

PINPOINT TEST D: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) — THX®

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK CIRCUITS SBP38 (BN/RD) AND SBP40 (VT/RD) FOR VOLTAGE	
• Key in OFF position. • Disconnect: THX® Amplifier C2364a.	**Yes** GO to D2 .

- Measure the voltage between the THX® amplifier, harness side and ground as follows:

THX® Amplifier Connector-Pin	Circuit
C2364a-9	SBP38 (BN/RD)
C2364a-10	SBP38 (BN/RD)
C2364a-11	SBP40 (VT/RD)
C2364a-12	SBP40 (VT/RD)

- **Are the voltages greater than 10 volts?**

No
VERIFY the smart junction box (SJB) fuse 38 (20A) or fuse 40 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D2 CHECK CIRCUIT GD114 (BK/BU) FOR AN OPEN

- Measure the resistance between the THX® amplifier, harness side and ground as follows:

THX® Amplifier Connector-Pin	Circuit
C2364a-22	GD114 (BK/BU)
C2364a-23	GD114 (BK/BU)
C2364a-24	GD114 (BK/BU)

- **Are the resistances less than 5 ohms?**

Yes
GO to D3 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK THE AUDIO SIGNALS TO THE THX® AMPLIFIER

- Disconnect: THX® Amplifier C2364c.
- Operate the audio unit in radio tuner mode.
- Measure the AC voltage between the audio circuits at the THX® amplifier as follows:

Suspect Speaker Bank	THX® Amplifier Connector-Pin	Circuit
LH	C2364c-1	VME07 (WH)
	C2364c-2	RME07 (WH/BN)
RH	C2364c-3	VME10 (WH/VT)
	C2364c-4	RME10 (WH/OG)

- **Is a fluctuating AC voltage present?**

Yes
GO to D6 .

No
GO to D4 .

D4 CHECK THE AUDIO CIRCUITS TO THE THX® AMPLIFIER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Audio Unit C240a.
- Key in ON position.
- Measure the voltage between the THX® amplifier, harness side and ground as follows:

THX® Amplifier Connector-Pin	Circuit
C2364c-1	VME07 (WH)
C2364c-2	RME07 (WH/BN)
C2364c-3	VME10 (WH/VT)
C2364c-4	RME10 (WH/OG)

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to D5 .

- **Is any voltage present?**

D5 CHECK THE AUDIO CIRCUITS TO THE THX® AMPLIFIER FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the THX® amplifier, harness side and the audio unit, harness side; and between the THX® amplifier, harness side and ground as follows:

THX® Amplifier Connector-Pin	Audio Unit Connector-Pin	Circuit
C2364c-1	C240a-8	VME07 (WH)
C2364c-2	C240a-21	RME07 (WH/BN)
C2364c-3	C240a-11	VME10 (WH/VT)
C2364c-4	C240a-12	RME10 (WH/OG)

- **Is the resistance less than 5 ohms between the THX® amplifier and the audio unit, and greater than 10,000 ohms between the THX® amplifier and ground?**

Yes
GO to D10 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK THE AUDIO SIGNALS TO THE SUSPECT SPEAKER

NOTE: The rear tweeters are wired in series, so the signal voltage must be checked with both speakers disconnected and the measurements made between the LR tweeter C4337-1 and the RR tweeter C4338-2.

- Key in OFF position.
- Connect: THX® Amplifier C2364a.
- Connect: THX® Amplifier C2364c.
- Disconnect: Suspect Speaker.
- Operate the audio unit in radio tuner mode.
- Measure the AC voltage between the suspect speaker pins, harness side as follows:

Suspect Speaker	Speaker Connector-Pin/ Circuit	Speaker Connector-Pin/ Circuit
LH subwoofer	C4212-1 VME01 (GN)	C4212-2 RME01 (GY)
LR door	C702-1 VME12 (BN/WH)	C702-2 RME12 (BN/BU)
LF door	C570-1 VME07 (WH)	C570-2 RME07 (WH/BN)
LH tweeter	C513-1 VME08 (GN/OG)	C513-2 RME08 (GY/OG)
LH front imaging	C2359-1 VME28 (BN/VT)	C2359-4 RME28 (BN/GN)
Center front imaging	C2359-2 VME15 (GN/BU)	C2359-5 RME15 (GY/BU)
RH front imaging	C2359-3 VME29 (GN/WH)	C2359-6 RME29 (BU/WH)
RH tweeter	C613-1 VME11 (VT/OG)	C613-2 RME11 (YE/OG)

Yes
INSTALL a new speaker for the suspect speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.

No
GO to D7 .

RF door	C647-1 VME10 (WH/VT)	C647-2 RME10 (WH/OG)
RR door	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)
RH subwoofer	C4212-3 VME02 (VT)	C4212-4 RME02 (YE)
Rear tweeters	C4337-1 VME30 (GN/BN)	C4330-2 RME30 (VT/BN)

- **Is a fluctuating AC voltage present?**

D7 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: THX® Amplifier C2364a or C2364b.
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	Speaker Connector-Pin
LR door	C702-1 C702-2	VME12 (BN/WH) RME12 (BN/BU)
LF door	C570-1 C570-2	VME07 (WH) RME07 (WH/BN)
LH tweeter	C513-1 C513-2	VME08 (GN/OG) RME08 (GY/OG)
LH front imaging	C2359-1 C2359-4	VME28 (BN/VT) RME28 (BN/GN)
Center front imaging	C2359-2 C2359-5	VME15 (GN/BU) RME15 (GY/BU)
RH front imaging	C2359-3 C2359-6	VME29 (GN/WH) RME29 (BU/WH)
RH tweeter	C613-1 C613-2	VME11 (VT/OG) RME11 (YE/OG)
RF door	C647-1 C647-2	VME10 (WH/VT) RME10 (WH/OG)
RR door	C802-1 C802-2	VME12 (BN/WH) RME12 (BN/BU)
RR tweeter	C4338-1 C4338-2	VME47 (BN/VT) RME30 (VT/BN)
LR tweeter	C4337-1 C4337-2	VME30 (GN/BN) VME47 (BN/VT)
RH subwoofer	C4212-3 C4212-4	VME02 (VT) RME02 (YE)
LH subwoofer	C4212-1 C4212-2	VME01 (GN) RME01 (GY)

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to D8 .

- **Is any voltage present?**

D8 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect speaker, harness side and the THX® amplifier, harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	THX® Amplifier Connector-Pin	Circuit
LR door	C702-1	C2364a-7	VME12 (BN/WH)/VME39 (GN/BN)
	C702-2	C2364a-6	RME12 (BN/BU)/RME39 (GY/BN)
LF door	C570-1	C2364a-3	VME07 (WH)
	C570-2	C2364a-2	RME07 (WH/BN)
LH tweeter	C513-1	C2364b-9	VME08 (GN/OG)
	C513-2	C2364b-10	RME08 (GY/OG)
LH front imaging	C2359-1	C2364b-2	VME28 (BN/VT)
	C2359-4	C2364b-1	RME28 (BN/GN)
Center front imaging	C2359-2	C2364b-4	VME15 (GN/BU)
	C2359-5	C2364b-3	RME15 (GY/BU)
RH front imaging	C2359-3	C2364b-6	VME29 (GN/WH)
	C2359-6	C2364b-5	RME29 (BU/WH)
RH tweeter	C613-1	C2364b-11	VME11 (VT/OG)
	C613-2	C2364b-12	RME11 (YE/OG)
RF door	C647-1	C2364a-5	VME10 (WH/VT)
	C647-2	C2364a-4	RME10 (WH/OG)
RR door	C802-1	C2364a-18	VME12 (BN/WH)/VME40 (BU/WH)
	C802-2	C2364a-19	RME12 (BN/BU)/RME40 (VT/WH)
RR tweeter	C4338-1	C4337-2	VME47 (BN/VT)
	C4338-2	C2364b-14	RME30 (VT/BN)
LR tweeter	C4337-1	C2364b-13	VME30 (GN/BN)
	C4338-1	C4337-2	VME47 (BN/VT)
RH subwoofer	C4212-3	C2364a-14	VME02 (VT)
	C4212-4	C2364a-15	RME02 (YE)
LH	C4212-1	C2364a-16	VME01 (GN)

Yes
GO to D9 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

subwoofer	C4212-2	C2364a-17	RME01 (GY)

- **Is the resistance less than 5 ohms between the suspect speaker and the THX® amplifier, and greater than 10,000 ohms between the suspect speaker and ground?**

D9 ISOLATE THE SUSPECT SPEAKER	
• Key in OFF position. • Connect: THX® Amplifier C2364a and C2364b. • Substitute a known good speaker for the suspect speaker. • Operate the audio unit in radio tuner mode. • **Is the concern still present?**	**Yes** GO to D11 . **No** INSTALL a new speaker for the suspect speaker. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test.
D10 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

D11 CHECK FOR CORRECT THX® AMPLIFIER OPERATION	

• Key in OFF position.
• Disconnect all the THX® amplifier connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the THX® amplifier connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: No Sound From All Speakers — THX® Audio System

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The audio unit enables the THX® amplifier through circuit CME31 (BU/GN). The THX® amplifier receives voltage through circuits SBP38 (BN/RD) and SBP40 (VT/RD), and ground through circuit GD114 (BK/BU).

The enable/clip circuit CME31 (BU/GN) carries out 2 functions: to turn the THX® amplifier on, and to monitor an overload condition to the THX® amplifier. In the event of an overload, the audio unit clips the audio output signal to the THX® amplifier (heard as distortion).

Possible Causes

- Fuse
- Circuit CME31 (BU/GN) open or short to ground
- Circuit GD114 (BK/BU) open
- Circuit SBP38 (BN/RD) open
- Circuit SBP40 (VT/RD) open
- THX® amplifier
- Audio unit

PINPOINT TEST E: NO SOUND FROM ALL SPEAKERS — THX® AUDIO SYSTEM

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>E1 CHECK CIRCUITS SBP38 (BN/RD) AND SBP40 (VT/RD) FOR VOLTAGE
• Key in OFF position.
• Disconnect: THX® Amplifier C2364a.
• Measure the voltage between the THX® amplifier, harness side and ground as follows:
<table><tr><th>THX® Amplifier Connector-Pin</th><th>Circuit</th></tr><tr><td>C2364a-9</td><td>SBP38 (BN/RD)</td></tr><tr><td>C2364a-10</td><td>SBP38 (BN/RD)</td></tr><tr><td>C2364a-11</td><td>SBP40 (VT/RD)</td></tr><tr><td>C2364a-12</td><td>SBP40 (VT/RD)</td></tr></table>• Are the voltages greater than 10 volts?</td><td>Yes
GO to E2 .

No
VERIFY the battery junction box (BJB) fuse 20 (20A) or fuse 21 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>E2 CHECK CIRCUIT GD114 (BK/BU) FOR AN OPEN
• Measure the resistance between the THX® amplifier, harness side and ground as follows:
<table><tr><th>THX® Amplifier Connector-Pin</th><th>Circuit</th></tr><tr><td></td><td></td></tr></table></td><td>Yes
GO to E3 .

No
REPAIR the circuit in</td></tr>
</table>

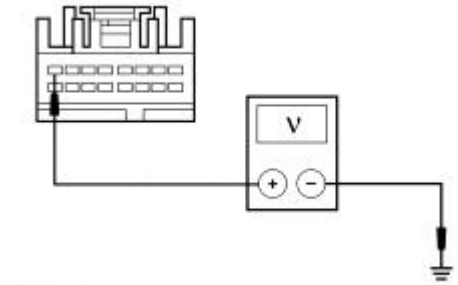
C2364a-22	GD114 (BK/BU)
C2364a-23	GD114 (BK/BU)
C2364a-24	GD114 (BK/BU)

- **Are the resistances less than 5 ohms?**

question. CLEAR the DTCs. REPEAT the self-test.

E3 CHECK CIRCUIT CME31 (BU/GN) FOR VOLTAGE

- Connect: THX® Amplifier C2364a.
- Disconnect: THX® Amplifier C2364c.
- Operate the audio unit in radio tuner mode.
- Measure the voltage between the THX® amplifier C2364c-8, circuit CME31 (BU/GN), harness side and ground.



N0056311

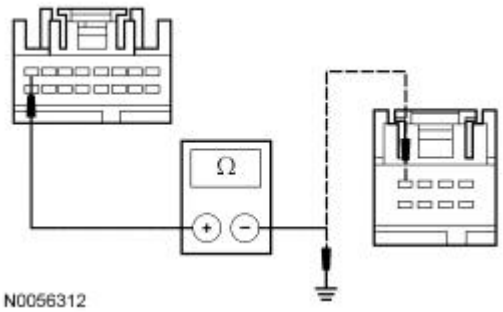
- **Is the voltage between 3.8 and 6.7 volts?**

Yes
GO to E5 .

No
GO to E4 .

E4 CHECK CIRCUIT CME31 (BU/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Audio Unit C240c.
- Measure the resistance between the THX® amplifier C2364c-8, circuit CME27 (YE/VT), harness side and the audio unit C240c-4, circuit CME27 (YE/VT), harness side; and between the THX® amplifier C2364c-8, circuit CME27 (YE/VT), harness side and ground.



N0056312

- **Is the resistance less than 5 ohms between the THX® amplifier and the audio unit, and greater than 10,000 ohms between the THX® amplifier and ground?**

Yes
SEND the audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair.

No
REPAIR the circuit. TEST the system for normal operation.

E5 CHECK FOR CORRECT THX® AMPLIFIER OPERATION

- Key in OFF position.
- Disconnect all the THX® amplifier connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the THX® amplifier connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a new THX® amplifier. REFER to Section 415-01 . REPEAT the audio unit self-test. CLEAR the audio unit DTCs.

No
The system is operating

	correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Subwoofer is Inoperative/Does Not Operate Correctly — Except THX®

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The subwoofer speaker and amplifier are integral. The enable/clip circuit SME23 (VT/RD) carries out 2 functions: to turn the subwoofer on, and to monitor an overload condition to the subwoofer. In the event of an overload, the audio unit clips the audio output signal to the subwoofer (heard as distortion). The subwoofer receives voltage through circuit SBP38 (BN/RD), and ground through circuit GD114 (BK/BU).

DTC B1154 — sets when a short to ground is detected on circuit RME22 (GN/WH) or VME22 (VT/GN). This DTC only sets during the on-demand self-test.

DTC B1155 — sets when a short to voltage is detected on circuit RME22 (GN/WH) or VME22 (VT/GN). This DTC only sets during the on-demand self-test.

DTC B2913 — sets when the audio unit does not detect the subwoofer through circuit SME23 (VT/RD) during the subwoofer connection test (part of the audio unit self-test).

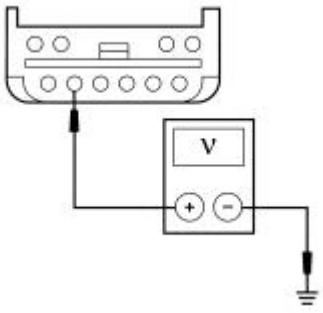
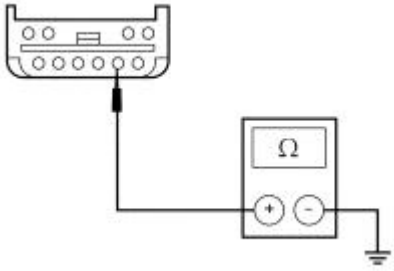
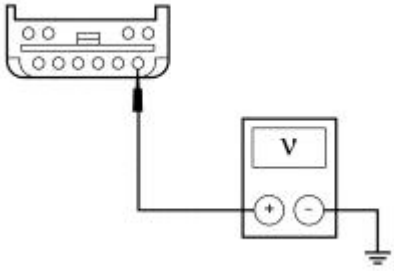
Possible Causes

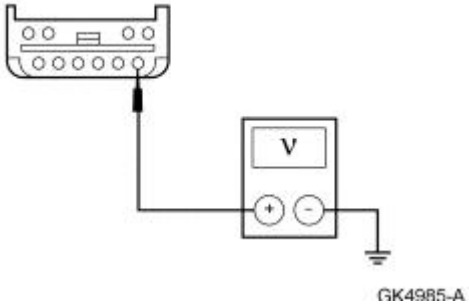
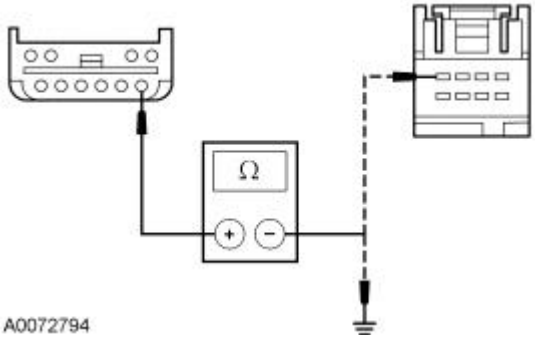
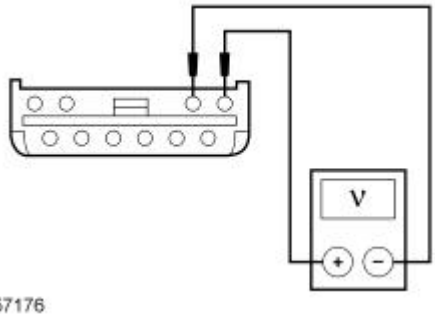
- Fuse
- Circuit GD114 (BK/BU) open
- Circuit RME22 (GN/WH) open, short to ground or voltage
- Circuit SBP38 (BN/RD) open
- Circuit SME23 (VT/RD) open, short to ground or voltage
- Circuit VME22 (VT/GN) open, short to ground or voltage
- Subwoofer
- Audio unit

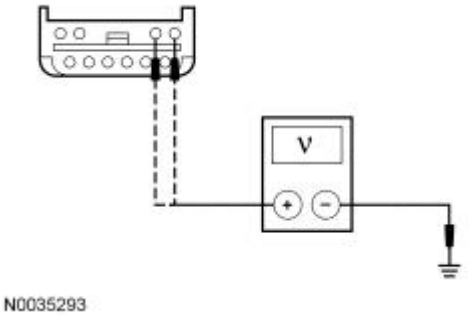
PINPOINT TEST F: THE SUBWOOFER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — EXCEPT THX®

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
F1 REVIEW THE AUDIO UNIT DTCs	
• Review the DTCs from the audio unit on-demand self-test. • **Are any DTCs present?**	**Yes** If DTC B1154 or B1155 is present, GO to F7 . If DTC B2913 is present, GO to F2 . For all other DTCs,

	REFER to the Audio Unit Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to F2 .
F2 CHECK CIRCUIT SBP38 (BN/RD) FOR VOLTAGE • Key in OFF position. • Disconnect: Subwoofer C466. • Measure the voltage between the subwoofer C466-5, circuit SBP38 (BN/RD), harness side and ground.  A0021366 • **Is the voltage greater than 10 volts?**	**Yes** GO to F3 . **No** VERIFY the smart junction box (SJB) fuse 38 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
F3 CHECK CIRCUIT GD114 (BK/BU) FOR AN OPEN • Measure the resistance between the subwoofer C466-2, circuit GD114 (BK/BU), harness side and ground.  GK5794-A • **Is the resistance less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR the circuit. TEST the system for normal operation.
F4 CHECK CIRCUIT SME23 (VT/RD) FOR VOLTAGE • Operate the audio unit in radio tuner mode. • Measure the voltage between the subwoofer C466-1, circuit SME23 (VT/RD), harness side and ground.  GK4985-A • **Is the voltage between 3.8 and 6.7 volts?**	**Yes** If DTC B2913 was present during the self-test, INSTALL a new subwoofer. REFER to Section 415-03 . TEST the system for normal operation. Otherwise, GO to F7 . **No** GO to F5 .
F5 CHECK CIRCUIT SME23 (VT/RD) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: Audio Unit C240c.	**Yes** GO to F6 .

• Key in ON position. • Measure the voltage between the subwoofer C466-1, circuit SME23 (VT/RD), harness side and ground.  GK4985-A • **Is any voltage present?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F6 CHECK CIRCUIT SME23 (VT/RD) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the subwoofer C466-1, circuit SME23 (VT/RD), harness side and the audio unit C240c-4, circuit SME23 (VT/RD), harness side; and between the subwoofer C466-1, circuit SME23 (VT/RD), harness side and ground.  A0072794 • **Is the resistance less than 5 ohms between the subwoofer and the audio unit, and greater than 10,000 ohms between the subwoofer and ground?**	**Yes** GO to F10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F7 CHECK THE AUDIO SIGNAL TO THE SUBWOOFER	
• Key in OFF position. • Disconnect: Subwoofer C466. • Operate the audio unit in radio tuner mode. • Measure the AC voltage between the subwoofer C466-7, circuit VME22 (VT/GN), harness side and the subwoofer C466-8, circuit RME22 (GN/WH), harness side.  A0057176 • **Is a fluctuating AC voltage present?**	**Yes** INSTALL a new subwoofer. REFER to Section 415-03 . CLEAR the DTCs. REPEAT the self-test. **No** GO to F8 .
F8 CHECK THE AUDIO CIRCUITS FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Audio Unit C240c.	**Yes** REPAIR the circuit in

• Key in ON position. • Measure the voltage between the subwoofer C466-7, circuit VME22 (VT/GN), harness side and ground; or between the subwoofer C466-8, circuit RME22 (GN/WH), harness side and ground.  N0035293 • **Is any voltage present?**	question. CLEAR the DTCs. REPEAT the self-test. **No** GO to F9 .
F9 CHECK THE AUDIO CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the subwoofer, harness side and the audio unit, harness side; and between the subwoofer, harness side and ground as follows: **Subwoofer Connector-Pin** / **Audio Unit Connector-Pin** / **Circuit** C466-7 / C240c-1 / VME22 (VT/GN) C466-8 / C240c-2 / RME22 (GN/WH) • **Is the resistance less than 5 ohms between the subwoofer and the audio unit, and greater than 10,000 ohms between the subwoofer and ground?**	**Yes** GO to F10 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
F10 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Video System Does Not Operate Correctly — No Audio

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The digital versatile disc (DVD) player routes audio signals to the audio unit. In single-play mode, the audio unit plays the DVD audio on all speakers. In dual-play mode, the DVD player controls the rear speakers (except THX®) and the headphones.

Possible Causes

- Circuit RME17 (GY) open, short to ground or voltage
- Circuit RME18 (YE) open, short to ground or voltage
- Circuit VME17 (GN) open, short to ground or voltage
- Circuit VME18 (VT) open, short to ground or voltage
- DVD player
- Audio unit

PINPOINT TEST G: THE VIDEO SYSTEM DOES NOT OPERATE CORRECTLY — NO AUDIO

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Before diagnosing the DVD player, make sure a known good DVD is installed.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>G1 CHECK THE OPERATION OF THE DVD VIDEO
• Operate the DVD player in single-play mode.
• Does the DVD video operate correctly?</td><td>Yes
GO to G2 .

No
GO to Symptom Chart .</td></tr>
<tr><td>G2 CHECK THE AUDIO CIRCUITS TO THE AUDIO UNIT FOR A SHORT TO VOLTAGE
• Key in OFF position.
• Disconnect: Audio Unit C240b.
• Disconnect: DVD Player C949.
• Key in ON position.
• Measure the voltage between the audio unit, harness side and ground as follows:
<table><tr><th>Audio Unit Connector-Pin</th><th>Circuit</th></tr><tr><td>C240b-1</td><td>VME17 (GN)</td></tr><tr><td>C240b-2</td><td>RME17 (GY)</td></tr><tr><td>C240b-9</td><td>VME18 (VT)</td></tr><tr><td>C240b-10</td><td>RME18 (YE)</td></tr></table>• Is any voltage present?</td><td>Yes
REPAIR the circuit in question.
TEST the system for normal operation.

No
GO to G3 .</td></tr>
<tr><td>G3 CHECK THE AUDIO CIRCUITS TO THE AUDIO UNIT FOR AN OPEN OR SHORT TO GROUND
• Key in OFF position.
• Measure the resistance between the audio unit, harness side and the DVD player, harness side; and between the audio unit, harness side and ground as follows:</td><td>Yes
GO to G4 .

No
REPAIR the circuit in question.
TEST the system for normal</td></tr>
</table>

<table>
<tr><td>

Audio Unit Connector-Pin	DVD Player Connector-Pin	Circuit
C240b-1	C949-10	VME17 (GN)
C240b-2	C949-9	RME17 (GY)
C240b-9	C949-26	VME18 (VT)
C240b-10	C949-25	RME18 (YE)

- **Is the resistance less than 5 ohms between the audio unit and the DVD player, and greater than 10,000 ohms between the audio unit and ground?**
</td><td>operation.</td></tr>
<tr><td>G4 ISOLATE THE DVD PLAYER</td><td></td></tr>
<tr><td>

- Connect: Audio Unit C240b.
- Install a known good DVD player.
- Operate the DVD player in single-play mode.
- **Does the DVD audio operate correctly?**
</td><td>Yes
SEND the DVD player to an authorized audio system repair facility. TEST the system for normal operation after the repair.

No
GO to G5 .</td></tr>
<tr><td>G5 CHECK FOR CORRECT AUDIO UNIT OPERATION</td><td></td></tr>
<tr><td>

- Key in OFF position.
- Disconnect all the audio unit connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the audio unit connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**
</td><td>Yes
REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.</td></tr>
</table>

Pinpoint Test H: No Auxiliary Headphone Audio — THX®

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Audio signals are sent from the audio unit to the auxiliary audio module or the digital versatile disc (DVD) player. In single-play mode, the audio unit controls the output to all speakers and the headphones. In dual-play mode, the auxiliary audio module (or DVD player) controls the headphones.

Possible Causes

- Circuit RME09 (BN/YE) open, short to ground or voltage
- Circuit RME12 (BN/BU) open, short to ground or voltage
- Circuit VME09 (BN/GN) open, short to ground or voltage
- Circuit VME12 (BN/WH) open, short to ground or voltage

- Headphones
- Auxiliary audio module
- DVD player

PINPOINT TEST H: NO AUXILIARY HEADPHONE AUDIO — THX®

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Before diagnosing this condition, be sure the headphone batteries are OK.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>H1 CHECK THE OPERATION OF THE BASE AUDIO SYSTEM</td><td rowspan="2">Yes
GO to H2 .

No
GO to Symptom Chart .</td></tr>
<tr><td>• Operate the audio unit in radio tuner mode.
• Does the audio system operate correctly?</td></tr>
<tr><td>H2 CHECK THE AUDIO UNIT OUTPUT TO THE AUXILIARY AUDIO MODULE (OR DVD PLAYER)</td><td rowspan="2">Yes
GO to H5 .

No
GO to H3 .</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Auxiliary Audio Module C3077 or DVD Player C949.
• Operate the audio unit in radio tuner mode.
• Measure the AC voltage between the auxiliary audio module (or DVD player) pins, harness side as follows:
<table><tr><th>Auxiliary Audio Module (or DVD Player) Connector-Pin/ Circuit</th><th>Auxiliary Audio Module (or DVD Player) Connector-Pin/ Circuit</th></tr><tr><td>C3077-11 or C949-11 VME12 (BN/WH)</td><td>C3077-12 or C949-12 RME12 (BN/BU)</td></tr><tr><td>C3077-27 or C949-27 VME09 (BN/GN)</td><td>C3077-28 or C949-28 RME09 (BN/YE)</td></tr></table>• Is a fluctuating AC voltage present?</td></tr>
<tr><td>H3 CHECK THE AUDIO CIRCUITS FROM THE AUDIO UNIT FOR A SHORT TO VOLTAGE</td><td rowspan="2">Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to H4 .</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Audio Unit C240a.
• Key in ON position.
• Measure the voltage between the audio unit, harness side and ground as follows:
<table><tr><th>Audio Unit Connector-Pin</th><th>Circuit</th></tr><tr><td>C240a-9</td><td>VME09 (BN/GN)</td></tr><tr><td>C240a-10</td><td>VME12 (BN/WH)</td></tr><tr><td>C240a-22</td><td>RME09 (BN/YE)</td></tr><tr><td>C240a-23</td><td>RME12 (BN/BU)</td></tr></table></td></tr>
</table>

- **Is any voltage present?**

H4 CHECK THE AUDIO CIRCUITS FROM THE AUDIO UNIT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio unit, harness side and the auxiliary audio module (or DVD player), harness side; and between the audio unit, harness side and ground as follows:

Audio Unit Connector-Pin	Auxiliary Audio Module (or DVD Player) Connector-Pin	Circuit
C240a-9	C3077-27 or C949-27	VME09 (BN/GN)
C240a-10	C3077-11 or C949-11	VME12 (BN/WH)
C240a-22	C3077-28 or C949-28	RME09 (BN/YE)
C240a-23	C3077-12 or C949-12	RME12 (BN/BU)

- **Is the resistance less than 5 ohms between the audio unit and the auxiliary audio module (or DVD player), and greater than 10,000 ohms between the audio unit and ground?**

Yes
GO to H5 .

No
REPAIR the circuit in question. TEST the system for normal operation.

H5 ISOLATE THE HEADPHONES

- Connect: Audio Unit C240a.
- Connect: Auxiliary Audio Module C3077 or DVD Player C949.
- Install a set of known good headphones.
- Operate the audio unit in radio tuner mode and listen through the headphones.
- **Do the headphones operate correctly?**

Yes
SEND the DVD player to an authorized audio system repair facility. TEST the system for normal operation after the repair.

No
GO to H6 .

H6 CHECK FOR CORRECT AUXILIARY AUDIO MODULE (OR DVD PLAYER) OPERATION

- Key in OFF position.
- Disconnect the auxiliary audio module (or DVD player) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the auxiliary audio module (or DVD player) connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

Yes
If equipped with an auxiliary audio module, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation.

If equipped with a DVD player, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: Loud Popping Sound When Cycling The Ignition

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Voltage is sent through the start input circuit CBP28 (GY/VT) to the audio unit with the key in START. Upon receiving this signal, the audio unit mutes all speaker outputs to eliminate the possibility of speaker pops during engine cranking.

For the Audiophile audio system, the audio unit disables the subwoofer while the key is in START by keeping the enable signal below 0.4 volts.

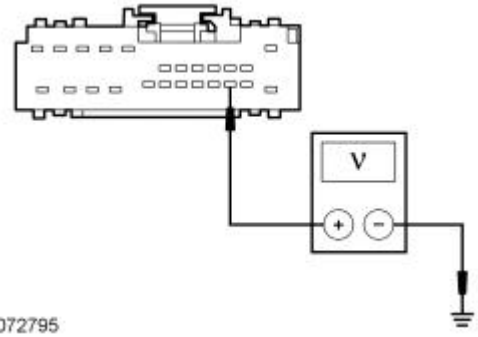
For the THX® audio system, the audio unit disables the THX® amplifier while the key is in START by keeping the enable signal below 0.4 volts.

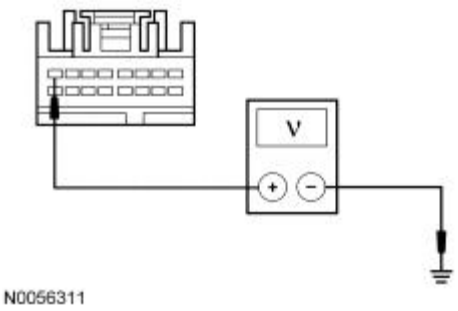
Possible Causes

- Fuse
- Circuit CBP28 (GY/VT) open
- Subwoofer (Audiophile)
- THX® amplifier
- Audio unit

PINPOINT TEST I: LOUD POPPING SOUND WHEN CYCLING THE IGNITION

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
I1 CHECK CIRCUIT CBP28 (GY/VT) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Audio Unit C240a. • Disconnect: Starter Relay. • Key in START position. • Measure the voltage between the audio unit C240a-15, circuit CBP28 (GY/VT), harness side and ground.  A0072795 • **Is the voltage greater than 10 volts?**	**Yes** For the Audiophile audio system, GO to I2 . For the THX® audio system, GO to I3 . For all others, SEND the audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** VERIFY the smart junction box (SJB) fuse 28 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
I2 ISOLATE THE SUBWOOFER	
• Key in OFF position. • Connect: Audio Unit C240a. • Disconnect: Subwoofer C466. • Cycle the key through all of the ignition switch positions.	**Yes** REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system

• **Is a loud popping sound present?**	for normal operation after the repair. **No** INSTALL a new subwoofer. REFER to Section 415-03 . TEST the system for normal operation.
I3 ISOLATE THE THX® AMPLIFIER	
• Key in OFF position. • Connect: Audio Unit C240a. • Disconnect: THX® Amplifier C2364c. • Key in START position. • Measure the voltage between the THX® Amplifier C2364c-8, circuit CME31 (BU/GN), harness side and ground.  N0056311 • **Is the voltage greater than 0.4 volts?**	**Yes** REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair. **No** GO to I4 .
I4 CHECK FOR CORRECT THX® AMPLIFIER OPERATION	

• Key in OFF position.
• Disconnect all the THX® amplifier connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the THX® amplifier connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new THX® amplifier. REFER to Section 415-01 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Steering Wheel Controls Are Inoperative/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio/Navigation for schematic and connector information.

Normal Operation

Voltage is sent from the audio unit to the steering wheel controls through circuit VME14 (GY/YE). When a switch is pressed, the voltage is routed through a specific resistor value for each function. The audio unit receives this reference voltage through circuit RME14 (BN/GN). The audio unit then uses this reference voltage to determine which control input function has been selected.

DTC B1117 — sets when a steering wheel control button is detected as active for greater than 120 seconds during normal operation, or for any duration during the self-test.

DTC B1136 — sets when the return voltage from the steering wheel controls is out-of-range. This can be caused by any failure on the steering wheel controls circuit.

DTC B2404 — sets when the return voltage from the steering wheel controls is out-of-range. This can be caused by any failure on the steering wheel controls circuit.

Possible Causes

- Circuit RME14 (BN/GN) open, short to ground or voltage
- Circuit VME14 (GY/YE) open, short to ground or voltage
- Clockspring
- Steering wheel controls
- Audio unit

PINPOINT TEST J: THE STEERING WHEEL CONTROLS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>J1 CHECK THE STEERING WHEEL CONTROLS RESISTANCE VALUES</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: Audio Unit C240a.
Measure the resistance between the audio unit C240a-18, circuit VME14 (GY/YE), harness side and the audio unit C240a-19, circuit RME14 (BN/GN), harness side while pressing the steering wheel controls as follows:

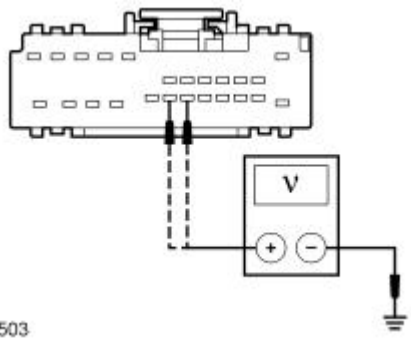
<table>
<tr><th>Switch</th><th>Resistance Range (Ohms)</th></tr>
<tr><td>VOL-</td><td>50.6-52.6</td></tr>
<tr><td>VOL+</td><td>118.0-121.4</td></tr>
<tr><td>SEEK+</td><td>208.0-213.1</td></tr>
<tr><td>SEEK-</td><td>330.8-338.4</td></tr>
<tr><td>MEDIA</td><td>503.0-514.1</td></tr>
<tr><td>No switches pressed</td><td>1,107-1,118</td></tr>
</table>

Are the resistance values within specification?

</td><td>Yes
GO to J5 .

No
GO to J2 .</td></tr>
<tr><td>J2 CHECK THE CIRCUITS TO THE CLOCKSPRING FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>

Disconnect: Clockspring C218a.
Key in ON position.
Measure the voltage between the audio unit C240a-18, circuit VME14 (GY/YE), harness side and ground; and between the audio unit C240a-19, circuit RME14 (BN/GN), harness side and ground.



A0073503

Is any voltage present?

</td><td>Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to J3 .</td></tr>
</table>

J3 CHECK THE CIRCUITS TO THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the audio unit, harness side and the clockspring, harness side; and between the audio unit, harness side and ground as follows: **Audio Unit Connector-Pin** / **Clockspring Connector-Pin** / **Circuit** C240a-18 / C218a-13 / VME14 (GY/YE) C240a-19 / C218a-12 / RME14 (BN/GN) • **Is the resistance less than 5 ohms between the audio unit and the clockspring, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** GO to J4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
J4 ISOLATE THE STEERING WHEEL CONTROLS	
• Key in OFF position. • Substitute the steering wheel controls with a known good unit. • Connect: Audio Unit C240c. • Operate the audio unit in radio tuner mode. • Press the steering wheel control switches and observe the audio unit. • **Does the audio system operate correctly?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL new steering wheel controls. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the self-test.
J5 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: The Satellite Audio Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The satellite radio receiver receives voltage through circuit SBP03 (BU/RD), and ground through circuit GD114 (BK/BU). Digital signals are received by the satellite antenna and sent to the satellite radio receiver. Audio signals are sent to the auxiliary audio module or the digital versatile disc (DVD) player (if

equipped), then to the audio unit.

Possible Causes

- Circuit RME17 (GY) open, short to ground or voltage
- Circuit RME18 (YE) open, short to ground or voltage
- Circuit RME41 (BU/BN) open, short to ground or voltage
- Circuit RME42 (YE/BU) open, short to ground or voltage
- Circuit VME17 (GN) open, short to ground or voltage
- Circuit VME18 (VT) open, short to ground or voltage
- Circuit VME41 (GN/OG) open, short to ground or voltage
- Circuit VME42 (VT/BN) open, short to ground or voltage
- Satellite radio receiver
- Auxiliary audio module
- DVD player
- Audio unit

PINPOINT TEST K: THE SATELLITE AUDIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
K1 VERIFY THE AUDIO UNIT RECOGNIZES THE SATELLITE RADIO RECEIVER	
• Key in ON position. • For vehicles without navigation, turn the audio unit on and press the AUX button repeatedly until SAT1 is displayed. • For vehicles with navigation, turn the audio unit on and verify the presence of the SR folder tab on the touchscreen. • **Is SAT1 or the SR folder tab available?**	**Yes** GO to K2 . **No** REFER to Section 418-00 to diagnose the communication network.
K2 VERIFY AN ACTIVE SUBSCRIPTION	
• Enter satellite mode on the audio unit and observe the display. • **Does the display read CALL SIRIUS?**	**Yes** The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription. **No** GO to K3 .
K3 CHECK THE RECORDED DTCs	
• Perform the satellite audio bezel diagnostic test. • **Are any satellite audio system DTCs present?**	**Yes** If DTC B1031 SAT or DTC B1032 SAT is present, Go To Pinpoint Test I . For all other DTCs, REFER to the Satellite Radio Receiver Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to K4 .

K4 CHECK THE SATELLITE RADIO RECEIVER OPERATION

- Perform the satellite bezel diagnostic self-test.
- **Are alternating LH/RH tones audible?**

Yes
GO to K10 .

No
GO to K5 .

K5 ISOLATE THE AUXILIARY AUDIO MODULE (OR DVD PLAYER)

- Key in OFF position.
- Disconnect: Auxiliary Audio Module C3077 or DVD Player C949.
- Connect fused (10A) jumper wires between the auxiliary audio module (or DVD player) pins as follows:

Auxiliary Audio Module or DVD Player Pin-Circuit/ Circuit	Auxiliary Audio Module or DVD Player Pin-Circuit/ Circuit
C3077-21 or C949-21 VME42 (VT/BN)	C3077-26 or C949-26 VME18 (VT)
C3077-22 or C949-22 RME42 (YE/BU)	C3077-25 or C949-25 RME18 (YE)
C3077-5 or C949-5 VME41 (GN/OG)	C3077-10 or C949-10 VME17 (GN
C3077-6 or C949-6 RME41 (BU/BN)	C3077-9 or C949-9 RME17 (GY)

- Key in ON position.
- Perform the satellite bezel diagnostic self-test.
- **Are alternating LH/RH tones audible?**

Yes
REMOVE the jumper wires. GO to K12 .

No
REMOVE the jumper wires. GO to K6 .

K6 CHECK THE AUDIO CIRCUITS FROM THE SATELLITE RADIO RECEIVER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Satellite Radio Receiver C3290.
- Key in ON position.
- Measure the voltage between the satellite radio receiver, harness side and ground as follows:

Satellite Radio Receiver Connector-Pin	Circuit
C3290-5	VME41 (GN/OG)
C3290-6	VME42 (VT/BN)
C3290-11	RME41 (BU/BN)
C3290-12	RME42 (YE/BU)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to K7 .

K7 CHECK THE AUDIO CIRCUITS FROM THE SATELLITE RADIO RECEIVER FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the satellite radio

Yes
GO to K8 .

receiver, harness side and the auxiliary audio module (or DVD player), harness side; and between the satellite radio receiver, harness side and ground as follows:

Satellite Radio Receiver Connector-Pin	Auxiliary Audio Module (or DVD Player) Connector-Pin	Circuit
C3290-5	C3077-5	VME41 (GN/OG)
C3290-6	C3077-21	VME42 (VT/BN)
C3290-11	C3077-6	RME41 (BU/BN)
C3290-12	C3077-22	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the satellite radio receiver and the auxiliary audio module (or DVD player), and greater than 10,000 ohms between the satellite radio receiver and ground?**

No
REPAIR the circuit in question.
TEST the system for normal operation.

K8 CHECK THE AUDIO CIRCUITS TO THE AUDIO UNIT FOR A SHORT TO VOLTAGE

- Disconnect: Audio Unit C240b.
- Key in ON position.
- Measure the voltage between the audio unit, harness side and ground as follows:

Audio Unit Connector-Pin	Circuit
C240b-1	VME17 (GN)
C240b-2	RME17 (GY)
C240b-9	VME18 (VT)
C240b-10	RME18 (YE)

- **Is any voltage present?**

Yes
REPAIR the circuit in question.
TEST the system for normal operation.

No
GO to K9 .

K9 CHECK THE AUDIO CIRCUITS TO THE AUDIO UNIT FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the audio unit, harness side and the auxiliary audio module (or DVD player), harness side; and between the audio unit, harness side and ground as follows:

Audio Unit Connector-Pin	Auxiliary Audio Module (or DVD Player) Connector-Pin	Circuit
C240b-1	C3077-10	VME17 (GN)
C240b-2	C3077-9	RME17 (GY)
C240b-9	C3077-26	VME18 (VT)

Yes
GO to K10 .

No
REPAIR the circuit in question.
TEST the system for normal operation.

C240b-10	C3077-25	RME18 (YE)

- **Is the resistance less than 5 ohms between the audio unit and the auxiliary audio module (or DVD player), and greater than 10,000 ohms between the audio unit and ground?**

K10 ISOLATE THE SATELLITE RADIO RECEIVER	
• Key in OFF position. • Connect: Auxiliary Audio Module C3077 or DVD Player C949. • Substitute a known good satellite radio receiver. • Operate the audio unit in satellite audio mode. • **Does the system operate correctly?**	**Yes** SEND the original satellite radio receiver to an authorized audio system repair facility. TEST the system for normal operation. **No** INSTALL the original satellite radio receiver. GO to K11 .
K11 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Key in OFF position.
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

K12 CHECK FOR CORRECT AUXILIARY AUDIO MODULE (OR DVD PLAYER) OPERATION	

• Key in OFF position.
• Disconnect the auxiliary audio module (or DVD player) connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the auxiliary audio module (or DVD player) connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	If equipped with an auxiliary audio module, INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation.
	
	If equipped with a DVD player, REMOVE the DVD player and SEND it to an authorized audio system repair facility. REFER to Section 415-07 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: Poor Reception — Satellite Audio

Normal Operation

Digital signals are received by the satellite antenna and sent to the satellite radio receiver, which then converts the signals and provides audio signals to the auxiliary audio module, or to the digital versatile disc (DVD) player, if equipped.

DTC B1031 — sets when an open or high resistance is detected in the satellite antenna circuit.

DTC B1032 — sets when a short to ground is detected in the satellite antenna circuit.

Possible Causes

- Satellite antenna cable
- Satellite antenna
- Satellite radio receiver

PINPOINT TEST L: POOR RECEPTION — SATELLITE AUDIO

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
L1 REVIEW THE DTCs	
• Review the DTCs from the satellite radio receiver self-test. • **Is DTC B1031 or B1032 present?**	**Yes** GO to L3 . **No** GO to L2 .
L2 CHECK THE OPERATION OF THE SATELLITE AUDIO	
• Drive the vehicle to an open location, free of obstacles. • Operate the audio unit in satellite audio mode. • **Is the reception OK?**	**Yes** The system is OK at this time. ADVISE the customer that the satellite signal can be affected by obstructions to the satellite antenna line of sight. **No** GO to L3 .
L3 CHECK THE SATELLITE ANTENNA CABLE	
• Key in OFF position. • Disconnect: Satellite Antenna Connection (at satellite radio receiver). • Disconnect: Satellite Antenna Connection (at satellite antenna). • Measure the resistance of the satellite radio antenna cable between the satellite radio receiver and the satellite antenna connection. • **Is the resistance less than 1 ohm?**	**Yes** GO to L4 . **No** INSTALL a new satellite antenna cable. CLEAR the DTCs. REPEAT the self-test.
L4 SUBSTITUTE THE SATELLITE ANTENNA	
• Install a known good satellite antenna. • Operate the audio unit in satellite audio mode. • **Is the reception OK?**	**Yes** INSTALL a new satellite antenna. REFER to Section 415-02 . CLEAR the DTCs. REPEAT the self-test.

	No REMOVE the satellite radio receiver and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.

Pinpoint Test M: The Audio Input Jack Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Audio signals are sent from the audio input jack to the audio unit. There are no external power or ground circuits to the audio input jack.

Possible Causes

- Circuit RME45 (YE/GN) open, short to ground or voltage
- Circuit RME46 (WH/GN) open, short to ground or voltage
- Circuit VME45 (BU) open, short to ground or voltage
- Circuit VME46 (BU/GN) open, short to ground or voltage
- Audio input jack
- Audio unit

PINPOINT TEST M: THE AUDIO INPUT JACK IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Before performing this pinpoint test, be sure the MP3 device is operating correctly.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>M1 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: Audio Input Jack C2362.
Disconnect: Audio Unit C240c.
Key in ON position.
Measure the voltage between the audio input jack, harness side and ground as follows:

<table>
<tr><th>Audio Input Jack Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C2362-1</td><td>VME46 (BU/GN)</td></tr>
<tr><td>C2362-2</td><td>RME46 (WH/GN)</td></tr>
<tr><td>C2362-3</td><td>RME45 (YE/GN)</td></tr>
<tr><td>C2362-4</td><td>VME45 (BU)</td></tr>
</table>

Is any voltage present?

</td><td>Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to M2 .</td></tr>
<tr><td>M2 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN OR SHORT TO GROUND</td><td></td></tr>
</table>

<table>
<tr>
<td>

Key in OFF position.
Measure the resistance between the audio input jack, harness side and the audio unit, harness side; and between the audio input jack, harness side and ground as follows:

<table>
<tr><th>Audio Input Jack Connector-Pin</th><th>Audio Unit Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C2362-1</td><td>C240b-6</td><td>VME46 (BU/GN)</td></tr>
<tr><td>C2362-2</td><td>C240b-14</td><td>RME46 (WH/GN)</td></tr>
<tr><td>C2362-3</td><td>C240b-8</td><td>RME45 (YE/GN)</td></tr>
<tr><td>C2362-4</td><td>C240b-7</td><td>VME45 (BU)</td></tr>
</table>

Is the resistance less than 5 ohms between the audio input jack and the audio unit, and greater than 10,000 ohms between the audio input jack and ground?

</td>
<td>Yes
GO to M3 .

No
REPAIR the circuit in question. TEST the system for normal operation.</td>
</tr>
<tr><td>M3 SUBSTITUTE THE AUDIO INPUT JACK</td><td rowspan="2"></td></tr>
<tr>
<td>

Install a known good audio input jack.
Operate the audio unit in auxiliary audio mode.
Does the system operate correctly?

</td>
<td>Yes
INSTALL a new audio input jack. REFER to Section 415-01 . TEST the system for normal operation.

No
INSTALL the original audio input jack. REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.</td>
</tr>
</table>

Pinpoint Test N: Voice Recognition Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, a signal is sent to the audio unit through VMN16 (BN/WH), and the audio unit enters voice recognition mode. A microphone located in the interior rear view mirror receives the voice command and sends a signal to the audio unit through circuits RMN07 (VT) and VMN07 (GY). Power to the interior rear view mirror is provided through circuit CBP31 (BU/OG), and ground through circuit GD133 (BK).

DTC B2633 — sets when an open, short to ground, or short to voltage is detected on the microphone circuits.

Possible Causes

- Fuse
- Circuit CBP31 (BU/OG) open, short to ground or voltage
- Circuit GD133 (BK) open, short to ground or voltage
- Circuit RMN07 (VT) open, short to ground or voltage

- Circuit VMN07 (GY) open, short to ground or voltage
- Circuit VMN16 (BN/WH) open, short to ground or voltage
- Steering wheel controls
- Microphone (part of the interior rear view mirror)
- Audio unit

PINPOINT TEST N: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

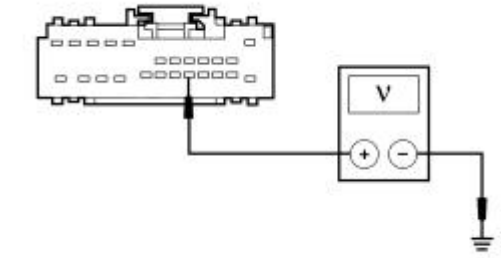
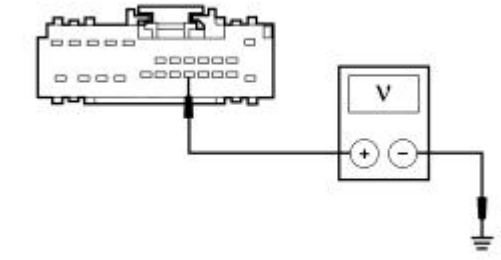
<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>N1 CHECK THE DTCs</td><td></td></tr>
<tr><td>• Review the DTCs from the audio unit self-test.
• Is DTC B2633 retrieved?</td><td>Yes
GO to N9 .

No
GO to N2 .</td></tr>
<tr><td>N2 CHECK THE OPERATION OF THE STEERING WHEEL CONTROL SWITCHES</td><td></td></tr>
<tr><td>• Operate the audio unit in radio tuner mode.
• Press the VOL+ and VOL- steering wheel control switches.
• Do the VOL+ and VOL- steering wheel control switches operate correctly?</td><td>Yes
GO to N3 .

No
Go To Pinpoint Test J .</td></tr>
<tr><td>N3 CHECK THE OPERATION OF THE VOICE RECOGNITION ICON</td><td></td></tr>
<tr><td>• Press the VOICE switch and observe the operation of the voice recognition icon on the audio unit.
• Does the voice recognition icon toggle with the VOICE switch?</td><td>Yes
GO to N9 .

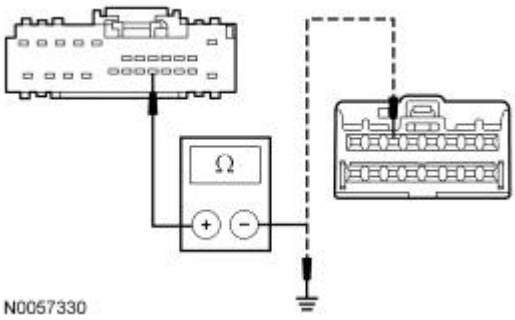
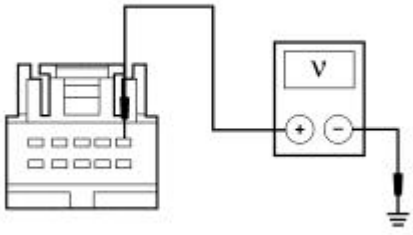
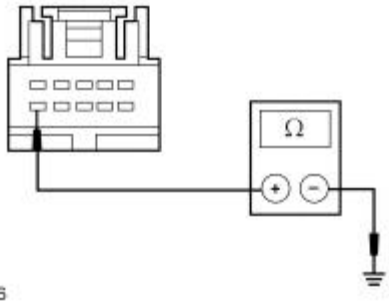
No
GO to N4 .</td></tr>
<tr><td>N4 CHECK THE VOICE SWITCH</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Steering Wheel Controls C2367 (Expedition, Expedition EL) or C2999 (Navigator).
• Measure the resistance between the steering wheel controls pins component side while pressing and releasing the VOICE switch as follows:
<table>
<tr><th>Vehicle</th><th>Steering Wheel Controls Connector-Pin</th><th>Steering Wheel Controls Connector-Pin</th><th>VOICE Switch Position</th><th>Resistance Value (Ohms)</th></tr>
<tr><td>Expedition, Expedition EL</td><td>C2367-7</td><td>C2367-8</td><td>Pressed
Released</td><td>50.6-51.6
1,050.4-1,071.6</td></tr>
<tr><td>Navigator</td><td>C2999-4</td><td>C2999-6</td><td>Pressed
Released</td><td>50.6-51.6
179.3-182.9</td></tr>
</table>
• Are all the resistance values within specification?</td><td>Yes
GO to N5 .

No
INSTALL new steering wheel controls. REFER to Section 415-01 . TEST the system for normal operation.</td></tr>
</table>

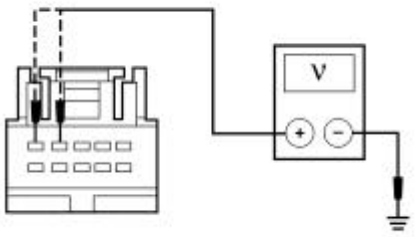
N5 CHECK CIRCUIT VMN16 (BN/WH) FOR A SHORT TO VOLTAGE	
• Disconnect: Audio Unit C240a. • Key in ON position. • Measure the voltage between the audio unit C240a-17, circuit VMN16 (BN/WH), harness side and ground.  N0057249 • **Is any voltage present?**	**Yes** GO to N6 . **No** GO to N7 .
N6 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Clockspring C218a. • Key in ON position. • Measure the voltage between the audio unit C240a-17, circuit VMN16 (BN/WH), harness side and ground.  N0057249 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new clockspring. REFER to Section 501-20B . TEST the system for normal operation.
N7 CHECK CIRCUIT VMN16 (BN/WH) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the audio unit, harness side and the steering wheel controls, harness side; and between the audio unit, harness side and ground as follows.	**Yes** GO to N14 . **No** GO to N8 .

Vehicle	Audio Unit Connector-Pin	Steering Wheel Controls Connector- Pin	Circuit
Expedition, Expedition EL	C240a-17	C2367-8	VMN16 (BN/WH)
Navigator	C240a-17	C2999-6	VMN16 (BN/WH)

• **Is the resistance less than 5 ohms between the audio unit and the steering wheel controls, and greater than 10,000 ohms between the audio unit and ground?**	
N8 CHECK THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Disconnect: Clockspring C218a.	**Yes** INSTALL a new

• Measure the resistance between the audio unit C240a-17, circuit VMN16 (BN/WH), harness side and the clockspring C218a-6, circuit VMN16 (BN/WH), harness side; and between the audio unit C240a-17, circuit VMN16 (BN/WH), harness side and ground.  N0057330 • **Is the resistance less than 5 ohms between the audio unit and the clockspring, and greater than 10,000 ohms between the audio unit and ground?**	clockspring. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
N9 CHECK CIRCUIT CBP31 (BU/OG) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Interior Rear View Mirror C9012. • Key in ON position. • Measure the voltage between the interior rear view mirror C9012-1, circuit CBP31 (BU/OG), harness side and ground.  N0057331 • **Is the voltage greater than 10 volts?**	**Yes** GO to N10 . **No** VERIFY the smart junction box (SJB) fuse 31 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
N10 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the interior rear view mirror C9012-10, circuit GD133 (BK), harness side and ground.  N0057336 • **Is the resistance less than 5 ohms?**	**Yes** GO to N11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
N11 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: Audio Unit C240b. • Key in ON position. • Measure the voltage between the interior rear view mirror C9012-4, circuit VMN07 (GY), harness side and ground; and between the interior rear view mirror C9012-5, circuit RMN07 (VT), harness side and	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-

ground.



N0057337

- **Is any voltage present?**

test.

No
GO to N12 .

N12 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the inside rear view mirror, harness side and the audio unit, harness side; and between the rear view mirror, harness side and ground as follows:

Interior Rear View Mirror Connector-Pin	Audio Unit Connector-Pin	Circuit
C9012-4	C240b-11	VMN07 (GY)
C9012-5	C240b-12	RMN07 (VT)

- **Is the resistance less than 5 ohms between the interior rear view mirror and the audio unit, and greater than 10,000 ohms between the interior rear view mirror and ground?**

Yes
GO to N13 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

N13 ISOLATE THE INTERIOR REAR VIEW MIRROR

- Substitute a known good interior rear view mirror.
- Operate the audio unit in navigation mode.
- Attempt several voice commands. For additional information, refer to the Owner's Literature.
- **Does the voice recognition operate correctly?**

Yes
INSTALL a new interior rear view mirror. REFER to Section 501-09 . CLEAR the DTCs. REPEAT the self-test.

No
GO to N14 .

N14 CHECK FOR CORRECT AUDIO UNIT OPERATION

- Disconnect all the audio unit connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the audio unit connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes
REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.

No
The system is

	operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Satellite radio receiver screws	8	71
THX® amplifier nuts	9	80

Audio System

Printable View (63 KB)

The following audio systems are available:

- Base
  - AM/FM/single compact disc (CD)/MP3
  - Six speakers
- Premium
  - AM/FM 6-CD in-dash CD changer with MP3
  - Six speakers
- Audiophile
  - AM/FM 6-CD in-dash CD changer with MP3
  - Nine speakers (includes subwoofers)
- THX®
  - AM/FM 6-CD in-dash CD changer with MP3
  - Fourteen speakers (includes subwoofer and center imaging speakers)
  - THX® amplifier (with digital signal processing capabilities)
- Navigation
  - AM/FM/6 disc in-dash CD changer with MP3
  - Touch-screen navigation integral to audio unit
  - Voice-activation
  - Available with Audiophile or THX®

In addition, the following options are available:

- Rear seat controls (part of the auxiliary audio module)
  - Not available on vehicles with bench seat
  - Wired headphones
  - Audio ports
  - Allows single/dual-play
- Digital versatile disc (DVD) player
  - Not available on vehicles with bench seat
  - Wireless headphones
  - A/V ports for connecting a gaming system
  - Allows single/dual-play
- Satellite audio
  - Available as an option with all audio units
  - Provides satellite-broadcast reception

All vehicles have an audio input jack, which can be used to connect a portable MP3 device to the vehicle. When connected, the audio files from the MP3 player can be broadcast through the vehicle speakers.

Audio System

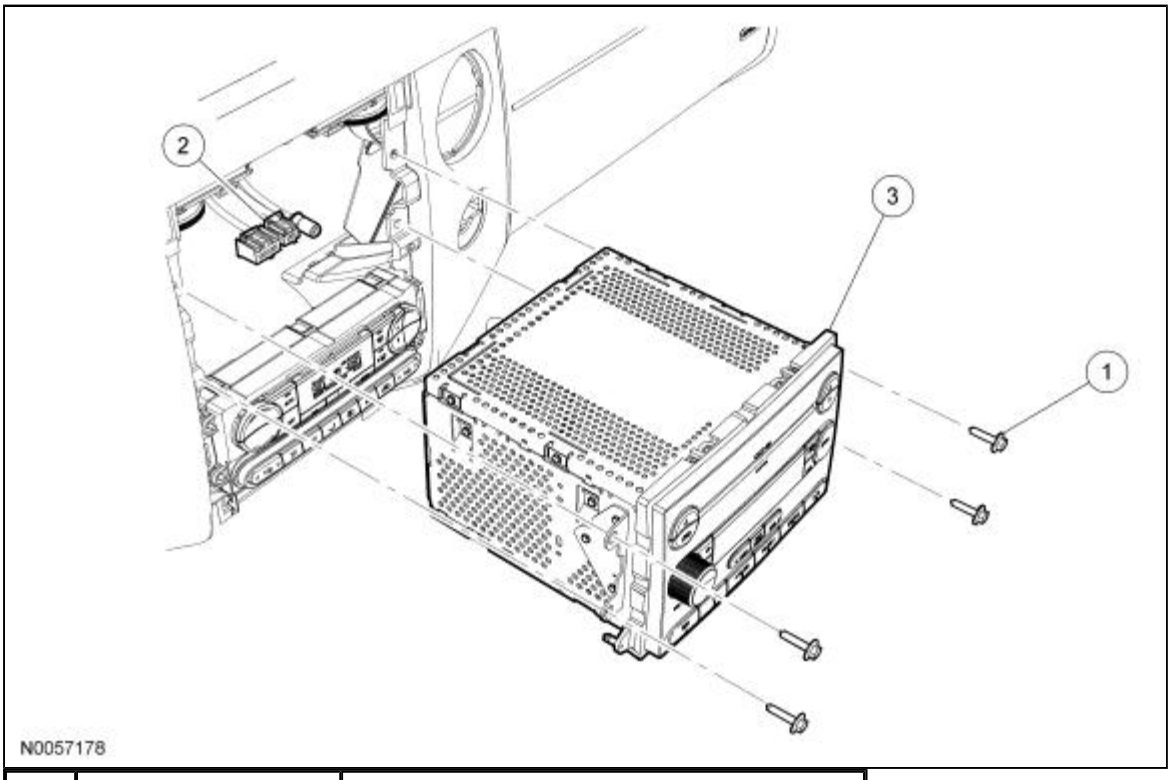
Printable View (62 KB)

Refer to Section 415-00 .

Audio Unit

Printable View (183 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	W707628-S	Audio unit screws (4 required)
2	—	Audio unit electrical connectors and antenna cable connector (part of 14401)
3	18C815/18C869/ 18K931	Audio unit

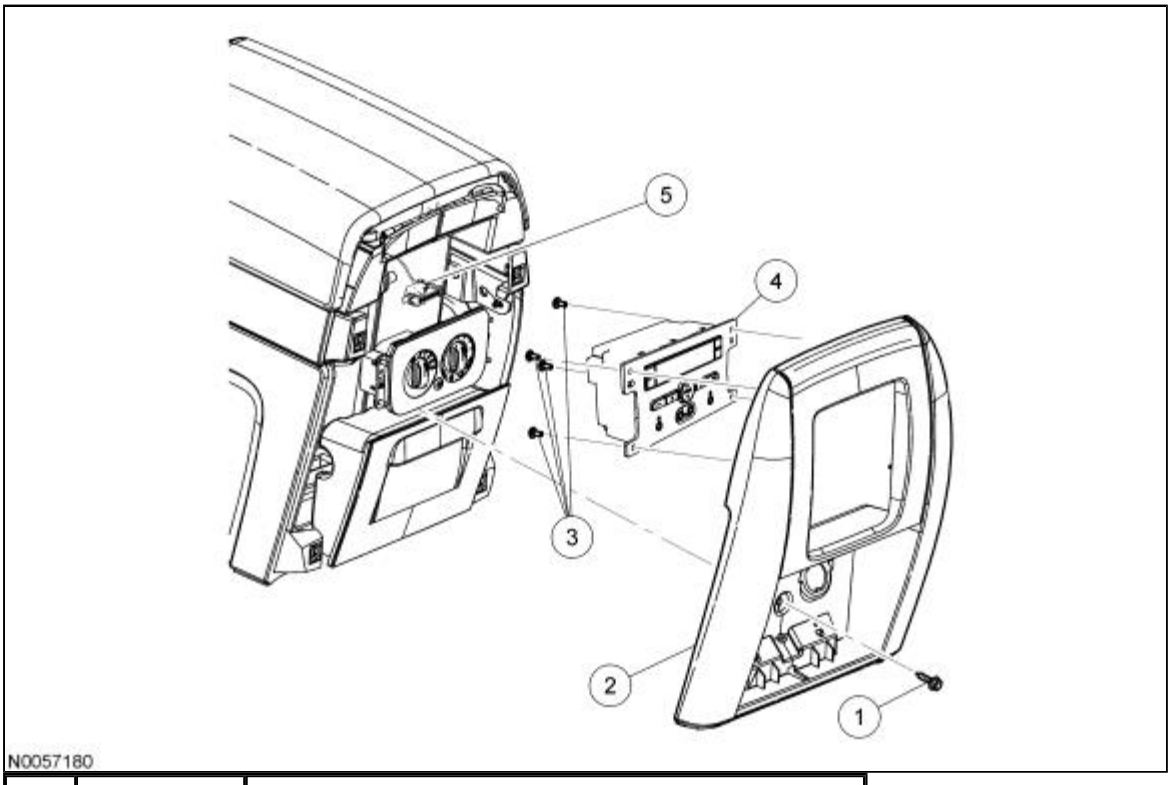
Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
2. Remove the 4 screws and the audio unit.
   - Disconnect the electrical connectors, the antenna cable connector, and the global positioning system (GPS) antenna (if present).
3. To install, reverse the removal procedure.

Auxiliary Audio Module

Printable View (171 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	—	Center console rear trim panel bolt
2	78045A12	Center console rear trim panel
3	W506821-S	Auxiliary audio module screws (4 required)
4	19A164	Auxiliary audio module
5	—	Auxiliary audio module electrical connector (part of 14B079)

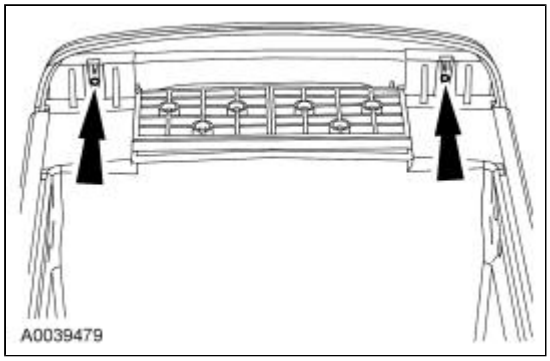
Removal and Installation

Navigator

1. Remove the floor console cupholders.
2. Remove the 2 screws securing the rear trim panel to the floor console.

Expedition

3. Remove the 2 screws under the armrest cover.



All vehicles

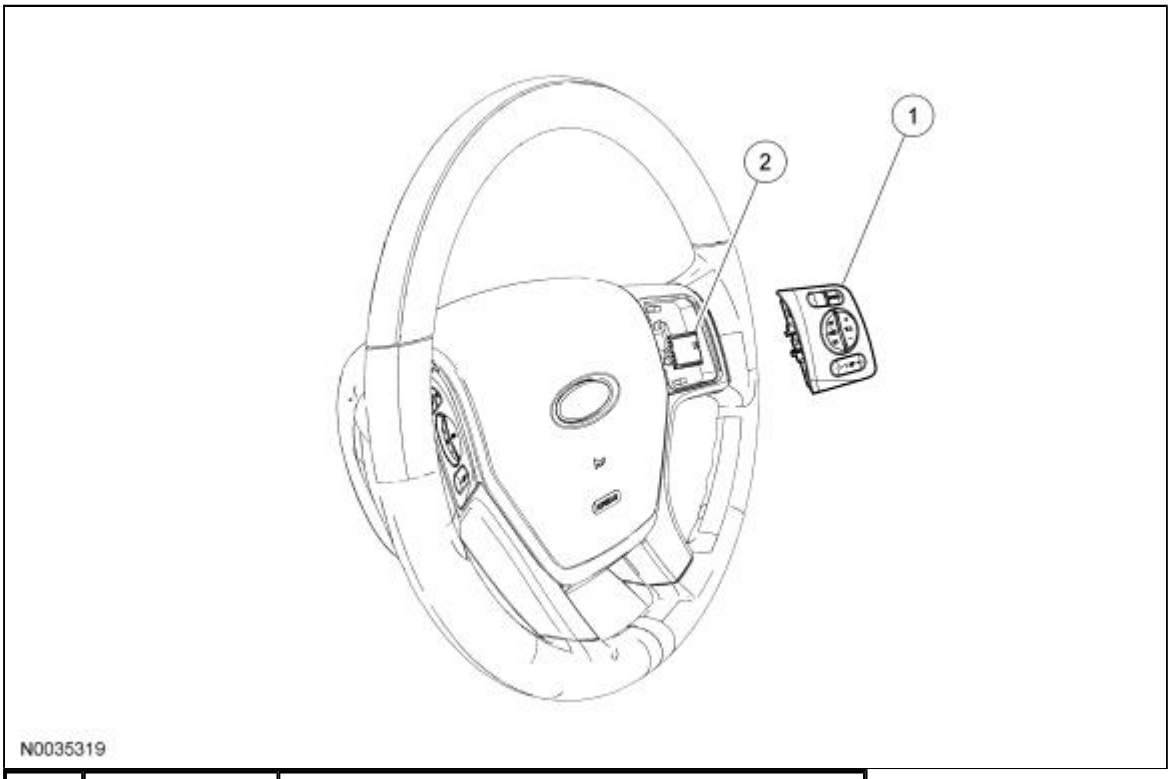
4. Remove the bolt and the center console rear trim panel.
    - Disengage the pin-type retainers.
    - Disconnect the auxiliary audio module electrical connector.

5. Remove the auxiliary audio module.
    - Remove the 4 screws.

6. To install, reverse the removal procedure.

Steering Wheel Controls — Expedition

Printable View (131 KB)



Item	Part Number	Description
1	9C888	Steering wheel controls
2	3600	Steering wheel controls electrical connector

Removal and Installation

1. **NOTE:** It is not necessary to remove the driver air bag module during this procedure.

   NOTE: When removing the steering wheel controls, disengage the RH side of the controls first.

   Using an appropriate tool, pry the steering wheel controls out of the steering wheel.

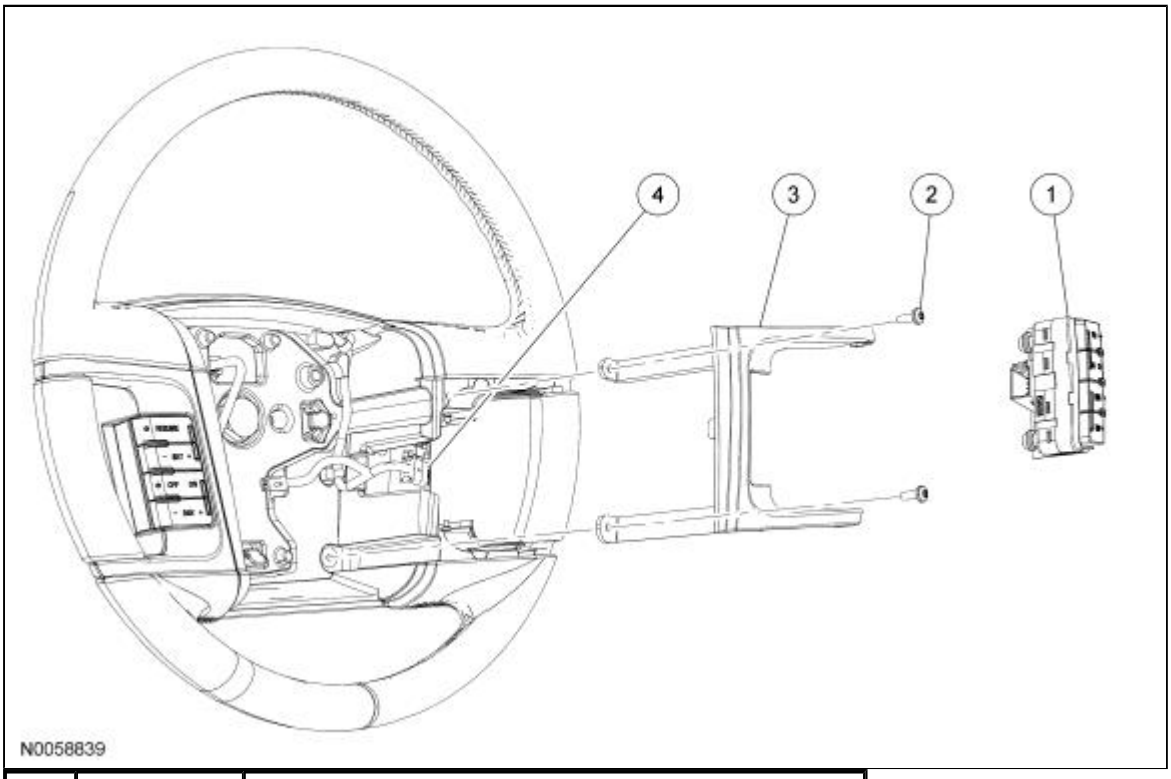
2. **NOTE:** Do not allow the electrical connector to fall back into the steering wheel.

   Remove the steering wheel controls.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Steering Wheel Controls — Navigator

Printable View (160 KB)



Item	Part Number	Description
1	9C888	Steering wheel controls
2	—	Steering wheel controls screws (part of 3600) (2 required)
3	—	Steering wheel controls bezel (part of 3600)
4	—	Steering wheel controls electrical connector (part of 3600)

Removal and Installation

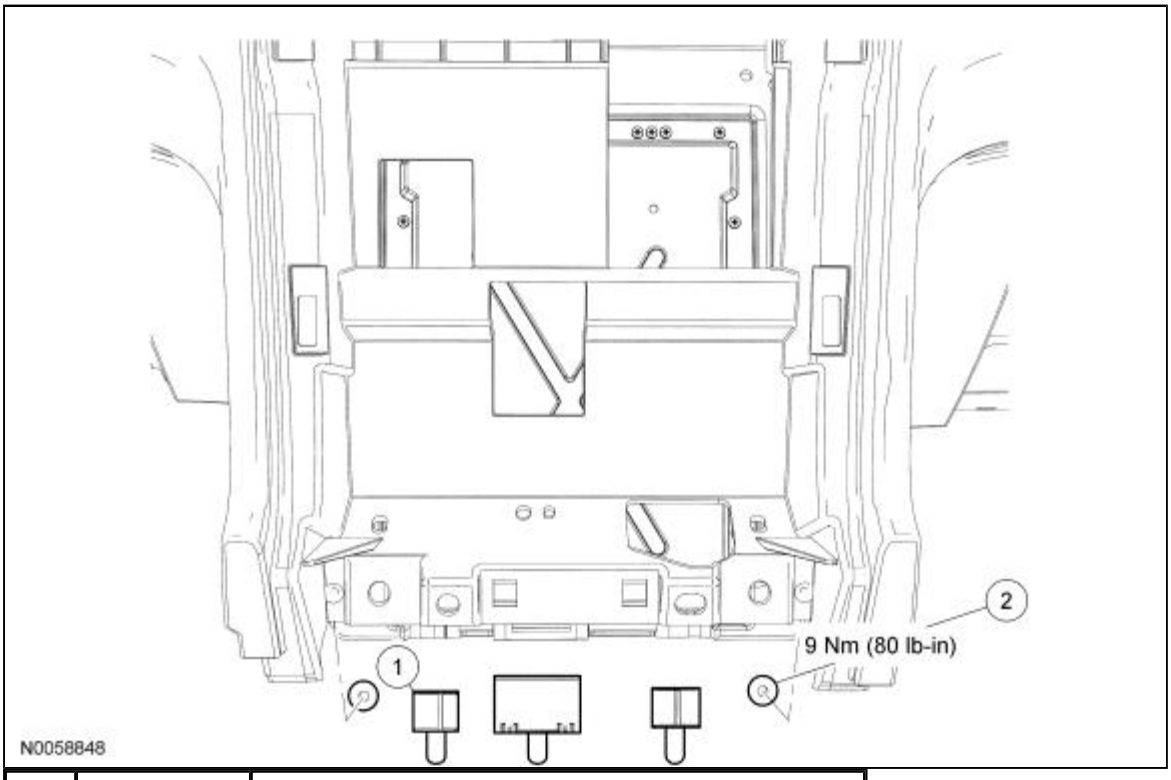
1. Remove the driver air bag module. For additional information, refer to Section 501-20B .
2. Remove the 2 screws and the steering wheel controls bezel.
3. **NOTE:** Using an appropriate tool, pry the switch from behind.

   Remove the steering wheel controls.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

Audio Amplifier — THX®

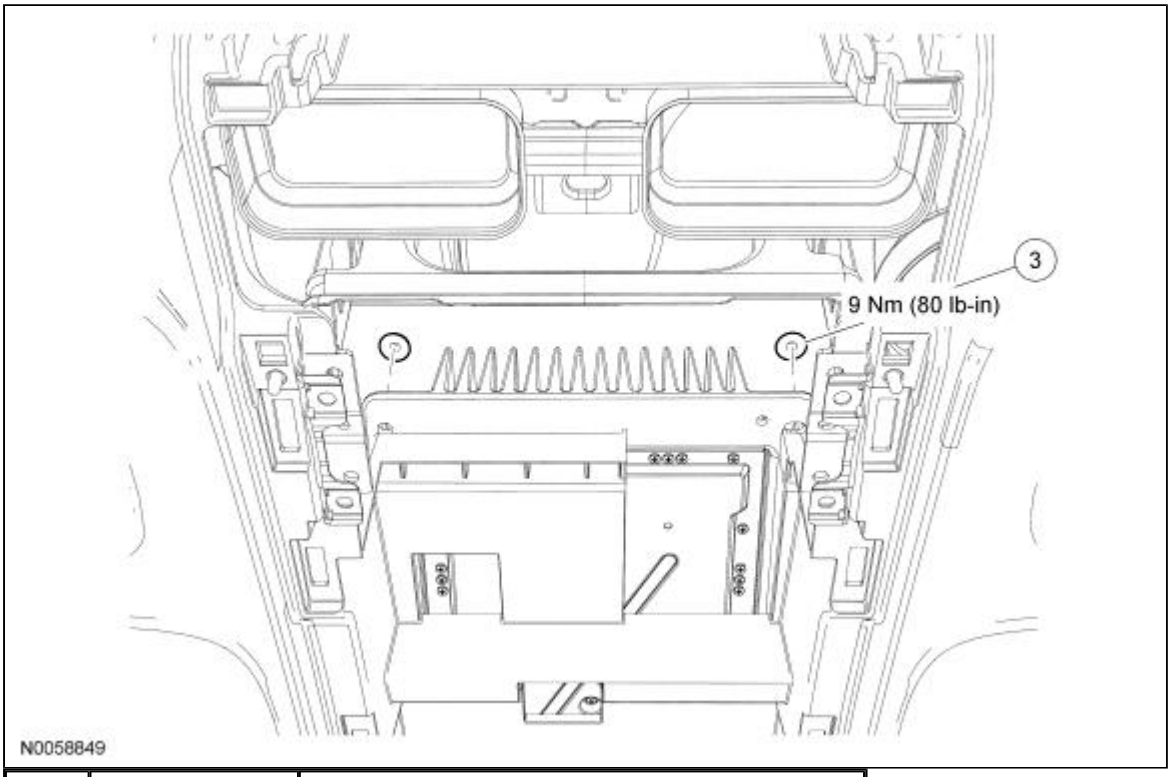
Printable View (366 KB)

THX® Amplifier Lower Attachment



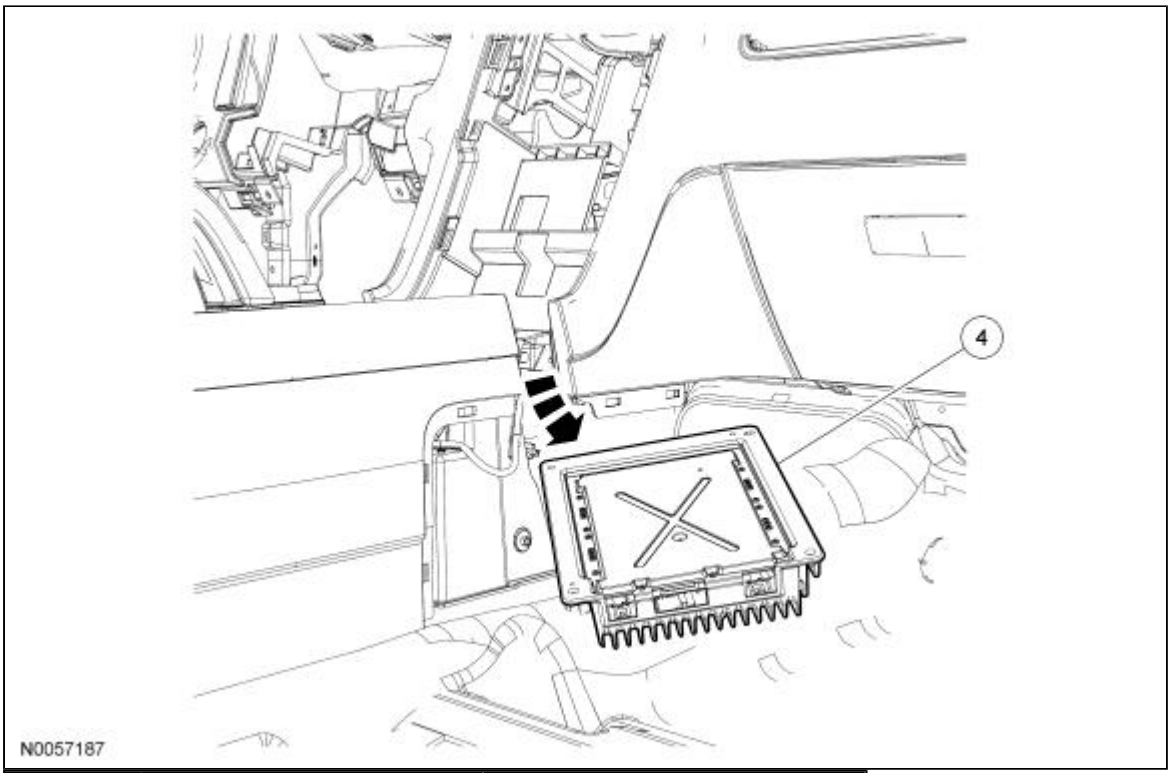
Item	Part Number	Description
1	—	THX® amplifier electrical connectors (part of 14401)
2	W701152-S	THX® amplifier lower nuts (2 required)

THX® Amplifier Upper Attachment



Item	Part Number	Description
3	W701152-S	THX® amplifier upper nuts (2 required)

THX® Amplifier Removal Routing



Item	Part Number	Description
4	18B849	THX® amplifier

Removal and Installation

1. Remove the audio unit. For additional information, refer to Audio Unit in this section.

2. Remove the necessary attachments and move the center console 5 cm (2.0 in) towards the rear of the vehicle. For additional information, refer to Section 501-12 .

3. Disconnect the THX® amplifier electrical connectors.

4. Remove the 2 lower THX® amplifier nuts.
   - To install, tighten to 9 Nm (80 lb-in).

5. **CAUTION: The THX® amplifier is heavy. Be sure to support the amplifier during removal, or damage to the vehicle may occur.**

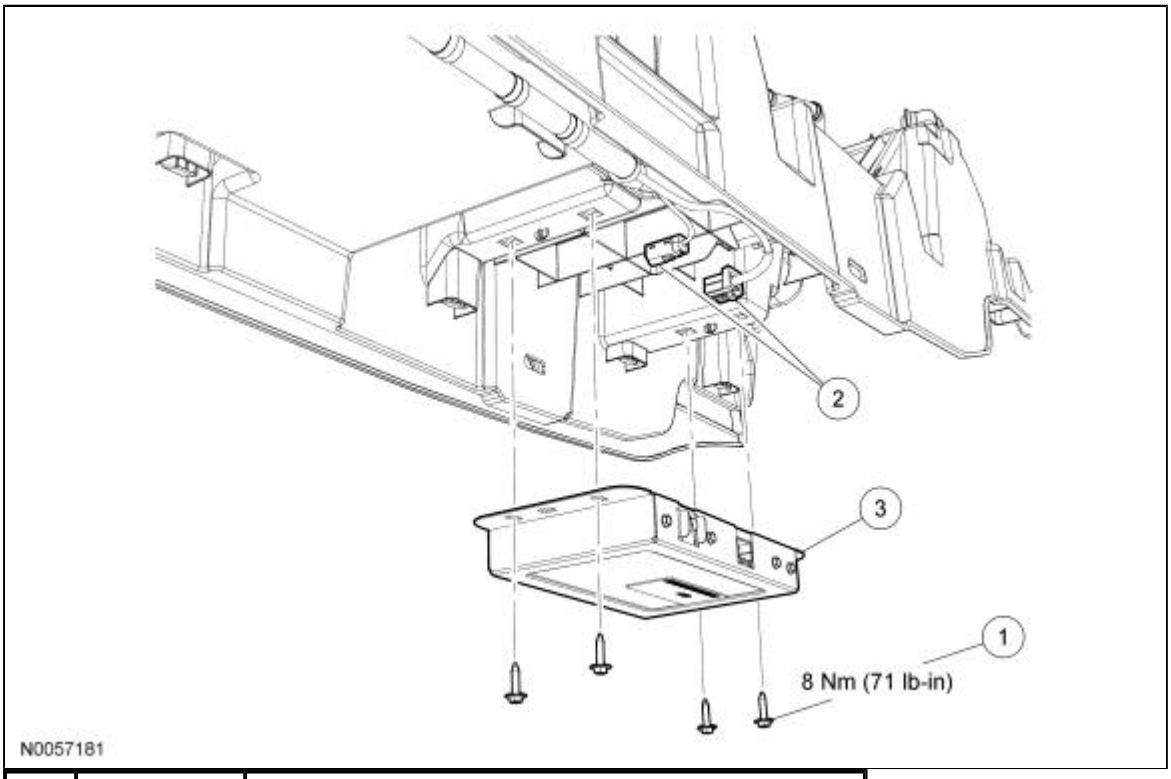
   Remove the 2 upper THX® amplifier nuts.
   - To install, tighten to 9 Nm (80 lb-in).

6. Remove the THX® amplifier.
   - Route the THX® amplifier down and towards the passenger side of the vehicle.

7. To install, reverse the removal procedure.

Satellite Radio Receiver

Printable View (142 KB)



Item	Part Number	Description
1	W707628-S	Satellite radio receiver screws (4 required)
2	—	Satellite radio receiver electrical connectors (part of 14A464)
3	18806	Satellite radio receiver

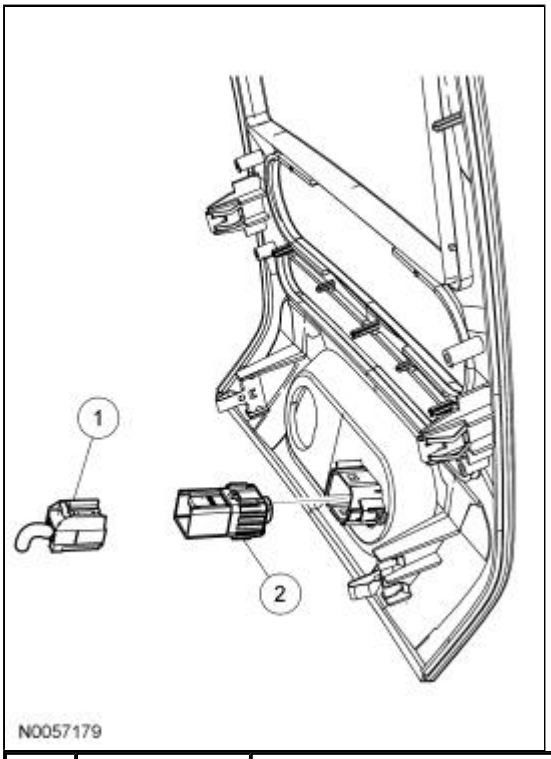
Removal and Installation

1. Remove the center console. For additional information, refer to Section 501-12 .
2. Remove the 4 screws and the satellite radio receiver.
   - Disconnect the electrical connectors.
   - To install, tighten the screws to 8 Nm (71 lb-in).
3. To install, reverse the removal procedure.

Audio Input Jack

Printable View (131 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	—	Audio input jack electrical connector (part of 14401)
2	19A164	Audio input jack

Removal and Installation

Expedition

1. Remove the instrument panel center finish panel. For additional information, refer to Section 501-12 .

Navigator

2. Remove the front floor console center finish panel. For additional information, refer to Section 501-12 .

All vehicles

3. Release the tabs and remove the audio input jack.
   - Disconnect the electrical connector.

4. To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Antenna isolator module stud	8	71
Satellite radio antenna bolt	5	44

Antenna

Printable View (63 KB)

AM/FM Antenna

The AM/FM antenna system consists of the following components:

- Antenna grid (part of right rear quarter glass)
- Antenna module
- 2-piece antenna cable

The antenna receives AM and FM radio waves. The waves are sent to the audio unit through the antenna cable.

The antenna is located on the inside of the right rear quarter glass and can be repaired, but not replaced separately from the glass. For additional information, refer to Section 501-11 .

Satellite Radio Antenna

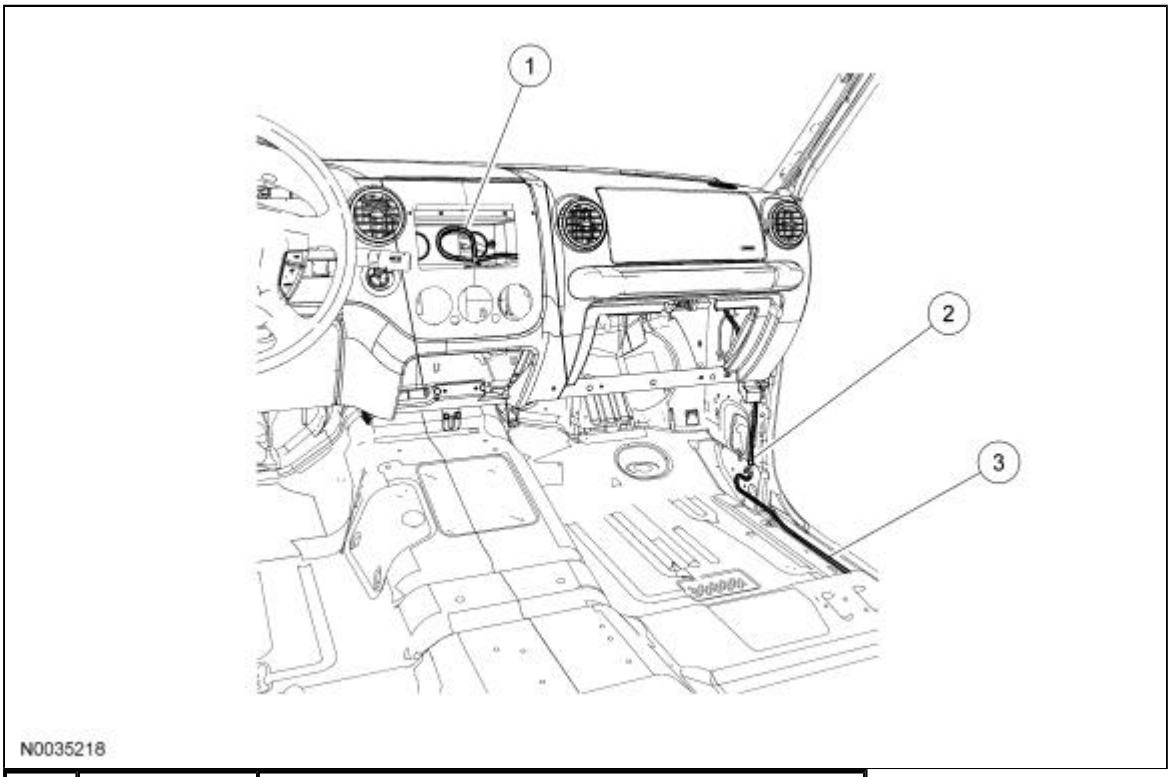
The satellite radio antenna system consists of the following components:

- Satellite radio antenna
- 2-piece satellite radio antenna cable

The satellite radio antenna receives digital audio signals and sends them to the satellite radio receiver through the satellite radio antenna.

Antenna Lead-In Cable — Front

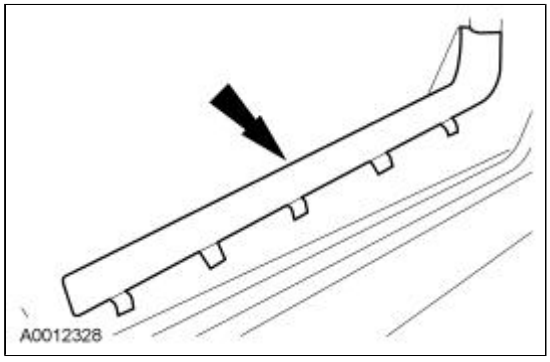
Printable View (197 KB)



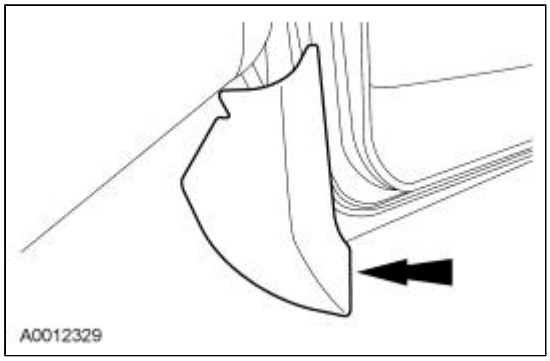
Item	Part Number	Description
1	18812	Antenna lead-in cable — front
2	—	Antenna lead-in cable connection (part of 18812)
3	18812	Antenna lead-in cable — rear

Removal and Installation

1. Remove the audio unit. For additional information, refer to Section 415-01 .
2. Remove the RH scuff plate.



3. Remove the RH A-pillar lower trim panel.



4. Disconnect the rear antenna lead-in cable from the front antenna lead-in cable.

5. **NOTE:** The antenna is an integral part of the wiring harness and cannot be replaced separately from the harness. Cut the ends off the old antenna cable and tape the remainder to the wiring harness to prevent noise.

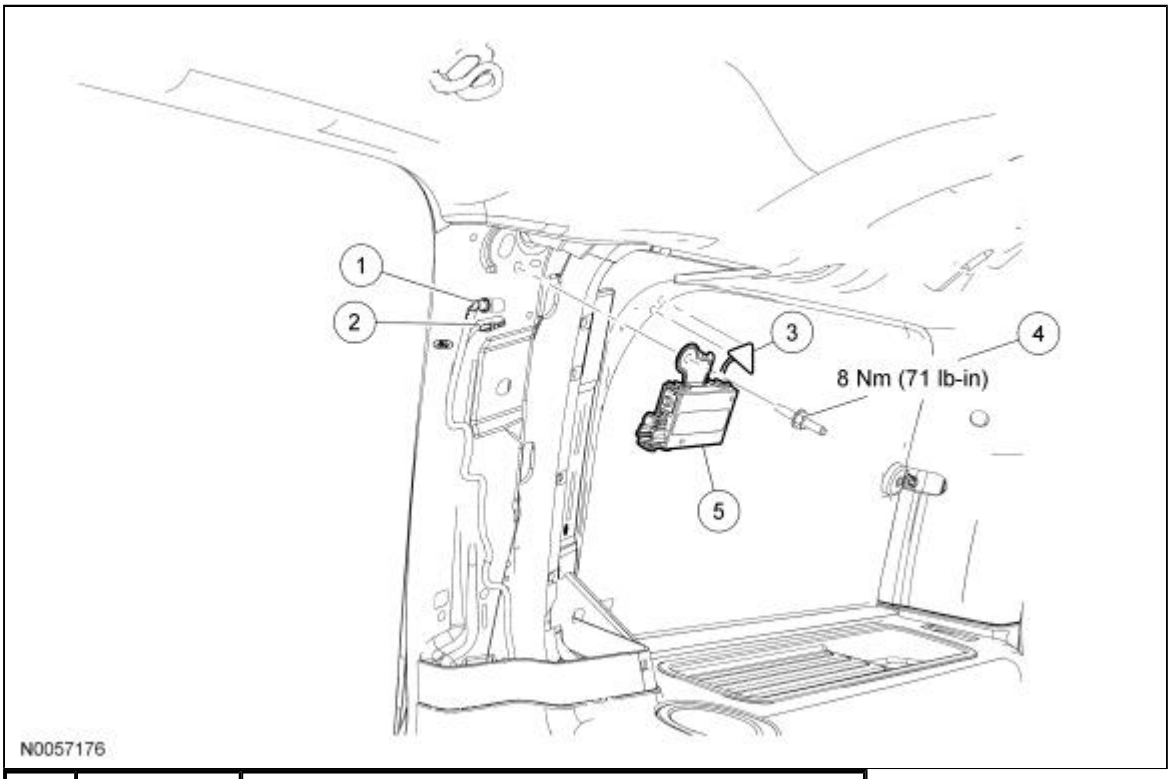
   Remove the ground plate and remove the antenna cable ends.

6. **NOTE:** When installing the new cable, tape or wire-tie the new cable to the wiring harness to prevent noise.

   To install, reverse the removal procedure.

Antenna Isolator Module

Printable View (132 KB)



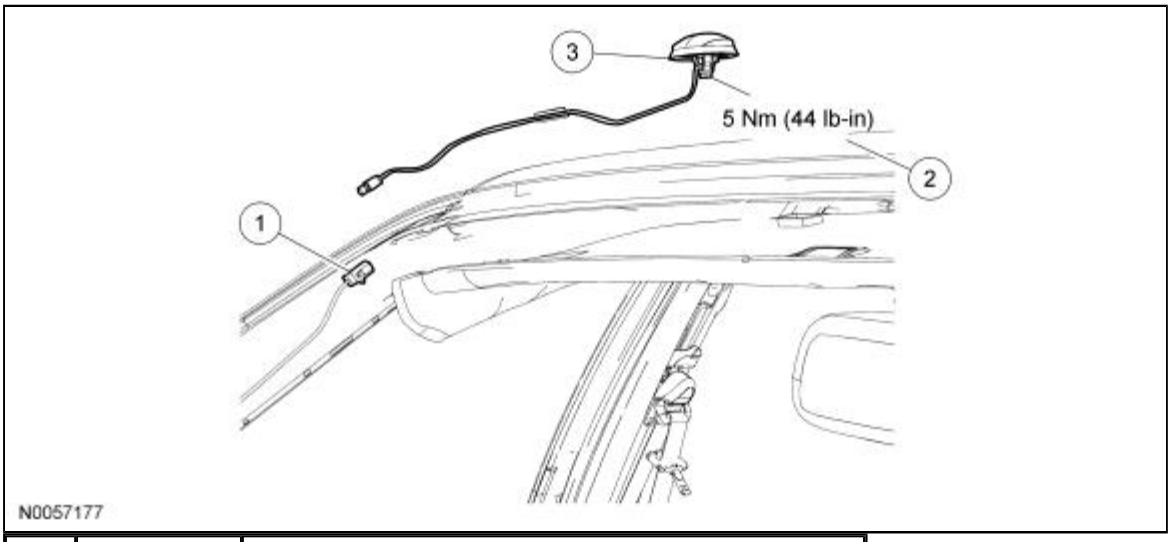
Item	Part Number	Description
1	—	Antenna cable connector (part of 14A005)
2	—	Antenna isolator module electrical connector (part of 14A005)
3	—	Antenna isolator module-to-quarter glass connector (part of 18K891)
4	W710898-S	Antenna isolator module stud
5	18K891	Antenna isolator module

Removal and Installation

1. Remove the RH C-pillar trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the antenna cable connector, the antenna isolator module electrical connector, and the antenna isolator module-to-quarter glass connector.
3. Remove the stud and the antenna isolator module.
   - To install, tighten to 8 Nm (71 lb-in).
4. To install, reverse the removal procedure.

Antenna — Satellite Radio

Printable View (104 KB)



Item	Part Number	Description
1	—	Satellite radio antenna electrical connector (part of 19A397)
2	—	Satellite radio antenna bolt (part of 10E893)
3	10E893	Satellite radio antenna

Removal and Installation

1. Remove the RH A-pillar trim panel. For additional information, refer to Section 501-05 .
2. Remove the RH sun visor. For additional information, refer to Section 501-05 .
3. Disconnect the satellite radio antenna electrical connector.
4. Lower the headliner enough to gain access to the satellite radio antenna bolt.
5. Loosen the bolt and remove the satellite radio antenna.
   - To install, tighten the bolt to 5 Nm (44 lb-in).
6. To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-ft
Radio frequency interference suppression bond-to-bulkhead screw	12	9
Radio frequency interference suppression bond-to-engine nut	11	8
Radio frequency interference suppression bond frame-to-floorpan screws	12	9

Speakers

Printable View (63 KB)

The following speaker configurations are available:

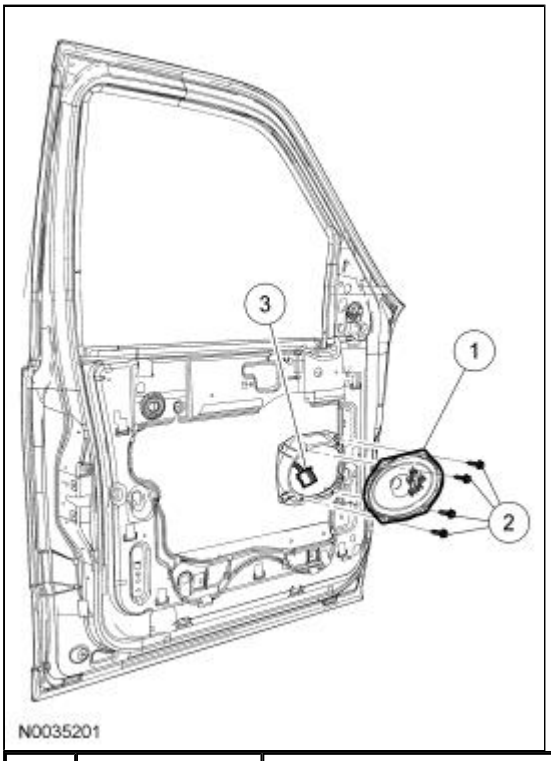
- Base/Premium
  - Two front door speakers
  - Two rear door speakers
  - Two sail-mounted tweeter speakers
- Audiophile
  - Two front door speakers
  - Two rear door speakers
  - Two sail-mounted tweeter speakers
  - Two subwoofers (mounted in a single enclosure)
- THX®
  - Two front door speakers
  - Two rear door speakers
  - Three front center imaging speakers (mounted in a single enclosure)
  - Two D-pillar rear imaging speakers (part of the D-pillar trim panels)
  - Two subwoofers (mounted in a single enclosure)

The THX® audio system is available with either the 6-CD or navigation audio unit.

Door Speaker

Printable View (175 KB)

NOTE: Front door shown, rear door similar.



Item	Part Number	Description
1	18808	Door speaker
2	N806034-S437	Door speaker screws (4 required)
3	—	Door speaker electrical connector (part of door harness)

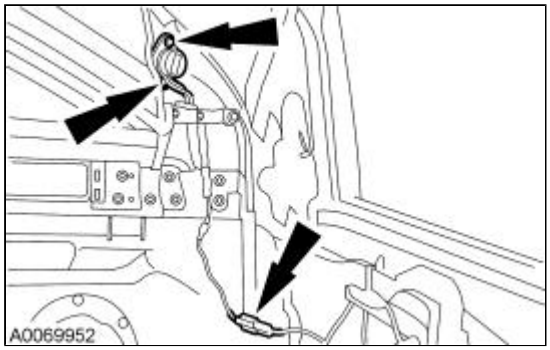
Removal and Installation

All speakers

1. Remove the door trim panels. For additional information, refer to Section 501-05 .

Front door tweeter speaker

2. Remove the 2 screws and the door tweeter speaker.
   - Disconnect the electrical connector.



Front or rear door speaker

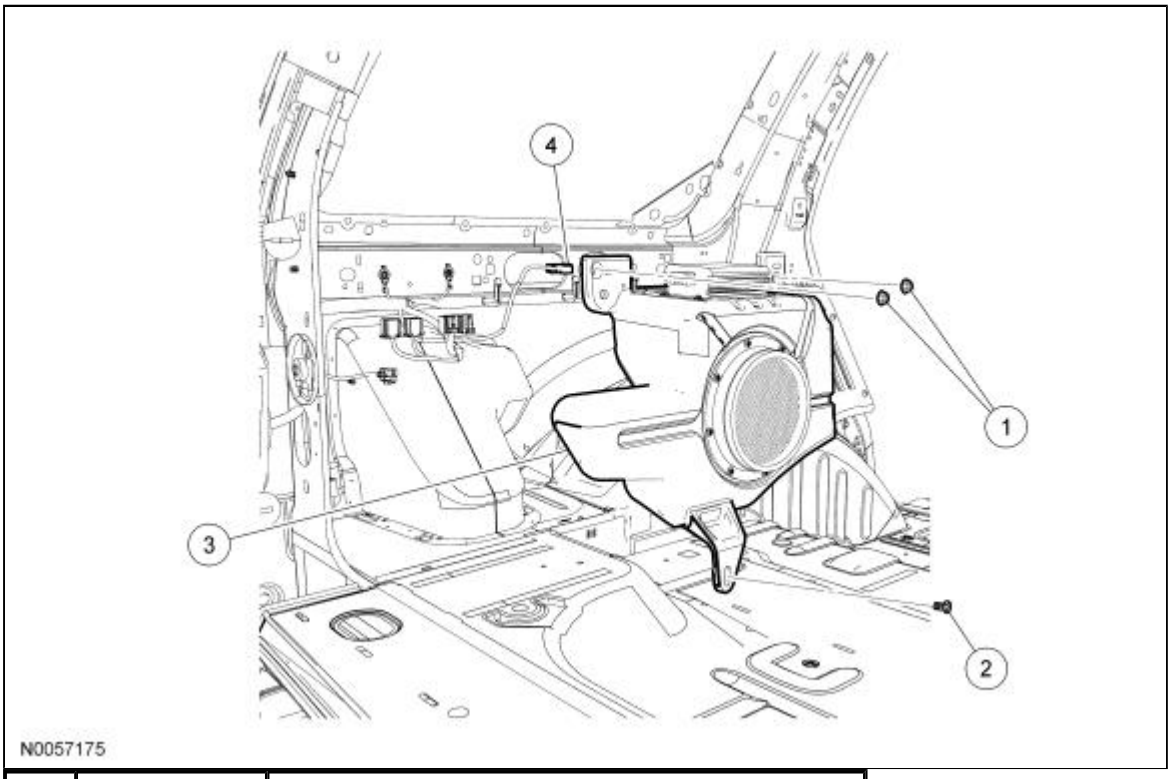
3. Remove the 4 screws and the speaker.
    - Disconnect the electrical connector.

All speakers

4. To install, reverse the removal procedure.

Subwoofer Speaker

Printable View (167 KB)



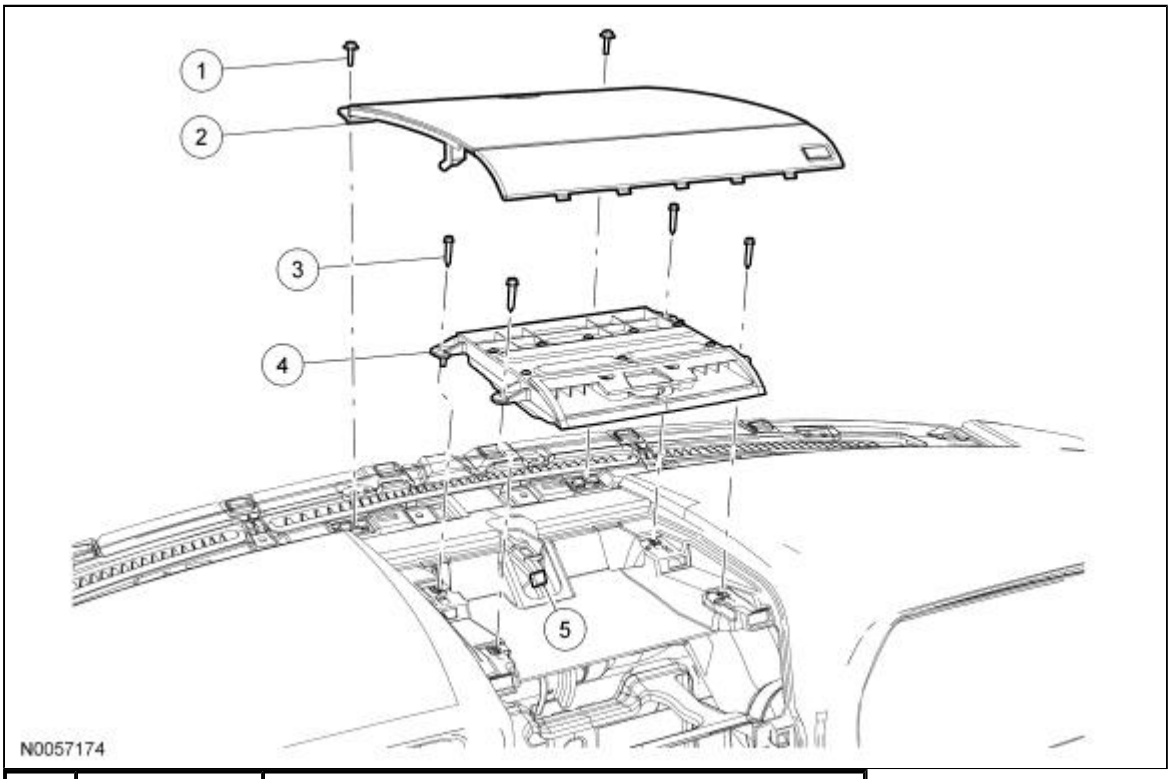
Item	Part Number	Description
1	W704346-S441	Subwoofer speaker nuts (2 required)
2	W712198-S439	Subwoofer speaker bolt
3	18C804	Subwoofer speaker
4	—	Subwoofer speaker electrical connector (part of 14A005)

Removal and Installation

1. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .
2. Remove the 2 nuts, the bolt, and the subwoofer speaker.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

Instrument Panel Speaker

Printable View (152 KB)



Item	Part Number	Description
1	W707628-S424	Instrument panel speaker cover screws (4 required)
2	78044A92	Instrument panel speaker cover
3	W705961-S403	Instrument panel speaker screws (4 required)
4	18808	Instrument panel speaker
5	—	Instrument panel speaker electrical connector (part of 14401)

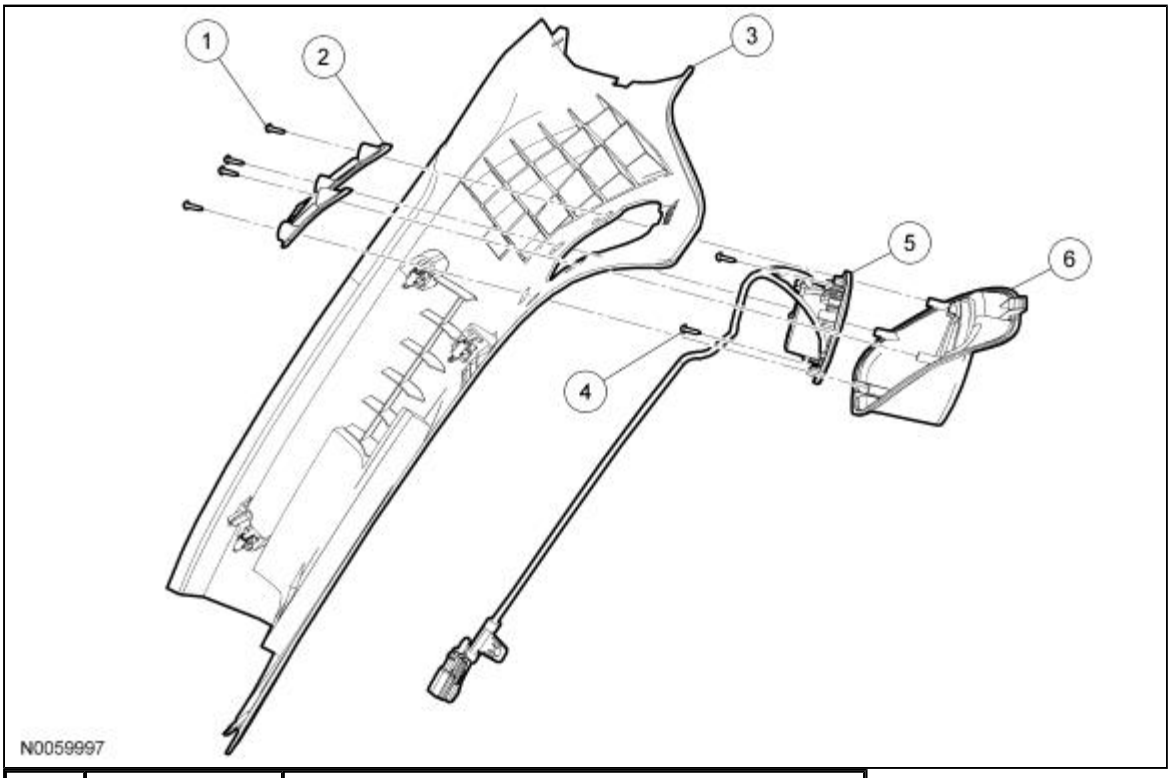
Removal and Installation

1. Remove the instrument panel center finish panel. For additional information, refer to Section 501-12 .
2. Remove the 4 screws and the instrument panel speaker cover.
3. Remove the 4 screws and the instrument panel speaker.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

Quarter Panel Speaker

Printable View (154 KB)

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	—	Speaker bracket screws (4 required)
2	—	Speaker bracket
3	—	D-pillar trim panel
4	—	Quarter panel speaker screws (2 required)
5	—	Quarter panel speaker
6	—	Quarter panel speaker cover

Removal and Installation

1. Remove the D-pillar trim panel. For additional information, refer to Section 501-05 .
2. Remove the 4 screws and the speaker bracket.
3. Separate the quarter panel speaker assembly from the D-pillar trim panel.
4. Remove the 2 screws and the quarter panel speaker.
5. To install, reverse the removal procedure.

Video System

Printable View (62 KB)

The video system consists of the following components:

- Digital versatile disc (DVD) player, mounted to the headliner
- Remote control
- Wireless headphones

The DVD player is not available on vehicles with 1st row bench seat.

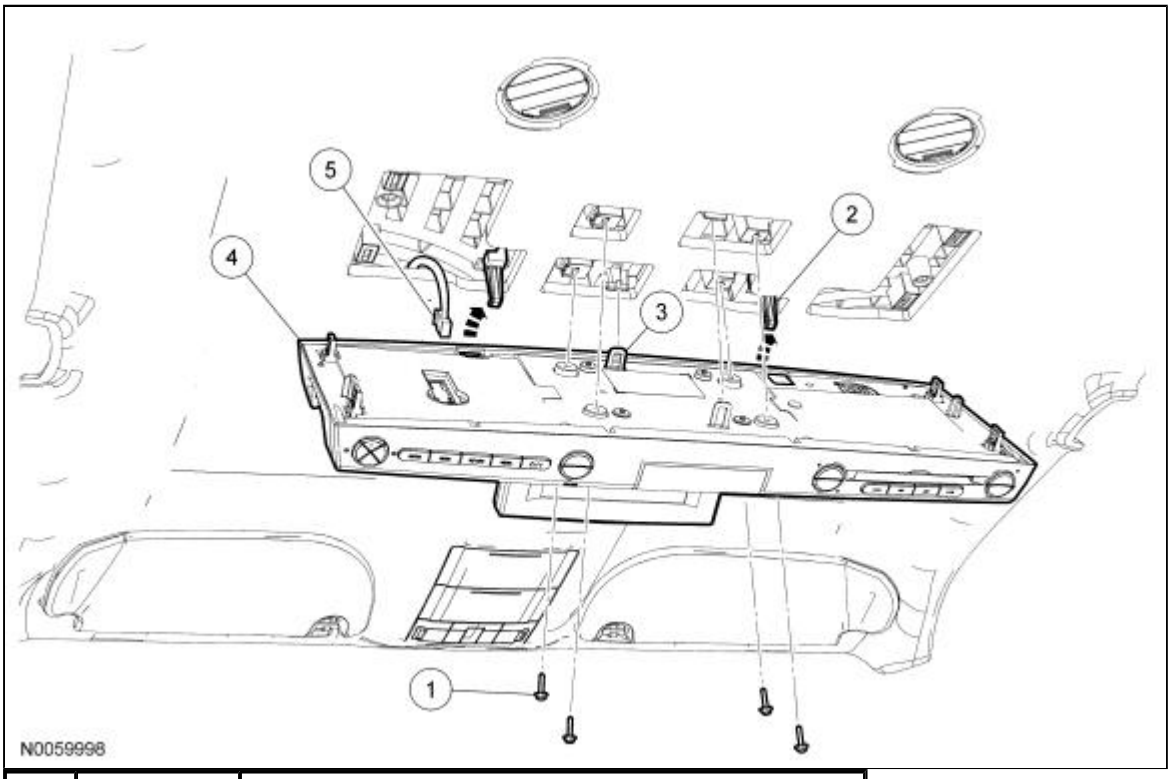
Video System

Printable View (62 KB)

Refer to Section 415-00 .

Digital Versatile Disc (DVD) Player

Printable View (168 KB)



Item	Part Number	Description
1	W704875-S	DVD player screws (4 required)
2	—	J-hook (part of 10E957)
3	—	U-hook (part of 10E947)
4	10E947	DVD player
5	—	Digital versatile disc (DVD) player electrical connector (part of 15A657)

Removal

NOTE: Programmable module installation (PMI) only needs to be carried out if the DVD player is being replaced.

1. Upload the DVD player configuration to the scan tool. For additional information, refer to Section 418-01 .

2. **NOTE:** Open the DVD player display.

   Remove the 4 screws.

3. Remove the DVD player.
   - Pull down on the sides of the DVD player to disengage the clips from the bracket.
   - Using a suitable tool, push the rear most U-hook forward and release the U-hooks.
   - Hang the DVD player on the J-hooks and disconnect the electrical connector.

- Remove the DVD player from the J-hooks.

Installation

1. Hang the DVD player on the J-hooks.
2. Connect the electrical connector.
3. Remove the DVD player from the J-hooks.
4. **NOTE:** Tilt the DVD player, as necessary, to align it correctly.

   Align the left side guide pin with the left side locating hole.
5. Lift up the right side of the DVD player and engage the U-hooks.
6. Install the 4 screws.
7. Push on the left and right sides of the DVD player to engage the clips.
8. Download the DVD player configuration from the scan tool. For additional information, refer to Section 418-01 .

Exterior Lighting

Printable View (85 KB)

NOTE: On vehicles equipped with perimeter lighting, this feature can be enabled or disabled. When enabled, the exterior lamps are illuminated when the UNLOCK button is pressed on the remote keyless entry (RKE) transmitter. For additional information, refer to Section 501-14 .

Headlamps — Expedition

The headlamp system is a dual-beam pattern system. It consists of replaceable low/high beam bulbs. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The smart junction box (SJB) supplies voltage to the headlamps when demanded.

If the headlamps are on when the ignition switch is turned off, the battery saver feature turns off the headlamps after 10 minutes have elapsed.

Headlamps — Navigator

The headlamp system is a single-beam pattern system with a shutter used to expose more light at a higher angle when the high beams are activated. It consists of high intensity discharge (HID) headlamps (with replaceable bulbs) and shutters that are integral to the headlamp assembly. There are 2 HID relays located within the battery junction box (BJB) that are used to provide voltage to the ballast located within each headlamp assembly. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The SJB supplies voltage to the HID relay coils when demanded.

There is also a separate bulb that is used for the flash-to-pass feature. This bulb also shares functionality as a parking lamp when the parking lamps are on. When the flash-to-pass feature is activated, the brighter filament within the bulb illuminates.

If the headlamps are on when the ignition switch is turned off, the battery saver feature turns off the headlamps after 10 minutes have elapsed.

Autolamps

The autolamp system provides light sensitive automatic on/off control of the exterior lamps. The autolamp system keeps the exterior lamps on for a pre-selected period of time after the ignition switch is turned to the OFF position (20 seconds is the factory default setting). The pre-selected time lapse is adjustable up to approximately 3 minutes. The time delay is programmed through the instrument cluster message center using the message center buttons or using the following steps.

NOTE: Steps 2 through 5 must be carried out within a 10 second period.

1. Start with the ignition switch off and the headlamp switch in the AUTOLAMPS ON position.
2. Place the headlamp switch in the OFF position.
3. Place the ignition switch in the RUN position.
4. Place the ignition switch in the OFF position.
5. Place the headlamp switch in the AUTOLAMPS ON position. The exterior lamps turn on at this point.
6. Wait the desired amount of time and place the headlamp switch in the OFF position (maximum of 3 minutes). The exterior lamps turn off and the autolamp time delay is now set.

Stoplamps

The stoplamps are supplied voltage when the brake pedal is applied.

Turn Signal/Hazard Lamps

The front turn signal lamps are located within the headlamp assemblies. The rear lamps share functionality with the stoplamps. When the multifunction switch is placed in the LH or RH TURN positions, the SJB routes voltage to the LH or RH turn signal lamps. The SJB then cycles the voltage on and off approximately 80 times per minute. If a front or rear turn bulb is inoperative, the SJB cycles the voltage on and off approximately 160 times per minute.

The hazard switch is located on the center instrument panel finish panel. When the hazard switch is pressed, the SJB supplies voltage to all the turn lamps. The SJB cycles the voltage on and off approximately 80 times per minute.

Parking Lamps

The SJB supplies voltage to the parking lamps when demanded. The front parking lamps are located in the headlamp assemblies. The rear parking lamps are located in the rear lamp assemblies.

Fog Lamps

The fog lamp switch is integral to the headlamp switch. When the fog lamp switch is engaged, the SJB provides ground for the fog lamp relay coil (integral to the SJB), which then energizes and routes voltage to the fog lamps. The fog lamps can be turned on when the ignition switch is in the RUN or ACC position, the parking lamps are on, and the high beam headlamps are off.

Reversing Lamps

When the transmission is placed in REVERSE (R), the transmission control module (TCM) provides power and ground for the reversing lamp relay coil. The reversing lamps receive voltage when the reversing lamp relay is energized. The reversing lamps are located within the rear lamp assemblies.

Trailer Tow

The battery junction box (BJB) supplies voltage to the trailer tow stop/turn, parking and reversing lamps. When the vehicle's rear stop/turn or parking lamps are illuminated, voltage is also supplied to a corresponding trailer tow relay (coil side) located in the BJB. When the reversing lamps are illuminated, voltage from the reversing lamp relay is also supplied to the trailer tow connector.

The trailer tow battery charge relay provides voltage to the trailer tow connector when the ignition switch is in the RUN position.

The vehicle comes equipped with circuitry to support trailer tow electric brakes.

Headlamps

Printable View (237 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB does not detect any of the inputs to the headlamp switch is active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). If the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received. If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

The SJB also monitors the multifunction switch for a flash-to-pass or high beam request. There are 2 voltage reference circuits which monitor this. When the multifunction switch is in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground.

NOTE: For Navigator, the high beam indicator does not illuminate with the flash-to-pass feature.

NOTE: The flash-to-pass feature does not require any input from the headlamp switch.

When the SJB receives an input requesting the headlamps on, the SJB supplies voltage to the low beams. If the low beams are on and the SJB receives a request for high beams (or just a flash-to-pass request), the SJB energizes an internal relay which routes voltage to the headlamps (and flash-to-pass lamps for Navigator).

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp

output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, 30-minute battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

The SJB FET protected output circuits for the headlamp system are for the LH low beam output and the RH low beam output circuits.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Headlamp switch
• Multifunction switch
• Headlamp assembly
	• Battery junction box (BJB) fuse(s):
	  ▪ 44 (20A) (LH high intensity discharge [HID] headlamp)
	  ▪ 48 (20A) (RH HID headlamp)
	• Smart junction box (SJB) fuse(s):
	  ▪ 7 (10A) (LH low beam)
	  ▪ 8 (10A) (RH low beam)
	  ▪ 23 (15A) (high beams)
	• Ballast
	• SJB
	• Bulb(s)
	• Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:

- Verify the ignition key is in the ON position.
- Verify the scan tool operation with a known good vehicle.
- Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go To Pinpoint Test D .
B1510	Flash To Pass Switch Circuit Short to Ground	Go To Pinpoint Test D .
B1696	Autolamp On Circuit Short To Ground	Go To Pinpoint Test D .
B2A22	Headlamp Off Circuit Open	ADDRESS any other DTCs first. Go To Pinpoint Test D .
B2A23	High Beam Input Circuit Short to Ground	Go To Pinpoint Test D .
B2A2E	Right Front Lamp Low Beam Circuit Open	If the low beam is inoperative, Go To Pinpoint Test B . If the low beam is always on, Go To Pinpoint Test D .
B2A2F	Right Front Lamp Low Beam Circuit Short to Ground	Go To Pinpoint Test B .
B2A30	Left Front Lamp Low Beam Circuit Open	If the low beam is inoperative, Go To Pinpoint Test B . If the low beam is always on, Go To Pinpoint Test D .
B2A31	Left Front Lamp Low Beam Circuit Short to Ground	Go To Pinpoint Test B .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with	• Circuitry	• REFER to Section 418-00 .

the smart junction box (SJB)	• SJB	
• Both low beams are inoperative	• SJB	• CHECK for recorded SJB DTCs. ▪ If DTCs are present, REFER to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart in this section. ▪ If no DTCs are present, INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
• **NOTE:** This symptom also diagnoses the flash-to-pass lamps if they are inoperative. Both high beams are inoperative	• Fuse • Circuitry • Multifunction switch • SJB	• Go To Pinpoint Test A .
• One low beam headlamp is inoperative	• Fuse • Circuitry • High intensity discharge (HID) relay • HID bulb • Headlamp assembly • Ballast • SJB	• Go To Pinpoint Test B .
• **NOTE:** This symptom also diagnoses the individual flash-to-pass lamps if one is inoperative. One high beam headlamp is inoperative	• Circuitry • Headlamp assembly	• Go To Pinpoint Test C .
• **NOTE:** This symptom also diagnoses the flash-to-pass lamps if they are on continuously. The headlamps are on continuously	• Circuitry • HID relay • Headlamp switch • Multifunction switch • SJB	• Go To Pinpoint Test D .
• The flash-to-pass feature is inoperative	• Circuitry • Multifunction switch • SJB	• Go To Pinpoint Test E .

Pinpoint Tests

Pinpoint Test A: The High Beams Are Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

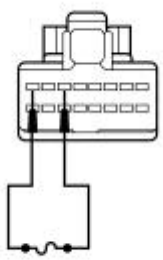
When the headlamp switch is placed in the HEADLAMPS ON position, the smart junction box (SJB) monitors the high beam request circuit from the multifunction switch through circuit CLF02 (GY/BN). When the multifunction switch is placed in the HIGH BEAM position, the signal is routed to ground through circuit GD138 (BK/WH). The SJB then energizes the high beam relay (integral to the SJB) which supplies voltage to the headlamps (and flash-to-pass lamps, if equipped) through circuit CLF08 (YE/VT).

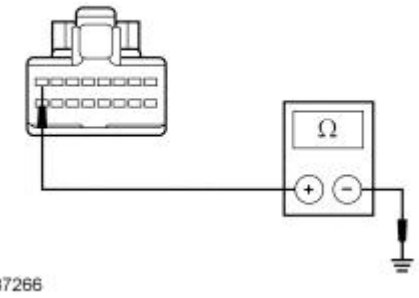
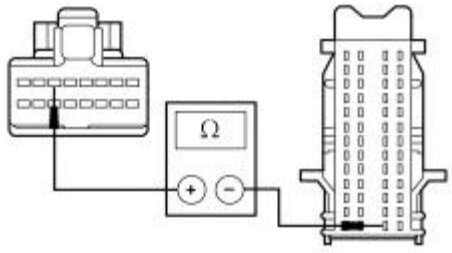
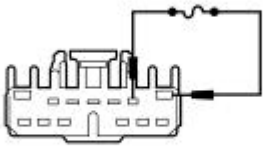
Possible Causes

- Fuse
- Circuit CLF02 (GY/BN) open
- Circuit CLF08 (YE/VT) open
- Circuit GD138 (BK/WH) open
- Multifunction switch
- SJB

PINPOINT TEST A: THE HIGH BEAMS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE HIGH BEAM INDICATOR • Key in ON position. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position. • **Does the high beam indicator illuminate?**	**Yes** GO to A5 . **No** GO to A2 .
A2 CHECK THE MULTIFUNCTION SWITCH • Place the headlamp switch in the OFF position. • Key in OFF position. • Disconnect: Multifunction Switch C202. • Connect a fused (5A) jumper wire between the multifunction switch C202-6, circuit CLF02 (GY/BN), harness side and the multifunction switch C202-8, circuit GD138 (BK/WH), harness side.  N0057365 • Place the headlamp switch in the HEADLAMPS ON position. • Key in ON position. • **Does the high beam indicator illuminate?**	**Yes** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to A3 .

A3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the multifunction switch C202-8, circuit GD138 (BK/WH), harness side and ground.  N0037266 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUIT CLF02 (GY/BN) FOR AN OPEN	
• Disconnect: SJB C2280g. • Measure the resistance between the multifunction switch C202-6, circuit CLF02 (GY/BN), harness side and the SJB C2280g-27, circuit CLF02 (GY/BN), harness side.  N0057366 • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK CIRCUIT CLF08 (YE/VT) FOR AN OPEN	
• Disconnect: SJB C2280a. • Connect a fused (15A) jumper wire between the SJB C2280a-1, circuit CBB69 (WH/VT), harness side and the SJB C2280a-2, circuit CLF08 (YE/VT), harness side.  N0057367 • **Do the high beams (or flash-to-pass lamps if Navigator) illuminate?**	**Yes** VERIFY the SJB fuse 23 (15A) is OK. If OK, GO to A6 . **No** REPAIR the circuit. TEST the system for normal operation.
A6 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

• Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: One Low Beam Headlamp Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation — Expedition

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH low beam headlamps, respectively. Ground is supplied on circuits GD120 (BK/GN) and GD123 (BK/GY) for the LH and RH headlamps, respectively.

Normal Operation — Navigator

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH high intensity discharge (HID) relay coils, respectively. Ground for the HID relay coils is provided through circuit GD123 (BK/GY). Switched voltage for the LH and RH HID relays is provided from the battery junction box (BJB) through circuits SBB44 (GN/RD) and SBB48 (VT/RD), respectively. When the relays are energized, voltage is routed to the LH and RH headlamps through circuits CLF30 (VT/BN) and CLF31 (YE/GY), respectively. Ground is supplied on circuits GD120 (BK/GN) and GD123 (BK/GY) for the LH and RH headlamps, respectively. The ballasts within each headlamp steps up the voltage needed to illuminate the HID bulbs.

DTC B2A2E — is an on-demand DTC that sets when the SJB detects an open in the RH low beam output circuit.

DTC B2A2F — is a continuous and on-demand DTC that sets when the SJB detects a short to ground in the RH low beam output circuit.

DTC B2A30 — is an on-demand DTC that sets when the SJB detects an open in the LH low beam output circuit.

DTC B2A31 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground in the LH low beam output circuit.

Possible Causes

- Fuse
- Circuit CLF04 (BN/BU) open or short to ground
- Circuit CLF05 (BU/GN) open or short to ground
- Circuit CLF30 (VT/BN) open
- Circuit CLF31 (YE/GY) open
- Circuit GD120 (BK/GN) open
- Circuit GD123 (BK/GY) open
- Circuit SBB44 (GN/RD) open
- Circuit SBB48 (VT/RD) open
- HID relay
- HID bulb
- Ballast
- Headlamp assembly

- SJB

PINPOINT TEST B: ONE LOW BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: For Expedition, due to varying wattage ratings and resulting current draw, certain aftermarket headlamp bulbs may cause the SJB to shut down the short circuit protection, resulting in the low beams becoming inoperative. Verify that the bulbs meet Ford specifications. If the bulbs do not meet Ford specifications, install the correct bulbs. Run the on-demand self-test (required to clear certain DTCs and reset the SJB). Correct any unresolved DTCs. Clear all DTCs. Test the system for normal operation.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>B1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST</td><td rowspan="2">Yes
For DTC B2A2E or B2A30, GO to B2 .

For DTC B2A2F or B2A31, GO to B5 .

For all other DTCs, REFER to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart in this section.

No
For Expedition, GO to B12 .

For Navigator, GO to B7 .</td></tr>
<tr><td>• Check the recorded results from the SJB self-test.
• Were any DTCs recorded?</td></tr>
<tr><td>B2 CHECK THE SJB HEADLAMP VOLTAGE SUPPLY CIRCUIT FOR VOLTAGE</td><td rowspan="2">Yes
For Expedition, REPAIR circuit GD120 (BK/GN) (LH low beam) or circuit GD123 (BK/GY) (RH low beam) for an open. CLEAR the DTCs. REPEAT the self-test.

For Navigator, GO to B4 .

No
VERIFY the SJB fuse 7 (10A) (LH low beam) or fuse 8 (10A) is OK. If OK, GO to B3 .</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Inoperative Headlamp (Expedition).
• Disconnect: Suspect HID Relay (Navigator).
• Measure the voltage between the inoperative headlamp or suspect HID relay, harness side and ground as follows:

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td colspan="2">Expedition</td></tr><tr><td>LH headlamp C1021-1</td><td>CLF04 (BN/BU)</td></tr><tr><td>RH headlamp C1041-1</td><td>CLF05 (BU/GN)</td></tr><tr><td colspan="2">Navigator</td></tr><tr><td>LH HID relay pin 1</td><td>CLF04 (BN/BU)</td></tr><tr><td>RH HID relay pin 1</td><td>CLF05 (BU/GN)</td></tr></table>
• Is the voltage greater than 10 volts?</td></tr>
<tr><td>B3 CHECK THE SJB HEADLAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN</td><td rowspan="2">Yes</td></tr>
<tr><td>• Disconnect: SJB C2280a.</td></tr>
</table>

- Measure the resistance between the inoperative headlamp or suspect HID relay, harness side and the SJB as follows:

Headlamp or Suspect HID Relay Connector-Pin	SJB Connector-Pin	Circuit
Expedition		
LH headlamp C1021-1	SJB C2280a-13	CLF04 (BN/BU)
RH headlamp C1041-1	SJB C2280a-4	CLF05 (BU/GN)
Navigator		
LH HID relay pin 1	SJB C2280a-13	CLF04 (BN/BU)
RH HID relay pin 1	SJB C2280a-4	CLF05 (BU/GN)

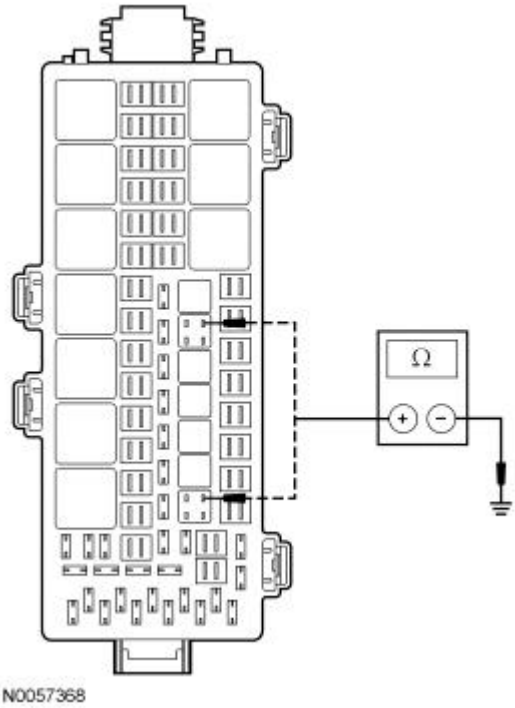
- **Is the resistance less than 5 ohms?**

GO to B12 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE HID RELAY GROUND CIRCUIT FOR AN OPEN

- Measure the resistance between the LH HID relay pin 2, circuit GD123 (BK/GY), harness side and ground; or between the RH HID relay pin 2, circuit GD123 (BK/GY), harness side and ground.



- **Is the resistance less than 5 ohms?**

Yes
INSTALL a new relay in question. CLEAR the DTCs. REPEAT the self-test.

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR A SHORT TO GROUND

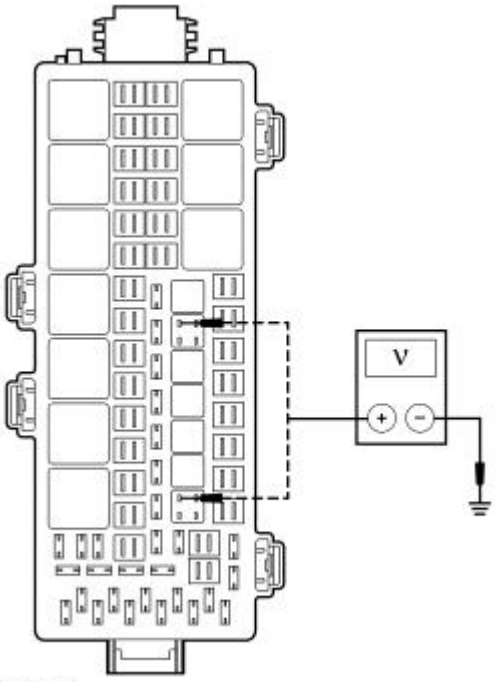
- Key in OFF position.
- Disconnect: SJB C2280a.
- Disconnect: Inoperative Headlamp (Expedition).
- Disconnect: Suspect HID Relay (Navigator).
- Measure the resistance between the inoperative headlamp or suspect HID relay, harness side and ground as follows:

Yes
For Expedition, GO to B12 .

For Navigator, GO to B6 .

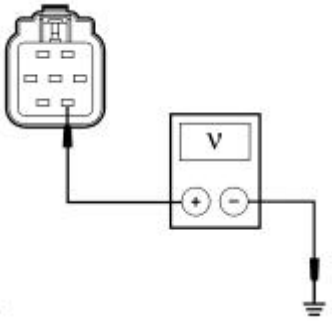
No

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td colspan="2">Expedition</td></tr><tr><td>LH headlamp C1021-1</td><td>CLF04 (BN/BU)</td></tr><tr><td>RH headlamp C1041-1</td><td>CLF05 (BU/GN)</td></tr><tr><td colspan="2">Navigator</td></tr><tr><td>LH HID relay pin 1</td><td>CLF04 (BN/BU)</td></tr><tr><td>RH HID relay pin 1</td><td>CLF05 (BU/GN)</td></tr></table> • **Is the resistance greater than 10,000 ohms?**	REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
B6 CHECK THE HID RELAY (DTC B2A2F or B2A31) • Carry out the HID relay component test. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Is the HID relay OK?**	**Yes** GO to B12 . **No** INSTALL a new HID relay. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
B7 CHECK THE HID RELAY (NO DTCs) • Key in OFF position. • Disconnect: Suspect HID Relay. • Carry out the HID relay component test. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Is the HID relay OK?**	**Yes** GO to B8 . **No** INSTALL a new HID relay. TEST the system for normal operation.
B8 CHECK CIRCUIT SBB44 (GN/RD) (LH HID RELAY) OR CIRCUIT SBB48 (VT/RD) (RH HID RELAY) FOR AN OPEN • Measure the voltage between the LH HID relay pin 3, circuit SBB44 (GN/RD), harness side and ground; or between the RH HID relay pin 3, circuit SBB48 (VT/RD), harness side and ground.	**Yes** GO to B9 . **No** VERIFY the BJB fuse 44 (20A) (LH HID relay) or fuse 48 (20A) (RH HID relay) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.



N0057369

- **Is the voltage greater than 10 volts?**

B9 CHECK CIRCUIT CLF30 (VT/BN) (LH HEADLAMP) OR CIRCUIT CLF31 (YE/GY) (RH HEADLAMP) FOR AN OPEN	
• Connect: Suspect HID Relay. • Disconnect: Inoperative Headlamp. • Place the headlamp switch in the HEADLAMPS ON position. • Measure the voltage between the LH headlamp C133-6, circuit CLF30 (VT/BN), harness side and ground; or between the RH headlamp C134-6, circuit CLF31 (YE/GY), harness side and ground.  N0060156 • **Is the voltage greater than 10 volts?**	**Yes** GO to B10 . **No** REPAIR the circuit in question. TEST the system for normal operation.
B10 CHECK THE HEADLAMP HARNESS	
• Place the headlamp switch in the OFF position. • Disconnect: Suspect Ballast. • Measure the resistance between the headlamp assembly, component side and the suspect ballast, harness side as follows:	**Yes** GO to B11 . **No** REPAIR or INSTALL a new headlamp assembly. REFER to Headlamp Assembly in this section. TEST the system for normal operation.

Inoperative Headlamp Connector-Pin	Ballast Connector-Pin	Circuit
LH headlamp C133 pin 6	C1284-3	1338 (WH)
LH headlamp C133 pin 4	C1284-2	57 (BK)

RH headlamp C134 pin 6	C1285-3	1338 (WH)
RH headlamp C134 pin 4	C1285-2	57 (BK)

- **Is the resistance less than 5 ohms?**

B11 CHECK THE BALLAST	
• Install a known good ballast. • Connect: Inoperative Headlamp. • Connect: Suspect Ballast. • Place the headlamp switch in the HEADLAMPS ON position. • **Does the inoperative headlamp now illuminate?**	**Yes** INSTALL a new ballast. REFER to Ballast in this section. TEST the system for normal operation. **No** INSTALL a new HID bulb. REFER to Headlamp Bulb in this section. TEST the system for normal operation.
B12 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: One High Beam Headlamp Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation — Expedition

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB energizes an internal relay. When the relay is energized, the relay routes voltage through circuit CLF08 (YE/VT) to the high beams. Ground for the high beams is shared with the low beams.

Normal Operation — Navigator

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB energizes an internal relay. When the relay is energized, the relay routes voltage through circuit CLF08 (YE/VT) to the headlamps and the flash-to-pass lamps. If the low beams are on, a shutter within each headlamp activates to give the appearance of high beam headlamps. Ground for the LH and RH flash-to-pass lamps is provided through circuits GD120 (BK/GN) and GD123 (BK/GY), respectively.

Possible Causes

- Circuit CLF08 (YE/VT) open
- Circuit GD120 (BK/GN) open
- Circuit GD123 (BK/GY) open

- Headlamp assembly

PINPOINT TEST C: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>C1 CHECK THE LOW BEAM OPERATION
• Check the operation of the low beams.
• Do the low beams operate correctly.</td><td>Yes
For Expedition, REPAIR circuit CLF08 (YE/VT) for an open. TEST the system for normal operation.

For Navigator, GO to C2 .

No
Go To Pinpoint Test B .</td></tr>
<tr><td>C2 CHECK CIRCUIT CLF08 (YE/VT) FOR AN OPEN
• Key in OFF position.
• Disconnect: Inoperative Headlamp or Flash-to-Pass Lamp.
• Place the headlamp switch in the HEADLAMPS ON position.
• Place the multifunction switch in the HIGH BEAM position.
• Measure the voltage between the inoperative lamp, harness side and ground as follows:
<table><tr><th>Inoperative Lamp</th><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>LH headlamp</td><td>C133-7</td><td>CLF08 (YE/VT)</td></tr><tr><td>RH headlamp</td><td>C134-7</td><td>CLF08 (YE/VT)</td></tr><tr><td>LH flash-to-pass</td><td>C1549-3</td><td>CLF08 (YE/VT)</td></tr><tr><td>RH flash-to-pass</td><td>C1550-3</td><td>CLF08 (YE/VT)</td></tr></table>• Is the voltage greater than 10 volts?</td><td>Yes
For the headlamp, REPAIR or INSTALL a new headlamp assembly. REFER to Headlamp Assembly in this section. TEST the system for normal operation.

For the flash-to-pass lamp, REPAIR circuit GD120 (BK/GN) (LH) or circuit GD123 (BK/GY) (RH) for an open. TEST the system for normal operation.

No
REPAIR the circuit. TEST the system for normal operation.</td></tr>
</table>

Pinpoint Test D: The Headlamps Are On Continuously

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation — Low Beams, Expedition

The smart junction box (SJB) sends reference signals to the headlamp switch through circuits CLF19 (VT/GN), CLF23 (WH/VT), CLF24 (YE/BU) and CLS05 (BU/GY). At any given time, the headlamp switch routes one of the input circuits to ground through circuit GD138 (BK/WH).

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH low beam headlamps, respectively.

Normal Operation — Low Beams, Navigator

The SJB sends reference signals to the headlamp switch through circuits CLF19 (VT/GN), CLF23 (WH/VT), CLF24 (YE/BU) and CLS05 (BU/GY). At any given time, the headlamp switch routes one of the input circuits to ground through circuit GD138 (BK/WH).

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) and CLF05 (BU/GN) to the LH and RH high intensity discharge (HID) relay coils, respectively. When the relays are energized, voltage is routed to the LH and RH headlamps through circuits CLF30 (VT/BN) and CLF31 (YE/GY), respectively.

Normal Operation — High Beam Headlamps

The SJB sends a reference signal to the multifunction switch through circuits CLF02 (GY/BN) and CLF27 (GN/BN). When the multifunction switch is placed in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground. When the SJB detects a request for flash-to-pass or high beams (when the low beams are on), the SJB energizes the high beam relay (integral to the SJB), which routes voltage through circuit CLF08 (YE/VT) to the headlamps (and flash-to-pass lamps for Navigator).

DTC B1472 — is an on-demand DTC that sets when the SJB detects the headlamps on input circuit is short to ground.

DTC B1510 — is an on-demand DTC that sets when the SJB detects the flash-to-pass request input circuit is short to ground.

DTC B1696 — is an on-demand DTC that sets when the SJB detects the autolamps on request input circuit is short to ground.

DTC B2A22 — is an on-demand DTC that sets when the SJB detects an open from the headlamp switch off circuit.

DTC B2A23 — is an on-demand DTC that sets when the SJB detects a short to ground on the high beam request input circuit.

DTC B2A2E — is an on-demand DTC that sets when the SJB detects a short to voltage from the RH low beam output circuit.

DTC B2A30 — is an on-demand DTC that sets when the SJB detects a short to voltage from the LH low beam output circuit.

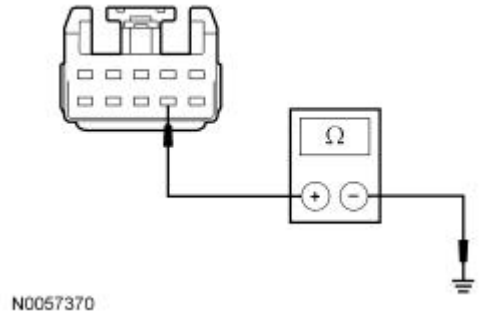
Possible Causes

- Circuit CLF02 (GY/BN) short to ground
- Circuit CLF04 (BN/BU) short to voltage
- Circuit CLF05 (BU/GN) short to voltage
- Circuit CLF08 (YE/VT) short to voltage
- Circuit CLF19 (VT/GN) open or short to ground
- Circuit CLF23 (WH/VT) open
- Circuit CLF24 (YE/BU) short to ground
- Circuit CLF27 (GN/BN) short to ground
- Circuit CLF30 (VT/BN) short to voltage
- Circuit CLF31 (YE/GY) short to voltage
- Circuit CLS05 (BU/GY) open
- Circuit GD138 (BK/WH) open

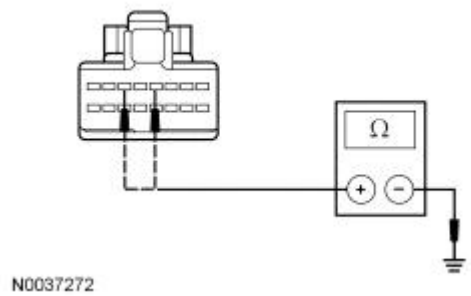
- HID relay
- Multifunction switch
- Headlamp switch
- SJB

PINPOINT TEST D: THE HEADLAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
D1 VERIFY THE HEADLAMP OPERATION	
• Key in ON position. • **Are the high beam headlamps or flash-to-pass lamps illuminated?**	**Yes** GO to D10 . **No** GO to D2 .
D2 CHECK THE SJB HEADLAMP SWITCH PIDs	
• Enter the following diagnostic mode on the diagnostic tool: SJB Headlamp Switch PIDs. • **NOTE:** Make sure the headlamp switch is lined up in the correct position when monitoring the PIDs. • Monitor all the SJB headlamp switch input PIDs while moving the headlamp switch through all positions. • **Do the headlamp switch positions agree with the PIDs?**	**Yes** GO to D7 . **No** GO to D3 .
D3 CHECK THE HEADLAMP SWITCH	
• Key in OFF position. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the headlamp switch OK?**	**Yes** GO to D4 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between the headlamp switch C205-7, circuit GD138 (BK/WH), harness side and ground.  N0057370 • **Is the resistance less than 5 ohms?**	**Yes** GO to D5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D5 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND	
• Disconnect: SJB C2280g.	**Yes**

• Measure the resistance between the headlamp switch, harness side and ground as follows: **Headlamp Switch Connector-Pin** / **Circuit** C205-4 (if equipped with autolamps) / CLF19 (VT/GN) C205-10 / CLF24 (YE/BU) • **Are the resistances greater than 10,000 ohms?**	GO to D6 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN	
• Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows: **Headlamp Switch Connector-Pin** / **SJB Connector-Pin** / **Circuit** C205-4 (if equipped with autolamps) / C2280g-19 / CLF19 (VT/GN) C205-9 / C2280g-47 / CLF23 (WH/VT) C205-5 / C2280g-31 / CLS05 (BU/GY) • **Are the resistances less than 5 ohms?**	**Yes** GO to D13 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
D7 CHECK THE SJB OUTPUT	
• Disconnect: SJB C2280a. • **Does the LH or RH headlamp continue to illuminate?**	**Yes** For Expedition, REPAIR circuit CLF04 (BN/BU) (LH headlamp) or circuit CLF05 (BU/GN) (RH headlamp) for a short to voltage as necessary. CLEAR the DTCs. REPEAT the self-test. For Navigator, GO to D8 . **No** GO to D13 .
D8 CHECK CIRCUIT CLF30 (VT/BN) (LH HEADLAMP) OR CIRCUIT CLF31 (YE/GY) (RH HEADLAMP) FOR A SHORT TO VOLTAGE	
• Disconnect: Suspect HID Relay. • **Does the LH or RH headlamp continue to illuminate?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to D9 .
D9 CHECK THE HID RELAY	
• Carry out the HID relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the HID relay OK?**	**Yes** REPAIR circuit CLF04 (BN/BU) (LH HID relay) or circuit CLF05 (BU/GN) (RH HID relay) as necessary. CLEAR the DTCs. REPEAT

	the self-test. **No** INSTALL a new HID relay. CLEAR the DTCs. REPEAT the self-test.
D10 CHECK CIRCUIT CLF08 (YE/VT) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: SJB C2280a. • Key in ON position. • **Do the high beams continue to illuminate?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to D11 .
D11 CHECK THE MULTIFUNCTION SWITCH • Key in OFF position. • Connect: SJB C2280a. • Disconnect: Multifunction Switch C202. • Key in ON position. • **Do the high beams continue to illuminate?**	**Yes** GO to D12 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
D12 CHECK CIRCUIT CLF02 (GY/BN) (HIGH BEAM) OR CIRCUIT CLF27 (GN/BN) (FLASH-TO-PASS) FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: SJB C2280g. • Measure the resistance between the multifunction switch C202-6, circuit CLF02 (GY/BN), harness side and ground; and between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and ground.  N0037272 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D13 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D13 CHECK FOR CORRECT SJB OPERATION
• Key in OFF position.
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR

	the DTCs. REPEAT the self-test.

Pinpoint Test E: The Flash-To-Pass Feature Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

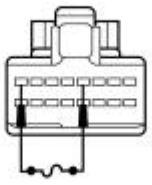
The smart junction box (SJB) sends a reference signal to the multifunction switch through circuit CLF27 (GN/BN). When the multifunction switch is placed in the FLASH-TO-PASS position, the voltage signal is routed to ground. When the SJB detects a request for the flash-to-pass, the SJB energizes the high beam relay (integral to the SJB), which supplies voltage to the headlamps (and flash-to-pass lamps if equipped)

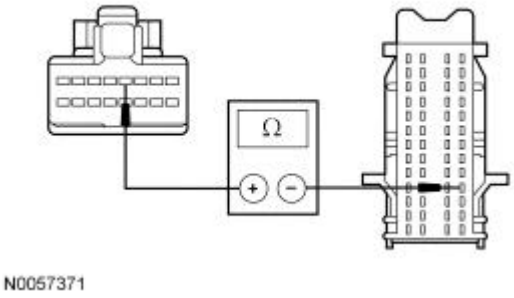
Possible Causes

- Circuit CLF27 (GN/BN) open
- Multifunction switch
- SJB

PINPOINT TEST E: THE FLASH-TO-PASS FEATURE IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
E1 VERIFY THE HIGH BEAM HEADLAMP OPERATION	
• Key in ON position. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position while observing the headlamps. • **Do the high beam headlamps illuminate?**	**Yes** GO to E2 . **No** Go To Pinpoint Test A .
E2 CHECK THE MULTIFUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multifunction Switch C202. • Connect a fused (5A) jumper wire between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the multifunction switch C202-8, circuit GD138 (BK/WH), harness side.  N0037273 • **Does the flash-to-pass feature operate correctly?**	**Yes** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to E3 .
E3 CHECK CIRCUIT CLF27 (GN/BN) FOR AN OPEN	

• Disconnect: SJB C2280g. • Measure the resistance between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the SJB C2280g-43, circuit CLF27 (GN/BN), harness side.  N0057371 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit. TEST the system for normal operation.
E4 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Autolamps

Printable View (182 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: For additional information on the perimeter lighting feature, refer to Section 501-14 .

The smart junction box (SJB) monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB does not detect any of the inputs to the headlamp switch is active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). If the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received. If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

The SJB also monitors the light sensor with a voltage reference signal. The light sensor input to the SJB varies with the ambient light conditions.

When the SJB receives an input from the headlamp switch indicating a request for the autolamps, the SJB monitors the light sensor for the ambient light condition. If the SJB determines the ambient light level is dark, the SJB supplies voltage to the exterior lamps.

If the ignition switch is already in the RUN position and the vehicle enters darkness/lighted area (such as when entering/exiting a non-lighted tunnel during the daytime), the transition from light to dark (or dark to light) needs to last 15 seconds before the SJB turns on the exterior lamps. This strategy is to prevent the exterior lamps from unnecessarily flashing on and off.

The SJB does react quicker under extreme light conditions. If the SJB has detected a very dark condition, the exterior lamps are turned on after 1.5 seconds. If the SJB has detected a very high

ambient light level, the exterior lamps are turned off after 4 seconds.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

   Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Circuitry • Light sensor • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go To Pinpoint Test G .
B1696	Autolamp On Circuit Short To Ground	Go To Pinpoint Test G .
B1791	Autolamp Sensor Input Circuit Open	Go To Pinpoint Test G .
B1793	Autolamp Sensor Input Circuit Short to Ground	Go To Pinpoint Test G .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• The autolamps are inoperative	• Light sensor • SJB	• Go To Pinpoint Test F .
• The autolamps are on continuously	• Circuitry • Light sensor • Headlamp switch • Electronic automatic temperature control (EATC) system • SJB	• Go To Pinpoint Test G .
• The autolamp time delay is inoperative	• SJB	• CHECK the SJB configuration and make sure the autolamp feature is configured correctly. ▪ If the SJB is configured correctly, INSTALL a new SJB. REFER to Section 419-10 . ▪ If the SJB is not configured correctly, RECONFIGURE the SJB. REFER to Section 418-01 . TEST the system for normal operation.
• The headlamps are inoperative with the autolamps on	• SJB	• REFER to Headlamps in this section.
• The parking lamps are inoperative with the autolamps on	• SJB	• REFER to Parking, Rear and License Plate Lamps in this section.

Pinpoint Tests

Pinpoint Test F: The Autolamps Are Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

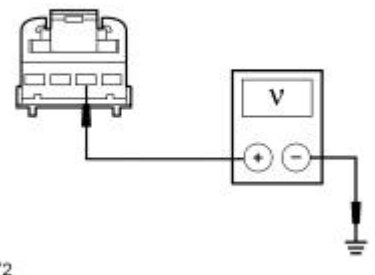
When the smart junction box (SJB) detects the headlamp switch in the AUTOLAMPS ON position, the SJB monitors the light sensor input. The light sensor determines the amount of light based on the input received from the ambient sky conditions. When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the headlamps, parking and license plate lamps.

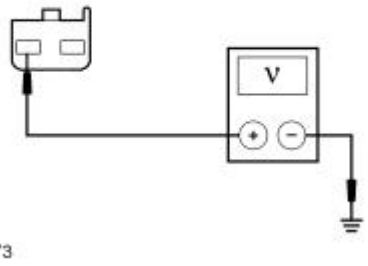
Possible Causes

- Light sensor
- SJB

PINPOINT TEST F: THE AUTOLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
F1 CHECK THE MANUAL HEADLAMP OPERATION	
• Place the headlamp switch in the HEADLAMPS ON position. • **Do the headlamps operate correctly?**	**Yes** GO to F2 . **No** REFER to Headlamps in this section.
F2 CHECK FOR VOLTAGE TO THE LIGHT SENSOR	
• Key in OFF position. • Disconnect: Light Sensor C286 or C2360. • Key in ON position. • Place the headlamp switch in the AUTOLAMPS ON position. • On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  N0057372 • On vehicles with manual temperature control, measure the voltage between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and ground.	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to F3 .

 N0057373 • **Is the voltage approximately 5 volts?**	
F3 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Autolamps Are On Continuously

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the headlamp switch through circuit CLF19 (VT/GN) and a signal to the light sensor through circuit VLF14 (BU/BN). On vehicles with manual climate control, ground for the light sensor is provided by circuit GD133 (BK). On vehicles with electronic automatic temperature control (EATC), ground for the light sensor is provided by the EATC module through circuit RH111 (GY/BU).

When the headlamp switch is placed in the AUTOLAMPS ON position, the voltage signal is routed to ground. When the SJB detects the headlamp switch in the AUTOLAMPS ON position, the SJB monitors the light sensor input. The light sensor determines the amount of light based on the input received from the ambient sky conditions. When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the headlamps, parking and license plate lamps.

DTC B1472 — is an on-demand DTC that sets when the SJB detects the headlamps on input circuit is short to ground.

DTC B1696 — is an on-demand DTC that sets when the SJB detects a short to ground in the autolamps on input circuit.

DTC B1791 — is an on-demand DTC that sets when the SJB detects an open on the light sensor input circuit.

DTC B1793 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the light sensor input circuit.

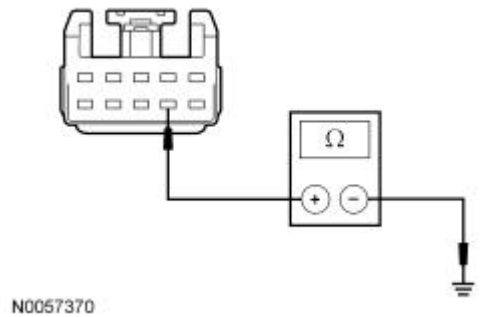
DTC B2A22 — is an on-demand DTC that sets when the SJB detects an open from the headlamp switch off circuit.

Possible Causes

- Circuit CLF19 (VT/GN) open or short to ground
- Circuit CLF23 (WH/VT) open
- Circuit CLF24 (YE/BU) short to ground
- Circuit CLS05 (BU/GY) open
- Circuit GD133 (BK) open
- Circuit GD138 (BK/WH) open
- Circuit RH111 (GY/BU) open
- Circuit VLF14 (BU/BN) open, short to ground or voltage
- Light sensor
- Headlamp switch
- EATC system
- SJB

PINPOINT TEST G: THE AUTOLAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
G1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Was DTC B1791 or B1793 recorded?**	**Yes** For DTC B1791, GO to G7 . For DTC B1793, GO to G11 . **No** GO to G2 .
G2 CHECK THE SJB HEADLAMP SWITCH PIDs	
• Enter the following diagnostic mode on the diagnostic tool: SJB Headlamp Switch PIDs. • **NOTE:** Make sure the headlamp switch is lined up in the correct position when monitoring the PIDs. • Monitor all the SJB headlamp switch input PIDs while moving the headlamp switch through all positions. • **Do the headlamp switch positions agree with the PIDs?**	**Yes** GO to G7 . **No** GO to G3 .
G3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN (HEADLAMP SWITCH)	
• Measure the resistance between the headlamp switch C205-7, circuit GD138 (BK/WH), harness side and ground.  	**Yes** GO to G4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

- **Is the resistance less than 5 ohms?**

G4 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205.
- Carry out the headlamp switch component test.

  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

- **Is the headlamp switch OK?**

Yes
GO to G5 .

No
INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.

G5 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: SJB C2280g.
- Measure the resistance between the headlamp switch, harness side and ground as follows:

Headlamp Switch Connector-Pin	Circuit
C205-4 (if equipped with autolamps)	CLF19 (VT/GN)
C205-10	CLF24 (YE/BU)

- **Are the resistances greater than 10,000 ohms?**

Yes
GO to G6 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

G6 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN

- Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows:

Headlamp Switch Connector-Pin	SJB Connector-Pin	Circuit
C205-4 (if equipped with autolamps)	C2280g-19	CLF19 (VT/GN)
C205-9	C2280g-47	CLF23 (WH/VT)
C205-5	C2280g-31	CLS05 (BU/GY)

- **Are the resistances less than 5 ohms?**

Yes
GO to G13 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

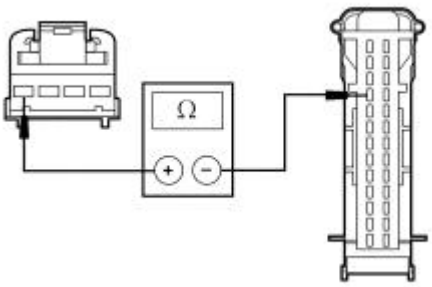
G7 CHECK CIRCUIT RH111 (GY/BU) OR CIRCUIT GD133 (BK) FOR AN OPEN

NOTE: If the vehicle is equipped with an EATC system, make sure the EATC system operates correctly before attempting to continue diagnosis of the autolamp system.

- Key in OFF position.
- Disconnect: Light Sensor C286 or C2360.
- Disconnect: EATC Module C228a.
- On vehicles with EATC, measure the resistance between the light sensor C286-4, circuit RH111 (GY/BU), harness side and the EATC module C228a-10, circuit RH111 (GY/BU), harness side.

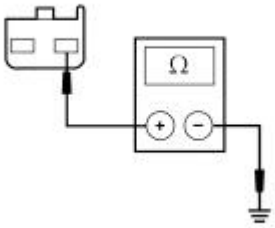
Yes
GO to G8 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



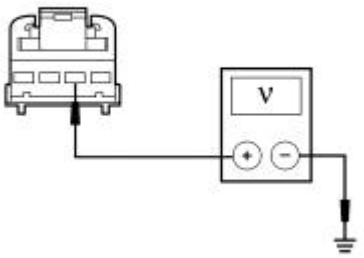
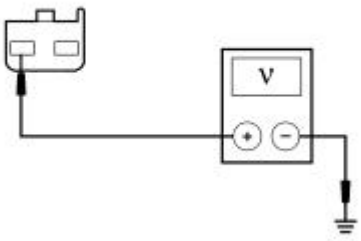
N0057376

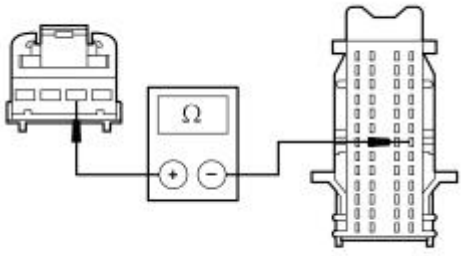
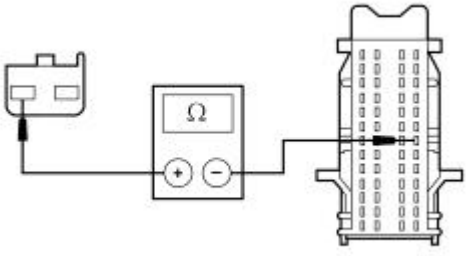
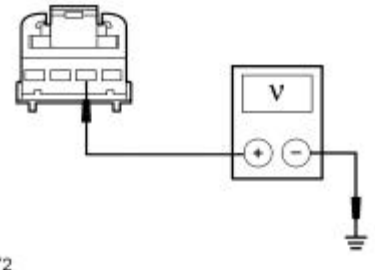
- On vehicles with manual climate control, measure the resistance between the light sensor C2360-2, circuit GD133 (BK), harness side and ground.

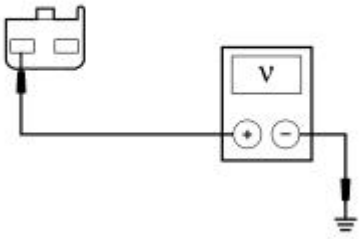


N0057377

- **Is the resistance less than 5 ohms?**

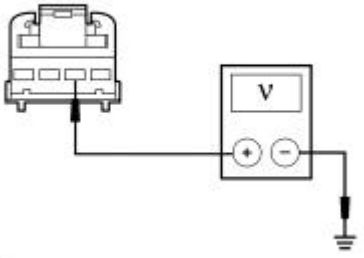
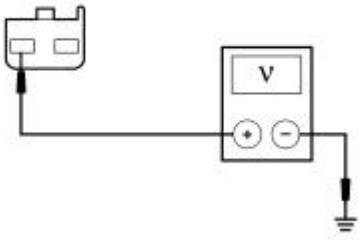
G8 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280g. • Key in ON position. • On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  N0057372 • On vehicles with manual climate control, measure the voltage between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and ground.  N0057373 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to G9 .

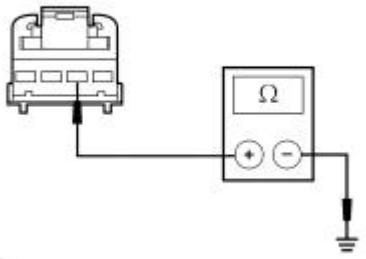
G9 CHECK CIRCUIT VLF14 (BU/BN) FOR AN OPEN	
• Key in OFF position. • On vehicles with EATC, measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and the SJB C2280g-46, circuit VLF14 (BU/BN), harness side.  N0057378 • On vehicles with manual climate control, measure the resistance between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and the SJB C2280g-46, circuit VLF14 (BU/BN), harness side.  N0057379 • **Is the resistance less than 5 ohms?**	**Yes** GO to G10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G10 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC B1791)	
• Connect: SJB C2280g. • Key in ON position. • Place the headlamp switch in the AUTOLAMPS ON position. • On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  N0057372 • On vehicles with manual climate control, measure the voltage between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and ground.	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to G13 .



N0057373

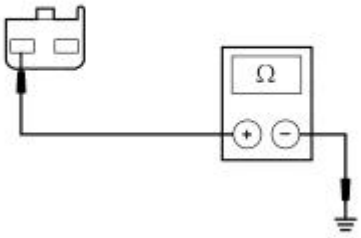
- **Is the voltage approximately 5 volts?**

G11 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC B1793)	
• Disconnect: Light Sensor C286 or C2360. • Key in ON position. • Place the headlamp switch in the AUTOLAMPS ON position. • On vehicles with EATC, measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  N0057372 • On vehicles with manual temperature control, measure the voltage between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and ground.  N0057373 • **Is the voltage approximately 5 volts?**	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to G12 .
G12 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: SJB C2280g. • On vehicles with EATC, measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.	**Yes** GO to G13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



N0057374

- On vehicles with manual temperature control, measure the resistance between the light sensor C2360-1, circuit VLF14 (BU/BN), harness side and ground.



N0057375

- **Is the resistance greater than 10,000 ohms?**

G13 CHECK FOR CORRECT SJB OPERATION	

• Key in OFF position.
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB.
	REFER to Section 419-10 .
	TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
	CLEAR the DTCs.
	REPEAT the self-test.

Stoplamps

Printable View (165 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) monitors the input from the stoplamp switch. When the brake pedal is applied, voltage is routed to the SJB and the high mounted stoplamp. The SJB then supplies voltage to the stoplamps.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, 30-minute battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

The SJB FET protected output circuits for the stoplamp system are for the LH rear stop/turn lamp output and the RH rear stop/turn lamp output circuits.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Stoplamp switch	• Battery junction box (BJB) fuse 31 (15A) (stoplamp switch) • Smart junction box (SJB) fuse 6 (20A) (rear stoplamps) • Bulb(s) • Circuitry • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1485	Brake Pedal Input Short to Battery	Go To Pinpoint Test J .
B2044	Left Rear Stop Lamp Circuit Short to Ground	Go To Pinpoint Test I .

B2045	Left Rear Stop Lamp Circuit Open	If the lamp is inoperative, Go To Pinpoint Test I . If the lamp is always on, Go To Pinpoint Test J .
B2046	Right Rear Stop Lamp Circuit Short to Ground	Go To Pinpoint Test I .
B2047	Right Rear Stop Lamp Circuit Open	If the lamp is inoperative, Go To Pinpoint Test I . If the lamp is always on, Go To Pinpoint Test J .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• The stoplamps are inoperative	• Fuse • Circuitry • Stoplamp switch	• Go To Pinpoint Test H .
• One or more stoplamps are inoperative	• Circuitry • Trailer tow turn relay • High mounted stoplamp • SJB	• Go To Pinpoint Test I .
• The stoplamps are on continuously	• Circuitry • Stoplamp switch • Trailer electronic brake controller • Powertrain control module (PCM) • Anti-lock brake system (ABS) module • SJB	• Go To Pinpoint Test J .

Pinpoint Tests

Pinpoint Test H: The Stoplamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

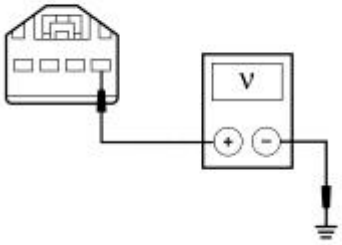
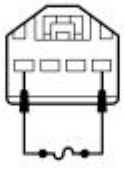
The stoplamp switch is supplied voltage through circuit SBB31 (WH/RD) from the battery junction box (BJB). When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the high mounted stoplamp through circuit CLS17 (YE/GY).

Possible Causes

- Fuse
- Circuit CLS17 (YE/GY) open
- Circuit SBB31 (WH/RD) open
- Stoplamp switch

PINPOINT TEST H: THE STOPLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK CIRCUIT SBB31 (WH/RD) FOR AN OPEN • Key in OFF position. • Disconnect: Stoplamp Switch C278. • Measure the voltage between the stoplamp switch C278-1, circuit SBB31 (WH/RD), harness side and ground.  N0038805 • **Is the voltage greater than 10 volts?**	**Yes** GO to H2 . **No** VERIFY the BJB fuse 31 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
H2 CHECK THE STOPLAMP SWITCH • Connect a fused (15A) jumper wire between the stoplamp switch C278-1, circuit SBB31 (WH/RD), harness side and the stoplamp switch C278-4, circuit CLS17 (YE/GY), harness side.  N0038807 • **Are the stoplamps illuminated?**	**Yes** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CLS17 (YE/GY) for an open. TEST the system for normal operation.

Pinpoint Test I: One Or More Stoplamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the high mounted stoplamp through circuit CLS17 (YE/GY). When the SJB detects the brake pedal applied, the SJB provides voltage to the LH and RH rear stoplamps, and the LH and RH trailer tow turn relays through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively. Ground for the LH and RH rear stoplamps is provided through circuits GD149 (BK/GY) and GD151 (BK/GN), respectively. Ground for the high mounted stoplamp is provided through circuit GD150 (BK/WH).

DTC B2044 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the LH rear stop/turn lamp voltage supply circuit.

DTC B2045 — is an on-demand DTC that sets when the SJB detects an open on the LH rear stop/turn lamp voltage supply circuit.

DTC B2046 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the RH rear stop/turn lamp voltage supply circuit.

DTC B2047 — is an on-demand DTC that sets when the SJB detects an open on the RH rear stop/turn lamp voltage supply circuit.

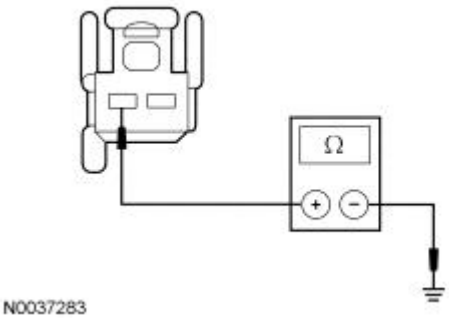
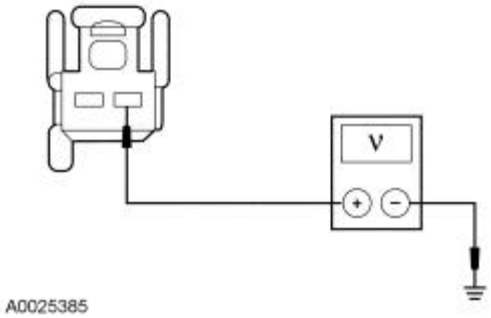
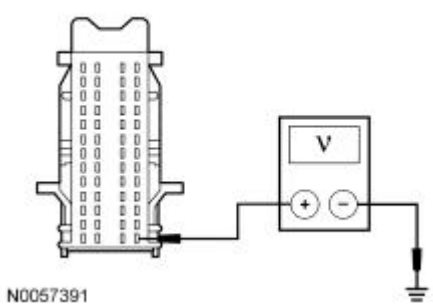
Possible Causes

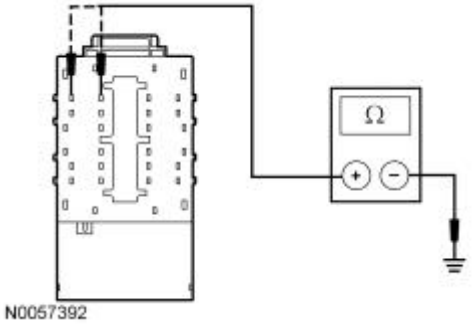
- Circuit CLS17 (YE/GY) open
- Circuit CLS18 (GY/BN) open or short to ground
- Circuit CLS19 (VT/OG) open or short to ground
- Circuit GD149 (BK/GY) open
- Circuit GD150 (BK/WH) open
- Circuit GD151 (BK/GN) open
- High mounted stoplamp
- Trailer tow turn relay
- SJB

PINPOINT TEST I: ONE OR MORE STOPLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
I1 DETERMINE THE INOPERATIVE STOPLAMP	
• Key in OFF position. • Apply the brake pedal and observe the stoplamps. • **Is the high mounted stoplamp illuminated?**	**Yes** GO to I4 . **No** GO to I2 .
I2 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN	
• Disconnect: High Mounted Stoplamp C475. • Measure the resistance between the high mounted stoplamp C475-2, circuit GD150 (BK/WH), harness side and ground.	**Yes** GO to I3 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0037283 • **Is the resistance less than 5 ohms?**	
I3 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN (TO HIGH MOUNTED STOPLAMP)	
• While applying the brake pedal, measure the voltage between the high mounted stoplamp C475-1, circuit CLS17 (YE/GY), harness side and ground.  A0025385 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new high mounted stoplamp. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
I4 USE THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB on-demand self-test. • **Were any DTCs present?**	**Yes** For DTCs B2044 or B2046, GO to I6 . For DTCs B2045 or B2047, GO to I8 . **No** GO to I5 .
I5 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN (TO SJB)	
• Disconnect: SJB C2280g. • While applying the brake pedal, measure the voltage between the SJB C2280g-40, circuit CLS17 (YE/GY), harness side and ground.  N0057391 • **Is the voltage greater than 10 volts?**	**Yes** GO to I8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
I6 CHECK THE TRAILER TOW TURN RELAY	

• Disconnect: LH Trailer Tow Turn Relay (DTC B2044). • Disconnect: RH Trailer Tow Turn Relay (DTC B2046). • Key in ON position. • Repeat the SJB on-demand self-test. • **Is on-demand DTC B2044 or B2046 retrieved again?**	**Yes** GO to I7 . **No** INSTALL a new trailer tow turn relay. CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
I7 CHECK CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: SJB C2280e. • Disconnect: Inoperative Stoplamp. • **NOTE:** For Navigator, both LH or both RH stoplamps must be disconnected for correct test results. • Measure the resistance between the SJB C2280e-25, circuit CLS18 (GY/BN), harness side and ground; or between the SJB C2280e-26, circuit CLS19 (VT/OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I10 . **No** REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
I8 CHECK CIRCUIT GD149 (BK/GY) (LH STOPLAMP) OR CIRCUIT GD151 (BK/GN) (RH STOPLAMP) FOR AN OPEN	
• Disconnect: Inoperative Rear Lamp. • Measure the resistance between the inoperative rear lamp, harness side and ground as follows:	**Yes** GO to I9 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Inoperative Stoplamp	Rear Lamp Connector-Pin	Circuit
Expedition		
LH rear	C4035-1	GD149 (BK/GY)
RH rear	C4032-1	GD151 (BK/GN)
Navigator		
LH rear	C4112-1	GD149 (BK/GY)
LH rear	C4113-1	GD149 (BK/GY)
RH rear	C4114-1	GD151 (BK/GN)
RH rear	C4115-1	GD151 (BK/GN)

<table>
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- **Is the resistance less than 5 ohms?**

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I9 CHECK THE CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG) FOR AN OPEN

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- Disconnect: SJB C2280e.
- Measure the resistance between the inoperative rear lamp, harness side and the SJB, harness side; and between the inoperative rear lamp, harness side and ground as follows:

Inoperative Stoplamp Connector-Pin	SJB Connector-Pin	Circuit
Expedition		
LH rear C4035-3	C2280e-25	CLS18 (GY/BN)
RH rear C4032-3	C2280e-26	CLS19 (VT/OG)
Navigator		
LH rear C4112-3	C2280e-25	CLS18 (GY/BN)
LH rear C4113-3	C2280e-25	CLS18 (GY/BN)
RH rear C4114-3	C2280e-26	CLS19 (VT/OG)
RH rear C4115-3	C2280e-26	CLS19 (VT/OG)

- **Is the resistance less than 5 ohms?**

</td><td>

Yes
GO to I10 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

</td></tr>
<tr><td>

I10 CHECK FOR CORRECT SJB OPERATION

</td><td></td></tr>
<tr><td>

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

</td><td>

Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

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Pinpoint Test J: The Stoplamps Are On Continuously

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the high mounted stoplamp, the powertrain control module (PCM), the anti-lock brake system (ABS) module and the trailer electric brake controller through circuit CLS17 (YE/GY). When the SJB detects the brake pedal applied, the SJB provides voltage to the LH and RH rear stoplamps, and the LH and RH trailer tow turn relays through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively.

DTC B1485 — is an on-demand DTC that sets when the SJB detects a short to voltage from the stoplamp switch input circuit.

DTC B2045 — is an on-demand DTC that sets when the SJB detects a short to voltage on the LH rear stop/turn lamp voltage supply circuit.

DTC B2047 — is an on-demand DTC that sets when the SJB detects a short to voltage on the RH rear stop/turn lamp voltage supply circuit.

Possible Causes

- Circuit CCB08 (VT/WH) short to voltage
- Circuit CLS17 (YE/GY) short to voltage
- Circuit CLS18 (GY/BN) short to voltage
- Circuit CLS19 (VT/OG) short to voltage
- Stoplamp switch
- Trailer electric brake controller
- ABS module
- PCM
- SJB

PINPOINT TEST J: THE STOPLAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
J1 DETERMINE IF ALL THE STOPLAMPS ARE ILLUMINATED	
• Key in OFF position. • Observe the stoplamps with the brake pedal released. • **Are all of the stoplamps illuminated?**	**Yes** GO to J3 . **No** GO to J2 .
J2 CHECK THE STOPLAMPS VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280e. • **Do the stoplamps continue to illuminate?**	**Yes** If the LH rear lamp continues to illuminate, REPAIR circuit CLS18 (GY/BN). CLEAR the DTCs. REPEAT the self-test. If the RH rear lamp continues to illuminate, REPAIR circuit CLS19 (VT/OG). CLEAR the DTCs. REPEAT the self-test. **No** GO to J10 .
J3 CHECK THE STOPLAMP SWITCH	
• Disconnect: Stoplamp Switch C278. • **Do the stoplamps continue to illuminate?**	**Yes** If the vehicle is equipped with a trailer electric brake controller, GO to J4 . If the vehicle is not equipped with a trailer electric brake controller, GO to J5 . **No** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
J4 CHECK THE TRAILER ELECTRIC BRAKE CONTROLLER	

• Disconnect: Trailer Electric Brake Controller C2142. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J5 . **No** INSTALL a new trailer electric brake controller. CLEAR the DTCs. REPEAT the self-test.
J5 CHECK THE PCM	
• Disconnect: PCM C175b. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J6 . **No** GO to J8 .
J6 CHECK THE ABS MODULE	
• Disconnect: ABS Module C135. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J7 . **No** GO to J9 .
J7 CHECK CIRCUIT CLS17 (YE/GY) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280e. • **Does the high mounted stoplamp continue to illuminate?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to J10 .
J8 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

J9 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the ABS module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

J10 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

■ pushed-out pins ● Connect all the SJB connectors and make sure they seat correctly. ● Operate the system and verify the concern is still present. ● **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Turn Signal and Hazard Lamps

Printable View (181 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) monitors the multifunction switch position by sending multiple voltage reference signals to the multifunction switch. When the multifunction switch is in the LH or RH TURN positions, or the hazard lamp switch is pressed, that input signal is routed to ground.

When the SJB receives a request for a turn signal or hazard lamps, the SJB supplies voltage to the appropriate turn lamps.

The timed on/off cycle is determined by the SJB and is set to flash approximately 80 times per minute if both the front and rear turn lamps operate correctly. If an individual turn signal lamp is inoperative, the SJB flashes the remaining turn lamp approximately 160 times per minute.

Field-Effect Transistor (FET) Protection

The SJB utilizes a FET protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, 30-minute battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

The SJB FET protected output circuits for the turn lamp system are for the LH front turn lamp output and

the RH front turn lamp output circuits. The rear turn lamps utilize the stoplamp circuitry and are also protected. For additional information regarding the rear lamps, refer to Stoplamps in this section.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Multifunction switch • Hazard flasher lamp switch	• Smart junction box (SJB) • Circuitry • Bulbs

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B2A27	Right Front Turn Lamp Circuit Open	Go To Pinpoint Test M .
B2A28	Right Front Turn Lamp Circuit Short to Ground	Go To Pinpoint Test M .
B2A29	Left Front Turn Lamp Circuit Open	Go To Pinpoint Test M .
B2A2A	Left Front Turn Lamp Circuit Short to Ground	Go To Pinpoint Test M .
B2071	Hazard Switch Signal Short to Ground	Go To Pinpoint Test N .
B2281	Right Turn Switch Short to Ground	Go To Pinpoint Test L .
B2282	Left Turn Switch Short to Ground	Go To Pinpoint Test L .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• The turn signal lamps are inoperative	• Circuitry • Multifunction switch • SJB	• Go To Pinpoint Test K .
• The turn signal lamps are always on	• Circuitry • Multifunction switch • SJB	• Go To Pinpoint Test L .
• One turn signal/hazard lamp is inoperative/always on	• Circuitry • Signal mirror • SJB	• Go To Pinpoint Test M .
• The hazard lamps are inoperative/always on	• Circuitry • Hazard flasher lamp switch • SJB	• Go To Pinpoint Test N .

Pinpoint Tests

Pinpoint Test K: The Turn Signal Lamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the multifunction switch through circuits CLS20 (BN/BU) (LH turn input) and CLS24 (BN/WH) (RH turn input). When the multifunction switch is placed in

the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB provides voltage to the appropriate turn lamps.

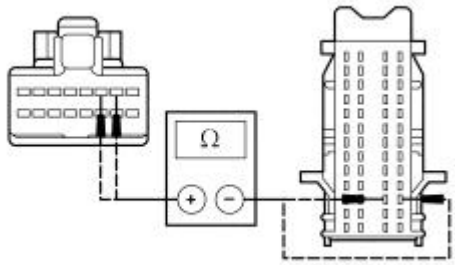
Possible Causes

- Circuit CLS20 (BN/BU) open
- Circuit CLS24 (BN/WH) open
- Multifunction switch
- SJB

PINPOINT TEST K: THE TURN SIGNAL LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
K1 CHECK FOR CORRECT HIGH BEAM OPERATION • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position while observing the high beam headlamps. • **Do the high beams operate correctly?**	**Yes** PLACE the headlamp switch in the OFF position. GO to K2 . **No** REFER to Headlamps in this section.
K2 CHECK THE MULTIFUNCTION SWITCH • Key in OFF position. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the multifunction switch OK?**	**Yes** GO to K3 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
K3 CHECK CIRCUIT CLS20 (BN/BU) (LH TURN SIGNAL) OR CLS24 (BN/WH) (RH TURN SIGNAL) FOR AN OPEN • Disconnect: SJB C2280g. • Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS20 (BN/BU), harness side and the SJB C2280g-42, circuit CLS20 (BN/BU), harness side; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS24 (BN/WH), harness side and the SJB C2280g-29, circuit CLS24 (BN/WH), harness side.	**Yes** GO to K4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 N0057393 • **Is the resistance less than 5 ohms?**	

K4 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Turn Signal Lamps Are Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the multifunction switch through circuits CLS20 (BN/BU) (LH turn input) and CLS24 (BN/WH) (RH turn input). When the multifunction switch is placed in the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB provides voltage to the appropriate turn lamps.

DTC B2281 — is an on-demand DTC that sets when the SJB detects the RH turn signal switch input is short to ground.

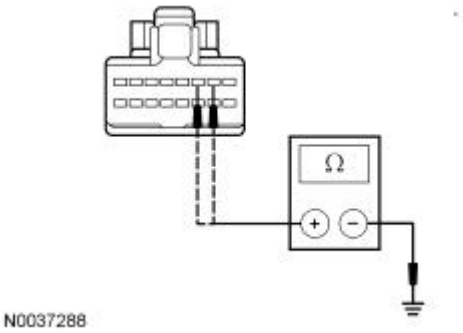
DTC B2282 — is an on-demand DTC that sets when the SJB detects the LH turn signal switch input is short to ground.

Possible Causes

- Circuit CLS20 (BN/BU) short to ground
- Circuit CLS24 (BN/WH) short to ground
- Multifunction switch
- SJB

PINPOINT TEST L: THE TURN SIGNAL LAMPS ARE ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
L1 CHECK THE MULTIFUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multifunction Switch C202. • Key in ON position. • **Do the turn lamps continue to flash on and off?**	**Yes** GO to L2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
L2 CHECK CIRCUIT CLS20 (BN/BU) (LH TURN SIGNAL) OR CIRCUIT CLS24 (BN/WH) (RH TURN SIGNAL) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: SJB C2280g. • Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS20 (BN/BU), harness side and ground; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS24 (BN/WH), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
L3 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test M: One Turn Signal/Hazard Lamp Is Inoperative/Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the multifunction switch in the LH TURN position, the SJB provides voltage through circuit CLS21 (BU/GN) to the LH front turn lamp and the signal mirror (if equipped). When the SJB detects the multifunction switch in the RH TURN position, the SJB provides voltage through circuit CLS25 (YE/VT) to the RH front turn lamp and the signal mirror (if equipped). Circuits GD123 (BK/GY) and GD120 (BK/GN) provide ground for the LH and RH front turn lamps, respectively. Circuits GD143 (BK/VT) and GD138 (BK/WH) provide ground for the LH and RH signal mirrors, respectively. The rear turn lamps are controlled utilizing the rear stoplamp circuitry.

DTC B2A27 — is an on-demand DTC that sets when the SJB detects an open or short to voltage on the RH front turn lamp voltage supply circuit.

DTC B2A28 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the RH front turn lamp voltage supply circuit.

DTC B2A29 — is an on-demand DTC that sets when the SJB detects an open or short to voltage on the LH front turn lamp voltage supply circuit.

DTC B2A2A — is a continuous and on-demand DTC that sets when the SJB detects a short to ground on the LH front turn lamp voltage supply circuit.

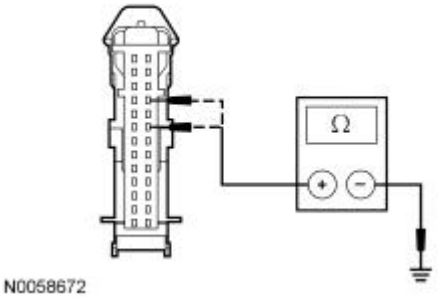
Possible Causes

- Circuit CLS21 (BU/GN) open, short to ground or voltage
- Circuit CLS25 (YE/VT) open, short to ground or voltage
- Circuit GD120 (BK/GN) open
- Circuit GD123 (BK/GY) open
- Circuit GD138 (BK/WH) open
- Circuit GD143 (BK/VT) open
- Signal mirror
- SJB

PINPOINT TEST M: ONE TURN SIGNAL/HAZARD LAMP IS INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
M1 CHECK THE STOPLAMPS	
• Apply and release the brake pedal while observing the stoplamps. • **Do the stoplamps operate correctly?**	**Yes** GO to M2 . **No** REFER to Stoplamps in this section.
M2 DETERMINE IF A TURN LAMP IS ALWAYS ON	
• Key in ON position. • Monitor the turn lamps while placing the multifunction switch in the RH TURN and then LH TURN positions. • **Is any turn lamp always on?**	**Yes** GO to M3 . **No** GO to M4 .
M3 CHECK CIRCUIT CLS21 (BU/GN) (LH TURN) OR CIRCUIT CLS25 (YE/VT) (RH TURN) FOR A SHORT TO VOLTAGE	

• Key in OFF position. • Disconnect: SJB C2280b. • Key in ON position. • **Does the turn lamp in question continue to illuminate?**	**Yes** For the LH turn lamp, REPAIR circuit CLS21 (BU/GN). CLEAR the DTCs. REPEAT the self-test. For the RH turn lamp, REPAIR circuit CLS25 (YE/VT). CLEAR the DTCs. REPEAT the self-test. **No** GO to M9 .
M4 USE THE RECORDED DTCs FROM THE SJB SELF-TEST • Check the recorded results from the SJB on-demand self-test. • **Was DTC B2A28 or B2A2A present?**	**Yes** If equipped with signal mirrors, GO to M5 . If not equipped with signal mirrors, GO to M6 . **No** GO to M7 .
M5 CHECK THE SIGNAL MIRROR (SHORT TO GROUND) • Key in OFF position. • Disconnect: LH Signal Mirror C622 (DTC B2A2A). • Disconnect: RH Signal Mirror C516 (DTC B2A28). • Key in ON position. • Repeat the SJB on-demand self-test. • **Is on-demand DTC B2A2A or B2A28 retrieved again?**	**Yes** GO to M6 . **No** INSTALL a new signal mirror in question. CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
M6 CHECK CIRCUIT CLS21 (BU/GN) (DTC B2A2A) OR CIRCUIT CLS25 (YE/VT) (DTC B2A28) FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: Inoperative Front Turn Lamp. • Disconnect: SJB C2280b. • Measure the resistance between the SJB C2280b-21 (DTC B2A2A), circuit CLS21 (BU/GN), harness side and ground; or between the SJB C2280b-23 (DTC B2A28), circuit CLS25 (YE/VT), harness side and ground.  N0058672 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to M9 . **No** REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
M7 CHECK THE GROUND CIRCUIT FOR AN OPEN • Key in OFF position. • Disconnect: Inoperative Turn Lamp.	**Yes** GO to M8 .

- Measure the resistance between the inoperative turn lamp, harness side and ground as follows

Inoperative Turn Lamp	Connector-Pin	Circuit
LH front (Expedition)	C1023-1	GD123 (BK/GY)
RH front (Expedition)	C1043-1	GD120 (BK/GN)
LH front (Navigator)	C156-1	GD123 (BK/GY)
RH front (Navigator)	C166-1	GD120 (BK/GN)
LH signal mirror	C516-2	GD143 (BK/VT)
RH signal mirror	C622-2	GD138 (BK/WH)

- **Is the resistance less than 5 ohms?**

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test

M8 CHECK CIRCUIT CLS21 (BU/GN) (LH TURN) OR CIRCUIT CLS25 (YE/VT) (RH TURN) FOR AN OPEN

- Disconnect: SJB C2280b.
- **NOTE:** If the signal mirror and the corresponding front turn lamp are both inoperative, follow the checks and directions for the front turn lamp.
- Measure the resistance between the inoperative turn lamp, harness side and the SJB, harness side as follows:

Inoperative Turn Lamp Connector-Pin	SJB Connector-Pin	Circuit
LH front (Expedition) C1023-3	C2280b-21	CLS21 (BU/GN)
RH front (Expedition) C1043-3	C2280b-23	CLS25 (YE/VT)
LH front (Navigator) C156-3	C2280b-21	CLS21 (BU/GN)
RH front (Navigator) C166-3	C2280b-23	CLS25 (YE/VT)
LH signal mirror C516-10	C2280b-21	CLS21 (BU/GN)
RH signal mirror C622-10	C2280b-23	CLS25 (YE/VT)

- **Is the resistance less than 5 ohms?**

Yes
For a signal mirror, INSTALL a new signal mirror. REFER to Side Turn Signal Lamp — Signal Mirror in this section.

For a front turn lamp, GO to M9 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test

M9 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Hazard Lamps Are Inoperative/Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a voltage reference signal to the hazard flasher lamp switch through circuit CLN30 (GN/OG). When the hazard flasher lamp switch is pressed, the voltage signal is routed to ground through circuit GD138 (BK/WH). When the SJB detects a request for the hazard lamps, the SJB provides voltage to the appropriate turn lamps.

The hazard flasher lamp switch is a momentary contact switch.

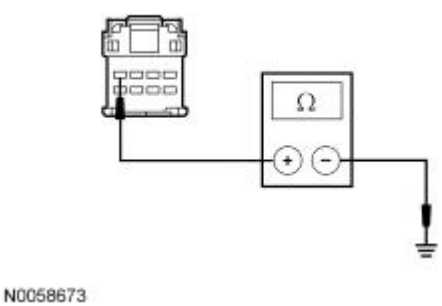
DTC B2071 — is an on-demand DTC that sets when the SJB detects a short to ground from the hazard flasher lamp switch input circuit.

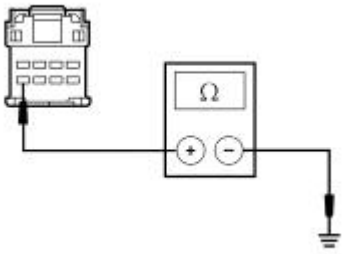
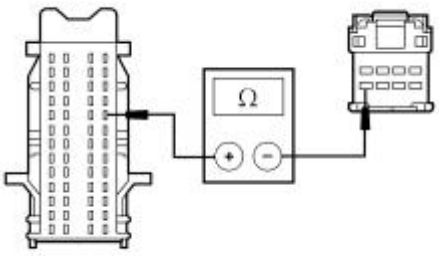
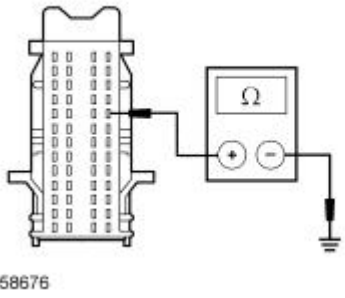
Possible Causes

- Circuit CLN30 (GN/OG) open or short to ground
- Circuit GD138 (BK/WH) open
- Hazard flasher lamp switch
- SJB

PINPOINT TEST N: THE HAZARD LAMPS ARE INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
N1 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: Hazard Flasher Lamp Switch C2361. • Measure the resistance between the hazard lamp switch C2361-4, circuit GD138 (BK/WH), harness side and ground.  N0058673 • **Is the resistance less than 5 ohms?**	**Yes** GO to N2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
N2 CHECK CIRCUIT CLN30 (GN/OG) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280g. • Measure the resistance between the hazard lamp switch C2361-8, circuit CLN30 (GN/OG), harness side and ground.	**Yes** GO to N3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-

 N0058674 • **Is the resistance greater than 10,000 ohms?**	test.
N3 CHECK CIRCUIT CLN30 (GN/OG) FOR AN OPEN	
• Measure the resistance between the SJB C2280g-48, circuit CLN30 (GN/OG), harness side and the hazard flasher lamp switch C2361-8, circuit CLN30 (GN/OG), harness side.  N0058675 • **Is the resistance less than 5 ohms?**	**Yes** GO to N4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test..
N4 CHECK THE HAZARD FLASHER LAMP SWITCH	
• Connect: Hazard Lamp Switch C2341. • While pressing and releasing the hazard flasher lamp switch, measure the resistance between the SJB C2280g-48, circuit CLN30 (GN/OG), harness side and ground.  N0058676 • **Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?**	**Yes** GO to N5 . **No** INSTALL a new hazard flasher lamp switch. REFER to Hazard Flasher Lamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
N5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been

	caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Parking, Rear and License Plate Lamps

Printable View (135 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB does not detect any of the inputs to the headlamp switch is active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). If the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received. If either of these situations occur, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

When the SJB receives an input from the headlamp switch indicating a request for the parking lamps, the SJB energizes the parking lamp relay, which supplies voltage to the exterior lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Smart junction box (SJB) fuse 22 (15A) (parking lamps) • SJB • Bulb(s) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1578	Lamp Park Input Circuit Short to Ground	Go To Pinpoint Test P .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• One or more parking, rear or license plate lamps is inoperative	• Fuse • Circuitry • SJB	• Go To Pinpoint Test O .
• The parking, rear or license plate lamps are on continuously	• Circuitry • Headlamp switch • SJB	• Go To Pinpoint Test P .

Pinpoint Tests

Pinpoint Test O: One Or More Parking, Rear or License Plate Lamps Is Inoperative

Refer to Wiring Diagrams Cell 92 , Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

When the headlamp switch is placed in the PARKING LAMPS ON position, the smart junction box (SJB) provides a ground for the parking lamp relay coil (integral to the SJB). When the parking lamp relay is energized, voltage is routed through circuit CLS30 (VT/WH) to the rear and front parking lamps. Ground is provided to the rear parking, liftgate and license plate lamps through circuit GD149 (BK/GY), circuit GD150 (BK/WH) or circuit GD151 (BK/GN). Ground is provided to the front parking and side marker lamps through circuit GD120 (BK/GN) or circuit GD123 (BK/GY).

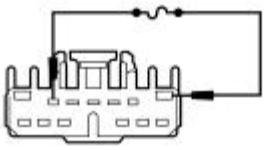
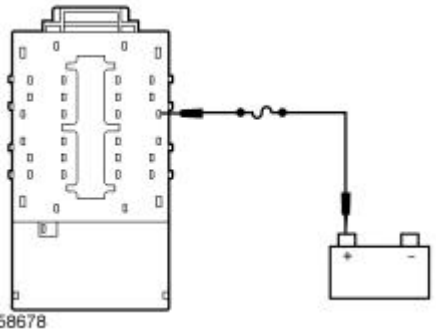
Possible Causes

- Fuse
- Circuit CLS30 (VT/WH) open
- Circuit GD120 (BK/GN) open
- Circuit GD123 (BK/GY) open
- Circuit GD149 (BK/GY) open
- Circuit GD150 (BK/WH) open
- Circuit GD151 (BK/GN) open
- SJB

PINPOINT TEST O: ONE OR MORE PARKING, REAR OR LICENSE PLATE LAMPS IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
O1 DETERMINE IF ALL THE PARKING LAMPS ARE INOPERATIVE	
• Key in OFF position.	**Yes**

• Place the headlamp switch to the PARKING LAMPS ON position. • **Are all the parking lamps inoperative?**	PLACE the headlamp switch in the OFF position. VERIFY the SJB fuse 22 (15A) is OK. If OK, GO to O5 . **No** If all the front parking lamps are inoperative, GO to O2 . If all the rear parking and license plate lamps are inoperative, GO to O3 . For all others, GO to O4 .
O2 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN (FRONT LAMPS)	
• Disconnect: SJB C2280a. • Connect a fused (10A) jumper wire between the SJB C2280a-1, circuit CBB69 (WH/VT), harness side and the SJB C2280a-6, circuit CLS30 (VT/WH), harness side.  N0058677 • Key in ON position. • **Do the front parking lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to O5 . **No** REPAIR the circuit. TEST the system for normal operation.
O3 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN (REAR LAMPS)	
• Disconnect: SJB C2280e. • Connect a fused (10A) jumper wire between the positive battery terminal and the SJB C2280e-20, circuit CLS30 (VT/WH), harness side.  N0058678 • **Do the rear parking lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to O5 . **No** REPAIR the circuit. TEST the system for normal operation.
O4 CHECK THE PARKING LAMP GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Inoperative Lamp. • Measure the resistance between the inoperative lamp, harness side and ground as follows:	**Yes** REPAIR circuit CLS30 (VT/WH) for an open. TEST the system for

Expedition

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD120 (BK/GN)
LH front side marker	C151-1	GD120 (BK/GN)
RH front side marker	C161-1	GD123 (BK/GY)
LH rear	C4035-1	GD149 (BK/GY)
RH rear	C4032-1	GD151 (BK/GN)
LH license plate	C452-1	57 (BK)
RH license plate	C462-2	57 (BK)

Navigator

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1549-1	GD120 (BK/GN)
RH front	C1550-1	GD123 (BK/GY)
LH front side marker	C151-1	GD120 (BK/GN)
RH front side marker	C161-1	GD123 (BK/GY)
LH rear	C4112-1	GD149 (BK/GY)
LH rear	C4113-1	GD149 (BK/GY)
RH rear	C4114-1	GD151 (BK/GN)
RH rear	C4115-1	GD151 (BK/GN)
LH liftgate 1	C412-1	GD150 (BK/WH)
LH liftgate 2	C419-1	GD150 (BK/WH)
RH liftgate 1	C415-1	GD150 (BK/WH)
RH liftgate 2	C418-1	GD150 (BK/WH)
LH license plate	C452-1	GD150 (BK/WH)
RH license plate	C462-2	GD150 (BK/WH)

- **Is the resistance less than 5 ohms?**

normal operation.

No
REPAIR the ground circuit in question. TEST the system for normal operation.

O5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The Parking, Rear Or License Plate Lamps Are On Continuously

Refer to Wiring Diagrams Cell 92 , Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the parking lamp request input from the headlamp switch through circuit CLS05 (BU/GY). The SJB provides a ground for the parking lamp relay coil (integral to the SJB) when a request for the parking lamps is received. When the parking lamp relay is energized, voltage is routed through circuit CLS30 (VT/WH) to the rear and front parking lamps.

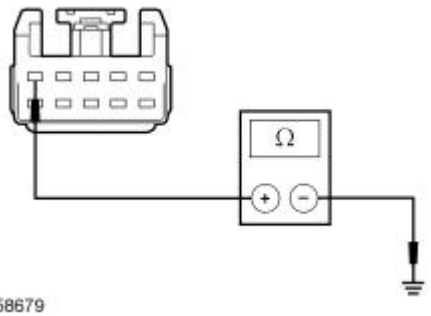
DTC B1578 — is an on-demand DTC that sets when the SJB detects a short to ground in the parking lamps on input circuit.

Possible Causes

- Circuit CLS30 (VT/WH) short to voltage
- Circuit CLS05 (BU/GY) short to ground
- Headlamp switch
- SJB

PINPOINT TEST P: THE PARKING, REAR OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
P1 USE THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Was DTC B1578 recorded?**	**Yes** GO to P2 . **No** GO to P4 .
P2 CHECK THE HEADLAMP SWITCH	
• Key in OFF position. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the headlamp switch OK?**	**Yes** GO to P3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
P3 CHECK CIRCUIT CLS05 (BU/GY) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280g. • Measure the resistance between the headlamp switch C205-5, circuit CLS05 (BU/GY), harness side and ground.	**Yes** GO to P6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0058679 • **Is the resistance greater than 10,000 ohms?**	
P4 CHECK CIRCUIT CLS30 (VT/WH) FOR A SHORT TO VOLTAGE (TO REAR LAMPS)	
• Key in OFF position. • Disconnect: SJB C2280e. • Key in ON position. • **Do the rear parking lamps continue to illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to P5 .
P5 CHECK CIRCUIT CLS30 (VT/WH) FOR A SHORT TO VOLTAGE (TO FRONT LAMPS)	
• Key in OFF position. • Disconnect: SJB C2280a. • Key in ON position. • **Do the front parking lamps continue to illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to P6 .
P6 CHECK FOR CORRECT SJB OPERATION	

• Key in OFF position.
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Fog Lamps

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Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) monitors the headlamp switch position by sending a voltage reference signal to the headlamp switch. When the fog lamp switch is engaged, the voltage reference signal is routed to ground.

The fog lamps can be turned on when the following conditions are met:

- The ignition switch is in the RUN or START position.
- The low beam headlamps or the parking lamps are on.
- The high beams are off.

When the SJB receives an input from the headlamp switch indicating a request for the fog lamps, the SJB provides voltage to the fog lamp relay. When the fog lamp relay is energized, voltage is routed to the fog lamps.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Smart junction box (SJB) fuse 21 (15A) (fog lamps) • Circuity • Bulb(s) • Headlamp switch • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B2254	Front Fog Lamp Switch Failure	Go To Pinpoint Test S .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• The fog lamps are inoperative	• Fuse • Circuitry • Headlamp switch • SJB	• Go To Pinpoint Test Q .
• An individual fog lamp is inoperative	• Circuitry	• **NOTE:** Make sure the fog lamp bulb is OK before carrying out diagnostics. Go To Pinpoint Test R .
• The fog lamps are on continuously	• Circuitry • Headlamp switch • SJB	• Go To Pinpoint Test S .
• The fog lamps on indicator is inoperative	• Circuitry • Headlamp switch • SJB	• Go To Pinpoint Test T .

Pinpoint Tests

Pinpoint Test Q: The Fog Lamps Are Inoperative

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the headlamp switch through circuit CLF29 (BN) to monitor the fog lamp request. When the fog lamp switch is engaged, the voltage signal is routed to ground.

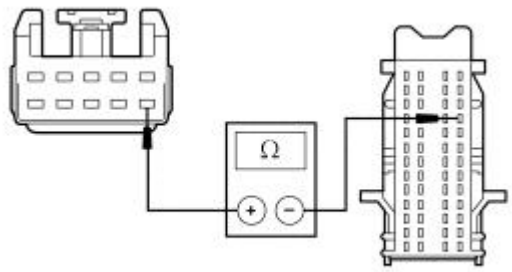
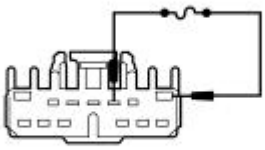
When the SJB detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integral to the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF21 (GY/VT) to the fog lamps.

Possible Causes

- Fuse
- Circuit CLF21 (GY/VT) open
- Circuit CLF29 (BN) open
- Headlamp switch
- SJB

PINPOINT TEST Q: THE FOG LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
Q1 CHECK THE HEADLAMP SWITCH PID • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: SJB Headlamp Switch PID. • Monitor the SJB FOG SW PID while engaging the fog lamp switch. • **Does the PID indicate the fog lamp switch is active?**	**Yes** GO to Q4 . **No** GO to Q2 .
Q2 CHECK THE HEADLAMP SWITCH • Key in OFF position. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the headlamp switch OK?**	**Yes** GO to Q3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
Q3 CHECK CIRCUIT CLF29 (BN) FOR AN OPEN • Disconnect: SJB C2280g. • Measure the resistance between the headlamp switch C205-6, circuit CLF29 (BN), harness side and the SJB C2280g-49, circuit CLF29 (BN), harness side.  N0058680 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q5 . **No** REPAIR the circuit. TEST the system for normal operation.
Q4 CHECK CIRCUIT CLF21 (GY/VT) FOR AN OPEN • Key in OFF position. • Connect a fused (15A) jumper wire between the SJB C2280a-1, circuit CBB69 (WH/VT), harness side and the SJB C2280a-3, circuit CLF21 (GY/VT), harness side.  N0058681 • Key in ON position. • **Do the fog lamps illuminate?**	**Yes** REMOVE the jumper wire. VERIFY the SJB fuse 21 (15A) is OK. If OK, GO to Q5 . **No** REPAIR the circuit. TEST the system for normal operation.

Q5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: An Individual Fog Lamp Is Inoperative

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

When the fog lamp relay is energized, voltage is routed through circuit CLF21 (GY/VT) to the fog lamps. Ground is provided on circuits GD120 (BK/GN) and GD123 (BK/GY) to the LH and RH fog lamps, respectively.

Possible Causes

- Circuit CLF21 (GY/VT) open
- Circuit GD120 (BK/GN) open
- Circuit GD123 (BK/GY) open

PINPOINT TEST R: AN INDIVIDUAL FOG LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>R1 CHECK THE GROUND CIRCUIT FOR AN OPEN</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Inoperative Fog Lamp.
• Measure the resistance between the inoperative fog lamp, harness side and ground as follows:

<table>
<tr><th>Inoperative Fog Lamp</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td colspan="3">Expedition</td></tr>
<tr><td>LH</td><td>C152-1</td><td>GD120 (BK/GN</td></tr>
<tr><td>RH</td><td>C162-1</td><td>GD123 (BK/GY</td></tr>
<tr><td colspan="3">Navigator</td></tr>
<tr><td>LH</td><td>C1322-A</td><td>GD120 (BK/GN</td></tr>
</table>
</td><td>Yes
REPAIR circuit CLF21 (GY/VT) for an open. TEST the system for normal operation.

No
REPAIR the ground circuit in question for an open. TEST the system for normal operation.</td></tr>
</table>

RH	C1323-A	GD123 (BK/GY

- **Is the resistance less than 5 ohms?**

Pinpoint Test S: The Fog Lamps Are On Continuously

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the headlamp switch through circuit CLF29 (BN) to monitor the fog lamp request. When the fog lamp switch is engaged, the voltage signal is routed to ground.

When the SJB detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integral to the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF21 (GY/VT) to the fog lamps and to circuit CLF28 (BN/WH) to the headlamp switch for the fog lamps on indicator.

DTC B2254 — is an on-demand DTC that sets when the SJB detects a short to ground on the fog lamp on input circuit.

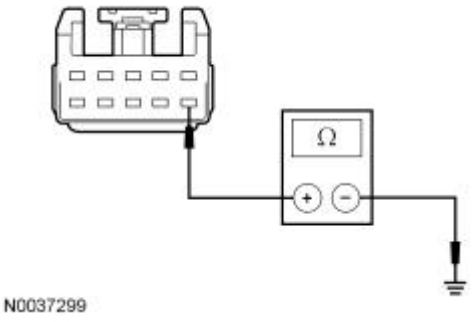
Possible Causes

- Circuit CLF21 (GY/VT) short to voltage
- Circuit CLF28 (BN/WH) short to voltage
- Circuit CLF29 (BN) short to ground
- Headlamp switch
- SJB

PINPOINT TEST S: THE FOG LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
S1 CHECK FOR RECORDED SJB DTCs	
• Check the recorded results from the SJB self-test. • **Is DTC B2254 present?**	**Yes** GO to S2 . **No** GO to S4 .
S2 CHECK THE HEADLAMP SWITCH	
• Key in OFF position. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the headlamp switch OK?**	**Yes** GO to S3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.

S3 CHECK CIRCUIT CLF29 (BN) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280h. • Measure the resistance between the headlamp switch C205-6, circuit CLF29 (BN), harness side and ground.  N0037299 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
S4 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280f. • Key in ON position. • **Do the fog lamps continue to illuminate?**	**Yes** GO to S5 . **No** REPAIR the circuit. TEST the system for normal operation.
S5 CHECK CIRCUIT CLF21 (GY/VT) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280a. • Key in ON position. • **Do the fog lamps continue to illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to S6 .
S6 CHECK FOR CORRECT SJB OPERATION	

• Key in OFF position.
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test T: The Fog Lamps On indicator Is Inoperative

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

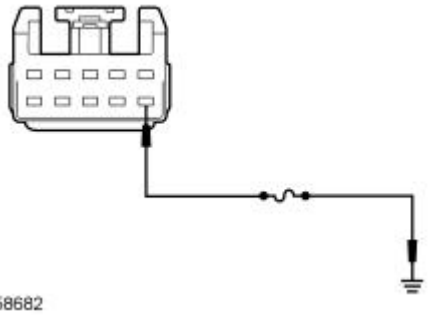
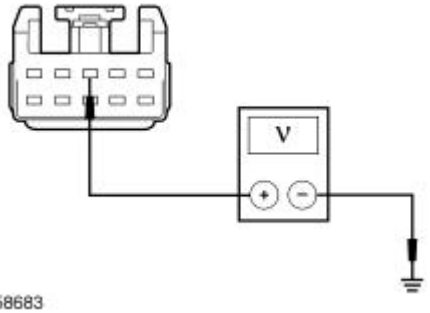
When the smart junction box (SJB) detects the fog lamps on request, the SJB provides ground to the fog lamp relay coil (integral to the SJB). When the fog lamp relay is energized, voltage is routed through circuit CLF21 (GY/VT) to the fog lamps and to circuit CLF28 (BN/WH) to the headlamp switch for the fog lamps on indicator.

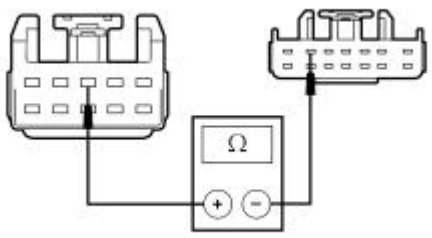
Possible Causes

- Circuit CLF28 (BN/WH) open
- Headlamp switch
- SJB

PINPOINT TEST T: THE FOG LAMPS ON INDICATOR IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
T1 CHECK THE HEADLAMP SWITCH **NOTE:** Make sure the headlamp switch is in the OFF position. • Key in OFF position. • Disconnect: Headlamp Switch C205. • Connect a fused (5A) jumper wire between the headlamp switch C205-6, circuit CLF29 (BN), harness side and ground.  N0058682 • Key in ON position. • **NOTE:** Make sure the fog lamps are illuminated when taking a reading. • Measure the voltage between the headlamp switch C205-3, circuit CLF28 (BN/WH), harness side and ground.  N0058683 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation. **No** REMOVE the jumper wire. GO to T2.
T2 CHECK CIRCUIT CLF28 (BN/WH) FOR AN OPEN • Key in OFF position. • Disconnect: SJB C2280f. • Measure the resistance between the headlamp switch C205-3, circuit CLF28 (BN/WH), harness side and the SJB C2280f-6, circuit CLF28 (BN/WH), harness side.	**Yes** GO to T3. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0058684 • **Is the resistance greater than 10,000 ohms?**	

T3 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Reversing Lamps

Printable View (175 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

For vehicles equipped with an automatic transmission, the transmission control module (TCM) sends gear status information to the instrument cluster over the communication network. The smart junction box (SJB) receives transmission gear status from the instrument cluster over the communication network. When a message is sent over the communication network stating the transmission is in REVERSE (R), the SJB energizes an internal relay which supplies voltage to the reversing lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery junction box (BJB) fuse 33 (20A) • Transmission control module (TCM) • Bulb(s) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the TCM.

9. If the DTCs retrieved are related to the concern, refer to the Transmission Control Module (TCM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Transmission Control Module (TCM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
P1910	Reverse Lamp Control Circuit/Open	Go To Pinpoint Test U .
P1911	Reverse Lamp Control Circuit Low	Go To Pinpoint Test U .
P1912	Reverse Lamp Control Circuit High	Go To Pinpoint Test W .
All other DTCs	—	REFER to Section 307-01A or Section 307-01B .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .

• The reversing lamps are inoperative	• Fuse • Circuitry • Battery junction box (BJB) • Reversing lamp relay • Transmission control module (TCM)	• Go To Pinpoint Test U .
• The individual reversing lamp is inoperative	• Circuitry	• Go To Pinpoint Test V .
• The reversing lamps are on continuously	• Circuitry • Reversing lamp relay • Rear view mirror • TCM	• Go To Pinpoint Test W .

Pinpoint Tests

Pinpoint Test U: The Reversing Lamps Are Inoperative

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

Normal Operation

Voltage is supplied from the battery junction box (BJB) fuse 33 (20A) to the switched side of the reversing lamps relay. The reversing lamps relay coil power is supplied by the transmission control module (TCM) (also called a main control valve body for Expedition and a mechatronic assembly for Navigator) through circuit CAT03 (GY/BN). The reversing lamps relay coil ground is controlled by the TCM through circuit RET24 (BN/BU). When the reversing lamps relay is energized, voltage is routed to the reversing lamps through circuit CLS10 (GN/BN).

DTC P1910 — sets when the TCM detects an open from the reversing lamps relay coil voltage supply circuit.

DTC P1911 — sets when the TCM detects a short to ground from the reversing lamps relay coil voltage supply circuit.

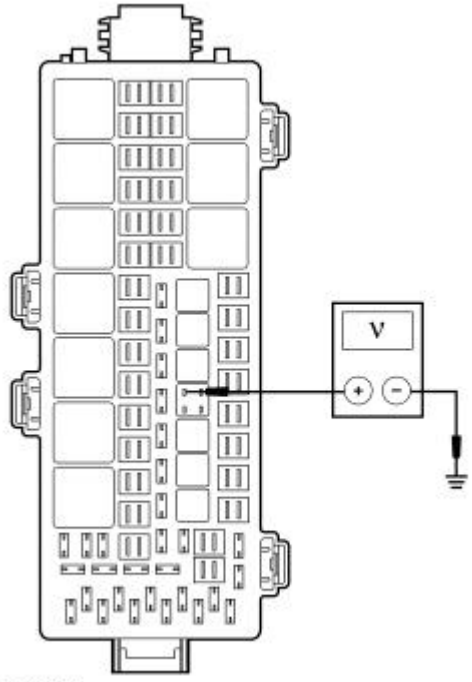
Possible Causes

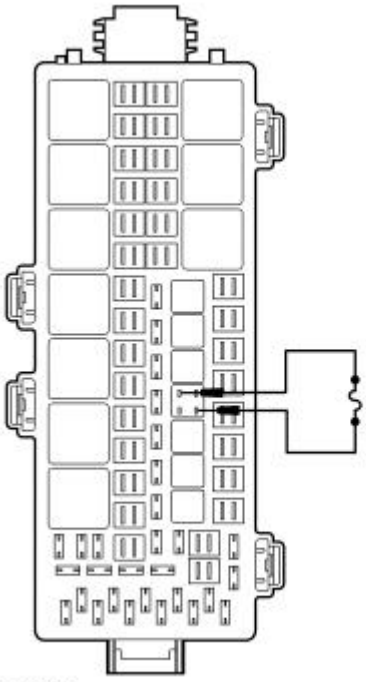
- Fuse
- Circuit CAT03 (GY/BN) open or short to ground
- Circuit CLS10 (GN/BN) open
- Circuit RET24 (BN/BU) open
- Reversing lamps relay
- BJB
- TCM

PINPOINT TEST U: THE REVERSING LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

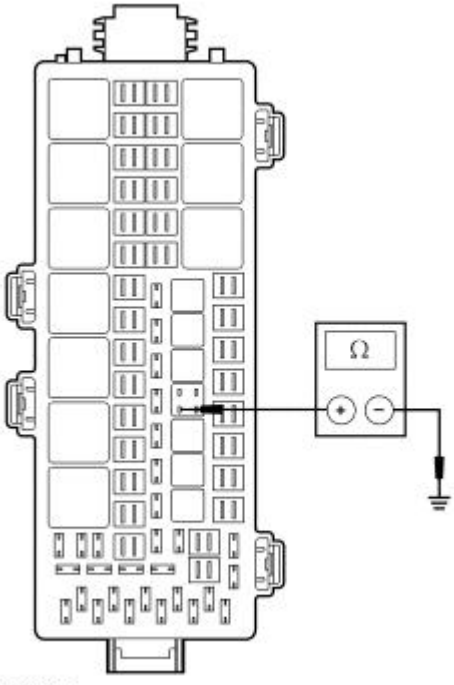
Test Step	Result / Action to Take

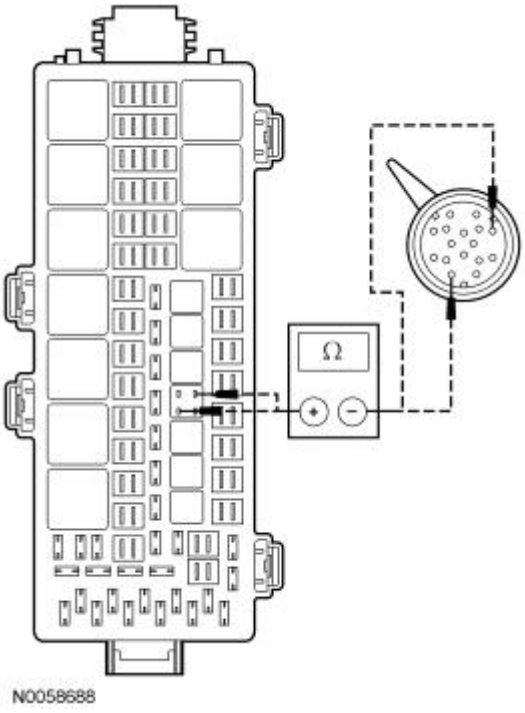
U1 CHECK THE REVERSING LAMPS RELAY	
• Key in OFF position. • Disconnect: Reversing Lamps Relay. • Carry out the reversing lamps relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the reversing lamps relay OK?**	**Yes** GO to U2 . **No** INSTALL a new reversing lamps relay. TEST the system for normal operation.
U2 CHECK THE BJB	
• Measure the voltage between the reversing lamps relay pin 3, harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to U3 . **No** VERIFY the BJB fuse 33 (20A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.
U3 CHECK CIRCUIT CLS10 (GN/BN) FOR AN OPEN	
• Connect a fused (15A) jumper wire between the reversing lamps relay pin 3, harness side and the reversing lamps relay pin 5, circuit CLS10 (GN/BN), harness side.	**Yes** REMOVE the jumper wire. GO to U4 . **No** REPAIR the circuit. TEST the system for normal operation.



N0058686

- **Do the reversing lamps illuminate?**

U4 CHECK CIRCUIT CAT03 (GY/BN) FOR A SHORT TO GROUND	
• Disconnect: TCM C1548 or C1473. • Measure the resistance between the reversing lamps relay pin 1, circuit CAT03 (GY/BN), harness side and ground.  N0058687 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to U5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
U5 CHECK CIRCUITS CAT03 (GY/BN) AND RET24 (BN/BU) FOR AN OPEN	
• Measure the resistance between the reversing lamps relay pin 1, circuit CAT03 (GY/BN), harness side and the TCM C1548-7 or C1473-7, circuit CAT03 (GY/BN), harness side; and between the	**Yes** GO to U6 .

reversing lamps relay pin 2, circuit RET24 (BN/BU), harness side and the TCM C1548-15 or C1473-15, circuit RET24 (BN/BU), harness side.  • **Are the resistances less than 5 ohms?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
U6 CHECK FOR CORRECT TCM OPERATION	

• Disconnect the TCM connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the TCM connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new TCM. REFER to Section 307-01A , Manual Control Valve Body or Section 307-01B , Mechatronic Assembly. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test V: The Individual Reversing Lamp Is Inoperative

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

When the reversing lamps relay is energized, voltage is routed to the reversing lamps through circuit CLS10 (GN/BN). The LH and RH reversing lamps are provided ground through circuits GD149 (BK/GY) and GD151 (BK/GN), respectively.

Possible Causes

- Circuit CLS10 (GN/BN) open

- Circuit GD149 (BK/GY) open
- Circuit GD151 (BK/GN) open

PINPOINT TEST V: THE INDIVIDUAL REVERSING LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>V1 CHECK CIRCUIT GD149 (BK/GY) OR CIRCUIT GD151 (BK/GN) FOR AN OPEN</td><td rowspan="2">Yes
REPAIR circuit CLS10 (GN/BN). TEST the system for normal operation.

No
REPAIR the ground circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>
• Key in OFF position.
• Disconnect: Inoperative Reversing Lamp.
• Measure the resistance between the inoperative reversing lamp, harness side and ground as follows:
<table>
<tr><th>Inoperative Reversing Lamp Connector-Pin</th><th>Circuit</th></tr>
<tr><td colspan="2">Expedition</td></tr>
<tr><td>LH C451-1</td><td>GD149 (BK/GY)</td></tr>
<tr><td>RH C461-1</td><td>GD151 (BK/GN)</td></tr>
<tr><td colspan="2">Navigator</td></tr>
<tr><td>LH C488-1</td><td>GD149 (BK/GY)</td></tr>
<tr><td>RH C487-1</td><td>GD151 (BK/GN)</td></tr>
</table>
• Is the resistance less than 5 ohms?
</td></tr>
</table>

Pinpoint Test W: The Reversing Lamps Are On Continuously

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

Voltage is supplied from the battery junction box (BJB) fuse 33 (20A) to the switched side of the reversing lamps relay. The reversing lamps relay coil power is supplied by the transmission control module (TCM) (also called a main control valve body for Expedition and a mechatronic assembly for Navigator) through circuit CAT03 (GY/BN). The reversing lamps relay coil ground is controlled by the TCM through circuit RET24 (BN/BU). When the reversing lamps relay is energized, voltage is routed to the reversing lamps, the interior rear view mirror, and BJB fuse 63 (15A) (trailer tow reversing lamps) through circuit CLS10 (GN/BN). Voltage from the BJB fuse 63 (15A) is then routed to the trailer tow connector through circuit CAT16 (GY/BN).

DTC P1912 — sets when the TCM detects a short to voltage from the reversing lamps relay coil voltage supply circuit.

Possible Causes

- Circuit CAT03 (GY/BN) short to voltage
- Circuit CAT16 (GY/BN) short to voltage
- Circuit CLS10 (GN/BN) short to voltage

- Reversing lamps relay
- Rear view mirror
- TCM

PINPOINT TEST W: THE REVERSING LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
W1 CHECK THE REVERSING LAMPS RELAY OUTPUT	
• Key in OFF position. • Disconnect: Reversing Lamps Relay. • Key in ON position. • **Do the reversing lamps continue to illuminate?**	**Yes** GO to W4 . **No** GO to W2 .
W2 CHECK THE REVERSING LAMPS RELAY	
• Key in OFF position. • Carry out the reversing lamps relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the reversing lamps relay OK?**	**Yes** GO to W3 . **No** INSTALL a new reversing lamps relay. TEST the system for normal operation.
W3 CHECK CIRCUIT CAT03 (GY/BN) FOR A SHORT TO VOLTAGE	
• Connect: Reversing Lamps Relay. • Disconnect: TCM C1548 or C1473. • Key in ON position. • **Do the reversing lamps continue to illuminate?**	**Yes** GO to W6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
W4 CHECK CIRCUIT CAT16 (GY/BN) FOR A SHORT TO VOLTAGE	
• Disconnect: BJB Fuse 63 (15A). • **Do the reversing lamps continue to illuminate?**	**Yes** GO to W5 . **No** REPAIR the circuit. TEST the system for normal operation.
W5 CHECK CIRCUITS CLS10 (GN/BN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Interior Rear View Mirror C911 or C9012. • Key in ON position.	**Yes** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation.

• **Do the reversing lamps continue to illuminate?**	**No** REPAIR the circuit. TEST the system for normal operation.
W6 CHECK FOR CORRECT TCM OPERATION	

• Disconnect the TCM connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the TCM connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new TCM. REFER to Section 307-01A , Manual Control Valve Body or Section 307-01B , Mechatronic Assembly. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Trailer Lamps

Printable View (354 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The trailer lamps and battery charge are supplied power by various relays that are energized to correspond with the exterior lighting functions of the vehicle. If equipped, the vehicle also supplies circuitry to support the installation of an aftermarket trailer brake control module (installed by the customer). The vehicle circuitry only supplies voltage, ground, voltage from the parking lamps circuit (to support backlighting), stoplamp switch input and a controlling circuit to the trailer tow connector. The trailer electric brakes themselves are controlled by the aftermarket trailer brake control module and not the vehicle itself.

Inspection and Verification

1. Verify the customer concern.
2. Verify the exterior lighting system of the vehicle is operating correctly. If not, refer to the appropriate pinpoint test in this section.
3. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical

• Battery junction box (BJB) fuse(s):
  ▪ 5 (40A) (trailer electric brake controller)
  ▪ 12 (25A) (trailer tow parking lamps)
  ▪ 13 (30A) (trailer tow battery charge relay switch side)
  ▪ 34 (25A) (trailer tow turn relays)
  ▪ 63 (15A) (trailer tow reversing lamps)
• Smart junction box (SJB) fuse 42 (10A) (trailer tow battery charge relay coil)
• Circuitry
• Trailer tow turn/stop relays
• Trailer tow battery charge relay

- Trailer tow parking lamp relay
- Trailer brake control module
- Trailer
- SJB

4. If the concern is not visually evident, verify the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The trailer lamps are inoperative — all	• Circuitry • Trailer	• Go To Pinpoint Test X .
• The individual trailer lamp is inoperative — trailer turn/stoplamp	• Fuse • Circuitry • Trailer tow turn relay • Battery junction box (BJB) • Trailer	• Go To Pinpoint Test Y .
• The trailer lamps are inoperative — trailer parking lamps	• Fuse • Circuitry • Trailer tow parking lamp relay • Trailer	• Go To Pinpoint Test Z .
• The trailer lamps are inoperative — trailer reversing lamps	• Fuse • Circuitry • Trailer	• Go To Pinpoint Test AA .
• The trailer lamps are on continuously	• Circuitry • Trailer tow relay • Trailer	• Go To Pinpoint Test AB .
• The trailer battery charging is inoperative/does not operate correctly	• Fuse • Circuitry • Trailer tow battery charge relay • Trailer • Smart junction box (SJB)	• Go To Pinpoint Test AC .
• The trailer electric brakes are inoperative/do not operate correctly	• Fuse • Circuitry • Trailer brake control module • Trailer	• Go To Pinpoint Test AD .

Pinpoint Tests

Pinpoint Test X: The Trailer Lamps Are Inoperative — All

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

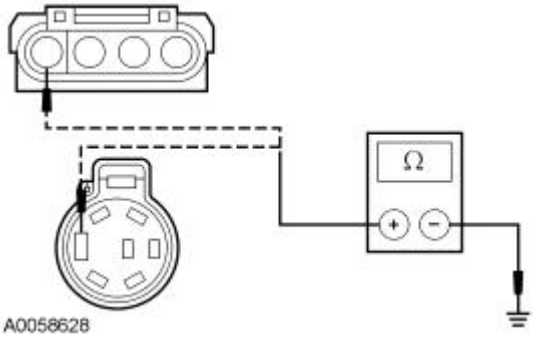
Normal Operation

The trailer tow connectors receive ground through circuit RAT08 (WH) for all of the trailer lamps.

Possible Causes

- Circuit RAT08 (WH) open
- Trailer

PINPOINT TEST X: THE TRAILER LAMPS ARE INOPERATIVE — ALL

Test Step	Result / Action to Take
X1 CHECK CIRCUIT RAT08 (WH) FOR AN OPEN	
• Disconnect: Trailer Tow C4098 (4-Pin). • Disconnect: Trailer Tow C4099 (7-Pin) . • Measure the resistance between the trailer tow C4098-4, circuit RAT08 (WH), harness side and ground; or the trailer tow C4099-2, circuit RAT08 (WH), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test Y: The Individual Trailer Lamp Is Inoperative — Trailer Turn/Stoplamp

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The trailer tow LH turn relay coil receives voltage through circuit CLS18 (GY/BN) when the vehicle LH rear stoplamp is illuminated. When the trailer tow LH turn relay is energized, the voltage is routed to the trailer tow connector through circuit CAT06 (YE).

The trailer tow RH turn relay coil receives voltage through circuit CLS19 (VT/OG) when the vehicle RH rear stoplamp is illuminated. When the trailer tow RH turn relay is energized, the voltage is routed to the trailer tow connector through circuit CAT09 (OG).

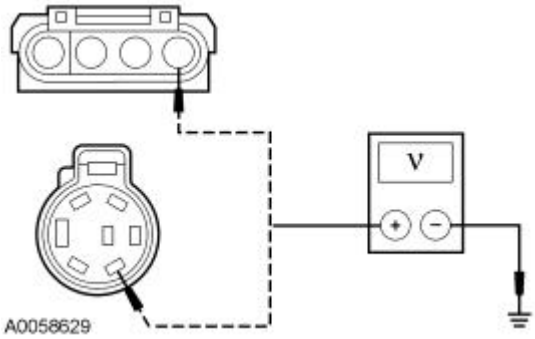
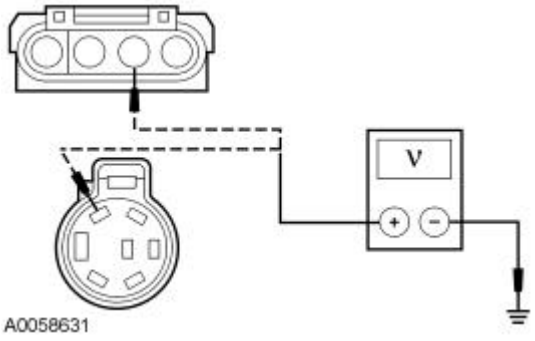
The battery junction box (BJB) fuse 34 (25A) supplies voltage to both trailer tow turn relays. The trailer tow turn/stop relay coils are grounded through circuit GD123 (BK/GY).

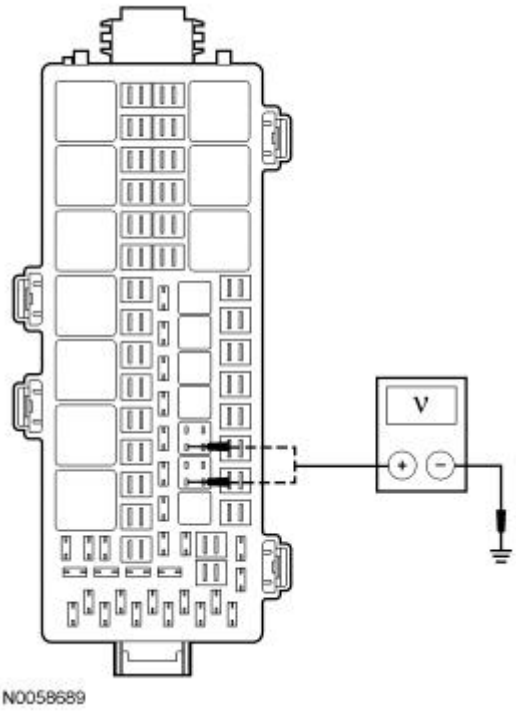
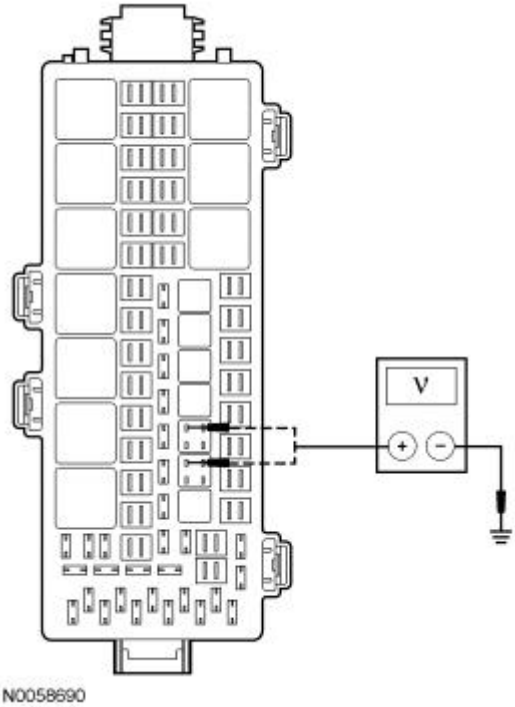
Possible Causes

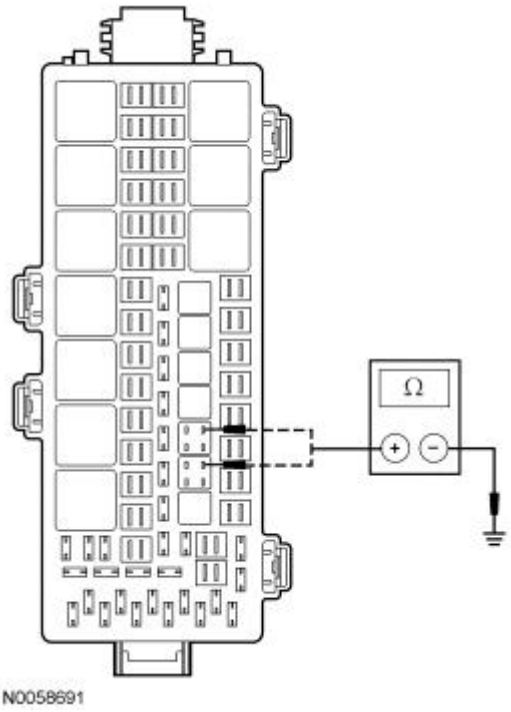
- Fuse
- Circuit CAT06 (YE) open
- Circuit CAT09 (OG) open
- Circuit CLS18 (GY/BN) open

- Circuit CLS19 (VT/OG) open
- Circuit GD123 (BK/GY) open
- BJB
- Trailer tow turn relay
- Trailer

PINPOINT TEST Y: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE — TRAILER TURN/STOPLAMP

Test Step	Result / Action to Take
Y1 CHECK CIRCUIT CAT06 (YE) OR CIRCUIT CAT09 (OG) FOR VOLTAGE • Key in OFF position. • Disconnect: Trailer Tow C4098 (4-Pin). • Disconnect: Trailer Tow C4099 (7-Pin) . • For the RH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C4098-1, circuit CAT09 (OG), harness side and ground; or between the trailer tow C4099-4, circuit CAT09 (OG), harness side and ground.  • For the LH trailer turn/stoplamp, while applying the brake pedal, measure the voltage between the trailer tow C4098-2, circuit CAT06 (YE), harness side and ground; or between the trailer tow C4099-1, circuit CAT06 (YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** GO to Y2 .
Y2 CHECK THE TRAILER TOW TURN RELAY • Disconnect: Suspect Trailer Tow Turn Relay. • Carry out the trailer tow turn relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the trailer tow turn relay OK?**	**Yes** GO to Y3 . **No** INSTALL a new trailer tow turn relay. TEST the system for normal operation.
Y3 CHECK CIRCUIT CLS18 (GY/BN) OR CIRCUIT CLS19 (VT/OG)	

FOR AN OPEN	
• While applying the brake pedal, measure the voltage between the trailer tow LH turn relay pin 1, circuit CLS18 (GY/BN), harness side and ground; or between the trailer tow RH turn relay pin 1, circuit CLS19 (VT/OG), harness side and ground.  N0058689 • **Is the voltage greater than 10 volts?**	**Yes** GO to Y4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
Y4 CHECK THE BJB	
• Measure the voltage between the trailer tow LH turn relay pin 3, harness side and ground; or between the trailer tow RH turn relay pin 3, harness side and ground.  N0058690 • **Is the voltage greater than 10 volts?**	**Yes** GO to Y5 . **No** VERIFY the BJB fuse 34 (25A) is OK. If OK, INSTALL a new BJB. TEST the system for normal operation.

Y5 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Measure the resistance between the trailer tow LH turn relay pin 2, circuit GD123 (BK/GY), harness side and ground; or between the trailer tow RH turn relay pin 2, circuit GD123 (BK/GY), harness side and ground.  N0058691 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit CAT06 (YE) (LH trailer turn/stop) or circuit CAT09 (OG) (RH trailer turn/stop) for an open. TEST the system for normal operation. **No** REPAIR the ground circuit in question. TEST the system for normal operation.

Pinpoint Test Z: The Trailer Lamps Are Inoperative — Trailer Parking Lamps

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

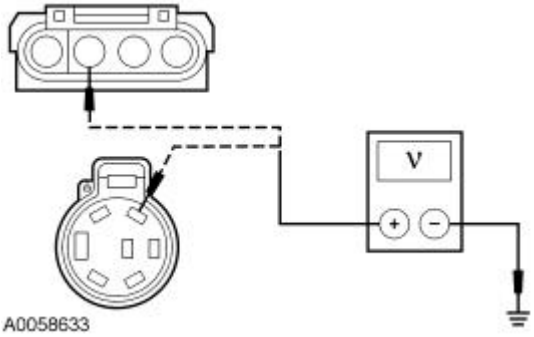
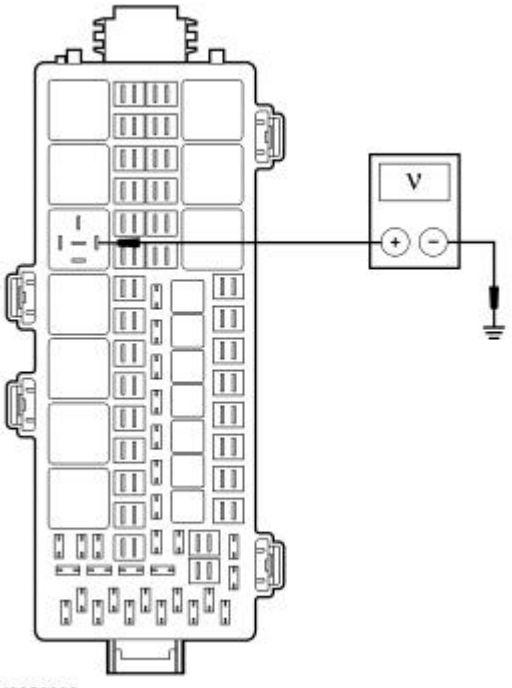
The trailer tow parking lamp relay coil receives voltage through circuit CLS30 (VT/WH) when the vehicle parking lamps are illuminated. The trailer tow parking lamp relay coil is grounded through circuit GD123 (BK/GY). The battery junction box (BJB) supplies voltage to the trailer tow parking lamp relay switch side through circuit SBB12 (GN/RD). When the trailer tow parking lamp relay is energized, the voltage is routed to the trailer tow connector through circuit CAT11 (BN).

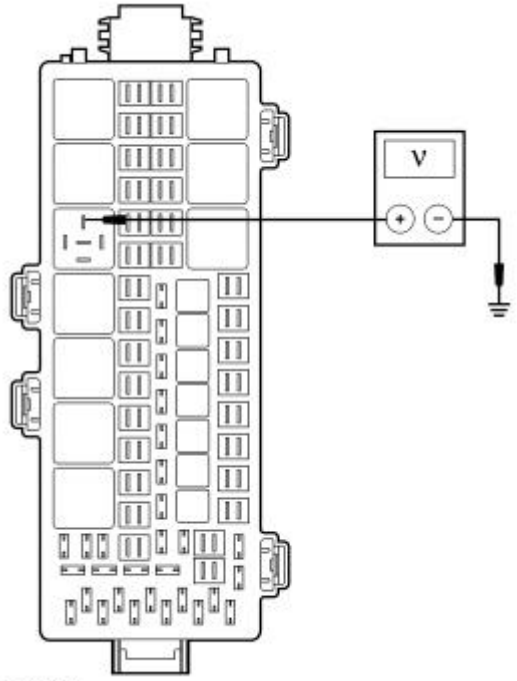
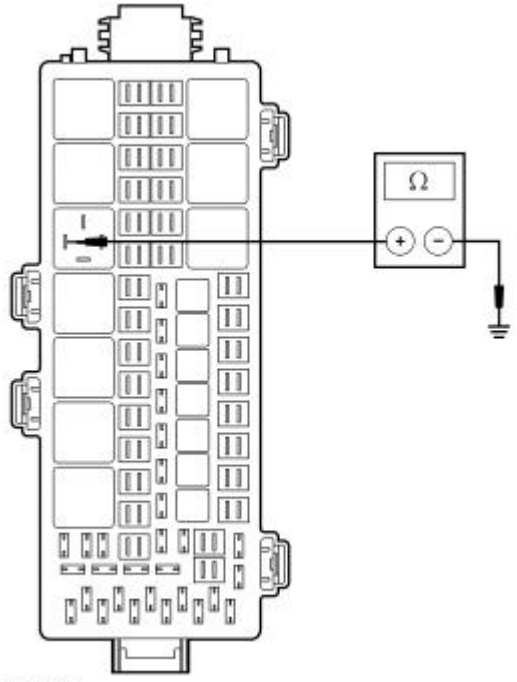
Possible Causes

- Fuse
- Circuit CAT11 (BN) open
- Circuit CLS30 (VT/WH) open
- Circuit GD123 (BK/GY) open
- Circuit SBB12 (GN/RD) open
- Trailer tow parking lamp relay
- Trailer

PINPOINT TEST Z: THE TRAILER LAMPS ARE INOPERATIVE — TRAILER PARKING LAMPS

Test Step	Result / Action to Take

Z1 CHECK CIRCUIT CAT11 (BN) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Trailer Tow C4098 (4-Pin). • Disconnect: Trailer Tow C4099 (7-Pin) . • Place the headlamp switch in the PARKING LAMPS ON position. • Measure the voltage between the trailer tow C4098-3, circuit CAT11 (BN), harness side and ground; or between the trailer tow C4099-6, circuit CAT11 (BN), harness side and ground.  A0058633 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** GO to Z2 .
Z2 CHECK THE TRAILER TOW PARKING LAMP RELAY	
• Place the headlamp switch in the OFF position. • Disconnect: Trailer Tow Parking Lamp Relay. • Carry out the trailer tow parking lamp relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the trailer tow parking lamp relay OK?**	**Yes** GO to Z3 . **No** INSTALL a new trailer tow parking lamp relay. TEST the system for normal operation.
Z3 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN	
• Place the headlamp switch in the PARKING LAMPS ON position. • Measure the voltage between the trailer tow parking lamp relay pin 85, circuit CLS30 (VT/WH), harness side and ground.  N0058692	**Yes** GO to Z4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• **Is the voltage greater than 10 volts?**	
Z4 CHECK CIRCUIT SBB12 (GN/RD) FOR AN OPEN	
• Place the headlamp switch in the OFF position. • Measure the voltage between the trailer tow parking lamp relay pin 30, circuit SBB12 (GN/RD), harness side and ground.  N0058693 • **Is the voltage greater than 10 volts?**	**Yes** GO to Z5 . **No** VERIFY the BJB fuse 12 (25A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
Z5 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Measure the resistance between the trailer tow parking lamp relay pin 86, circuit GD123 (BK/GY), harness side and ground.  N0058694 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit CAT11 (BN) for an open. TEST the system for normal operation. **No** REPAIR circuit GD123 (BK/GY. TEST the system for normal operation.

Pinpoint Test AA: The Trailer Lamps Are Inoperative — Trailer Reversing Lamps

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

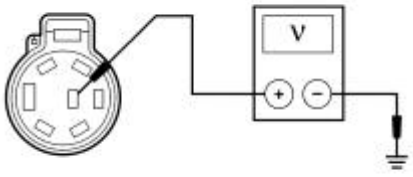
Normal Operation

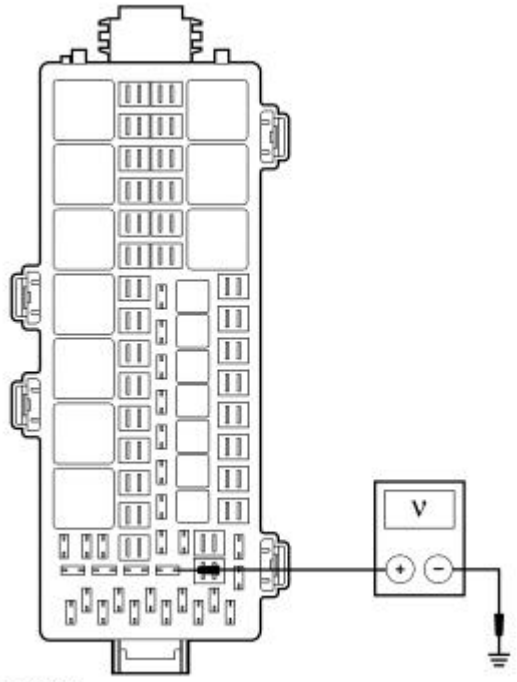
The battery junction box (BJB) fuse 63 (15A) receives voltage from circuit CLS10 (GY/BN) when the vehicle reversing lamps are illuminated. The voltage is then routed to the trailer tow connector through circuit CAT16 (GY/BN).

Possible Causes

- Fuse
- Circuit CAT16 (GY/BN) open
- Circuit CLS10 (GY/BN) open
- Trailer

PINPOINT TEST AA: THE TRAILER LAMPS ARE INOPERATIVE — TRAILER REVERSING LAMPS

Test Step	Result / Action to Take
AA1 CHECK CIRCUIT CAT16 (GY/BN) FOR VOLTAGE	
• Disconnect: Trailer Tow C4099 (7-Pin) . • Apply the parking brake. • Key in ON position. • Place the transmission in REVERSE (R). • Measure the voltage between the trailer tow C4099-7, circuit CAT16 (GY/BN), harness side and ground.  A0025848 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the BJB fuse 63 (15A) is OK. If OK, GO to AA2 .
AA2 CHECK FOR VOLTAGE TO THE BJB FUSE 63 (15A)	
• Measure the voltage between the BJB fuse 63 (15A), circuit CLS10 (GY/BN), input side and ground.	**Yes** REPAIR circuit CAT16 (GY/BN) for an open. TEST the system for normal operation. **No** REPAIR circuit CLS10 (GY/BN) for an open. TEST the system for normal operation.



- **Is the voltage greater than 10 volts?**

Pinpoint Test AB: The Trailer Lamps Are On Continuously

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation — Trailer Tow Turn/Stoplamp

The trailer tow LH turn relay coil receives voltage through circuit CLS18 (GY/BN) when the vehicle LH rear stoplamp is illuminated. When the trailer tow LH turn relay is energized, the voltage is routed to the trailer tow connector through circuit CAT06 (YE).

The trailer tow RH turn relay coil receives voltage through circuit CLS19 (VT/OG) when the vehicle RH rear stoplamp is illuminated. When the trailer tow RH turn relay is energized, the voltage is routed to the trailer tow connector through circuit CAT09 (OG).

Normal Operation — Trailer Tow Parking

The trailer tow parking lamp relay coil receives voltage through circuit CLS30 (VT/WH) when the vehicle parking lamps are illuminated. When the trailer tow parking lamp relay is energized, the voltage is routed to the trailer tow connector through circuit CAT11 (BN).

Possible Causes

- Circuit CAT06 (YE) short to voltage
- Circuit CAT09 (OG) short to voltage
- Circuit CAT11 (BN) short to voltage
- Trailer tow relay
- Trailer

PINPOINT TEST AB: THE TRAILER LAMPS ARE ON CONTINUOUSLY

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>AB1 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: Trailer Tow C4098 (4-Pin).
Disconnect: Trailer Tow C4099 (7-Pin) .
Key in ON position.
Measure the voltage the between trailer tow connector, harness side and ground as follows:

<table>
<tr><th>Trailer Tow Connector</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>4-pin
7-pin</td><td>C4098-2
C4099-1</td><td>CAT06
(YE)</td></tr>
<tr><td>4-pin
7-pin</td><td>C4098-1
C4099-4</td><td>CAT09
(OG)</td></tr>
<tr><td>4-pin
7-pin</td><td>C4098-3
C4099-6</td><td>CAT11
(BN)</td></tr>
</table>

Is any voltage present?

</td><td>Yes
GO to AB2 .

No
The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.</td></tr>
<tr><td>AB2 CHECK THE SUSPECT RELAY</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: Suspect Trailer Tow Relay.
Carry out the component test for the suspect trailer tow relay.

Refer to Wiring Diagrams Cell 149 for schematic and connector information.
Is the trailer tow relay OK?

</td><td>Yes
REPAIR circuit CAT06 (YE) (LH turn), circuit CAT09 (OG) (RH turn), or circuit CAT11 (BN) (parking lamps) for a short to voltage. TEST the system for normal operation.

No
INSTALL a new turn trailer tow relay. TEST the system for normal operation.</td></tr>
</table>

Pinpoint Test AC: The Trailer Battery Charging Is Inoperative/Does Not Operate Correctly

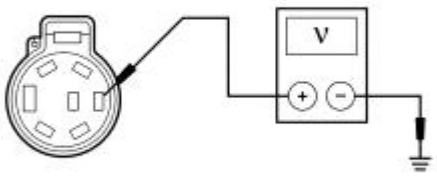
Normal Operation

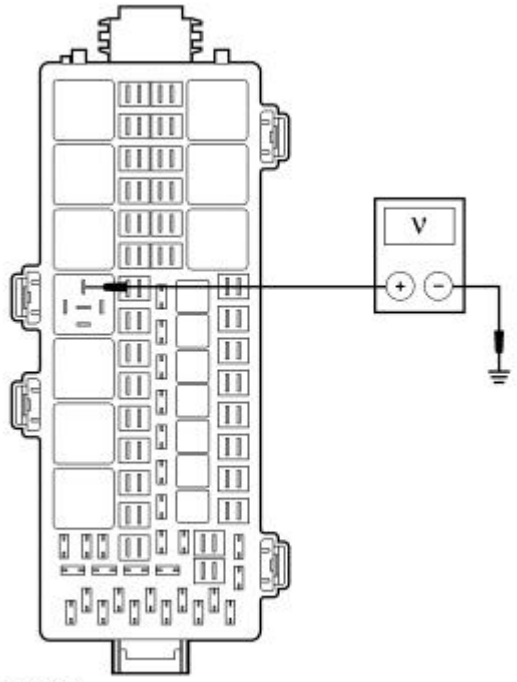
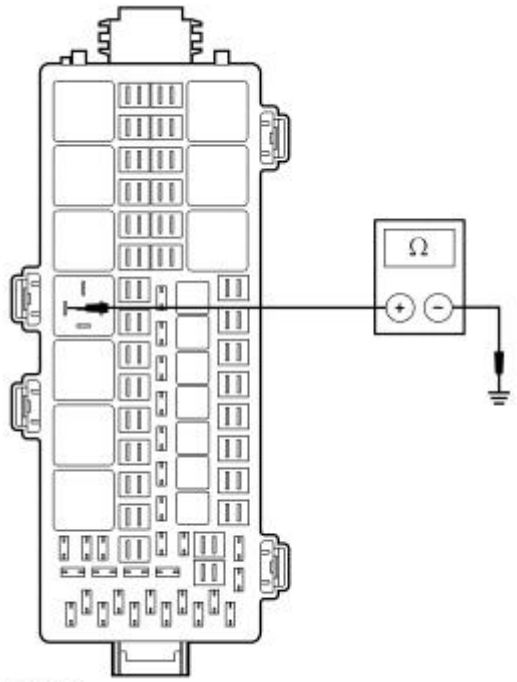
The trailer battery charge relay coil receives voltage from the smart junction box (SJB) fuse 42 (10A) through circuit CAT23 (GY/YE) when the ignition switch is in the RUN position. Ground for the trailer battery charge relay coil is supplied through circuit GD123 (BK/GY). The battery junction box (BJB) fuse 13 (30A) supplies voltage to the trailer battery charge relay switch side through circuit SSB13 (GY/RD). When the trailer battery charge relay is energized, the voltage is routed to the trailer tow connector through circuit CAT14 (OG).

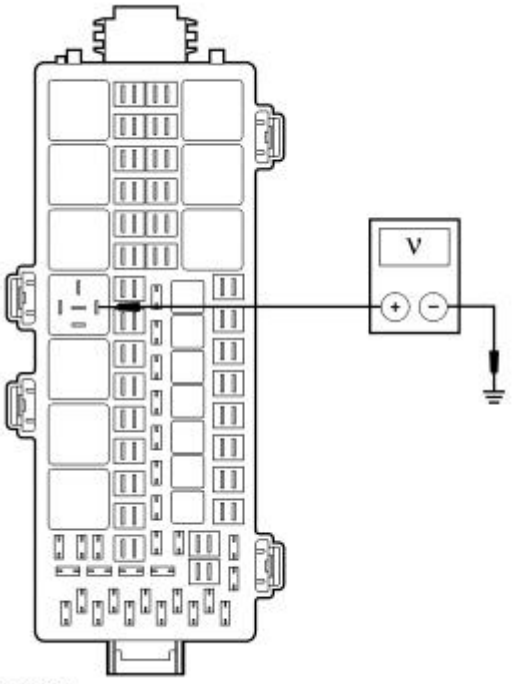
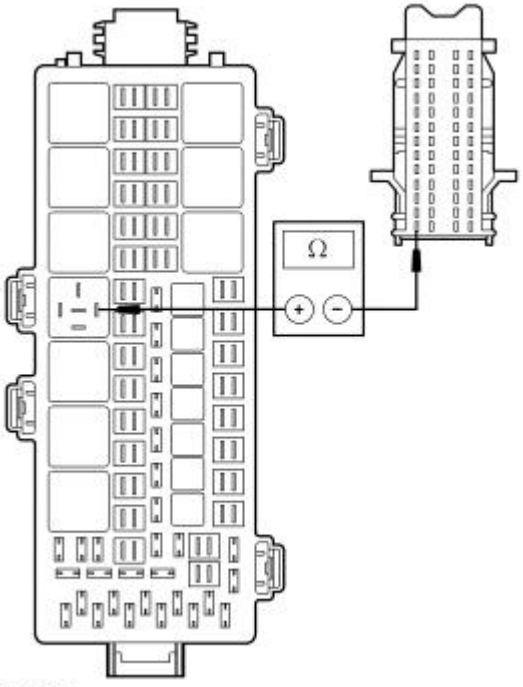
Possible Causes

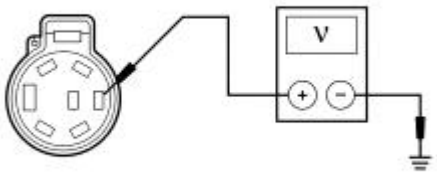
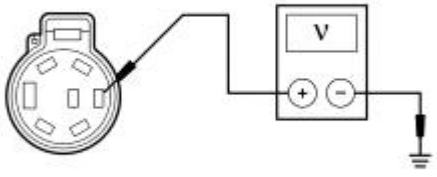
- Fuse
- Circuit CAT14 (OG) open or short to voltage
- Circuit CAT23 (GY/YE) open or short to voltage
- Circuit GD123 (BK/GY) open
- Circuit SSB13 (GY/RD) open
- Trailer battery charge relay
- Trailer
- SJB

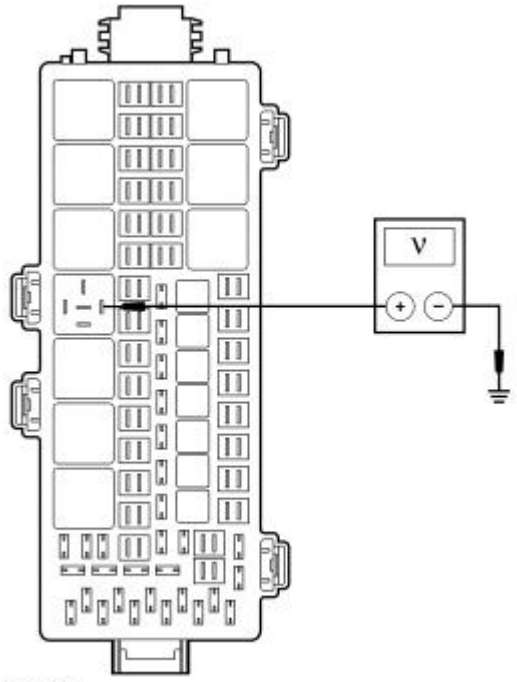
PINPOINT TEST AC: THE TRAILER BATTERY CHARGING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AC1 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR (BATTERY CHARGE INOPERATIVE)	
• Key in OFF position. • Disconnect: Trailer Tow C4099. • Key in ON position. • Measure the voltage between the trailer tow C4099-5, circuit CAT14 (OG) and ground.  A0025428 • **Is the voltage greater than 10 volts?**	**Yes** GO to AC7 . **No** GO to AC2 .
AC2 CHECK THE TRAILER BATTERY CHARGE RELAY (INOPERATIVE)	
• Key in OFF position. • Disconnect: Trailer Battery Charge Relay. • Carry out the trailer battery charge relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the trailer battery charge relay OK?**	**Yes** GO to AC3 . **No** INSTALL a new trailer battery charge relay. TEST the system for normal operation.
AC3 CHECK CIRCUIT SSB13 (GY/RD) FOR AN OPEN	
• Measure the voltage between the trailer battery charge relay pin 30, circuit SSB13 (GY/RD), harness side and ground.	**Yes** GO to AC4 . **No** VERIFY the BJB fuse 13 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

 N0058696 • **Is the voltage greater than 10 volts?**	
AC4 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the trailer battery charge relay pin 86, circuit GD123 (BK/GY), harness side and ground.  N0058697 • **Is the resistance less than 5 ohms?**	**Yes** GO to AC5 . **No** REPAIR the circuit. TEST the system for normal operation.
AC5 CHECK FOR VOLTAGE TO THE TRAILER BATTERY CHARGE RELAY COIL	
• Key in ON position. • Measure the voltage between the trailer battery charge relay	**Yes** REPAIR circuit CAT14

pin 85, circuit CAT23 (GN/YE), harness side and ground.  N0058698 • **Is the voltage greater than 10 volts?**	(OG) for an open. TEST the system for normal operation. **No** VERIFY the SJB fuse 42 (10A) is OK. If OK, GO to AC6 .
AC6 CHECK CIRCUIT CAT23 (GN/YE) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280g. • Measure the resistance between the trailer battery charge relay pin 85, circuit CAT23 (GN/YE), harness side and the SJB C2280g-1, circuit CAT23 (GN/YE), harness side.  N0058699 • **Is the resistance less than 5 ohms?**	**Yes** GO to AC11 . **No** REPAIR the circuit. TEST the system for normal operation.
AC7 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR (BATTERY CHARGE ALWAYS ON)	

• Key in OFF position. • Measure the voltage between the trailer tow C4099-5, circuit CAT14 (OG) and ground.  A0025428 • **Is any voltage present?**	**Yes** GO to AC8 . **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
AC8 CHECK CIRCUIT CAT14 (OG) FOR A SHORT TO VOLTAGE	
• Disconnect: Trailer Battery Charge Relay. • Measure the voltage between the trailer tow C4099-5, circuit CAT14 (OG) and ground.  A0025428 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to AC9 .
AC9 CHECK THE TRAILER BATTERY CHARGE RELAY (ALWAYS ON)	
• Carry out the trailer battery charge relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the trailer battery charge relay OK?**	**Yes** GO to AC10 . **No** INSTALL a new trailer battery charge relay. TEST the system for normal operation.
AC10 CHECK CIRCUIT CAT23 (GN/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280g. • Measure the voltage between the trailer battery charge relay pin 86, circuit CAT23 (GN/YE), harness side and ground.	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to AC11 .

 • **Is any voltage present?**	
AC11 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AD: The Trailer Electric Brakes Are Inoperative/Do Not Operate Correctly

Normal Operation

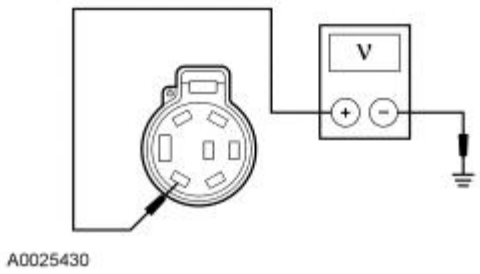
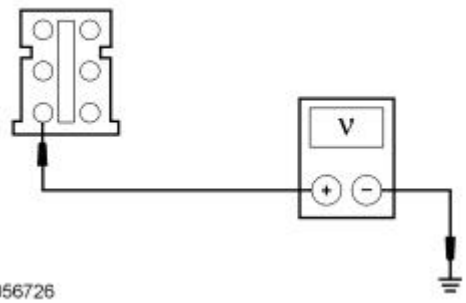
The trailer brake control module is provided voltage at all times by the battery junction box (BJB) fuse 5 (40A) through circuit SBB05 (GY/RD). Ground for the trailer brake control module is provided through circuit GD138 (BK/WH). The trailer brake control module receives voltage from the stoplamp switch through circuit CLS17 (YE/GY) when the brake pedal is applied. When requested, the trailer brake control module sends voltage to the trailer tow connector through circuit CAT19 (BU). Circuit CLS30 (VT/WH) supplies voltage to the trailer brake control module when the parking lamps are on.

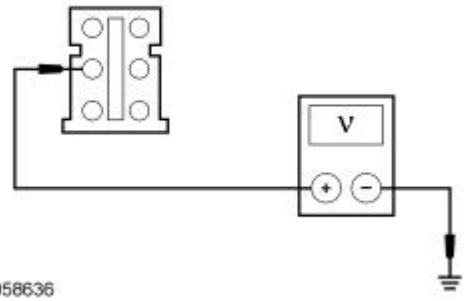
Possible Causes

- Fuse
- Circuit CAT19 (BU) open, short to ground or voltage
- Circuit CLS17 (YE/GY) open
- Circuit CLS30 (VT/WH) open
- Circuit GD138 (BK/WH) open
- Circuit SBB05 (GY/RD) open
- Trailer brake control module

- Trailer

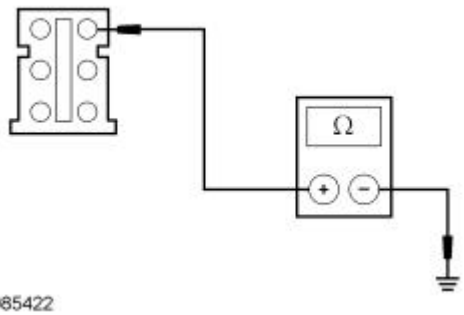
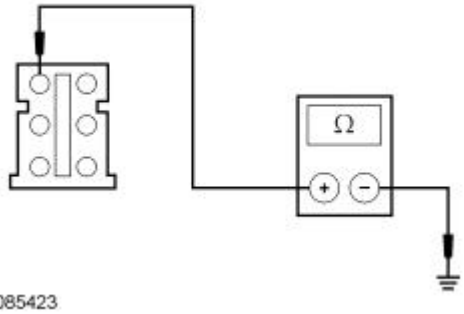
PINPOINT TEST AD: THE TRAILER ELECTRIC BRAKES ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

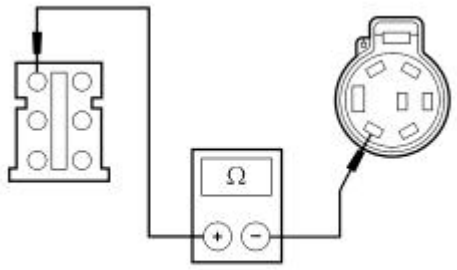
Test Step	Result / Action to Take
AD1 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (INOPERATIVE CONDITION)	
• Key in OFF position. • Disconnect: Trailer Tow C4099. • While applying the brake pedal, measure the voltage between the trailer tow C4099-3, circuit CAT19 (BU), harness side and ground.  A0025430 • **Is the voltage greater than 10 volts?**	**Yes** GO to AD8 . **No** GO to AD2 .
AD2 CHECK CIRCUIT SBB05 (GY/RD) FOR AN OPEN	
• Disconnect: Trailer Brake Control Module C2142. • Measure the voltage between the trailer brake control module C2142-1, circuit SBB17 (RD), harness side and ground.  A0056726 • **Is the voltage greater than 10 volts?**	**Yes** GO to AD3 . **No** VERIFY the BJB fuse 12 (40A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
AD3 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN	
• While applying the brake pedal, measure the voltage between the trailer brake control module C2142-2, circuit CLS17 (YE/GY), harness side and ground.	**Yes** GO to AD4 . **No** REPAIR the circuit. TEST the system for normal operation.



A0058636

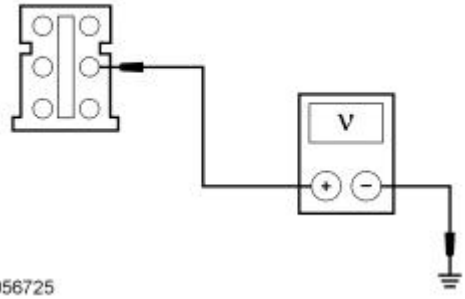
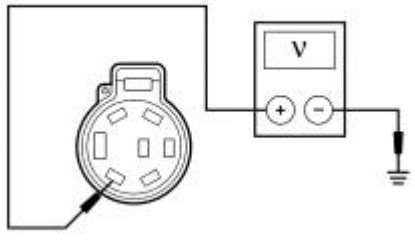
- **Is the voltage greater than 10 volts?**

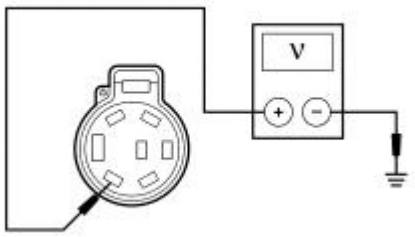
AD4 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between the trailer brake control module C2142-6, circuit GD138 (BK/WH), harness side and ground.  A0085422 • **Is the resistance less than 5 ohms?**	**Yes** GO to AD5 . **No** REPAIR the circuit. TEST the system for normal operation.
AD5 CHECK CIRCUIT CAT19 (BU) FOR A SHORT TO GROUND	
• Measure the resistance between the trailer brake control module C2142-3, circuit CAT19 (BU), harness side and ground.  A0085423 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AD6 . **No** REPAIR the circuit. TEST the system for normal operation.
AD6 CHECK CIRCUIT CAT19 (BU) FOR AN OPEN	
• Measure the resistance between the trailer brake control module C2142-3, circuit CAT19 (BU), harness side and the trailer tow C4099-3, circuit CAT19 (BU), harness side.	**Yes** GO to AD7 . **No** REPAIR the circuit. TEST the system for normal operation.



N0037318

- **Is the resistance less than 5 ohms?**

AD7 CHECK CIRCUIT CLS30 (VT/WH) FOR AN OPEN • Place the headlamp switch in the PARKING LAMPS ON position. • Measure the voltage between the trailer brake control module C238-5, circuit CLS30 (VT/WH), harness side and ground.  A0056725 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer brake control module. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
AD8 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (DOES NOT OPERATE CORRECTLY) • With the brake pedal released, measure the voltage between the trailer tow C4099-3, circuit CAT19 (BU), harness side and ground.  A0025430 • **Is any voltage present?**	**Yes** GO to AD9 . **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
AD9 CHECK CIRCUIT CAT19 (BU) FOR A SHORT TO VOLTAGE • Disconnect: Trailer Brake Control Module C2142. • Measure the voltage between the trailer tow C4099-3, circuit CAT19 (BU), harness side and ground.	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new trailer brake control module. TEST the system for normal operation.



A0025430

- **Is any voltage present?**

Headlamp Adjustment

Printable View (119 KB)

Headlamp Aiming

1. The headlamp aiming procedure depends on what type of beam pattern the headlamp is equipped with. Vehicles may come equipped with visual optical left (VOL) or visual optical right (VOR) headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
    - VOL and SAE
    - VOR and SAE

2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.
    - Photometric aimers can aim VOL- and VOR- headlamps. This is the preferred method of headlamp aiming.
    - Visual or screen method aiming can be used to aim VOL- and VOR- headlamps.
    - Mechanical aimers cannot be used with VOR- or VOL-type headlamps. Aerodynamic lamps that can be aimed mechanically have 3 nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction manual.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not necessary for VOL or VOR headlamps.

NOTE: Consult your state vehicle inspection manual for recommended tolerance ranges for visual aiming.

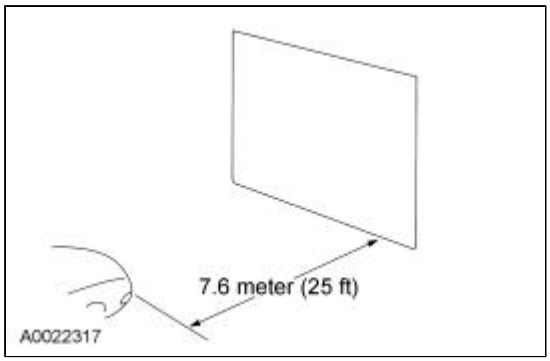
NOTE: The sight shield may need to be positioned or removed for access to the adjusters.

1. Before starting headlamp adjustment:
    - check the tire inflation.
    - check that no other load is in the vehicle other than a half tank of fuel.
    - check that the headlamps are clean.
    - check for correct headlamp operation.
    - check that the vehicle is on level ground.
    - if the vehicle is equipped with air suspension, make sure that the switch is on.

2. **NOTE:** The vertical wall or screen must be a minimum of 2.4-m (8-ft) wide.

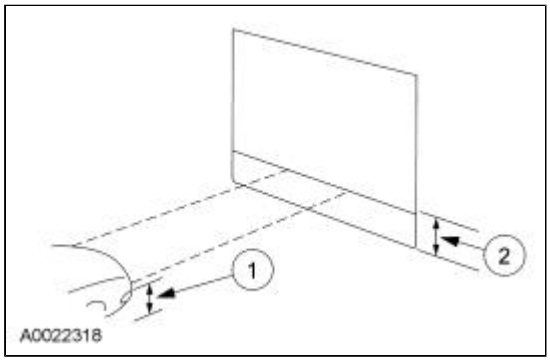
   Park the vehicle on a level surface approximately 7.6-m (25-ft) from the vertical wall or screen

directly in front of it.



3. **NOTE:** The center of the lamp is marked either on the lens (circle, crosshair or other mark) or on the bulb shield internal to the lamp (crosshair or other mark).

   Mark a horizontal reference line on the vertical wall or screen.
   1. Measure the center of the headlamp height to ground and record the measurement.
   2. Make a 2.4-meter (8-ft) horizontal mark (using masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.



4. **NOTE:** This procedure should be done in a dark environment to effectively see the headlamp beam pattern.

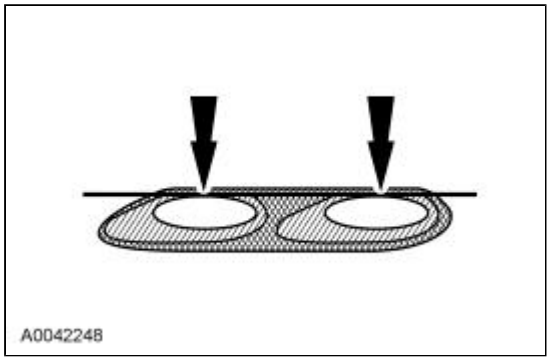
   Turn on the low beam headlamps to illuminate the wall or screen and open the hood.

5. On the wall or screen, locate the high intensity area of the beam pattern.

VOR-type headlamps

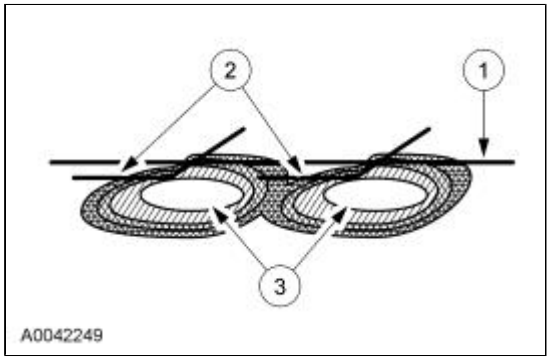
6. **NOTE:** The appearance of the VOR beam pattern may vary between vehicles.

   Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the top edge of this cutoff is not even with the horizontal reference line, the headlamp beam needs to be adjusted using the headlamp adjusting screw.



VOL-type headlamps

7. For VOL-type headlamps, there is a distinct cutoff in the left portion of the beam pattern. The edge of this cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line. Adjust the headlamp as necessary using the headlamp adjusting screw.
    1. Horizontal reference line.
    2. Top edge of the beam pattern.
    3. High intensity zone.



Mechanical Aiming

1. For the mechanical aiming procedure, refer to the appropriate mechanical headlamp aimer instruction manual.

Front Fog Lamp Adjustment

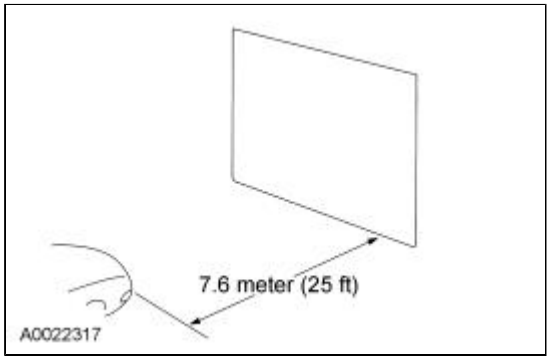
Printable View (93 KB)

1. **NOTE:** Horizontal aim is not required for this vehicle and is not adjustable. Consult your state vehicle inspection center for recommended tolerance ranges for visual aiming.

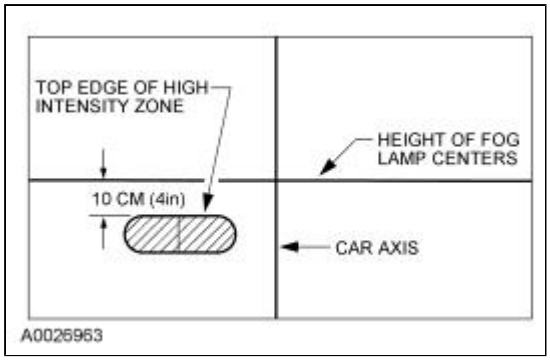
   Before starting the fog lamp assembly adjustment:
   - check the tire inflation.
   - make sure there are no other loads in the vehicle other than a half tank of fuel.
   - make sure the vehicle is on level ground.
   - make sure the fog lamps and headlamps are clean.
   - make sure the headlamps are operating and are correctly aimed.

2. **NOTE:** The vertical wall screen must be a minimum of 2.4-m (8-ft) wide.

   Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.



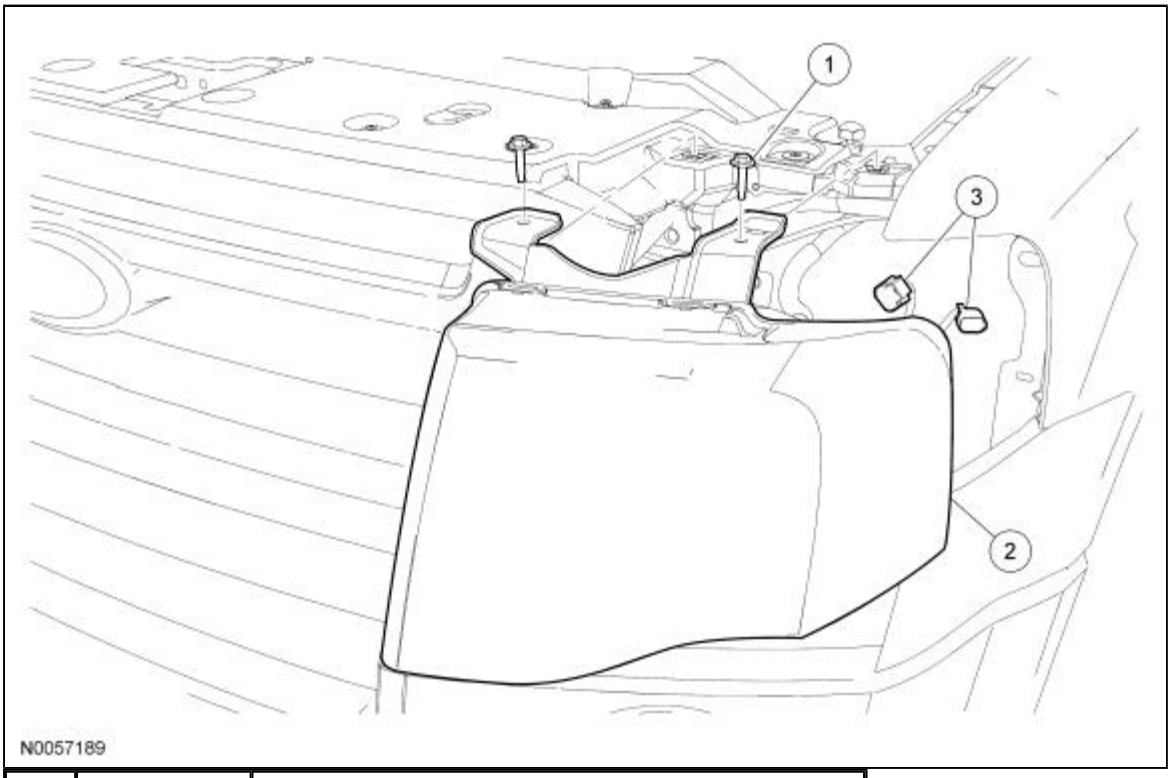
3. The correct visual aim for the fog lamps is with the top edge of the high-intensity zone 10 cm (4 in) below the horizontal center of the fog lamps.



Headlamp Assembly

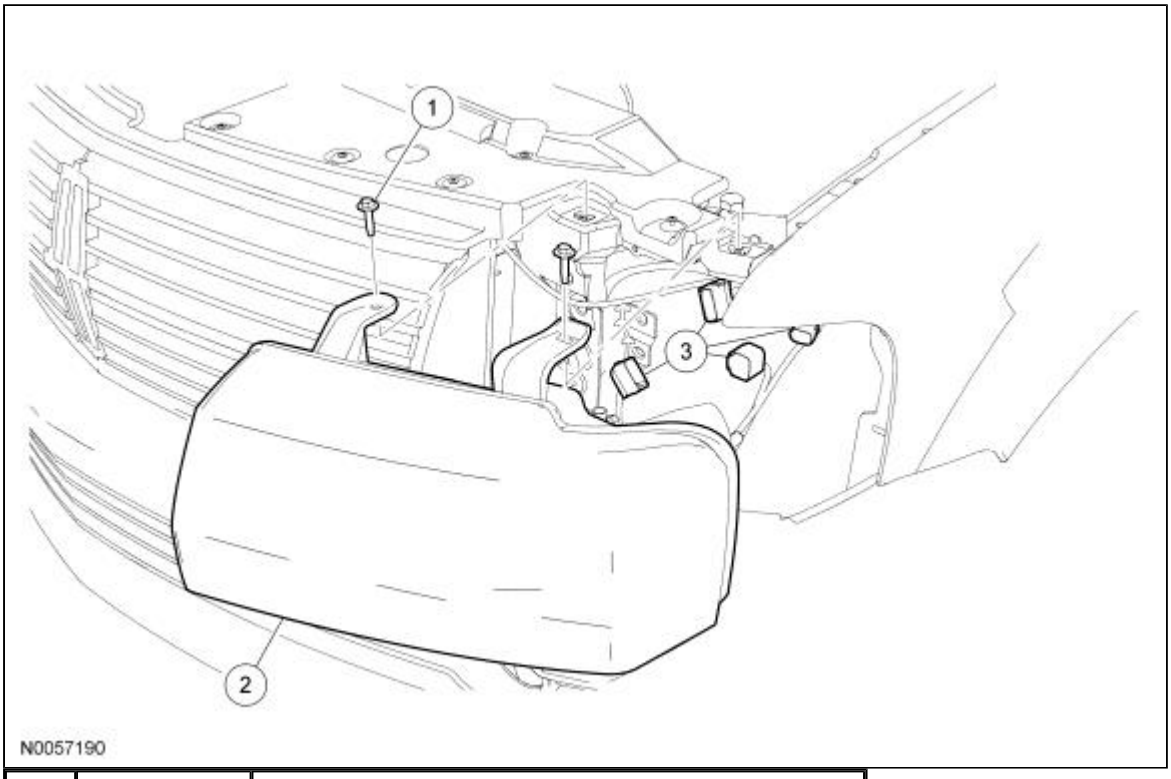
Printable View (233 KB)

Expedition



Item	Part Number	Description
1	W505425	Headlamp assembly bolts (2 required)
2	13006/13005	Headlamp assembly (LH/RH)
3	—	Headlamp assembly electrical connectors (part of 12A581)

Navigator



Item	Part Number	Description
1	W505425	Headlamp assembly bolts (2 required)
2	13006/13005	Headlamp assembly (LH/RH)
3	—	Headlamp assembly electrical connectors (part of 12A581)

Removal and Installation

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

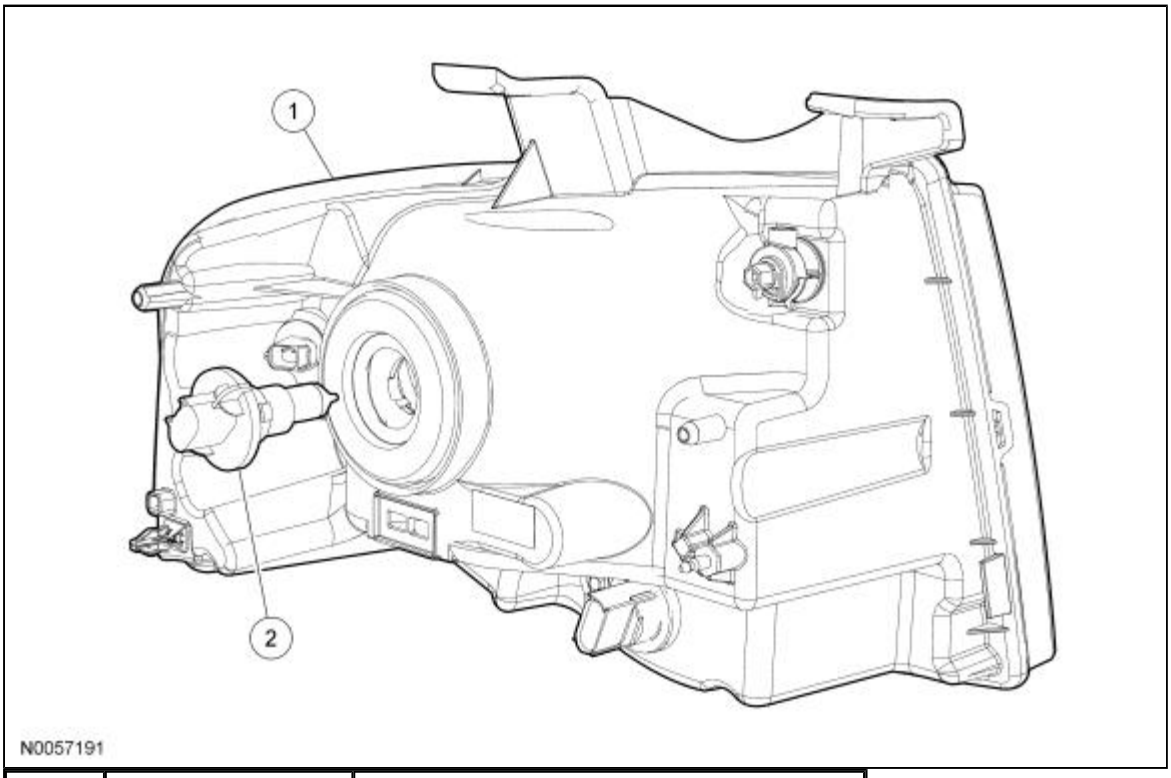
1. Remove the 2 bolts and the headlamp assembly.
   - Disconnect the electrical connectors.

2. To install, reverse the removal procedure.
   - If necessary, adjust the headlamps. For additional information, refer to Headlamp Adjustment in this section.

Headlamp Bulb

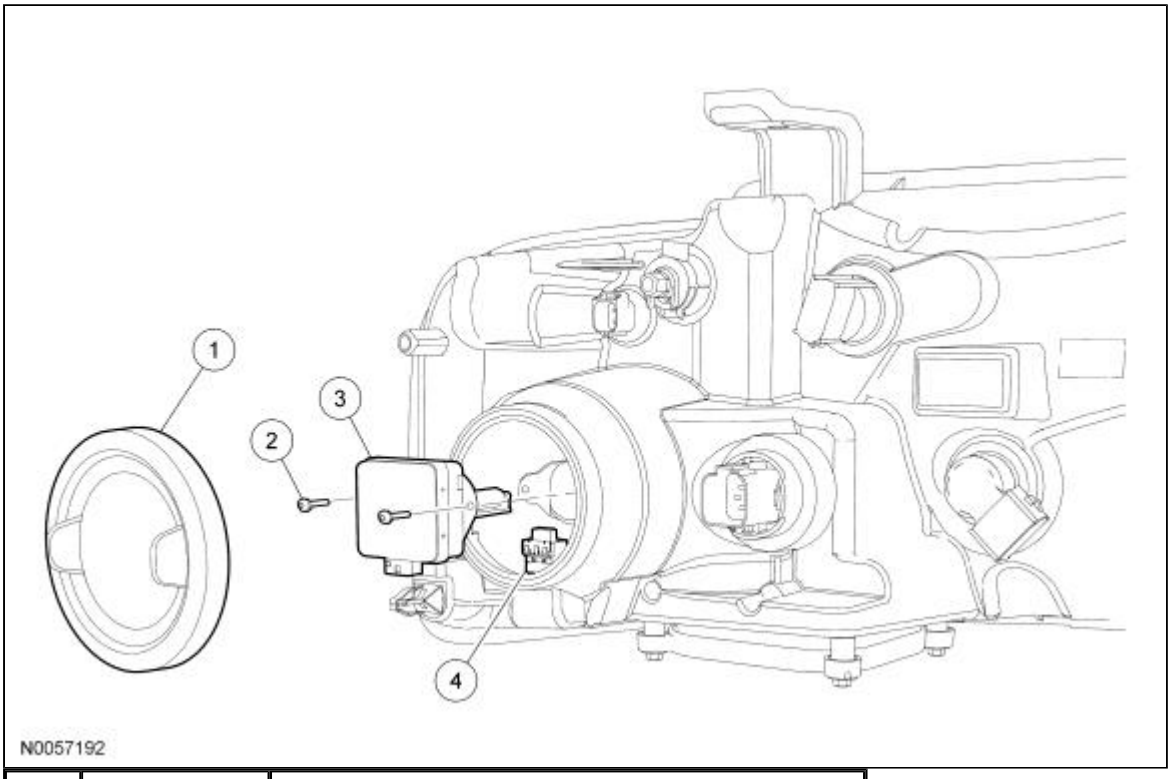
Printable View (255 KB)

Expedition Headlamp



Item	Part Number	Description
1	13006/13005	Headlamp assembly (LH/RH)
2	13N021	Headlamp bulb

Navigator High Intensity Discharge (HID) Headlamp Bulb



Item	Part Number	Description
1	13N019	HID bulb access cover
2	—	HID bulb screws (2 required) (part of 13A006)
3	13N021	HID bulb
4	13A006	HID bulb electrical connector and harness

Removal and Installation

WARNING: The headlamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp where they can settle on the lens and reflector. Never turn on the headlamp with the bulb removed from the headlamp.

NOTE: Make sure that the headlamp switch and the ignition switch are in the OFF position.

All vehicles

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

Expedition

2. Rotate the headlamp bulb approximately 1/8 turn counterclockwise and remove the bulb from the headlamp assembly.

Navigator

3. Remove the HID bulb access cover.

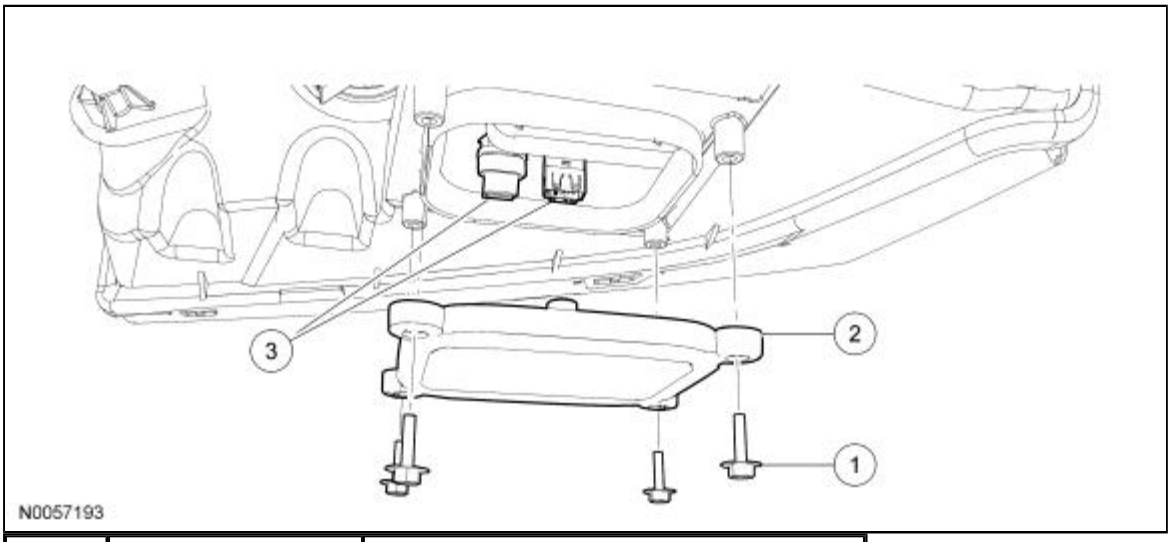
4. Remove the 2 screws and the HID bulb.
    - Disconnect the electrical connector.

All vehicles

5. To install, reverse the removal procedure.

Ballast

Printable View (128 KB)



Item	Part Number	Description
1	W704874	Ballast bolts (4 required)
2	13C1770	Ballast
3	13A006	Ballast electrical connectors

Removal and Installation

NOTE: Make sure that the headlamp switch and the ignition switch are in the OFF position.

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

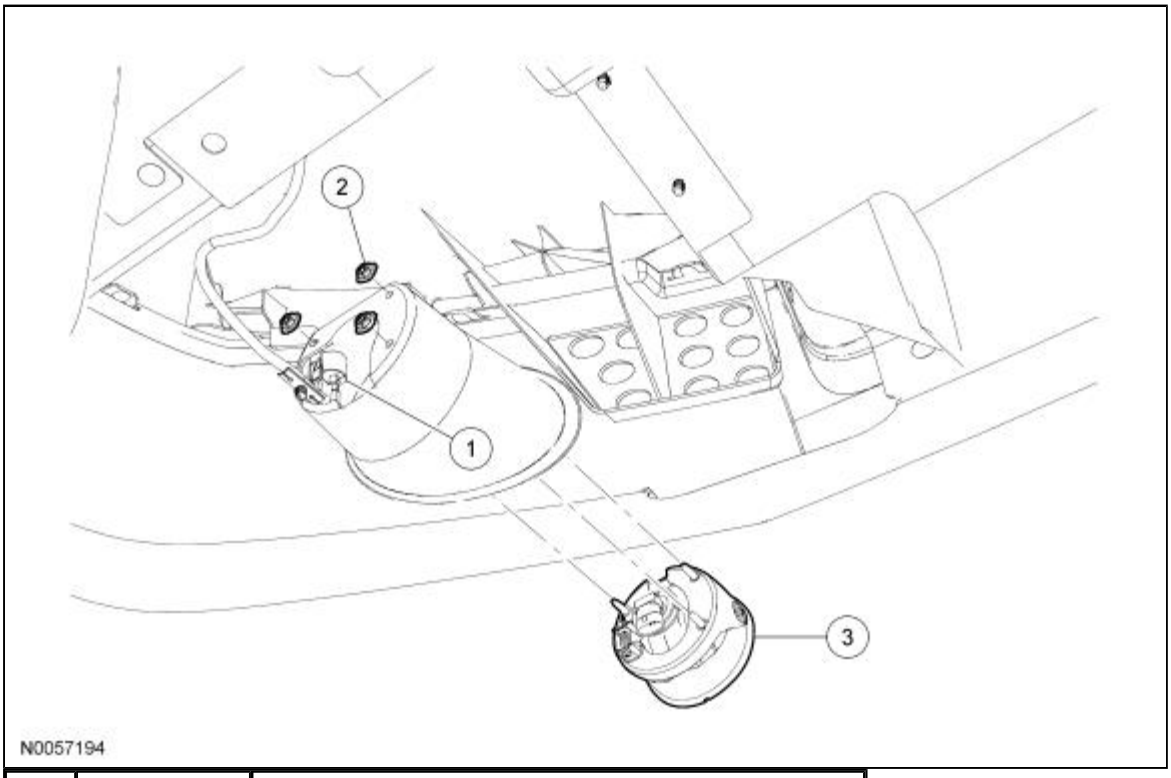
2. Remove the 4 bolts and the ballast.
   - Disconnect the electrical connectors.

3. To install, reverse the removal procedure.

Fog Lamp

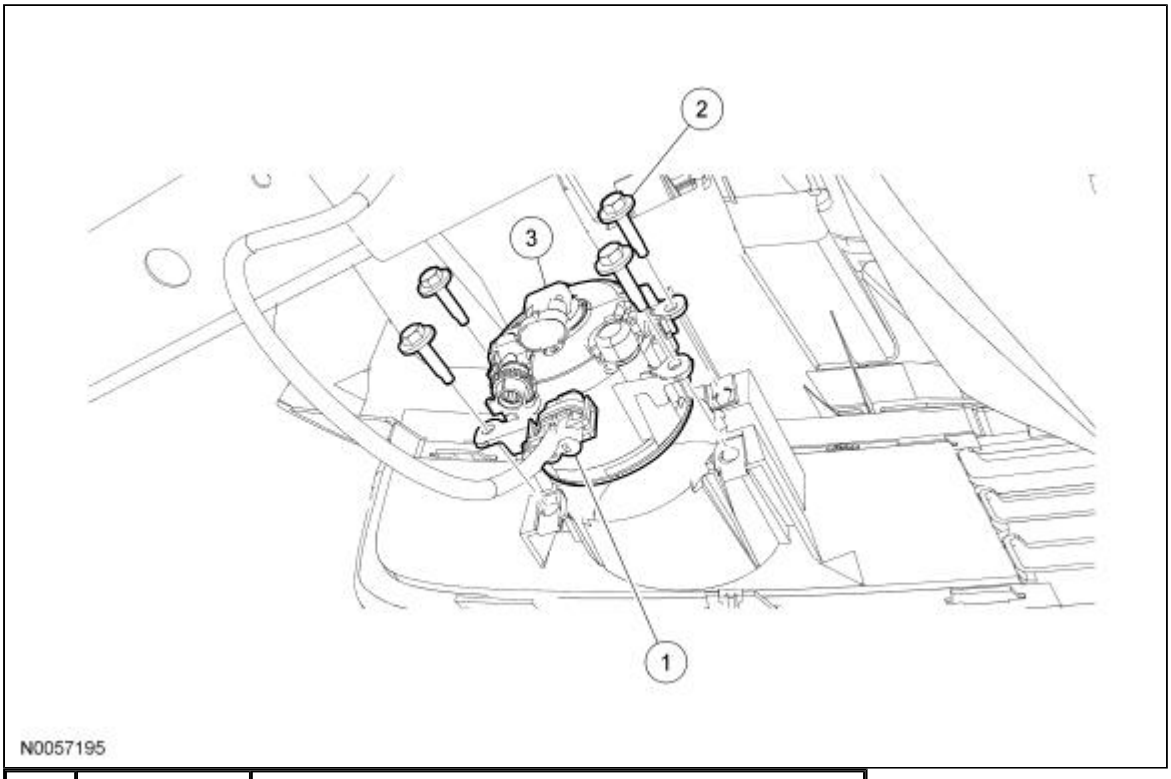
Printable View (222 KB)

Expedition



Item	Part Number	Description
1	—	Fog lamp bulb electrical connector (part of 12A581)
2	N623403	Fog lamp nuts (3 required)
3	15200	Fog lamp

Navigator



Item	Part Number	Description
1	—	Fog lamp bulb electrical connector (part of 12A581)
2	—	Fog lamp bolts (4 required)
3	15200	Fog lamp

Removal and Installation

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

Expedition

1. Remove the 3 nuts and the fog lamp.
    - Disconnect the electrical connector.

Navigator

2. Remove the 4 bolts and the fog lamp.
    - Disconnect the electrical connector.

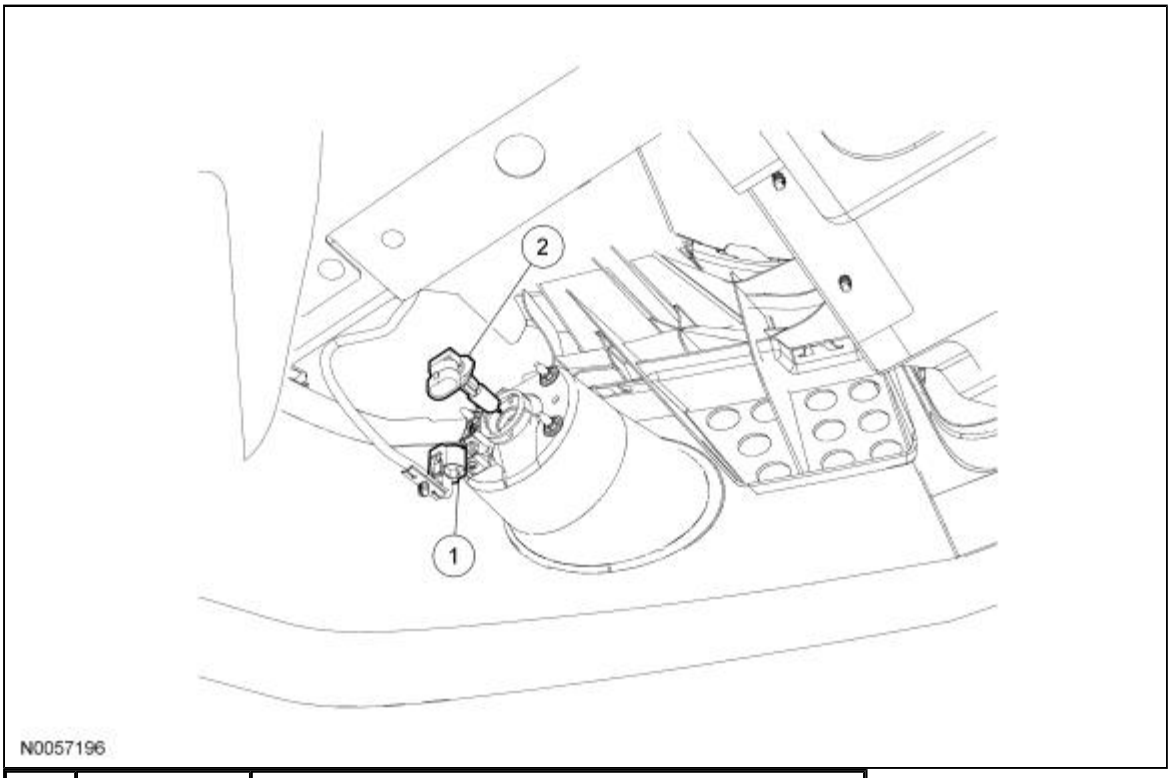
All vehicles

3. To install, reverse the removal procedure.
    - If necessary, adjust the fog lamps. For additional information, refer to Front Fog Lamp Adjustment in this section.

Fog Lamp Bulb

Printable View (145 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	—	Fog lamp bulb electrical connector (part of 12A581)
2	13466	Fog lamp bulb

Removal and Installation

WARNING: The fog lamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE: The fog lamp bulb should not be removed from the fog lamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp where they can settle on the lens and reflector. Never turn on the fog lamp with the bulb removed from the fog lamp.

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

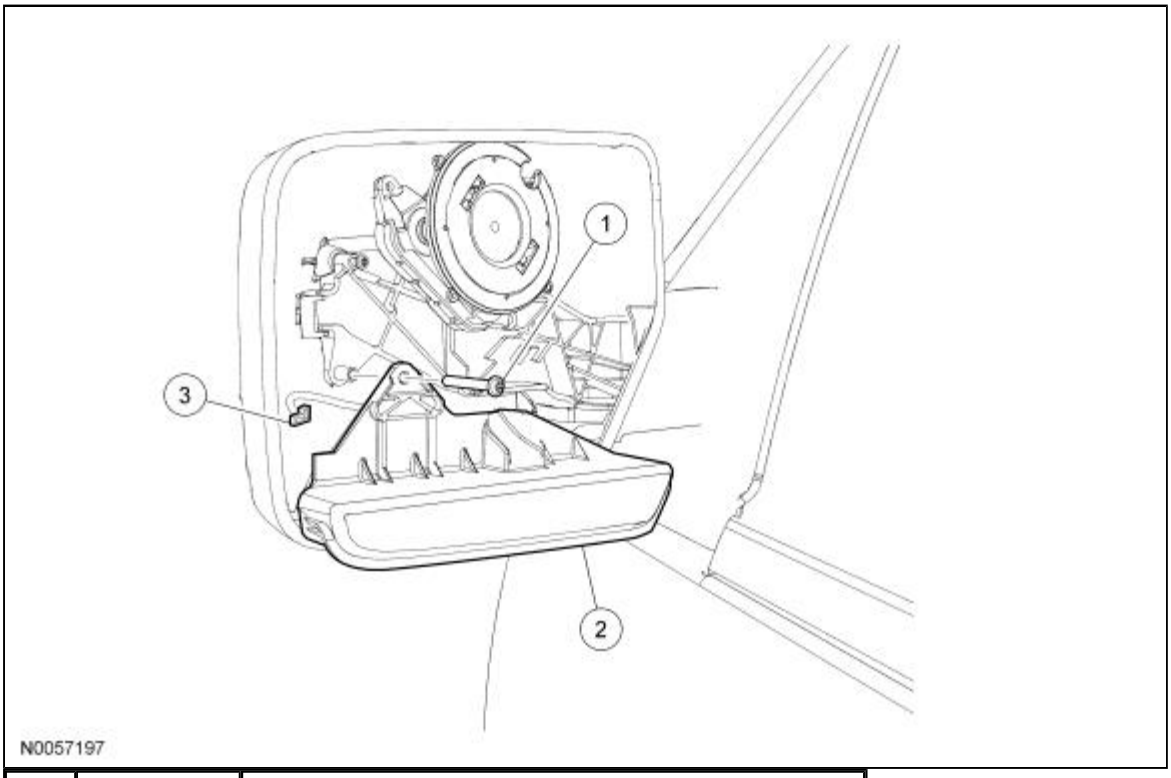
2. Disconnect the electrical connector and remove the fog lamp bulb.

3. To install, reverse the removal procedure.

Side Turn Signal Lamp — Signal Mirror

Printable View (142 KB)

NOTE: Navigator shown, Expedition similar.



Item	Part Number	Description
1	—	Signal mirror LED screw (part of 17682/17683)
2	—	Signal mirror LED (part of 17682/17683)
3	—	Signal mirror LED electrical connector (part of 17682/17683)

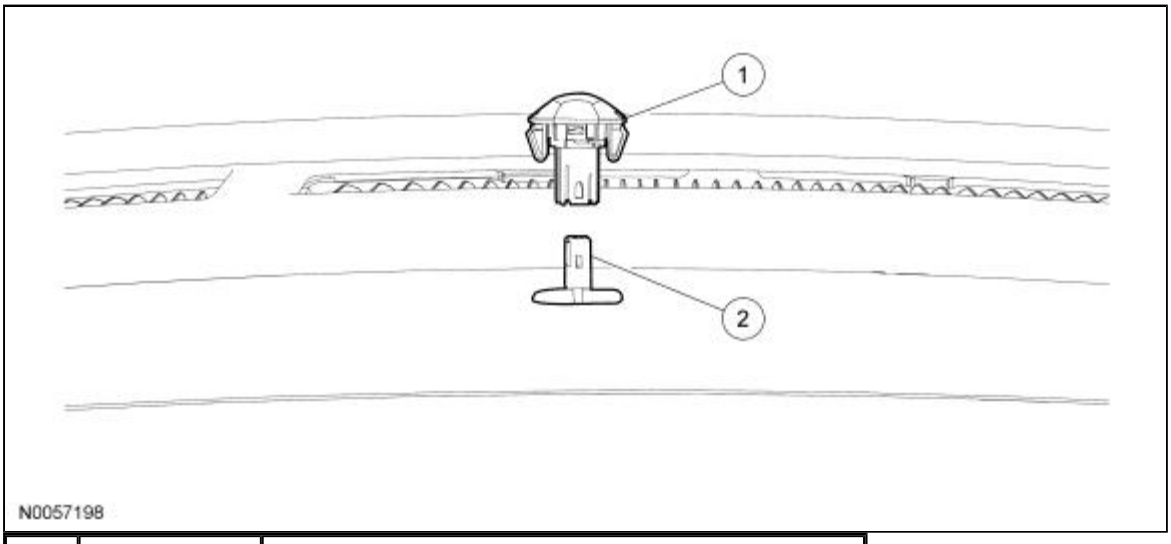
Removal and Installation

1. Remove the mirror glass. For additional information, refer to Section 501-09 .
2. Remove the screw and the signal mirror LED.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

Light Sensor

Printable View (98 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	13A018	Light sensor
2	—	Light sensor electrical connector (part of 14401)

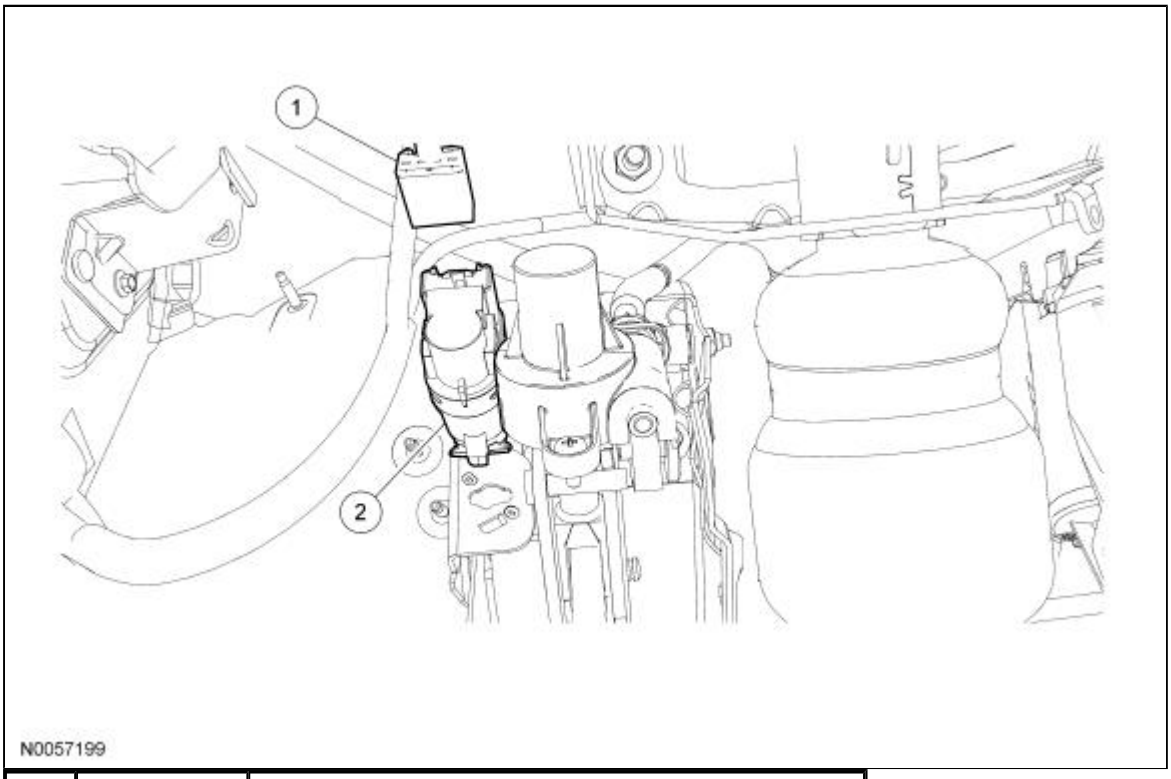
Removal and Installation

1. Using a suitable tool, remove the light sensor from the instrument panel.
    - Disconnect the electrical connector.

2. To install, reverse the removal procedure.

Stoplamp Switch

Printable View (161 KB)



Item	Part Number	Description
1	—	Stoplamp switch electrical connector (part of 12A581)
2	13480	Stoplamp switch

Removal

1. Disconnect the stoplamp switch electrical connector.
2. **NOTE:** The stoplamp switch will be difficult to remove if the switch plunger is not depressed. A slight rearward force should be adequate to depress the plunger.

   With a light force (approximately 1-4 N [1-3 lb]), pull rearward on the brake pedal, rotate the stoplamp switch 45 degrees clockwise and remove the stoplamp switch.

Installation

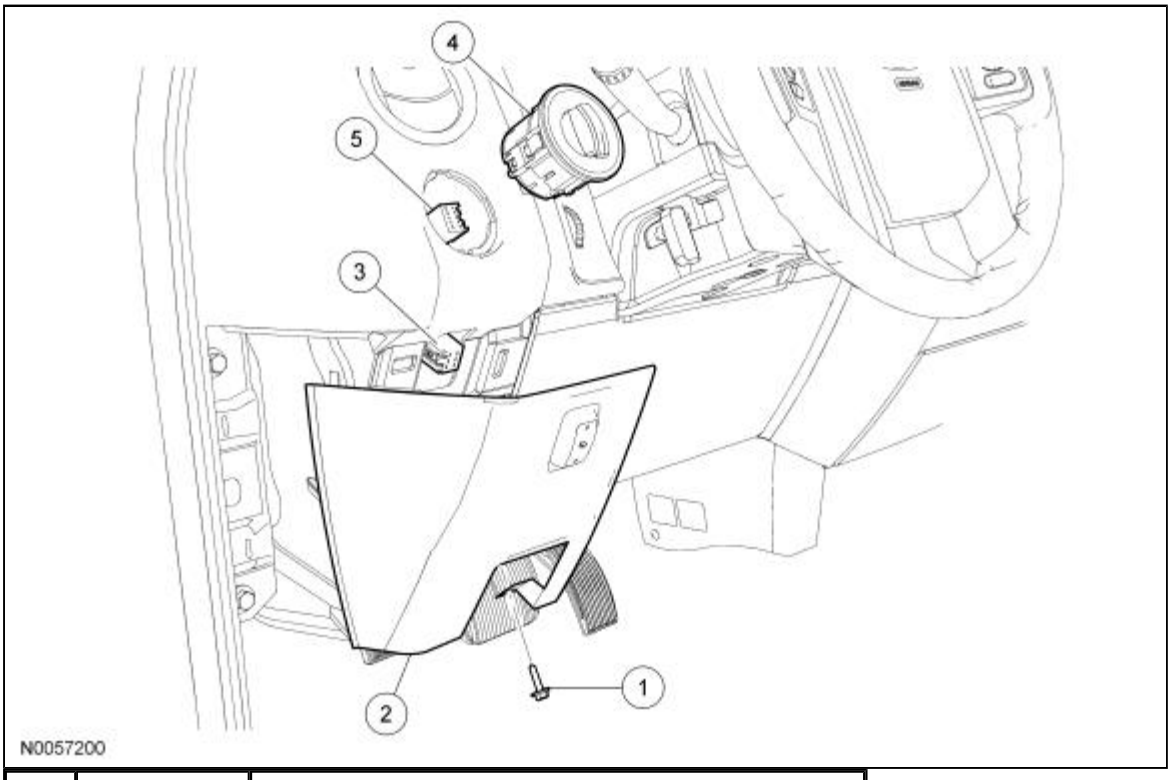
CAUTION: It is very important to not press, pull or touch the brake pedal assembly during the installation of the stoplamp switch. Failure to follow these instructions may damage the stoplamp switch.

1. Without movement to the brake pedal assembly, install the stoplamp switch and rotate 45 degrees counterclockwise.
2. Connect the stoplamp switch electrical connector.

Headlamp Switch

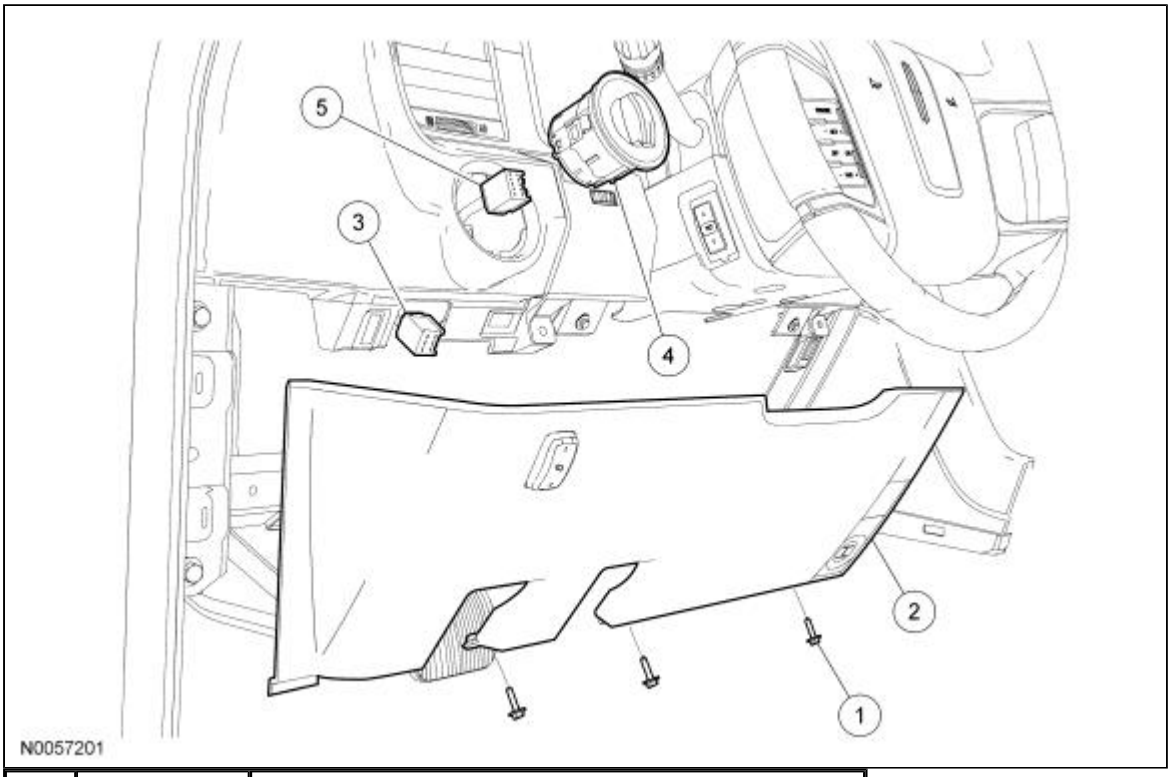
Printable View (267 KB)

Expedition



Item	Part Number	Description
1	W707628	LH lower instrument panel finish panel screw
2	7804338	LH lower instrument panel finish panel screw
3	—	Electrical connector (part of 14401)
4	11654	Headlamp switch
5	—	Headlamp switch electrical connector (part of 14401)

Navigator



Item	Part Number	Description
1	W707628	Steering column finish panel screws (3 required)
2	7804459	Steering column finish panel screw
3	—	Electrical connector (part of 14401)
4	11654	Headlamp switch
5	—	Headlamp switch electrical connector (part of 14401)

Removal and Installation

Expedition

1. Remove the screw and the LH lower instrument panel finish panel.
    - Disconnect the electrical connector.

Navigator

2. Remove the 3 screws and the steering column finish panel.
    - Disconnect the electrical connectors.

All vehicles

3. **NOTE:** The headlamp switch is removed by releasing the tabs and pushing from behind.

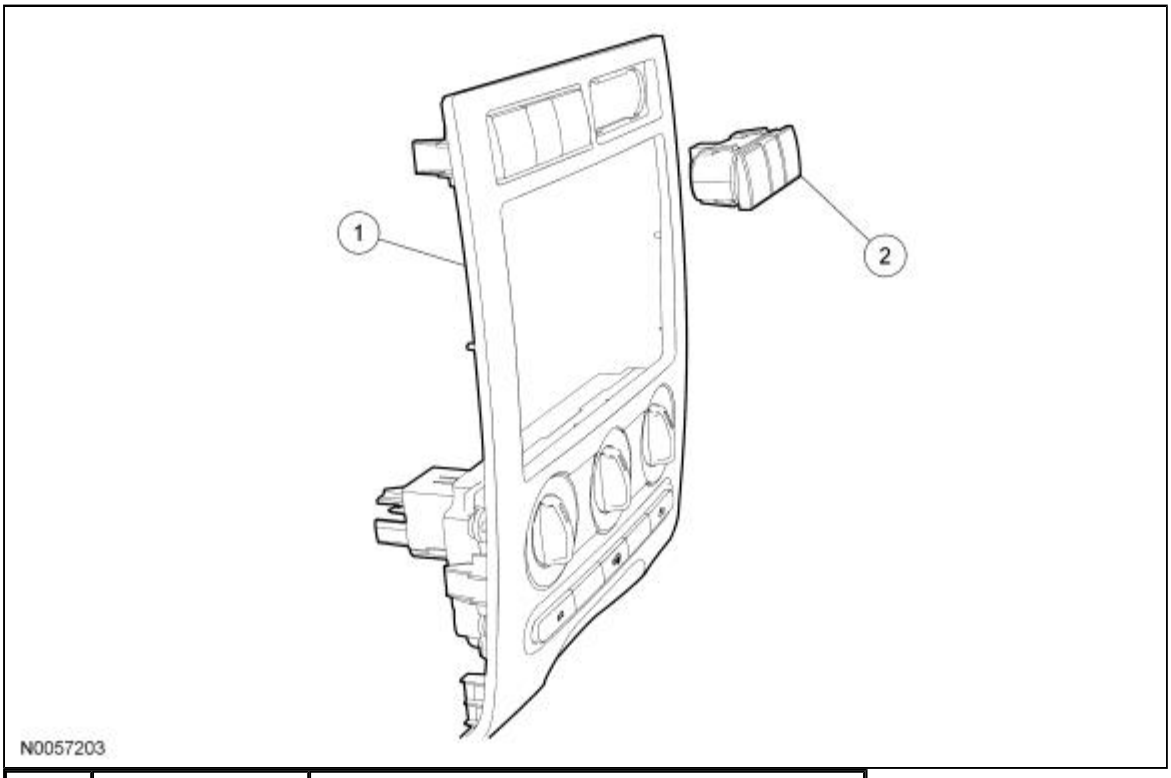
   Remove the headlamp switch.
    - Disconnect the electrical connector.

4. To install, reverse the removal procedure.

Hazard Flasher Lamp Switch

Printable View (120 KB)

NOTE: Expedition shown, Navigator similar.



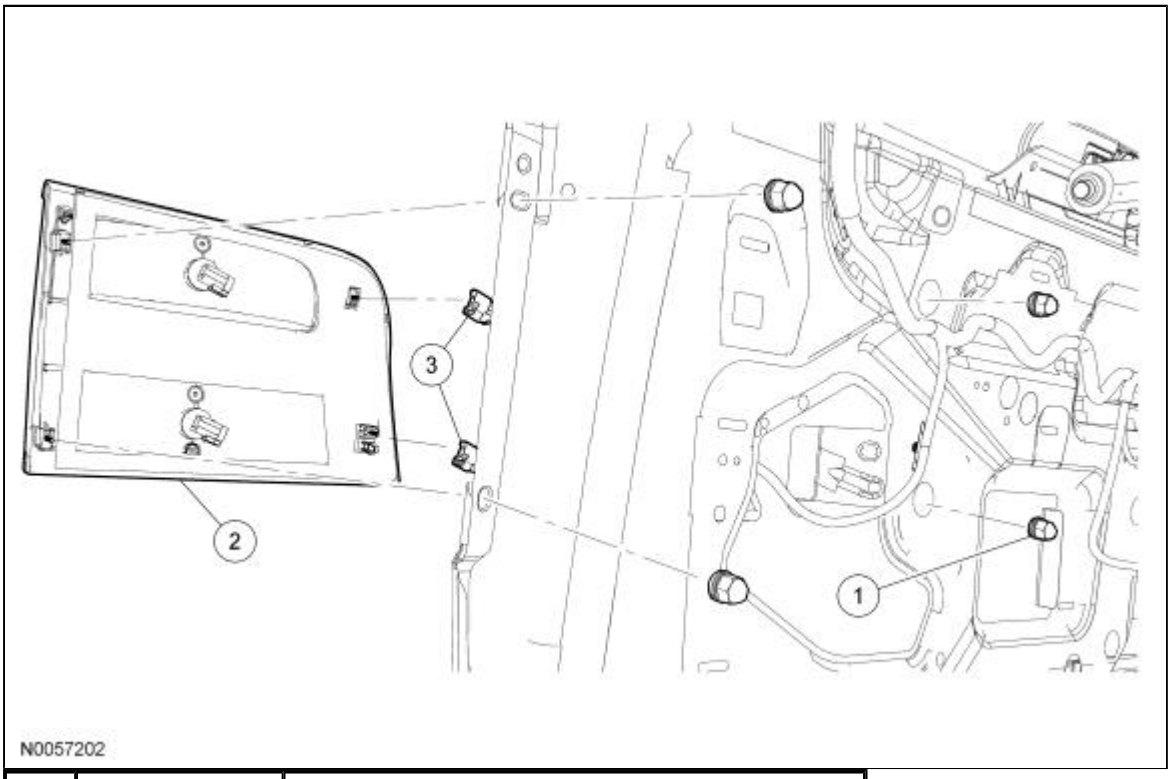
Item	Part Number	Description
1	7804302	Instrument cluster center finish panel
2	13D734	Hazard flasher lamp switch

Removal and Installation

1. Remove the instrument cluster center finish panel. For additional information, refer to Section 501-12 .
2. Release the tabs and remove the hazard flasher lamp switch.
3. To install, reverse the removal procedure.

Parking Lamp — Liftgate

Printable View (153 KB)



Item	Part Number	Description
1	N805296	Liftgate parking lamp nuts (4 required)
2	13B505/13B504	Liftgate parking lamp (LH/RH)
3	—	Liftgate parking lamp electrical connectors (part of 14086)

Removal and Installation

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
   - Remove the watershield.

2. Remove the 4 nuts and the liftgate parking lamp.
   - Disconnect the electrical connectors.

3. To install, reverse the removal procedure.

Interior Lighting

Printable View (63 KB)

The interior lighting system consists of the following:

- Smart junction box (SJB)
- Interior/map lamp assembly
- Rail lamps (if equipped)
- Glove compartment lamp assembly
- Dimmer switch
- Illuminated vanity mirrors (if equipped)
- Rear cargo lamp
- Puddle lamps (if equipped)
- Door ajar switches
- Liftgate glass ajar switch

The interior lighting system consists of 2 subsystems:

- Courtesy lamps
- Demand lamps

The courtesy lamps are controlled by the SJB. The courtesy lamp subsystem consists of the ajar switches, the interior dome lamps, the puddle lamps, the roof rail lamps, the cargo lamp, and the overhead console lamps (if equipped). The SJB supplies voltage to the courtesy lamps when the SJB receives the required input.

The demand lamps subsystem consists of the glove compartment lamp, the dimmer switch, the cargo lamp, all map/reading lamps, the roof rail lamps, and the LH and RH vanity mirror lamps.

The SJB supplies power to the interior lighting system. The SJB sets DTCs if certain circuit failures exist with the interior lighting system.

Interior Lighting

Printable View (304 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communications Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) supplies voltage to the interior lighting system. The interior lighting system illuminates the courtesy lamps while a vehicle door is open or ajar, and the vehicle speed is less than 15 km/h (9 mph) or 5 km/h (3 mph) for puddle lamps. The SJB controls all interior lighting functions and timing by monitoring inputs from the door ajar switches, the dimmer switch, and the vehicle speed.

Interior Lighting Delay

The interior lighting delay feature provides temporary illumination of the courtesy lamps after the doors are opened and then closed. The interior lighting delay feature keeps the courtesy lamps on for a period of 25 seconds. If during the 25-second delay time the SJB detects that the ignition has been turned to RUN, ACC, START, or if the vehicle is locked using the remote keyless entry (RKE) transmitter, the courtesy lamp illumination is discontinued.

Illuminated Entry

The illuminated entry requests the courtesy lamps to illuminate when the ignition is OFF and the RKE transmitter UNLOCK button is pressed. The illuminated entry requests the courtesy lamps off after 25 seconds have elapsed, the ignition is switched to ON, or when the RKE transmitter LOCK button is pressed.

Illuminated Exit

The illuminated exit requests the courtesy lamps illuminate for 25 seconds when all doors are closed and the ignition key is removed from the ignition lock cylinder. The illuminated exit deactivates when any door becomes ajar, the ignition key is inserted into the ignition lock cylinder, or 25 seconds have elapsed.

Theater Lighting

The theater lighting option ramps-up the courtesy lamps over 0.7 second when courtesy lamp activation is requested. The theater lighting feature ramps-down the courtesy lamps over 1.7 seconds when interior lighting deactivation is requested by any feature other than the panic alarm or the battery saver.

Interior Lamp Arbitrator

The interior lamp arbitrator (located in the SJB) chooses between the interior lighting, the interior mode, the interior lighting delay, the illuminated entry, the illuminated exit, the battery saver, and the alarm flash processing to determine which feature has precedence of activating and deactivating the interior lamps. The features are prioritized as follows: alarm flash processing, battery saver, interior mode, interior lighting, interior light delay, illuminated entry, and illuminated exit.

Battery Saver

The battery saver is internal to the SJB and provides automatic shut-off of the demand lamps (cargo lamp, vanity lamps, map lamps and glove compartment lamp) and courtesy lamps after a time-out period in order to save battery voltage. A timer in the SJB is started when the ignition is turned to the OFF position. When the time-out period for the lamps has elapsed, the voltage is automatically shut off to the lamps by the battery saver. While the battery saver has voltage disabled, if the ignition is turned to any position other than OFF, any door becomes ajar, or the UNLOCK button of the RKE transmitter is pressed, the battery saver restores voltage and starts the timer again.

NOTE: Time out is 1 minute if the vehicle has less than 80 km (50 miles).

The battery saver time-outs are as follows:

- Courtesy lamps, if the dome lamp is off or the liftgate/liftglass is closed = 10 minutes
- Courtesy lamps, if the dome lamp is on or the liftgate/liftglass is open, demand lamps = 30 minutes

The SJB utilizes a protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after a customer demand of the function (switching the component on, 30-minute battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

The SJB field-effect transistor (FET) protected output circuits for the interior lighting system are for the puddle lamps and interior lamp output circuits.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Courtesy lamps
• Map lamps
• Vanity lamps
• Door ajar switches
	• Smart junction box (SJB) fuse(s):
	  ▪ 9 (15A)
	  ▪ 10 (15A)
	  ▪ 25 (10A)
	• Circuitry
	• Courtesy lamps
	• Map lamps
	• Cargo lamps
	• Vanity lamps
	• Glove compartment lamp
	• Dimmer switch
	• SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool release software.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart or the Power Liftgate Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1320	Driver Door Ajar Circuit Open	Go To Pinpoint Test C .
B1328	Passenger Door Ajar Circuit Open	Go To Pinpoint Test C .

B1331	Decklid Ajar Rear Door Circuit Failure	Go To Pinpoint Test C .
B1336	Door Ajar RR Circuit Open	Go To Pinpoint Test C .
B1572	Door Ajar LR Circuit	Go To Pinpoint Test C .
B1688	Lamp Dome Input Circuit Short to Ground	Go To Pinpoint Test C .
B2077	Liftgate Ajar Circuit Failure	Go To Pinpoint Test C .
B2A35	Interior Lighting Output Circuit Open	If the courtesy lamps are inoperative, Go To Pinpoint Test A . If the courtesy lamps stay on continuously, Go To Pinpoint Test C .
B2A36	Interior Lighting Output Circuit Short to Ground	Go To Pinpoint Test A .
B2A39	Puddle Lamp Output Circuit Open	Go To Pinpoint Test J .
B2A3A	Puddle Lamp Output Circuit Short to Ground	If the puddle lamps are inoperative, Go To Pinpoint Test J . If the puddle lamps are always on, Go To Pinpoint Test L .
All other DTCs	—	REFER to Section 419-10 .

Power Liftgate Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B2718	Liftgate/Decklid Ajar Output Short to Battery	Go To Pinpoint Test C .
B2721	Liftgate/Decklid Ajar Output Short to Ground or Open	If interior lamps are inoperative, Go To Pinpoint Test A . If interior lamps are always on, Go To Pinpoint Test C .
B2723	Glass Position Switch Active During Selftest	Go To Pinpoint Test C .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section 418-00 .
• The courtesy lamps flash on and off	• The SJB is not configured correctly.	• CONFIGURE the SJB. REFER to Section 418-01 .
• The courtesy lamps are inoperative	• Fuse • Circuitry • Dimmer switch	• Go To Pinpoint Test A .

	• SJB	
• An individual courtesy lamp is inoperative	• Circuitry • Interior lamp	• Go To Pinpoint Test B.
• The courtesy lamps stay on continuously	• Circuitry • Ajar switch • Liftgate ajar switch • Liftgate glass ajar switch • Dimmer switch • Power liftgate module • SJB	• Go To Pinpoint Test C.
• The courtesy lamps do not turn on with one door open	• Circuitry • Ajar switch • SJB	• Go To Pinpoint Test D.
• The courtesy lamps do not turn on with the liftgate or liftgate glass open	• Circuitry • Ajar switch • Liftgate ajar switch • Liftgate glass ajar switch • Power liftgate module • SJB	• Go To Pinpoint Test H.
• The demand lamps are inoperative	• Fuse • Circuitry • SJB	• Go To Pinpoint Test E.
• An individual demand lamp is inoperative	• Circuitry • Interior lamp	• Go To Pinpoint Test F.
• The illuminated entry is inoperative when using the remote keyless entry (RKE) transmitter	• RKE system • SJB	• Go To Pinpoint Test G.
• The battery saver does not deactivate after time-out	• Circuitry • SJB	• Go To Pinpoint Test I.
• The puddle lamps are inoperative	• Fuse • Circuitry • Exterior mirror • SJB	• Go To Pinpoint Test J.
• The puddle lamps stay on continuously	• Circuitry • SJB	• Go To Pinpoint Test L.
• The courtesy lamps are inoperative from the dimmer switch	• Circuitry • Dimmer switch • SJB	• Go To Pinpoint Test K.

Pinpoint Tests

Pinpoint Test A: The Courtesy Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89, Interior Lamps for schematic and connector information.

Normal Operation

Power is supplied to the courtesy lamps through the smart junction box (SJB) fuse 9 (15A), which supplies voltage to the courtesy lamps/demand lamps solid-state relay in the SJB. When any door is opened, the ajar switch opens, signaling the SJB. The SJB monitors the ajar circuits, and based on the ajar status, the SJB energizes the solid-state relay supplying voltage to the courtesy lamps on circuit VLN33 (GY/VT). The SJB also monitors the dome defeat output through circuit VLN36 (GY/OG). A short to ground on circuit VLN36 (GY/OG) will cause the courtesy lamps to be inoperative. Ground for the courtesy lamps is supplied through circuit GD150 (BK/WH).

DTC B2A35 — is an on-demand DTC that sets when the SJB detects an open from the interior lighting circuit.

DTC B2A36 — is a continuous and on-demand DTC that sets when the SJB detects a short to ground from the interior lighting circuit.

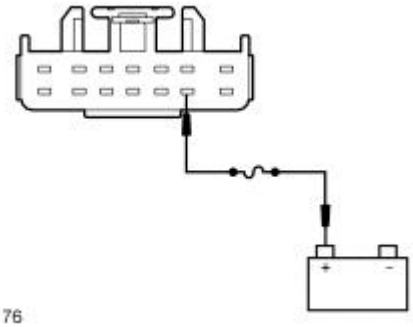
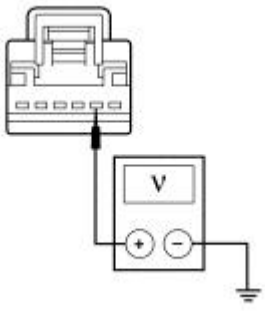
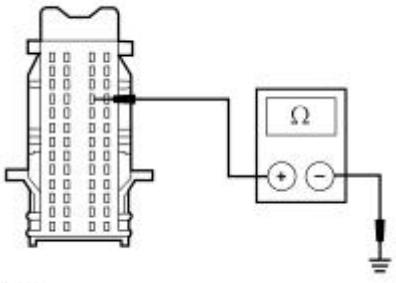
Possible Causes

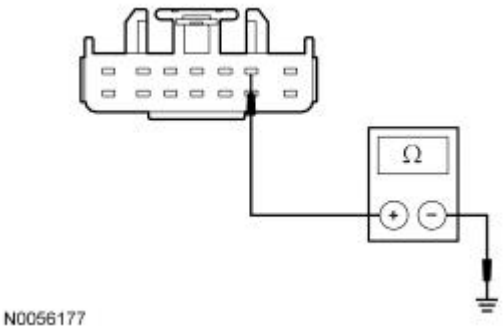
- Fuse
- Circuit VLN33 (GY/VT) open or short to ground
- Circuit VLN36 (GY/OG) short to ground
- Circuit GD150 (BK/WH) open
- Dimmer switch
- SJB

PINPOINT TEST A: THE COURTESY LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE SJB DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS	
• Use the recorded results from the SJB continuous and on-demand self-test. • **Are any SJB DTCs recorded?**	**Yes** For DTC B2A35, GO to A2. For DTC B2A36, GO to A4. For all other DTCs, REFER to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to A2.
A2 CHECK THE OPERATION OF THE DEMAND LIGHTING	
• Operate the demand lighting function on any interior lamp. • **Does the interior lamp illuminate?**	**Yes** GO to A3. **No** REPAIR circuit GD150 (BK/WH) for an open. CLEAR the DTCs. REPEAT the self-test.
A3 CHECK CIRCUIT VLN33 (GY/VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280f.	**Yes** VERIFY the SJB fuse 9 (15A) is OK.

• Connect a fused (10A) jumper wire between the SJB C2280f-9, circuit VLN33 (GY/VT), harness side and battery positive.  N0056176 • **Do the courtesy lamps illuminate?**	If OK, GO to A5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A4 CHECK THE DIMMER CONTROL SWITCH	
• Key in OFF position. • Disconnect: Dimmer Switch C2065. • Key in ON position. • Measure the voltage between the dimmer switch C2065-2, circuit VLN36 (GY/OG), harness side and ground.  N0037306 • **Is the voltage greater than 10 volts?**	**Yes** GO to A5 . **No** INSTALL a new dimmer control switch. REFER to Section 413-00 . TEST the system for normal operation.
A5 CHECK CIRCUIT VLN36 (GY/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Connect: Dimmer Switch C2065 . • Disconnect: SJB C2280g. • Measure the resistance between the SJB C2280g-36, circuit VLN36 (GY/OG), harness side and ground.  N0057325 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
A6 CHECK CIRCUIT VLN33 (GY/VT) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: SJB C2280f.	**Yes** GO to A7 .

• Disconnect: All Interior Lamps. • Measure the resistance between the SJB C2280f-9, circuit VLN33 (GY/VT), harness side and ground.  N0056177 • **Is the resistance greater than 10,000 ohms?**	**No** REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
A7 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

Pinpoint Test B: An Individual Courtesy Lamp Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

Circuit VLN33 (GY/VT) provides voltage to each courtesy lamp when activated. The courtesy lamps are grounded through circuit GD150 (BK/WH).

Possible Causes

- Circuit VLN33 (GY/VT) open
- Circuit GD150 (BK/WH) open
- Interior lamp

PINPOINT TEST B: AN INDIVIDUAL COURTESY LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK THE INTERIOR LAMP	
• Key in OFF position.	**Yes**

- Disconnect: Suspect Interior Lamp.
- Open the driver door.
- Measure the voltage between the suspect interior lamp pins, harness side as follows:

Location	Connector-Pin/ Circuit	Connector-Pin/ Circuit
Front interior/map lamp (without overhead console)	C931-1 VLN33 (GY/VT)	C931-2 GD150 (BK/WH)
Front interior/map lamp (with overhead console)	C929-2 VLN33 (GY/VT)	C929-1 GD150 (BK/WH)
Cargo lamp	C926-1 VLN33 (GY/VT)	C926-2 GD150 (BK/WH)
RH rail lamp	C942-2 VLN33 (GY/VT)	C942-1 GD150 (BK/WH)
LH rail lamp	C941-2 VLN33 (GY/VT)	C941-1 GD150 (BK/WH)

- **Is the voltage greater than 10 volts?**

INSTALL a new interior lamp for the lamp in question. TEST the system for normal operation.

No
GO to B2 .

B2 CHECK CIRCUIT VLN33 (GY/VT) FOR VOLTAGE

- Measure the voltage between the suspect interior lamp, circuit VLN33 (GY/VT), harness side and ground as follows:

Location	Connector-Pin
Front interior/map lamp (without overhead console)	C931-1
Front interior/map lamp (with overhead console)	C929-2
Cargo lamp	C926-1
RH rail lamp	C942-2
LH rail lamp	C941-2

- **Is the voltage greater than 10 volts?**

Yes
REPAIR circuit GD150 (BK/WH) for an open. TEST the system for normal operation.

No
REPAIR circuit VLN33 (GY/VT) for an open. TEST the system for normal operation.

Pinpoint Test C: The Courtesy Lamps Stay On Continuously

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When any door, liftgate, or liftgate glass is opened, the ajar switch or the power liftgate module opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB supplies voltage to the courtesy lamps on circuit VLN33 (GY/VT).

DTC B1320 — is an on-demand DTC that sets when the SJB detects an open from the driver door ajar circuit.

DTC B1328 — is an on-demand DTC that sets when the SJB detects an open from the passenger door ajar circuit.

DTC B1331 — is an on-demand DTC that sets when the SJB detects an open from the liftgate or the liftgate glass ajar circuit.

DTC B1336 — is an on-demand DTC that sets when the SJB detects an open from the RR door ajar circuit.

DTC B1572 — is an on-demand DTC that sets when the SJB detects an open from the LR door ajar circuit.

DTC B1688 — is an on-demand DTC that sets when the SJB detects a short to ground from the dimmer switch circuit.

DTC B2077 — is an on-demand DTC that sets when the SJB detects an open from the liftgate glass or the liftgate ajar circuit.

DTC B2A35 — is an on-demand DTC that sets when the SJB detects an open or a short to voltage from the courtesy lamp circuit.

DTC B2718 — is a continuous and on-demand DTC that sets when the power liftgate module detects a short to voltage from the SJB, the liftgate glass, or the liftgate ajar circuit.

DTC B2721 — is a continuous and on-demand DTC that sets when the power liftgate module detects an open from the SJB, or the liftgate ajar circuit.

DTC B2723 — is an on-demand DTC that sets when the power liftgate module detects an open from the liftgate glass ajar circuit.

Possible Causes

- Circuit CPL10 (GN/WH) open
- Circuit CPL26 (GN/VT) open
- Circuit CLN28 (GN/BU) short to ground
- Circuit CPL31 (WH) open
- Circuit CPL36 (GN) open
- Circuit CPL39 (YE) open
- Circuit CPL58 (GY/OG) open
- Circuit GD138 (BK/WH) open
- Circuit GD143 (BK/VT) open
- Circuit GD150 (BK/WH) open
- Circuit VLN33 (GY/VT) short to voltage
- Dimmer switch
- Ajar switch
- Liftgate ajar switch
- Liftgate glass ajar switch
- Power liftgate module
- SJB

PINPOINT TEST C: THE COURTESY LAMPS STAY ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>C1 CHECK THE SJB DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS</td><td></td></tr>
<tr><td>NOTE: Make sure the dimmer switch is not in the defeat position.
• Use the recorded results from the SJB continuous and the on-demand self-test.
• Are any SJB DTCs recorded?</td><td>Yes
For DTCs B1320, B1328, B1336, or B1572, GO to C2 .

For DTC B1688, GO to C5 .

For DTC B2A35, GO to C7 .

For DTCs B1331 or B2077 (manual liftgate), GO to C8 .

For DTCs B1331 or B2077 (power liftgate), GO to C13 .

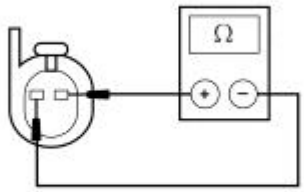
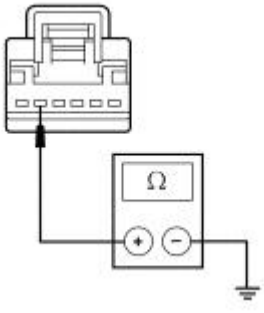
No
If equipped with a power liftgate, GO to C13 .

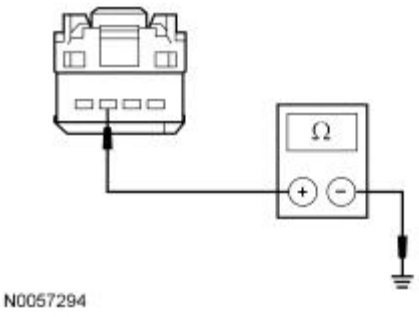
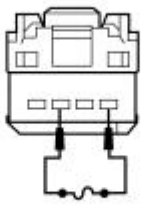
If equipped with a manual liftgate, GO to C19 .</td></tr>
<tr><td>C2 CHECK THE DOOR AJAR GROUND CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Suspect Ajar Switch.
• Measure the resistance between the suspect ajar switch connector, harness side and ground as follows:

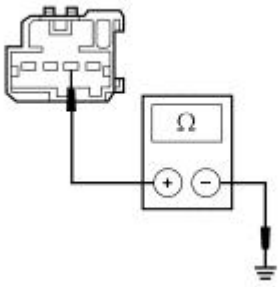
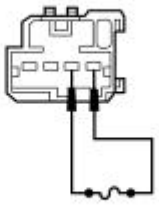
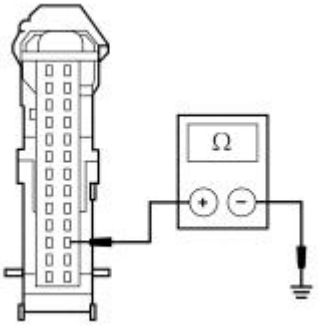
<table><tr><th>Location</th><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>LH front</td><td>C526-1</td><td>GD143 (BK/VT)</td></tr><tr><td>RH front</td><td>C602-1</td><td>GD138 (BK/WH)</td></tr><tr><td>LH rear</td><td>C715-1</td><td>GD138 (BK/WH)</td></tr><tr><td>RH rear</td><td>C820-1</td><td>GD138 (BK/WH)</td></tr></table>
• Is the resistance less than 5 ohms?</td><td>Yes
GO to C3 .

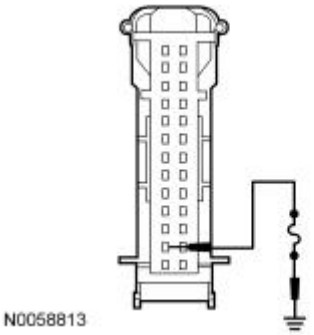
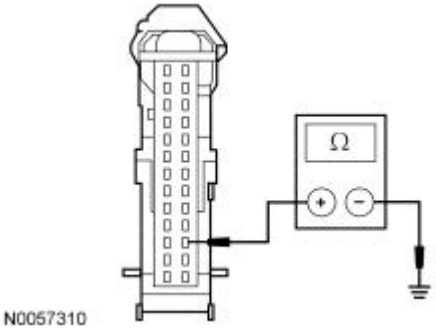
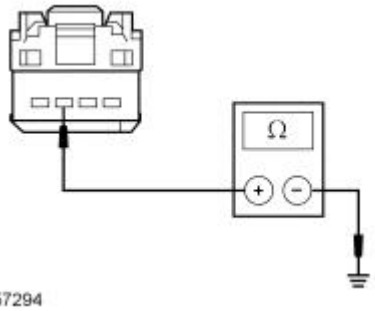
No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>C3 CHECK THE DOOR AJAR SWITCH OPERATION</td><td></td></tr>
<tr><td>• Disconnect: Suspect Door Ajar Switch.
• Measure the resistance between the suspect ajar switch connector pin 1 and pin 2, component side, while toggling the switch open and closed.</td><td>Yes
GO to C4 .

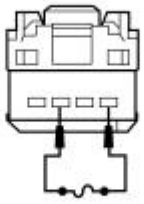
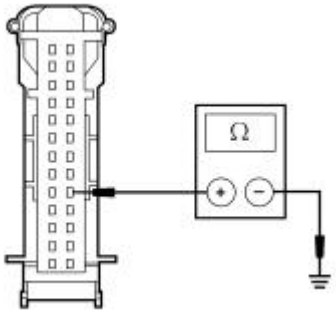
No
INSTALL a new ajar switch in question. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the</td></tr>
</table>

 N0058812 • **Is the resistance less than 5 ohms with the switch closed?**	self-test.
C4 CHECK THE DOOR AJAR SWITCH INPUT CIRCUITS • Disconnect: SJB C2280d. • Measure the resistance between the suspect ajar switch connector, harness side and the SJB connector, harness side as follows: **Location** / **SJB Connector-Pin/ Circuit** / **Suspect Ajar Switch Connector-Pin/ Circuit** LH front: C2280d-14 CPL26 (GN/VT) / C526-2 CPL26 (GN/VT) RH front: C2280d-2 CPL31 (WH) / C602-2 CPL31 (WH) LH rear: C2280d-3 CPL39 (YE) / C715-2 CPL36 (GN) RH rear: C2280d-15 CPL36 (GN) / C820-2 CPL36 (GN) • **Is the resistance less than 5 ohms?**	**Yes** GO to C19 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK THE DIMMER SWITCH • Key in OFF position. • Disconnect: Dimmer Switch C2065. • **Are the courtesy lamps still illuminated?**	**Yes** GO to C6 . **No** INSTALL a new dimmer switch. REFER to Section 413-00 . CLEAR the DTCs. REPEAT the self-test.
C6 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO GROUND • Disconnect: SJB C2280g. • Measure the resistance between the dimmer switch C2065-5, circuit CLN28 (GN/BU), harness side and ground.  N0057293 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C19 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUIT VLN33 (GY/VT) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280f. • Key in ON position. • Observe the courtesy lamps. • **Are the courtesy lamps still illuminated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C19 .
C8 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (MANUAL LIFTGATE)	
• Key in OFF position. • Disconnect: Liftgate Glass Ajar Switch C4040. • Measure the resistance between the liftgate glass ajar switch C4040-3, circuit GD150 (BK/WH), harness side and ground.  N0057294 • **Is the resistance less than 5 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK THE LIFTGATE GLASS AJAR SWITCH (MANUAL LIFTGATE)	
• Connect a fused (5A) jumper wire between the liftgate glass ajar switch C4040-1, circuit CPR50 (BN/BU), harness side and the liftgate glass ajar switch C4040-3, GD150 (BK/WH), harness side.  N0057295 • **Do the courtesy lamps turn off?**	**Yes** INSTALL a new liftgate glass ajar switch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the jumper wire. GO to C10 .
C10 CHECK CIRCUIT CPR50 (BN/BU) FOR AN OPEN (MANUAL LIFTGATE)	
• Connect: Liftgate Glass Ajar Switch C4040. • Disconnect: Liftgate Ajar Switch C457. • **NOTE:** Make sure the liftgate glass is closed. • Measure the resistance between the liftgate ajar switch C457-3, circuit CPR50 (BN/BU), harness side and ground.	**Yes** GO to C11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0057308 • **Is the resistance less than 5 ohms?**	
C11 CHECK THE LIFTGATE AJAR SWITCH (MANUAL LIFTGATE)	
• Connect a fused (5A) jumper wire between the liftgate ajar switch C457-4, circuit CPL58 (GY/OG), harness side and the liftgate ajar switch C457-3, circuit CPR50 (BN/BU), harness side.  N0057309 • **Do the courtesy lamps turn off?**	**Yes** INSTALL a new liftgate ajar switch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the jumper wire. GO to C12 .
C12 CHECK CIRCUIT CPL58 (GY/OG) FOR AN OPEN (MANUAL LIFTGATE)	
• Key in OFF position. • Connect: Liftgate Ajar Switch C457. • Disconnect: SJB C2280d. • **NOTE:** Make sure the liftgate is closed. • Measure the resistance between the SJB C2280d-16, circuit CPL58 (GY/OG), harness side and ground.  N0057310 • **Is the resistance less than 5 ohms?**	**Yes** GO to C19 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C13 CHECK THE POWER LIFTGATE MODULE DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS	
• Use the recorded results from the power liftgate module continuous and the on-demand self-test. • **Are any power liftgate module DTCs recorded?**	**Yes** For DTCs B2718 or B2721, GO to C14 . For DTC B2723, GO to C16 .

	No GO to C19 .
C14 CHECK THE POWER LIFTGATE MODULE	
• Disconnect: Power Liftgate Module C4174b. • **NOTE:** If the fuse fails, repair the circuit for a short to voltage. • Connect a fused (5A) jumper wire between the power liftgate module C4174b-2, circuit CPL58 (GY/OG), harness side and ground.  N0058813 • **Do the courtesy lamps turn off?**	**Yes** GO to C20 . **No** LEAVE the jumper wire connected. GO to C15 .
C15 CHECK CIRCUIT CPL58 (GY/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-16, circuit CPL58 (GY/OG), harness side and ground.  N0057310 • **Is the resistance less than 5 ohms?**	**Yes** GO to C19 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C16 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (POWER LIFTGATE)	
• Key in OFF position. • Disconnect: Liftgate Glass Ajar Switch C4040. • Measure the resistance between the liftgate glass ajar switch C4040-3, circuit GD150 (BK/WH), harness side and ground.  N0057294 • **Is the resistance less than 5 ohms?**	**Yes** GO to C17 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C17 CHECK THE LIFTGATE GLASS AJAR SWITCH	

• Connect a fused (5A) jumper wire between the liftgate glass ajar switch C4040-1, circuit CPR50 (BN/BU), harness side and the liftgate glass ajar switch C4040-3, circuit GD150 (BK/WH), harness side.  N0057295 • **Do the courtesy lamps turn off?**	**Yes** INSTALL a new liftgate glass ajar switch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the jumper wire. GO to C18 .
C18 CHECK CIRCUIT CPR50 (BN/BU) FOR AN OPEN	
• Key in OFF position. • Connect: Liftgate Glass Ajar Switch C4040. • Disconnect: Power Liftgate Module C4174b. • **NOTE:** Make sure the liftgate glass is closed. • Measure the resistance between the power liftgate module C4174b-18, circuit CPR50 (BN/BU), harness side and ground.  N0058814 • **Is the resistance less than 5 ohms?**	**Yes** GO to C20 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C19 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

C20 CHECK FOR CORRECT POWER LIFTGATE MODULE OPERATION	

• Disconnect all the power liftgate module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the power liftgate module connectors and make sure they seat correctly.
	Yes
	INSTALL a new power liftgate module. REFER to Section 501-03 . TEST the system for normal operation.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Courtesy Lamps Do Not Turn On With One Door Open

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When any door is opened, the ajar switch opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB will supply voltage to the courtesy lamps on circuit VLN33 (GY/VT).

Possible Causes

- Circuit CPL26 (GN/VT) short to ground
- Circuit CPL31 (WH) short to ground
- Circuit CPL36 (GN) short to ground
- Circuit CPL39 (YE) short to ground
- Ajar switch
- SJB

PINPOINT TEST D: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK THE SJB DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS	
• Verify all the doors are closed. • Use the recorded results from the SJB continuous and the on-demand self-test. • **Are any DTCs recorded?**	**Yes** REFER to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to D2 .
D2 CHECK THE DOOR AJAR PIDs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: SJB PID. • Check the ajar SJB PID while opening and closing all the doors. • **Do all the door ajar PID values agree with the door positions?**	**Yes** GO to D5 . **No** GO to D3 .
D3 CHECK THE AJAR SWITCH OPERATION	

<table>
<tr><td>

- Disconnect: Suspect Ajar Switch .
- **Do the courtesy lamps illuminate?**

</td><td>

Yes
INSTALL a new ajar switch in question. REFER to Section 501-14 . TEST the system for normal operation.

No
GO to D4 .

</td></tr>
<tr><td>

D4 CHECK THE AJAR SWITCH CIRCUIT FOR A SHORT TO GROUND

- Disconnect: SJB C2280d.
- Measure the resistance between the suspect ajar switch, harness side and ground as follows:

Location	Connector-Pin	Circuit
LH front	C526-2	CPL26 (GN/VT)
RH front	C602-2	CPL31 (WH)
LH rear	C715-2	CPL36 (GN)
RH rear	C820-2	CPL36 (GN)

- **Is the resistance greater than 10,000 ohms?**

</td><td>

Yes
GO to D5 .

No
REPAIR the circuit in question. TEST the system for normal operation.

</td></tr>
<tr><td>

D5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

</td><td>

Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

</td></tr>
</table>

Pinpoint Test E: The Demand Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

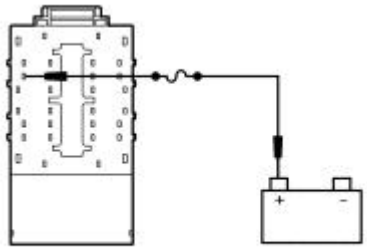
The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD150 (BK/WH).

Possible Causes

- Fuse
- Circuit CLN09 (YE/GN) open or short to ground
- Circuit GD150 (BK/WH) open
- SJB

PINPOINT TEST E: THE DEMAND LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
E1 CHECK CIRCUIT CLN09 (YE/GN) FOR AN OPEN	**Yes** VERIFY the SJB fuse 25 (10A) is OK. If OK, GO to E2 . **No** REPAIR the circuit. TEST the system for normal operation.
• Key in OFF position. • Disconnect: SJB C2280e. • **NOTE:** If the fuse fails, repair circuit CLN09 (YE/GN) for a short to ground. • Connect a fused (10A) jumper wire between the SJB C2280e-21, circuit CLN09 (YE/GN), harness side and battery positive.  N0056178 • **Do the demand lamps illuminate when switched on?**	
E2 CHECK THE OPERATION OF THE COURTESY LIGHTING	**Yes** GO to E3 . **No** REPAIR circuit GD150 (BK/WH) for an open. CLEAR the DTCs. REPEAT the self-test.
• Open the driver door. • **Do the courtesy lamps illuminate?**	
E3 CHECK FOR CORRECT SJB OPERATION	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**	

Pinpoint Test F: An Individual Demand Lamp Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD150 (BK/WH). The glove compartment lamp is grounded through circuit GD138 (BK/WH).

Possible Causes

- Circuit CLN09 (YE/GN) open
- Circuit GD150 (BK/WH) open

- Circuit GD138 (BK/WH) open
- Interior lamp

PINPOINT TEST F: AN INDIVIDUAL DEMAND LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 CHECK CIRCUIT CLN09 (YE/GN) FOR AN OPEN</td><td rowspan="2">Yes
GO to F2 .

No
REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>

Key in OFF position.
Disconnect: Suspect Demand Lamp .
Key in ON position.
Measure the voltage between the suspect demand lamp, harness side and ground as follows:

<table>
<tr><th>Location</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>RH vanity mirror lamp</td><td>C906-1</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>LH vanity mirror lamp</td><td>C907-1</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>Front interior/map lamp (without overhead console)</td><td>C931-3</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>Front interior/map lamp (with overhead console)</td><td>C929-3</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>Cargo lamp</td><td>C926-3</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>RH rail lamp</td><td>C942-3</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>LH rail lamp</td><td>C941-3</td><td>CLN09 (YE/GN)</td></tr>
<tr><td>Glove compartment lamp</td><td>C254-1</td><td>CLN09 (YE/GN)</td></tr>
</table>

Is the voltage greater than 10 volts?

</td></tr>
<tr><td>F2 CHECK THE GROUND CIRCUIT FOR AN OPEN</td><td rowspan="2">Yes
INSTALL a new interior lamp for the lamp in question. TEST the system for normal operation.

No
REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>

Measure the resistance between the suspect demand lamp, harness side and ground as follows:

<table>
<tr><th>Location</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>RH vanity mirror lamp</td><td>C906-2</td><td>GD150 (BK/WH)</td></tr>
<tr><td>LH vanity mirror lamp</td><td>C907-2</td><td>GD150 (BK/WH)</td></tr>
<tr><td>Front interior/map lamp (without overhead console)</td><td>C931-2</td><td>GD150 (BK/WH)</td></tr>
</table>
</td></tr>
</table>

Front interior/map lamp (with overhead console)	C929-1	GD150 (BK/WH)
Cargo lamp	C926-2	GD150 (BK/WH)
RH rail lamp	C942-1	GD150 (BK/WH)
LH rail lamp	C941-1	GD150 (BK/WH)
Glove compartment lamp	C254-2	GD138 (BK/WH)

- **Is the resistance less than 5 ohms?**

Pinpoint Test G: The Illuminated Entry Is Inoperative When Using The Remote Keyless Entry (RKE) Transmitter

Normal Operation

The illuminated entry provides interior lighting whenever the smart junction box (SJB) receives a door unlock request from the RKE transmitter. The SJB provides voltage on circuit VLN33 (GY/VT) for the courtesy lamps.

Possible Causes

- RKE system
- SJB

PINPOINT TEST G: THE ILLUMINATED ENTRY IS INOPERATIVE WHEN USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

Test Step	Result / Action to Take
G1 CHECK FOR CORRECT RKE OPERATION	
• Using the RKE transmitter, lock and unlock the doors. • **Do the doors lock and unlock?**	**Yes** GO to G2 . **No** REFER to Section 501-14 .
G2 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 .
	TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Courtesy Lamps Do Not Turn On With the Liftgate Or The Liftgate Glass

Open

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When the liftgate or the liftgate glass is opened, the ajar switch opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB will supply voltage to the courtesy lamps on circuit VLN33 (GY/VT).

DTC B2721 — sets when the power liftgate module detects a short to ground from the SJB, or liftgate ajar circuit.

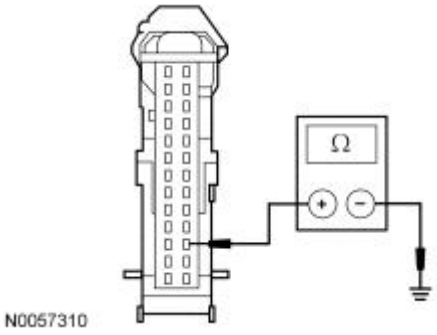
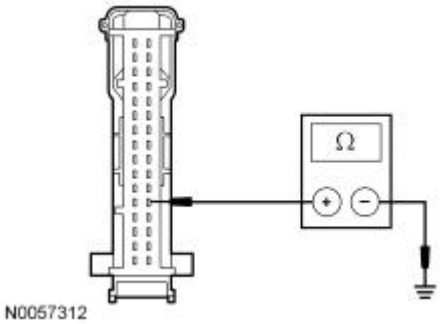
Possible Causes

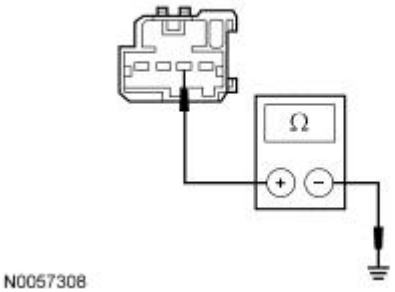
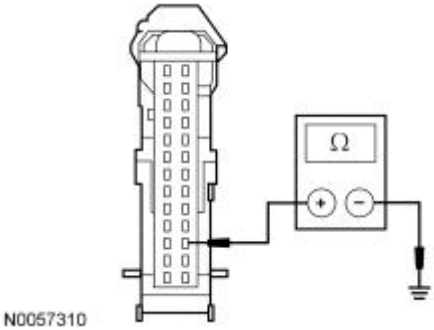
- Circuit CPL58 (GY/OG) short to ground
- Circuit CPR50 (BN/BU) short to ground
- Ajar switch
- Liftgate ajar switch
- Liftgate glass ajar switch
- Power liftgate module
- SJB

PINPOINT TEST H: THE COURTESY LAMPS DO NOT TURN ON WITH THE LIFTGATE OR THE LIFTGATE GLASS OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK THE LIFTGATE TYPE	
• Identify the vehicle liftgate type. • **Is the vehicle equipped with a power liftgate?**	**Yes** GO to H2 . **No** GO to H8 .
H2 CHECK THE POWER LIFTGATE MODULE DTCs FROM BOTH THE CONTINUOUS AND THE ON-DEMAND SELF-TESTS	
• Use the recorded results from the power liftgate module continuous and the on-demand self-test. • **Is DTC B2721 recorded?**	**Yes** GO to H3 . **No** GO to H5 .
H3 CHECK THE POWER LIFTGATE MODULE	
• Key in OFF position. • Disconnect: Power Liftgate Module C4174b. • **Do the courtesy lamps illuminate?**	**Yes** GO to H13 . **No** GO to H4 .

H4 CHECK CIRCUIT CPL58 (GY/OG) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-16, circuit CPL58 (GY/OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H12 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
H5 CHECK THE LIFTGATE GLASS AJAR PID	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Power Liftgate Module PID. • Monitor the power liftgate module liftgate glass ajar PID while opening and closing the liftgate glass. • **Do the liftgate glass ajar PID values agree with the liftgate glass ajar positions?**	**Yes** GO to H13 . **No** GO to H6 .
H6 CHECK THE LIFTGATE GLASS AJAR SWITCH (POWER LIFTGATE)	
• Disconnect: Liftgate Glass Ajar Switch C4040. • **Do the courtesy lamps illuminate?**	**Yes** INSTALL a new liftgate glass ajar switch. REFER to Section 501-14 . TEST the system for normal operation. **No** GO to H7 .
H7 CHECK CIRCUIT CPR50 (BN/BU) FOR A SHORT TO GROUND (POWER LIFTGATE)	
• Key in OFF position. • Disconnect: Power Liftgate Module C4174b. • Measure the resistance between the power liftgate module C4174b-18, circuit CPR50 (BN/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H13 . **No** REPAIR the circuit. TEST the system for normal operation.
H8 CHECK THE LIFTGATE AND LIFTGATE GLASS AJAR SWITCH OPERATION (MANUAL LIFTGATE)	
• Key in OFF position.	**Yes**

• Disconnect: Liftgate Ajar Switch C457. • Disconnect: Liftgate Glass Ajar Switch C4040. • Measure the resistance between the suspect liftgate ajar switch connector pins, component side, while toggling the switch open and closed as follows: **Location** / **Connector-Pin** / **Connector-Pin** Liftgate ajar switch / C457-4 / C457-3 Liftgate glass ajar switch / C4040-1 / C4040-3 • **Is the resistance less than 5 ohms when the switch is closed and greater than 10,000 ohms when the switch is open?**	GO to H9 . **No** INSTALL a new liftgate or liftgate glass ajar switch for the switch in question. REFER to Section 501-14 . TEST the system for normal operation.
H9 CHECK THE SJB MODULE	
• Key in OFF position. • Disconnect: SJB C2280d. • Observe the courtesy lamps. • **Do the courtesy lamps operate with the SJB module disconnected?**	**Yes** GO to H12 . **No** GO to H10 .
H10 CHECK CIRCUIT CPR50 (BN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between the liftgate ajar switch C457-3, circuit CPR50 (BN/BU), harness side and ground.  N0057308 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H11 . **No** REPAIR the circuit. TEST the system for normal operation.
H11 CHECK CIRCUIT CPL58 (GY/OG) FOR A SHORT TO GROUND	
• Measure the resistance between the SJB C2280d-16, circuit CPL58 (GY/OG), harness side and ground.  N0057310 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H12 . **No** REPAIR the circuit. TEST the system for normal operation.
H12 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for:	**Yes** INSTALL a new SJB. REFER

■ corrosion ■ damaged pins ■ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
H13 CHECK FOR CORRECT POWER LIFTGATE MODULE OPERATION	
• Disconnect all the power liftgate module connectors. • Check for: ■ corrosion ■ damaged pins ■ pushed-out pins • Connect all the power liftgate module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new power liftgate module. REFER to Section 501-03 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Battery Saver Does Not Deactivate After Time-Out

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides a battery saver function. The battery saver function provides automatic shutoff of the interior lamps (demand lamps, and glove compartment lamp) after a predetermined time has elapsed in order to save battery power.

Possible Causes

- Circuit CLN09 (YE/GN) short to voltage
- SJB

PINPOINT TEST I: THE BATTERY SAVER DOES NOT DEACTIVATE AFTER TIME-OUT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
I1 CHECK CIRCUIT CLN09 (YE/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280e. • Key in ON position. • Turn any demand lamp on. • **Does the demand lamp turn on?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to I2 .

I2 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 .
	TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Puddle Lamps are Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the puddle lamps through circuit CLN25 (VT). The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD143 (BK/VT), and the RH exterior mirror is grounded through circuit GD138 (BK/WH).

DTC B2A39 — sets when the SJB detects an open on the puddle lamp output circuit.

DTC B2A3A — sets when the SJB detects a short to ground on the puddle lamp output circuit.

Possible Causes

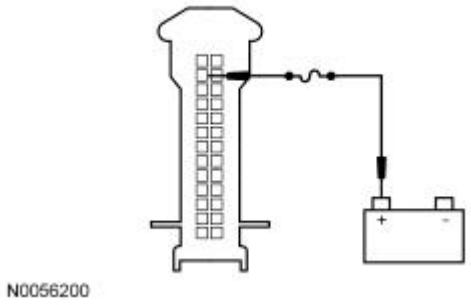
- Fuse
- Circuit CLN25 (VT) open or short to ground
- Circuit GD138 (BK/WH) open
- Circuit GD143 (BK/VT) open
- Exterior mirror
- SJB

PINPOINT TEST J: THE PUDDLE LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
J1 CHECK THE PUDDLE LAMP OPERATION	
• Observe the puddle lamps. • **Are both the puddle lamps inoperative?**	**Yes** GO to J2 . **No** GO to J3 .
J2 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280d. • **NOTE:** If the fuse fails, repair circuit CLN25 (VT) for a short to ground.	**Yes** REMOVE the jumper wire. GO to J5 .

- Connect a fused (10A) jumper wire between the SJB C2280d-12, circuit CLN25 (VT), harness side and battery positive.



- **Do the puddle lamps illuminate?**

No
REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

J3 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN

- Disconnect: Suspect Exterior Mirror.
- **NOTE:** The courtesy lamps must be active during this test.
- Open any door.
- Measure the voltage between the suspect exterior mirror connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH exterior mirror	C622-11	CLN25 (VT)
LH exterior mirror	C516-11	CLN25 (VT)

- **Is the voltage greater than 10 volts?**

Yes
GO to J4 .

No
REPAIR the circuit. TEST the system for normal operation.

J4 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Measure the resistance between the suspect exterior mirror connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH exterior mirror	C622-2	GD138 (BK/WH)
LH exterior mirror	C516-2	GD143 (BK/VT)

- **Is the resistance less than 5 ohms?**

Yes
INSTALL a new exterior mirror in question. REFER to Section 501-09 . TEST the system for normal operation.

No
REPAIR the circuit in question. TEST the system for normal operation.

J5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system

	for normal operation.

Pinpoint Test K: The Courtesy Lamps Are Inoperative From The Dimmer Control Switch

Refer to Wiring Diagrams Cell 89 , Interior Lighting for schematic and connector information.

Normal Operation

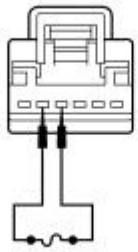
The smart junction box (SJB) monitors the dimmer switch status on circuit CLN28 (GN/BU) to determine if the courtesy lamps are requested. Based on the dimmer switch status, the SJB supplies voltage to the courtesy lamps through circuit CLN09 (YE/GN).

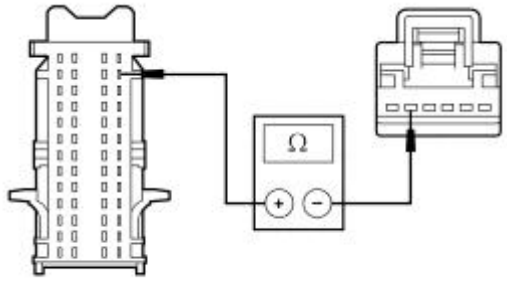
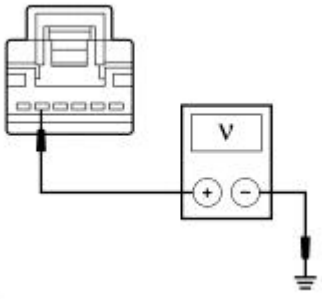
Possible Causes

- Circuit CLN28 (GN/BU) open or short to voltage
- Dimmer switch
- SJB

PINPOINT TEST K: THE COURTESY LAMPS ARE INOPERATIVE FROM THE DIMMER SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
K1 CHECK THE PANEL ILLUMINATION OPERATION	
• Observe the panel illumination lamps while rotating the dimmer switch from the low to high position. • **Do the panel illumination lamps operate correctly?**	**Yes** GO to K2 . **No** REFER to Section 413-00 .
K2 CHECK THE DIMMER SWITCH	
• Key in OFF position. • Disconnect: Dimmer Switch C2065. • Connect a fused (2A) jumper wire between the dimmer switch C2065-5, circuit CLN28 (GN/BU), harness side and the dimmer switch C2065-4, circuit RLN29 (WH/OG), harness side.  N0037303 • **Do the courtesy lamps illuminate?**	**Yes** INSTALL a new dimmer switch. REFER to Section 413-00 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to K3 .
K3 CHECK CIRCUIT CLN28 (GN/BU) FOR AN OPEN	
• Disconnect: SJB C2280g. • Measure the resistance between the dimmer switch C2065-5, circuit CLN28 (GN/BU), harness side and the SJB C2280g-	**Yes** GO to K4 .

51, circuit CLN28 (GN/BU), harness side.  N0057291 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. TEST the system for normal operation.
K4 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between the dimmer switch C2065-5, circuit CLN28 (GN/BU), harness side and ground.  N0057292 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to K5 .
K5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Puddle Lamps Stay On Continuously

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the puddle lamps through circuit CLN25 (VT). The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD143 (BK/VT), and the RH exterior mirror is grounded through circuit GD138 (BK/WH).

DTC B2A39 — sets when the SJB detects a short to voltage on the puddle lamp output circuit.

Possible Causes

- Circuit CLN25 (VT) short to voltage
- SJB

PINPOINT TEST L: THE PUDDLE LAMPS STAY ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
L1 CHECK CIRCUIT CLN25 (VT) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280d. • **Do the puddle lamps continue to illuminate?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to L2 .
L2 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Daytime Running Lamps (DRL)

Printable View (79 KB)

Expedition

NOTE: The smart junction box (SJB) must be configured when installing a new module. For additional information, refer to Section 418-01 .

The DRL system operates the low beam headlamps at a reduced intensity.

The SJB supplies pulse width modulated (PWM) voltage to illuminate the low beam headlamps at a reduced intensity when the following conditions are met:

- The ignition switch is in the RUN position.
- The headlamps have not been turned on by the autolamp system or the headlamp switch.
- The transmission is not in PARK (P).

Navigator

NOTE: The SJB must be configured when installing a new module. For additional information, refer to Section 418-01 .

The DRL system illuminates the fog lamps at full intensity.

The SJB energizes the fog lamp relay when the following conditions are met:

- The ignition switch is in the RUN position.
- The headlamps have not been turned on by the autolamp system or the headlamp switch.
- The transmission is not in PARK (P).

Daytime Running Lamps (DRL)

Printable View (89 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: When installing a new smart junction box (SJB), it must be configured for this feature, if originally equipped. Refer to Section 418-01 .

The SJB controls the DRL by using various inputs to determine whether or not the DRL should be illuminated. These inputs include:

- Ignition switch position
- Headlamp switch position
- Headlamps on or off
- Transmission gear selection

Inspection and Verification

1. Verify the customer concern by operating the daytime running lamps (DRL) following these steps:
   - Place the ignition switch in the RUN position.
   - Place the headlamp switch in the OFF position.
   - Place the transmission in any gear other than PARK (P).
   - If the DRL does not operate, make sure the SJB is configured for DRL before proceeding to the next step.

2. Carry out the continuous and on-demand self tests for the SJB.
   - If any DTCs are retrieved related to the concern, refer to Section 419-10 .
     - If no DTCs are retrieved, go to the next step.

3. For Expedition, verify the low beam operation.
   - Place the headlamp switch in the HEADLAMPS ON position.
     - If the low beams do not operate correctly, refer to Section 417-01 .
     - If the low beams operate correctly and the DRL operation is incorrect, proceed to the next step.

4. For Navigator, verify the fog lamp operation.
   - Place the ignition switch in the RUN position.
   - Place the headlamp switch in the HEADLAMPS ON position and engage the fog lamp switch.

- If the fog lamps do not operate correctly, refer to Section 417-01 .
- If the fog lamps operate correctly and the DRL operation is incorrect, proceed to the next step.

5. Check the SJB inputs.
   - Monitor the ignition switch, the headlamp switch input PIDs and the transmission gear status PIDs.
     - If the ignition switch PIDs do not agree with the ignition switch position, refer to Section 211-05 .
     - If the transmission gear status PIDs do not agree with the gear selector lever position, refer to Section 307-01A or Section 307-01B .
     - If the headlamp switch PIDs do not agree with the headlamp switch position, refer to Section 417-01 .
     - If the PIDs indicate correct ignition, headlamp switch and transmission gear status, install a new SJB. Refer to Section 419-10 . Test the system for normal operation.

Communications Network

Printable View (120 KB)

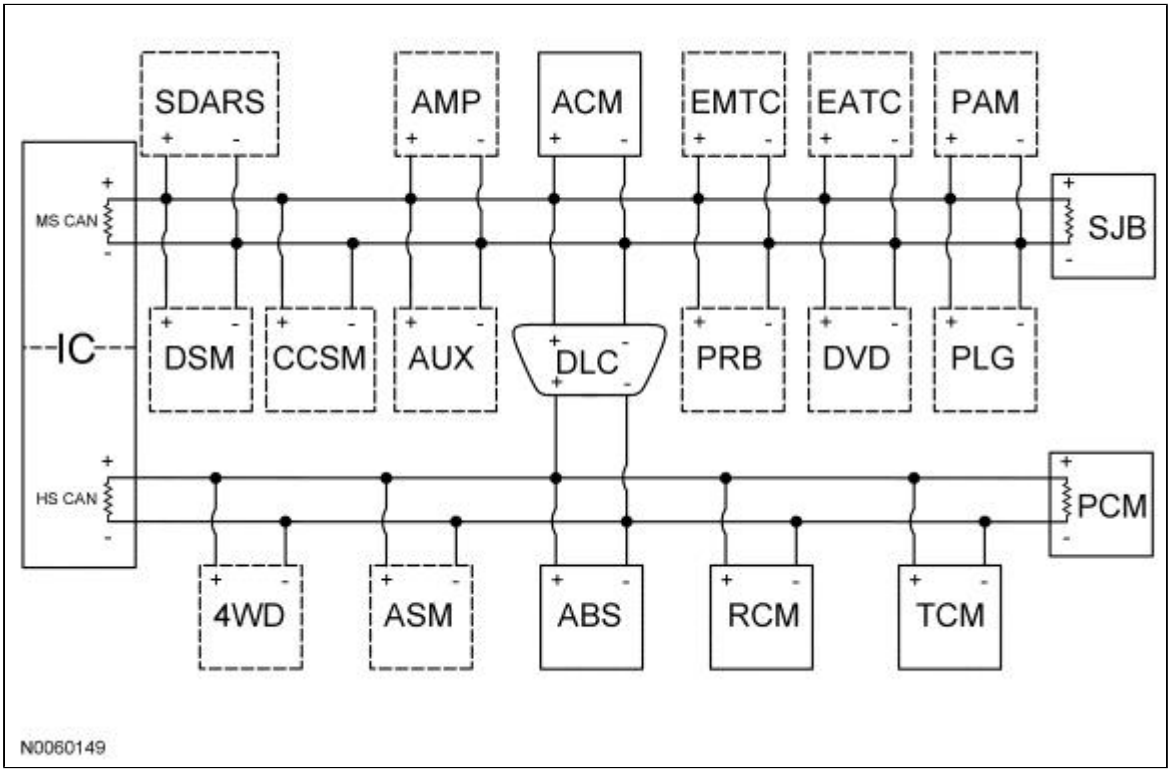
Vehicle communication utilizes both medium and high speed controller area network (CAN) communications. CAN is used for many modules to communicate with each other on a common network. CAN in-vehicle networking, is a method for transferring data among distributed electronic modules via a serial data bus. Without serial networking, intermodule communication requires dedicated, point to point wiring resulting in bulky, expensive, complex, and difficult to install wiring harnesses. Applying a serial data network reduces the number of wires combining the signals on a single network. Information is sent to the individual control modules that control each function.

The vehicle has 2 module communication networks:

- Medium speed (MS) CAN
- High speed (HS) CAN

Both networks are connected to the data link connector (DLC). This makes diagnosis and testing of these systems easier by allowing one scan tool to be able to diagnose and control any module on both networks from one connector. The DLC can be found under the instrument panel between the steering column and the audio unit.

Network Topology



Module Name	Network Type	Termination Module
Air suspension module (ASM) (if equipped)	HS-CAN	No
Audio control module (ACM)	MS-CAN	No
Auxiliary audio module (AUX) (if equipped)	MS-CAN	No

Anti-lock brake system (ABS) module	HS-CAN	No
Digital versatile disc (DVD) player (if equipped)	MS-CAN	No
Driver seat module (DSM) (if equipped)	MS-CAN	No
Electronic automatic temperature control (EATC) module (if equipped)	MS-CAN	No
Electronic manual temperature control module (if equipped)	MS-CAN	No
Climate controlled seat module (if equipped)	MS-CAN	No
Four wheel drive (4WD) control module (if equipped)	HS-CAN	No
Instrument cluster (IC) (gateway module)	HS-CAN MS-CAN	Yes Yes
Parking aid module (PAM) (if equipped)	MS-CAN	No
Power liftgate (PLG) module (if equipped)	MS-CAN	No
Power running board module (PRB) (if equipped)	MS-CAN	No
Powertrain control module (PCM)	HS-CAN	Yes
Restraints control module (RCM)	HS-CAN	No
Smart junction box (SJB)	MS-CAN	Yes
Satellite digital audio radio system (SDARS) (if equipped)	MS-CAN	No
THX® amplifier (AMP) (if equipped)	MS-CAN	No
Transmission control module (TCM) (if equipped)	HS-CAN	No

MS-CAN Network Operation

The MS-CAN network communicates using bussed messages. The MS-CAN has an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The MS-CAN is a medium speed communication network used for the following modules:

- SJB
- Audio unit
- Instrument cluster
- DSM (if equipped)
- DVD player (if equipped)
- Electronic manual temperature control module (if equipped)
- EATC module (if equipped)
- SDARS module (if equipped)
- Parking aid module (if equipped)
- Power liftgate module (if equipped)
- Auxiliary audio module (if equipped)
- THX® amplifier (if equipped)
- Power running board module (if equipped)
- Climate controlled seat module (if equipped)

HS-CAN Network Operation

The HS-CAN network communicates using bussed messages. The HS-CAN network uses an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The HS-CAN is a high speed communication network used for the following modules:

- PCM
- RCM
- ABS module
- Instrument cluster
- TCM (if equipped)
- 4WD control module (if equipped)
- Air suspension module (if equipped)

Network Termination

The CAN network uses a network termination circuit to improve communication reliability. The network termination of the CAN bus takes place inside the termination modules by termination resistors. Termination modules are located at either end of the bus network. As network messages are broadcast in the form of voltage signals, the network voltage signals are stabilized by the termination resistors. Each termination module has a 120 ohm resistor across the positive and negative bus connection in the termination module. With 2 termination modules on each network, and the 120 ohm resistors located in a parallel circuit configuration, the total network impedance, or total resistance is 60 ohms.

Network termination improves bus message reliability by:

- stabilizing bus voltage.
- eliminating electrical interference.

Gateway Module

The instrument cluster is the gateway module, translating HS-CAN to MS-CAN and vice versa. This information allows a message to be distributed throughout both networks. The instrument cluster is the only module on this vehicle that has this ability.

Communications Network

Printable View (836 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

Vehicle communication utilizes both medium and high speed controller area network (CAN) communications. CAN is a method for transferring data among distributed electronic modules via a serial data bus.

The vehicle is equipped with 2 module communication networks:

- Medium speed (MS) CAN
- High speed (HS) CAN

MS-CAN

The MS-CAN is a medium speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The MS-CAN network will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The MS-CAN network may remain operational when 1 of the 2 termination resistors are not present.

The MS-CAN network operates at a maximum data transfer speed of 125 Kbps for bus messages and designed for general information transfer. The network will remain operational, but at a degraded level when certain circuit faults are present. The HS-CAN network may remain operational with only one termination resistor present.

The following modules are on the MS-CAN network:

- Smart junction box (SJB)
- Instrument cluster
- Audio unit
- THX® amplifier (if equipped)
- Satellite radio receiver (if equipped)
- Power running board module (if equipped)
- Parking aid module (if equipped)
- Power liftgate module (if equipped)
- Electronic manual temperature control module (if equipped)
- Electronic automatic temperature control (EATC) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Climate controlled seat module (if equipped)
- Auxiliary audio module (if equipped)
- Digital versatile disc (DVD) player (if equipped)

The following fault chart describes the specific MS-CAN network failures and their resulting symptom:

MS-CAN Network Communication Fault Chart

Failure Description	Symptom
MS-CAN (+) shorted to MS-CAN (-)	No communication
MS-CAN (+) short to voltage	No communication
MS-CAN (-) short to voltage	No communication
MS-CAN (+) short to ground	No communication
MS-CAN (-) short to ground	Unreliable communication
MS-CAN (+) open	Unreliable communication
MS-CAN (-) open	Unreliable communication
Module loss of voltage or ground	No communication
Module internal failure	No communication

HS-CAN

The HS-CAN is a high speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The HS-CAN network will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The HS-CAN bus may remain operational when 1 of the 2 termination resistors are not present.

The HS-CAN network operates at a maximum data transfer speed of 500 Kbps and is designed for real time information transfer and control. The network will remain operational, but at a degraded level when certain circuit faults are present. The HS-CAN network may remain operational with only one termination resistor present.

The following modules are on the HS-CAN network:

- Powertrain control module (PCM)

- Anti-lock brake system (ABS) module
- Restraints control module (RCM)
- Instrument cluster
- Transmission control module (TCM)
- Four wheel drive (4WD) control module (if equipped)
- Air suspension module (if equipped)

The following fault chart describes the specific HS-CAN network failures and their resulting symptom:

HS-CAN Network Communication Fault Chart

Failure Description	Symptom
HS-CAN (+) shorted to HS-CAN (-)	No communication
HS-CAN (+) short to voltage	No communication
HS-CAN (-) short to voltage	No communication
HS-CAN (+) short to ground	No communication
HS-CAN (-) short to ground	Unreliable communication
HS-CAN (+) open	Unreliable communication
HS-CAN (-) open	Unreliable communication
Module loss of voltage or ground	No communication
Module internal failure	No communication

The following chart describes the specific CAN network messages broadcast by each module, and the module(s) that receive the message:

CAN Network Module Communication Message Chart

Broadcast Message	Originating Module	Network Type	Receiving Module(s)
ABS event in progress	Anti-lock brake system (ABS) module	HS-CAN	• Powertrain control module (PCM) • Restraints control module (RCM)
ABS/trac system configuration	ABS module	HS-CAN	• Four wheel drive (4WD) control module
ABS malfunction indicator request	ABS module	HS-CAN	• Instrument cluster
A/C clutch inhibit request	Transmission control module (TCM)	HS-CAN	• PCM
A/C clutch request	Electronic automatic temperature control (EATC) module	MS-CAN	• Instrument cluster
A/C clutch request (gateway)	Instrument cluster	HS-CAN	• PCM
A/C clutch status	PCM	HS-CAN	• Instrument cluster • TCM
A/C clutch status (gateway)	Instrument cluster	MS-CAN	• EATC module

Accelerator pedal position	PCM	HS-CAN	• ABS module • RCM • TCM • 4WD control module
Accessory delay status	Smart junction box (SJB)	MS-CAN	• Audio unit
Advance-Trac (stability control) event in progress	ABS	HS-CAN	• PCM • RCM
Advance-Trac (stability control) indicator/message request	ABS	HS-CAN	• Instrument cluster
Airbag deployment event status	RCM	HS-CAN	• PCM
Airbag malfunction indicator request	RCM	HS-CAN	• Instrument cluster
Air suspension enable status	Instrument cluster	HS-CAN	• Air suspension module
Air suspension status	Air suspension module	HS-CAN	• Instrument cluster
Ambient temperature	EATC module	MS-CAN	• Instrument cluster • Power running board module
Autolamp delay request	Instrument cluster	MS-CAN	• SJB
Autolamp delay status	SJB	MS-CAN	• Instrument cluster
Axle ratio	PCM	HS-CAN	• ABS module • Instrument cluster • TCM
Barometric pressure	PCM	HS-CAN	• Instrument cluster • TCM
Barometric pressure (gateway)	Instrument cluster	MS-CAN	• SJB
Brake fluid level status	SJB	MS-CAN	• Instrument cluster
Brake malfunction indicator request	ABS module	HS-CAN	• Instrument cluster
Brake switch status	PCM	HS-CAN	• Instrument cluster • RCM • TCM • 4WD control module
Charging system malfunction indicator request	PCM	HS-CAN	• Instrument cluster
Charging system status	PCM	HS-CAN	• Instrument cluster
Climate controlled seat setting	EATC module	MS-CAN	• Climate controlled seat module
Climate controlled seat status	Climate controlled seat module	MS-CAN	• EATC module
Door ajar status	SJB	MS-CAN	• Instrument cluster • Power running board module
Door ajar status (gateway)	Instrument cluster	HS-CAN	• ABS module • Air suspension module
Door lock enabled (autolock)	Instrument cluster	MS-CAN	• SJB
Door unlock enabled (auto un-lock)	Instrument cluster	MS-CAN	• SJB
Door lock enabled status	SJB	MS-CAN	• Instrument cluster

(autolock)			
Door unlock enabled status (auto un-lock)	SJB	MS-CAN	• Instrument cluster
Easy entry/exit command	Instrument cluster	MS-CAN	• Driver seat module (DSM)
Easy entry/exit status	DSM	MS-CAN	• Instrument cluster
Engine coolant temperature	PCM	HS-CAN	• ABS module • Instrument cluster • TCM
Engine coolant temperature (gateway)	Instrument cluster	MS-CAN	• EATC module
Engine fail-safe cooling mode status	PCM	HS-CAN	• Instrument cluster • TCM
Engine fail-safe electronic throttle control (ETC) mode status	PCM	HS-CAN	• TCM
Engine load %	PCM	HS-CAN	• TCM
Engine malfunction indicator lamp (MIL) request	PCM	HS-CAN	• Instrument cluster
Engine malfunction indicator lamp (MIL) request	TCM	HS-CAN	• PCM • Instrument cluster
Engine off timer	PCM	HS-CAN	• Instrument cluster
Engine off timer (gateway)	Instrument cluster	MS-CAN	• EATC module
Engine RPM	PCM	HS-CAN	• ABS module • Air suspension module • Instrument cluster • TCM
Engine RPM (gateway)	Instrument cluster	MS-CAN	• Climate controlled seat module • EATC module
Engine RPM request	TCM	HS-CAN	• PCM
Engine torque data	PCM	HS-CAN	• TCM
Engine torque reduction request	ABS module	HS-CAN	• PCM • 4WD control module
Engine torque reduction request	TCM	HS-CAN	• PCM
Fuel cap off indicator request	PCM	HS-CAN	• Instrument cluster
Fuel level input status (instant)	Instrument cluster	HS-CAN	• PCM
Headlamp high beam indicator request	SJB	MS-CAN	• Instrument cluster
Headlamp warning chime request	SJB	MS-CAN	• Instrument cluster
Ignition switch position	Instrument cluster	HS-CAN	• ABS module • Air suspension module • PCM • RCM • TCM • 4WD control module
Ignition switch position	SJB	MS-CAN	• Audio unit

			• Auxiliary audio module • Climate controlled seat module • DSM • Digital versatile disc (DVD) player • EATC module • Parking aid module • Power liftgate module • Power running board module • Satellite digital audio radio system (SDARS) • THX® amplifier
Illumination dimmer level	SJB	MS-CAN	• Audio unit • EATC module • Instrument cluster
Key fob button status	SJB	MS-CAN	• DSM
Key-in-ignition status	SJB	MS-CAN	• DSM
Key-in-ignition chime request	SJB	MS-CAN	• Instrument cluster
Navigation radio rolling wheel count	ABS module	HS-CAN	• Instrument cluster
Navigation radio rolling wheel count (gateway)	Instrument cluster	MS-CAN	• Audio unit
Odometer count	PCM	HS-CAN	• Instrument cluster
Parking aid disable switch status	Instrument cluster	MS-CAN	• Parking aid module
Parking aid system status	Parking aid module	MS-CAN	• Instrument cluster
Parking brake status	SJB	MS-CAN	• Instrument cluster
Parking brake status (gateway)	Instrument cluster	HS-CAN	• PCM
PATS OK to start	Instrument cluster	HS-CAN	• PCM
PATS security data	Instrument cluster	HS-CAN	• PCM
PATS security data	PCM	HS-CAN	• Instrument cluster
PATS theft condition	PCM	HS-CAN	• Instrument cluster
Power liftgate enable/disable	Instrument cluster	MS-CAN	• Power liftgate module
Power liftgate command	SJB	MS-CAN	• Power liftgate module
Power liftgate status	Power liftgate module	MS-CAN	• Instrument cluster
Power running board enable/disable	Instrument cluster	MS-CAN	• Power running board module
Power running board status	Power running board module	HS-CAN	• Instrument cluster
Power running board status (gateway)	Instrument cluster	HS-CAN	• Air suspension module
Safety belt indicator request	RCM	HS-CAN	• Instrument cluster
Safety belt indicator status	Instrument cluster	HS-CAN	• RCM
Safety belt minder chime/flash request	RCM	HS-CAN	• Instrument cluster
Safety belt minder chime/flash	Instrument cluster	HS-CAN	• RCM

status			
Speed control indicator request	PCM	HS-CAN	• Instrument cluster
Speed control status	PCM	HS-CAN	• Instrument cluster • TCM
Speed control target speed	PCM	HS-CAN	• TCM
Steering wheel angle	ABS	HS-CAN	• TCM • 4WD control module
Throttle position	PCM	HS-CAN	• TCM
Tire pressure monitoring system (TPMS) status	SJB	MS-CAN	• Instrument cluster
TPMS sensor status (LF, RF, RR, LR, spare)	SJB	MS-CAN	• Instrument cluster
Tire size information	ABS module	HS-CAN	• PCM
Torque converter lockup status	TCM	HS-CAN	• Instrument cluster • PCM
Transmission malfunction indicator request	TCM	HS-CAN	• Instrument cluster
Transmission output shaft speed	TCM	HS-CAN	• PCM
Transmission overdrive indicator request	TCM	HS-CAN	• Instrument cluster
Transmission selector (PRNDL) range	TCM	HS-CAN	• ABS module • Instrument cluster • PCM • 4WD control module
Transmission selector (PRNDL) range (gateway)	Instrument cluster	MS-CAN	• Audio unit • DSM • SJB • Parking aid module • Power liftgate module
Transmission shift in progress	TCM	HS-CAN	• ABS module • PCM
Transmission temperature	TCM	HS-CAN	• PCM
Transmission torque converter lockup status	TCM	HS-CAN	• PCM
Transmission turbine shaft speed	TCM	HS-CAN	• PCM
Turn signal request	SJB	MS-CAN	• Instrument cluster
Vehicle speed	PCM	HS-CAN	• Air suspension module • Instrument cluster • RCM
Vehicle speed (gateway)	Instrument cluster	MS-CAN	• Audio unit • EATC module • Climate controlled seat module • Parking aid module • Power liftgate module • Power running board module • SJB
VIN information	PCM	HS-CAN	• ABS module

			• Instrument cluster • RCM • TCM • 4WD control module
VIN information (gateway)	Instrument cluster	MS-CAN	• EATC module
Wheel speed output (RF, LF, RR, LR)	ABS module	HS-CAN	• PCM • TCM • 4WD control module
4WD coupling mode and status	4WD control module	HS-CAN	• ABS module • Instrument cluster • PCM • TCM
4WD auto indicator/message request	4WD control module	HS-CAN	• Instrument cluster
4WD high indicator/message request	4WD control module	HS-CAN	• Instrument cluster
4WD low indicator/message request	4WD control module	HS-CAN	• Instrument cluster

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical

• Battery junction box (BJB) fuse(s):
  ▪ 7 (40A) (no communication with power running board module)
  ▪ 8 (40A) (no communication with climate controlled seat module)
  ▪ 35 (20A) (no communication with 4WD control module)
  ▪ 36 (10A) (no communication with PCM)
  ▪ 37 (15A) (no communication with TCM)
  ▪ 43 (20A) (no communication with 4WD control module)
  ▪ 45 (30A) (no communication with DSM)
  ▪ 47 (30A) (no communication with air suspension module)
  ▪ 65 (10A) (no communication with air suspension module)
  ▪ 73 (5A) (no communication with TCM)
  ▪ 76 (20A) (no communication with PCM)
  ▪ 77 (10A) (no communication with ABS module)
• Smart junction box (SJB) fuse(s):
  ▪ 2 (15A) (no communication with DSM)
  ▪ 3 (15A) (no communication with satellite radio receiver, auxiliary audio module, DVD)
  ▪ 5 (10A) (no communication with SJB)
  ▪ 14 (10A) (no communication with power liftgate module)
  ▪ 15 (10A) (no communication with electronic manual temperature control module, EATC module)
  ▪ 20 (15A) (no power to scan tool)
  ▪ 26 (10A) (no communication with instrument cluster)
  ▪ 27 (20A) (no communication with SJB)
  ▪ 28 (5A) (no communication with audio unit)
  ▪ 29 (5A) (no communication with instrument cluster)
  ▪ 32 (10A) (no communication with RCM)

    - 35 (10A) (no communication with parking aid module)
    - 37 (10A) (no communication with Electronic manual temperature control module, EATC module)
    - 38 (20A) (no communication with THX® amplifier)
    - 39 (20A) (no communication with audio unit)
    - 40 (20A) (no communication with THX® amplifier)
- Data link connector (DLC)
- Wiring harness
- Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the DLC.

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Go To Pinpoint Test W , to diagnose no power to the scan tool.

5. **NOTE:** During the network test, the scan tool will first attempt to communicate with the PCM, after establishing communication with the PCM, the scan tool will then attempt to communicate with all other modules on the vehicle.

   Carry out the network test.
   - If the network test passes, retrieve and record the continuous memory DTCs and proceed to Step 6.
   - If the network test fails, GO to Symptom Chart to identify the module not communicating.

6. If the DTCs retrieved are related to the concern, go to the Communication Network Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Communication Network Diagnostic Trouble Codes (DTC) Chart

NOTE: DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module.

DTC	Description	Source	Action
U0001	High Speed CAN Communication Bus Off	Anti-lock brake system (ABS) module	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0073	Control Module Communication Bus Off	Air suspension module	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0073	Control Module	Transmission	The module could not communicate on the

	Communication Bus Off	control module (TCM)	network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0100	Lost Communication With ECM/PCM	ABS module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test A .
U0100	Lost Communication With ECM/PCM	Air suspension module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test A .
U0100	Lost Communication With ECM/PCM	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test A .
U0100	Lost Communication With ECM/PCM	TCM	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test A .
U0100	Lost Communication With ECM/PCM	Four wheel drive (4WD) control module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test A .
U0101	Lost Communication With TCM	ABS module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test B .
U0101	Lost Communication With TCM	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test B .
U0101	Lost Communication With TCM	4WD control module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test B
U0102	Lost Communication With Transfer Case Control Module (4x4CM)	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test E .
U0102	Lost Communication With Transfer Case Control Module (4x4CM)	TCM	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test E .
U0114	Lost Communication With Four-Wheel Drive Control Module	ABS module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test E .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test C .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	TCM	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test C .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	4WD control module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test C .
U0122	Lost Communication With Vehicle Dynamics Control Module	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test F .
U0140	Lost Communication With Body Control Module (GEM)	ABS module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .

U0140	Lost Communication With Body Control Module (GEM)	Air suspension module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .
U0140	Lost Communication With Body Control Module (GEM)	Audio unit	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	Auxiliary audio module	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	Driver seat module (DSM)	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .
U0140	Lost Communication With Body Control Module (GEM)	DVD player	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .
U0140	Lost Communication With Body Control Module (GEM)	Parking aid module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .
U0140	Lost Communication With Body Control Module (GEM)	Power liftgate module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test H .
U0151	Lost Communication With Restraints Control Module	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test D .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	ABS module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test G .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Air suspension module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test G .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Audio unit	REFER to Section 415-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	DSM	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Parking aid module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test G .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Power liftgate module	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test G .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Smart junction box	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test G .

U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	THX® amplifier	REFER to Section 415-00 .
U0159	Lost Communication With Parking Assist Control Module (PAM)	Audio unit	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test S .
U0159	Lost Communication With Parking Assist Control Module (PAM)	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test S .
U0164	Lost Communication With HVAC Control Module (EATC)	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test I .
U0184	Lost Communication With Radio (ACM)	Auxiliary audio module	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	Digital versatile disc (DVD) player	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	Satellite radio receiver	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	THX® amplifier	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Audio unit	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Auxiliary audio module	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	DVD player	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Audio unit	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Satellite radio receiver	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	THX® amplifier	REFER to Section 415-00 .
U0208	Lost Communication With Seat Control Module	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test P .
U0230	Lost Communication With Rear Gate Module (LTM)	Instrument cluster	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, Go To Pinpoint Test T .
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	Audio unit	REFER to Section 415-00 .
U0244	Lost Communication	Instrument	CLEAR the DTC. REPEAT the network test with

	With Running Board Control Module (PRB)	cluster	the scan tool. If the DTC returns, Go To Pinpoint Test R .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	Audio unit	REFER to Section 415-00 .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	Satellite radio receiver	REFER to Section 415-00 .
U0255	Lost Communication With Front Controls Interface Module	Satellite radio receiver	REFER to Section 415-00 .
U0256	Lost Communication With Front Display Interface Module	Satellite radio receiver	REFER to Section 415-00 .
U0401	Invalid Data Received from ECM/PCM A	ABS module	RETRIEVE and FOLLOW DTCs from the PCM.
U0402	Invalid Data Received from TCM	ABS module	RETRIEVE and FOLLOW DTCs from the TCM.
U0414	Invalid Data Received from 4WD module	ABS module	RETRIEVE and FOLLOW DTCs from the 4WD control module.
U0415	Invalid Data Received from Anti-Lock Brake System (ABS) Control Module	4WD control module	RETRIEVE and FOLLOW DTCs from the ABS module.
U1900	CAN Communication Bus Fault-Receive Error	Power running board module	GO to Symptom Chart for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	Restraints control module (RCM)	GO to Symptom Chart for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	4WD	GO to Symptom Chart for module that failed network test.
U1901	CAN Network #2 Communication Bus Fault - Receive Error	ABS	REFER to Section 206-09 .
U2011	Module Transmitted Invalid Data (Non SCP)	Air suspension module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2013	Compass Module is not Responding	Instrument cluster	REFER to Section 413-08 .
U2023	Fault Received From External Node	Instrument cluster	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2023	Fault Received From External Node	Parking aid module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2023	Fault Received From External Node	4WD	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.

U2471	Unexpected PRNDL State	DSM	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2471	Unexpected PRNDL State	Parking aid module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2471	Unexpected PRNDL State	Power liftgate module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2472	Unexpected Ignition State	Instrument cluster	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2472	Unexpected Ignition State	Parking aid module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2472	Unexpected Ignition State	Power liftgate module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2472	Unexpected Ignition State	Smart junction box (SJB)	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2473	Unexpected Vehicle Speed (VSS)	Audio unit	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2473	Unexpected Vehicle Speed (VSS)	Parking aid module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2473	Unexpected Vehicle Speed (VSS)	Power liftgate module	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .
U2473	Unexpected Vehicle Speed (VSS)	SJB	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The powertrain control module (PCM) does not respond to the scan tool	• Circuitry • PCM	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, Section 5, pinpoint test QA before proceeding to Pinpoint Test A . If pinpoint test QA has been completed, Go To Pinpoint Test A .
• The transmission control module (TCM) does not respond to the scan tool	• Fuse • Circuitry • TCM	• Go To Pinpoint Test B .
• The anti-lock brake system (ABS) module does not respond to the scan tool	• Fuse • Circuitry • ABS module	• Go To Pinpoint Test C .
• The restraints control module (RCM) does not respond to the scan tool	• Fuse • Circuitry • Case ground open • RCM	• Go To Pinpoint Test D .
• The four wheel drive (4WD) control module	• Fuse • Circuitry	• Go To Pinpoint Test E .

does not respond to the scan tool	• 4WD control module	
• The air suspension module does not respond to the scan tool	• Fuse • Circuitry • Air suspension module	• Go To Pinpoint Test F .
• The instrument cluster does not respond to the scan tool	• Fuse • Circuitry • Instrument cluster	• Go To Pinpoint Test G .
• The smart junction box (SJB) does not respond to the scan tool	• Fuse • Circuitry • SJB	• Go To Pinpoint Test H .
• The electronic manual temperature control module does not respond to the scan tool	• Fuse • Circuitry • Electronic manual temperature control module	• Go To Pinpoint Test I .
• The electronic automatic temperature control (EATC) module does not respond to the scan tool	• Fuse • Circuitry • EATC module	• Go To Pinpoint Test J .
• The audio unit does not respond to the scan tool	• Fuse • Circuitry • Audio unit	• Go To Pinpoint Test K .
• The THX® amplifier does not respond to the scan tool	• Fuse • Circuitry • THX® amplifier	• Go To Pinpoint Test L .
• The satellite radio receiver does not respond to the scan tool	• Fuse • Circuitry • Satellite radio receiver	• Go To Pinpoint Test M .
• The auxiliary audio module does not respond to the scan tool	• Fuse • Circuitry • Auxiliary audio module	• Go To Pinpoint Test N .
• The digital versatile disc (DVD) player does not respond to the scan tool	• Fuse • Circuitry • DVD player	• Go To Pinpoint Test O .
• The driver seat module (DSM) does not respond to the scan tool	• Fuse • Circuitry • DSM	• Go To Pinpoint Test P .
• The climate controlled seat module does not respond to the scan tool	• Fuse • Circuitry • Climate controlled seat module	• Go To Pinpoint Test Q .
• The power running board module does not respond to the	• Fuse • Circuitry • Power running	• Go To Pinpoint Test R .

scan tool	board module	
• The parking aid module does not respond to the scan tool	• Fuse • Circuitry • Parking aid module	• Go To Pinpoint Test S .
• The power liftgate module does not respond to the scan tool	• Fuse • Circuitry • Power liftgate module	• Go To Pinpoint Test T .
• No medium speed controller area network (MS-CAN) communication, all modules are not responding	• Circuitry • Audio unit • SJB • Instrument cluster • THX® amplifier (if equipped) • Satellite radio receiver (if equipped) • Climate controlled seat module (if equipped) • Auxiliary audio module (if equipped) • DVD player (if equipped) • DSM (if equipped) • Electronic manual temperature control module (if equipped) • EATC module (if equipped) • Parking aid module (if equipped) • Power running board module (if equipped) • Power liftgate module (if equipped)	• Go To Pinpoint Test U .
• No high speed controller area network (HS-CAN) communication, all modules are not responding	• Circuitry • PCM • ABS module • RCM • Instrument cluster • TCM • Air suspension module (if equipped) • 4WD control module (if equipped)	• Go To Pinpoint Test V .
• No power to the scan tool	• Fuse • Circuitry	• Go To Pinpoint Test W .

	• Scan tool	

Pinpoint Tests

Pinpoint Test A: The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 25 , Electronic Engine Controls - 5.4L for schematic and connector information.

Normal Operation

The PCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the PCM. The PCM shares the HS-CAN network with the transmission control module (TCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped), the air suspension module (if equipped) and the instrument cluster.

DTC U0100 — sets in a module which had attempted to communicate with the PCM and failed.

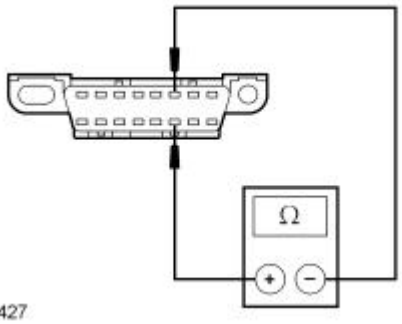
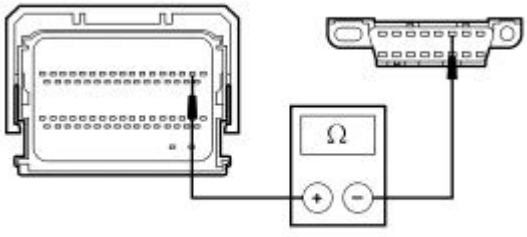
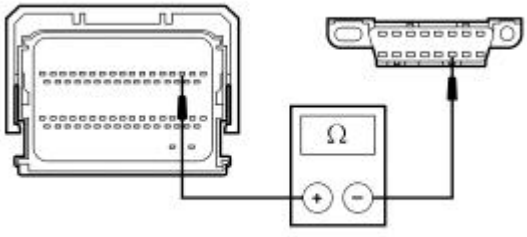
Possible Causes

- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- PCM

PINPOINT TEST A: THE POWERTRAIN CONTROL MODULE (PCM) DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 POWERTRAIN CONTROL/EMISSIONS DIAGNOSIS (PC/ED) MANUAL PINPOINT TEST QA VERIFICATION CHECK	
• Verify that pinpoint test QA has been performed. • **Has pinpoint test QA been performed?**	**Yes** GO to A2 . **No** REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual, Section 5, pinpoint test QA to diagnose no communication with the PCM.
A2 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. • Disconnect the battery ground cable.	**Yes** GO to A4 . **No**

• Measure the resistance between the data link connector (DLC) C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	GO to A3 .
A3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN	
• Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0026577 • Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026578 • **Are the resistances less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
A4 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or

	corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test B: The Transmission Control Module (TCM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 30 , Transmission Controls - 6HP26 for schematic and connector information.

Normal Operation

The TCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the TCM. The TCM shares the HS-CAN network with the powertrain control module (PCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped), the air suspension module (if equipped) and the instrument cluster. Voltage for the TCM is provided by circuits CBB73 (WH/BN) and SBB37 (GY/RD). Circuit GD113 (BK/YE) provides ground.

DTC U0101 — sets in a module which had attempted to communicate with the TCM and failed.

Possible Causes

- Fuse
- Circuit CBB73 (WH/BN) open
- Circuit GD113 (BK/YE) open
- Circuit SBB37 (GY/RD) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- TCM

PINPOINT TEST B: THE TRANSMISSION CONTROL MODULE (TCM) DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>B1 CHECK THE TCM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>

Key in OFF position.
Disconnect: TCM C1548 (Expedition) or C1473 (Navigator).
Key in ON position.
Measure the voltage between the TCM, harness side and ground as follows:

<table>
<tr><th>Vehicle</th><th>TCM Connector-Pin</th><th>Circuit</th></tr>
<tr><td>Navigator</td><td>C1473-14</td><td>SBB37 (GY/RD)</td></tr>
<tr><td>Expedition</td><td>C1548-14</td><td>SBB37 (GY/RD)</td></tr>
</table>
</td><td>Yes
GO to B2 .

No
VERIFY that the battery junction box (BJB) fuse 37 (15A) or fuse 73 (5A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
</table>

Navigator	C1473-9	CBB73 (WH/BN)
Expedition	C1548-9	CBB73 (WH/BN)

- **Are the voltages greater than 10 volts?**

B2 CHECK THE TCM GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the TCM, harness side and ground as follows:

Vehicle	TCM Connector-Pin	Circuit
Navigator	C1473-13	GD113 (BK/YE)
Expedition	C1548-13	GD113 (BK/YE)
Navigator	C1473-16	GD113 (BK/YE)
Expedition	C1548-16	GD113 (BK/YE)

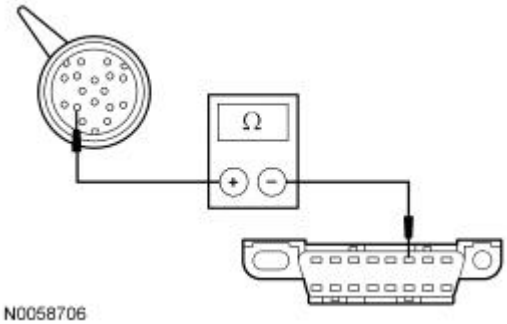
- **Are the resistances less than 5 ohms?**

Yes
GO to B3 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

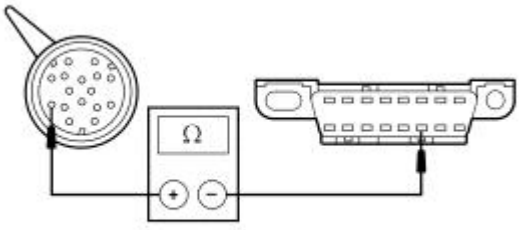
B3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE TCM FOR AN OPEN

- Measure the resistance between the TCM C1473-6 (Navigator) or C1548-6 (Expedition), circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0058706

- Measure the resistance between the TCM C1473-2 (Navigator) or C1548-2 (Expedition), circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.



N0058707

- **Are the resistances less than 5 ohms?**

Yes
GO to B4 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

B4 CHECK FOR CORRECT TCM OPERATION

- Disconnect the TCM connector.
- Check for:
  - corrosion
  - damaged pins

Yes
INSTALL a new TCM. REFER to Section 307-01A for the 6HP26 transmission or

▪ pushed-out pins • Connect the TCM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Section 307-01B for the 6R75. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test C: The Anti-Lock Brake System (ABS) Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the ABS module. The ABS module shares the HS-CAN network with the powertrain control module (PCM), the transmission control module (TCM), the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped), the air suspension module (if equipped) and the instrument cluster. Voltage for the ABS module is provided by circuit CBB77 (WH), and ground is provided by circuit GD120 (BK/GN).

DTC U0121 — sets in a module which had attempted to communicate with the ABS control module and failed.

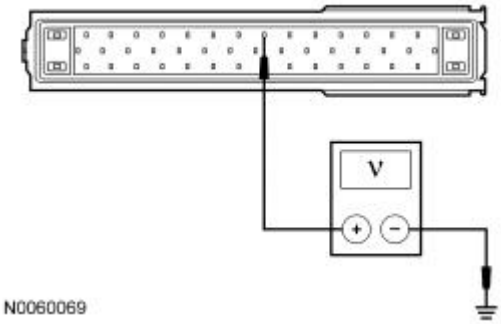
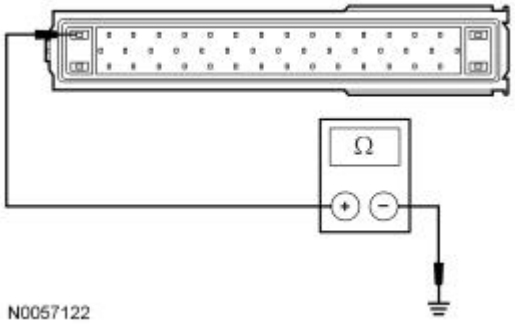
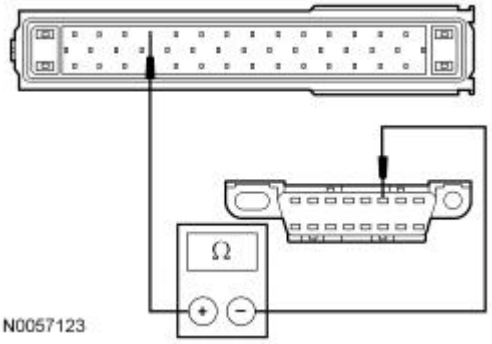
Possible Causes

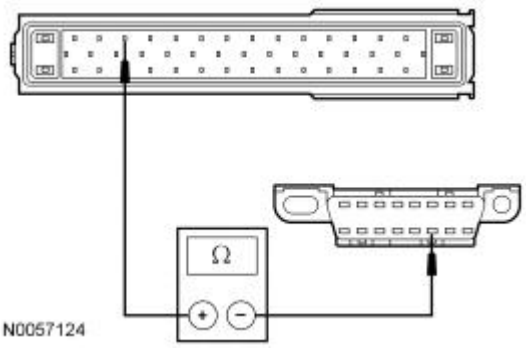
- Fuse
- Circuit CBB77 (WH) open
- Circuit GD120 (BK/GN) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- ABS module

PINPOINT TEST C: THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK THE ABS VOLTAGE SUPPLY CIRCUIT CBB77 (WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: ABS Module C135.	**Yes** GO to C2 .

• Key in ON position. • Measure the voltage between the ABS module C135-8, circuit CBB77 (WH), harness side and ground.  N0060069 • **Is the voltage greater than 10 volts?**	**No** VERIFY the battery junction box (BJB) fuse 77 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
C2 CHECK THE ABS GROUND CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the ABS module C135-16, circuit GD120 (BK/GN), harness side and ground.  N0057122 • **Is the resistance less than 5 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
C3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE ABS MODULE FOR AN OPEN	
• Measure the resistance between the ABS module C135-12, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0057123 • Measure the resistance between the ABS module C135-13, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to C4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 • **Are the resistances less than 5 ohms?**	
C4 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the ABS module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test D: The Restraints Control Module (RCM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The RCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the RCM. The RCM shares the HS-CAN network with the powertrain control module (PCM), the transmission control module (TCM), the anti-lock brake system (ABS) module, the four wheel drive (4WD) control module (if equipped), the air suspension module (if equipped) and the instrument cluster. Voltage for the RCM is provided by circuit CBP32 (GN/VT), and the RCM is case grounded.

DTC U0151 — sets in a module which had attempted to communicate with the RCM and failed.

Possible Causes

- Fuse
- Circuit CBP32 (GN/VT) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- Case ground open
- RCM

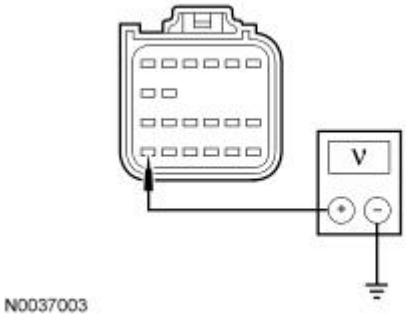
PINPOINT TEST D: THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE SCAN TOOL

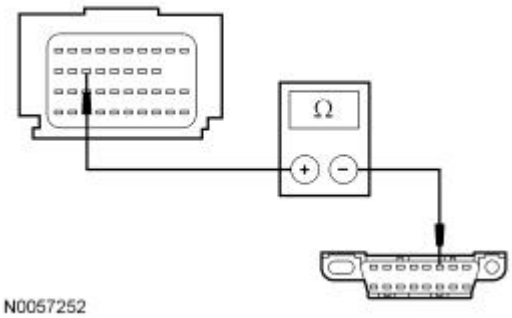
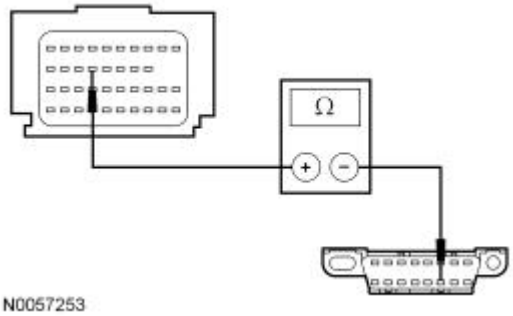
WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

Test Step	Result / Action to Take
D1 CHECK THE RCM CONNECTION • Key in OFF position. • Depower the SRS. Refer to Section 501-20B . • Disconnect: RCM C310a. • Disconnect: RCM C310b. • **Are RCM C310a pin 24 and RCM C310b pins 17 and 18 OK?**	**Yes** GO to D2 . **No** REPAIR the RCM connector pins as necessary. REPOWER the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D2 CHECK THE RCM VOLTAGE SUPPLY CIRCUIT CBP32 (GN/VT) FOR AN OPEN • Deactivate the SRS. Refer to Section 501-20B . • Repower the SRS. Refer to Section 501-20B . • Key in ON position. • Measure the voltage between the RCM C310a-24, circuit CBP32 (GN/VT), harness side and ground.  N0037003 • **Is the voltage greater than 10 volts?**	**Yes** GO to D3 . **No** VERIFY the smart junction box (SJB) fuse 32 (10A) is OK. If OK, REPAIR the circuit. REACTIVATE the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D3 CHECK THE RCM CASE GROUND • Key in OFF position. • Measure the resistance between the RCM case and a good chassis ground. • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR the RCM case ground as necessary. REACTIVATE the SRS. REFER to Section 501-20B .

	CLEAR the DTCs. REPEAT the network test with the scan tool.
D4 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE RCM FOR AN OPEN	
• Measure the resistance between the RCM C310b-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0057252 • Measure the resistance between the RCM C310b-17, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0057253 • **Are the resistances less than 5 ohms?**	**Yes** GO to D5 . **No** REPAIR the circuit in question. REACTIVATE the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D5 CHECK FOR CORRECT RCM OPERATION	
• Disconnect all the RCM connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the RCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RCM. REACTIVATE the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test E: The Four Wheel Drive (4WD) Control Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 34 , Four Wheel Drive Systems for schematic and connector information.

Normal Operation

The 4WD control module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the 4WD control module. The 4WD control module shares the HS-CAN with powertrain control module (PCM), the transmission control module (TCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the air suspension module (if equipped) and the instrument cluster. Voltage is supplied by circuits CBP35 (YE/GY), SBB35 (BU/RD) and SBB43 (BU/RD). Ground is supplied by circuits GD123 (BK/GY) and GD133 (BK).

DTC U0102 or DTC U0114 — sets in a module which had attempted to communicate with the 4WD control module and failed.

Possible Causes

- Fuse
- Circuit CBP35 (YE/GY) open
- Circuit GD123 (BK/GY) open
- Circuit GD133 (BK) open
- Circuit SBB35 (BU/RD) open
- Circuit SBB43 (BU/RD) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- 4WD control module

PINPOINT TEST E: THE FOUR WHEEL DRIVE (4WD) CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>E1 CHECK THE 4WD CONTROL MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN</td><td rowspan="2">Yes
GO to E2 .

No
VERIFY the battery junction box (BJB) fuse 35 (20A) or fuse 43 (20A) is OK and the SJB fuse 35 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: 4WD Control Module C281a.
• Disconnect: 4WD Control Module C281b.
• Key in ON position.
• Measure the voltage between the 4WD control module, harness side and ground as follows:

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C281a-8</td><td>CBP35 (YE/GY)</td></tr><tr><td>C281b-6</td><td>SBB43 (BU/RD)</td></tr><tr><td>C281b-7</td><td>SBB35 (BU/RD)</td></tr></table>• Are the voltages greater than 10 volts?</td></tr>
<tr><td>E2 CHECK THE 4WD CONTROL MODULE GROUND CIRCUITS FOR AN OPEN</td><td rowspan="2">Yes
GO to E3 .

No</td></tr>
<tr><td>• Key in OFF position.
• Measure the resistance between the 4WD control module, harness side and ground as follows:</td></tr>
</table>

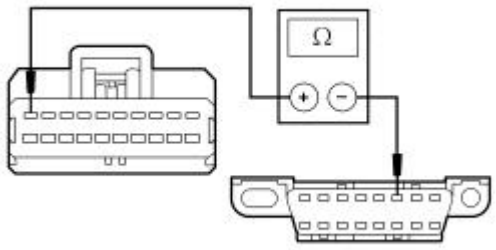
Connector-Pin	Circuit
C281b-3	GD133 (BK)
C281b-10	GD123 (BK/GY)

- **Are the resistances less than 5 ohms?**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

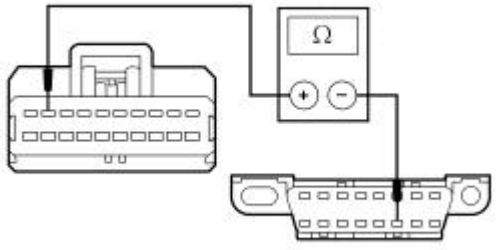
E3 CHECK THE HIGH SPEED CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE 4WD CONTROL MODULE FOR AN OPEN

- Measure the resistance between the 4WD control module C281a-10, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0053241

- Measure the resistance between the 4WD control module C281a-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.



N0053242

- **Are the resistances less than 5 ohms?**

Yes
GO to E4 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

E4 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION

- Disconnect all the 4WD control module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the 4WD control module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a 4WD control module. REFER to Section 308-07A . CLEAR the DTCs. REPEAT the network test with the scan tool.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test F: The Air Suspension Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 41 , Vehicle Dynamic Suspension for schematic and connector information.

Normal Operation

The air suspension module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the air suspension module. The air suspension module shares the HS-CAN with powertrain control module (PCM), the transmission control module (TCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped) and the instrument cluster. Voltage for the air suspension module is provided by circuits CBB65 (WH/OG) and SBB47 (WH/RD). Circuits GD120 (BK/GN) and GD133 (BK) provide ground.

DTC U0122 — sets in a module which had attempted to communicate with the air suspension module and failed.

Possible Causes

- Fuse
- Circuit CBB65 (WH/OG) open
- Circuit SBB47 (WH/RD) open
- Circuit GD120 (BK/GN) open
- Circuit GD133 (BK) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- Air suspension module

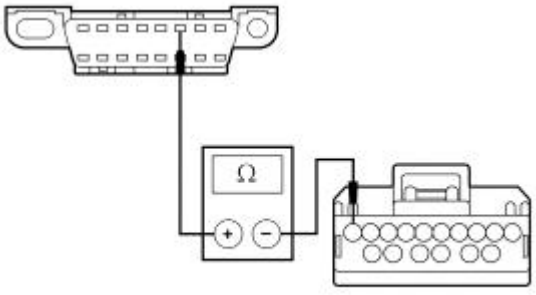
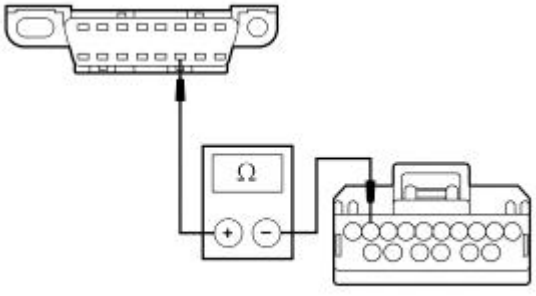
PINPOINT TEST F: THE AIR SUSPENSION MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 CHECK THE AIR SUSPENSION MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN</td><td rowspan="2">Yes
GO to F2 .

No
VERIFY the battery junction box (BJB) fuse 47 (30A) or fuse 65 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Air Suspension Module C2131a.
• Key in ON position.
• Measure the voltage between the air suspension module, harness side and ground as follows:

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C2131a-3</td><td>CBB65 (WH/OG)</td></tr><tr><td>C2131a-11</td><td>SBB47 (WH/RD)</td></tr><tr><td>C2131a-12</td><td>SBB47 (WH/RD)</td></tr></table>
• Are the voltages greater than 10 volts?</td></tr>
<tr><td>F2 CHECK THE AIR SUSPENSION MODULE GROUND CIRCUITS FOR AN OPEN</td><td rowspan="2">Yes</td></tr>
<tr><td>• Key in OFF position.</td></tr>
</table>

• Measure the resistance between the air suspension module, harness side and ground as follows: **Connector-Pin** / **Circuit** C2131a-5 / GD133 (BK) C2131a-14 / GD120 (BK/GN) • **Are the resistances less than 5 ohms?**	GO to F3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
F3 CHECK THE CAN CIRCUITS BETWEEN THE DLC AND THE AIR SUSPENSION MODULE FOR AN OPEN	
• Measure the resistance between the air suspension module C2131a-10, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0053584 • Measure the resistance between the air suspension module C2131a-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH) harness side.  N0053585 • **Are the resistances less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
F4 CHECK FOR CORRECT AIR SUSPENSION MODULE OPERATION	
• Disconnect all the air suspension module connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the air suspension module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new air suspension module. REFER to Section 204-05 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test G: The Instrument Cluster Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the HS-CAN network connection to the instrument cluster and circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the MS-CAN network connection to the instrument cluster. The instrument cluster shares the HS-CAN network with the powertrain control module (PCM), the transmission control module (TCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped) and the air suspension module (if equipped). The instrument cluster shares the MS-CAN network with the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the driver seat module (DSM) (if equipped), the climate controlled seat module (if equipped), the power liftgate module (if equipped), the parking aid module (if equipped), the power running board module (if equipped), the auxiliary audio module and the digital versatile disc (DVD) player. Voltage for the instrument cluster is provided by circuits CBP29 (WH/VT) and SBP26 (YE/RD). Circuit GD133 (BK) provides ground.

DTC U0155 — sets in a module which had attempted to communicate with the instrument cluster and failed.

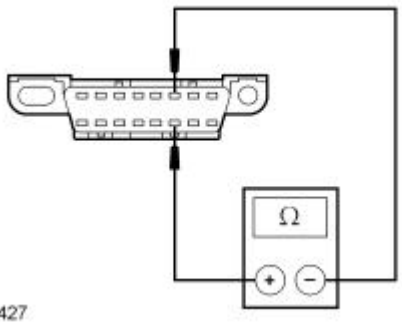
Possible Causes

- Fuse
- Circuit CBP29 (WH/VT) open
- Circuit GD133 (BK) open
- Circuit SBP26 (YE/RD) open
- Circuit VDB04 (WH/BU) open (HS-CAN +)
- Circuit VDB05 (WH) open (HS-CAN -)
- Instrument cluster

PINPOINT TEST G: THE INSTRUMENT CLUSTER DOES NOT RESPOND TO THE SCAN TOOL

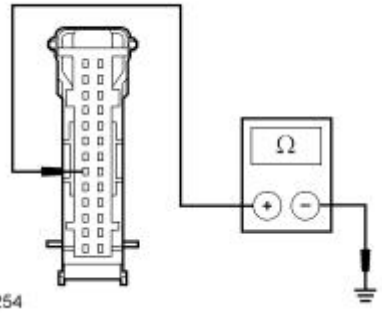
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

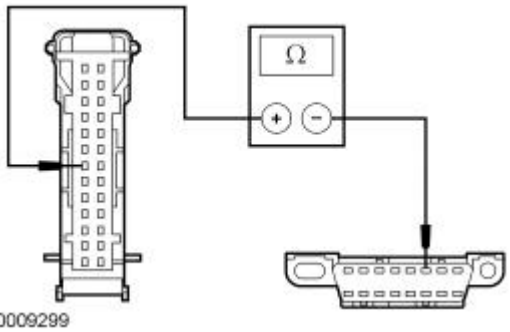
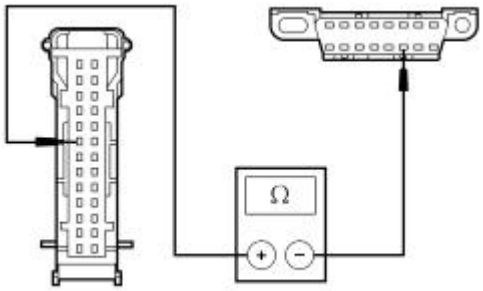
Test Step	Result / Action to Take
G1 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. • Disconnect the battery ground cable. • Disconnect the scan tool cable from the data link connector (DLC). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to G2 . **No** GO to G4 .



N0026427

- **Is the resistance between 54 and 66 ohms?**

G2 CHECK THE INSTRUMENT CLUSTER VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Disconnect: Instrument Cluster C220. • Connect the battery ground cable. • Key in ON position. • Measure the voltage between the instrument cluster, harness side and ground as follows: **Instrument Cluster Connector-Pin** / **Circuit** C220-1 / SBP26 (YE/RD) C220-14 / CBP29 (WH/VT) • **Are the voltages greater than 10 volts?**	**Yes** GO to G3. **No** VERIFY the smart junction box (SJB) fuse 26 (10A) or fuse 29 (5A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
G3 CHECK THE INSTRUMENT CLUSTER GROUND CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the instrument cluster C220-6, circuit GD133 (BK), harness side and ground.  N0057254 • **Is the resistance less than 5 ohms?**	**Yes** GO to G5. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
G4 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE INSTRUMENT CLUSTER FOR AN OPEN	
• Measure the resistance between the instrument cluster C220-7, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	**Yes** GO to G5. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0009299 • Measure the resistance between the instrument cluster C220-8, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0057255 • **Are the resistances less than 5 ohms?**	
G5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test H: The Smart Junction Box (SJB) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 10 , Grounds for schematic and connector information.

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The SJB communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the SJB. The SJB shares the MS-CAN network with the instrument cluster, the electronic

manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the driver seat module (DSM) (if equipped), the climate controlled seat module (if equipped), the power liftgate module (if equipped), the parking aid module (if equipped), the power running board module (if equipped), the auxiliary audio module (if equipped) and the digital versatile disc (DVD) player (if equipped). Voltage for the SJB is provided by circuit CDC33 (VT/GN). Circuit GD133 (BK) provides ground.

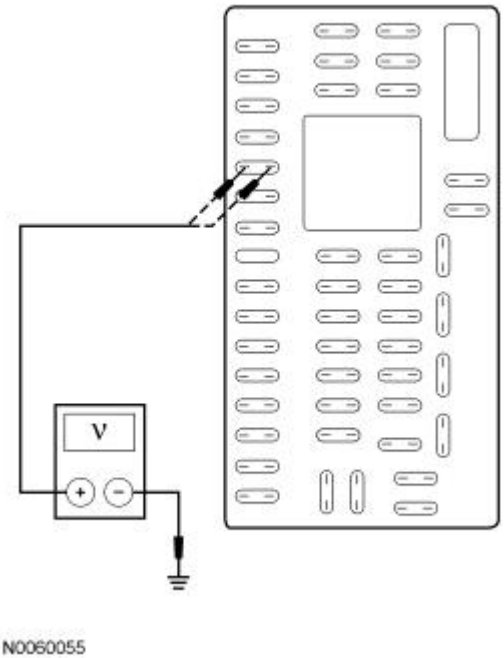
DTC U0140 — sets in a module which had attempted to communicate with the SJB and failed.

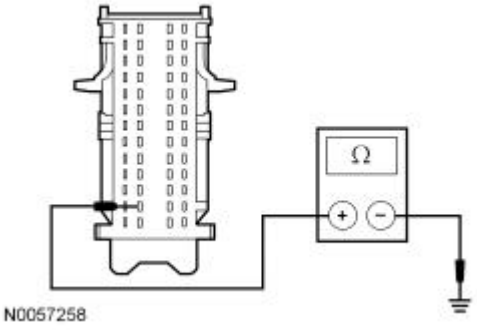
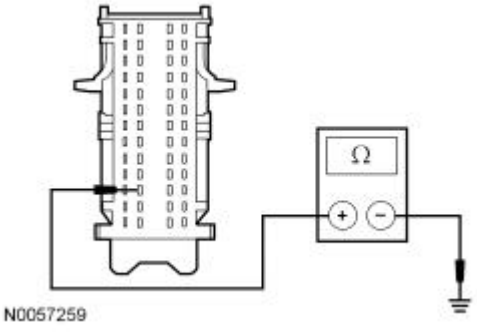
Possible Causes

- Fuse
- Circuit CDC33 (VT/GN) open
- Circuit GD133 (BK) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- SJB

PINPOINT TEST H: THE SMART JUNCTION BOX (SJB) DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK THE SJB FUSE FOR VOLTAGE • Key in OFF position. • **NOTE:** Measurements are taken with the fuses installed. • Measure the voltage between the SJB fuse 5 (10A) and ground.  N0060055 • **Is the voltage greater than 10 volts?**	**Yes** GO to H2 . **No** VERIFY the smart junction box (SJB) fuse 5 (10A) is OK. If OK, GO to H4 .

H2 CHECK THE SJB GROUND CIRCUITS FOR AN OPEN • Key in OFF position. • Disconnect: SJB C2280e. • Measure the resistance between the SJB, harness side and ground as follows: **SJB Connector-Pin** / **Circuit** C2280e-8 / GD133 (BK) C2280e-12 / GD133 (BK) • **Are the resistances less than 5 ohms?**	**Yes** GO to H3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
H3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SJB FOR AN OPEN • Disconnect: SJB C2280g. • Measure the resistance between the SJB C2280g-37, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0057258 • Measure the resistance between the SJB C2280g-38, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057259 • **Are the resistances less than 5 ohms?**	**Yes** GO to H4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

H4 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with

	the scan tool.

Pinpoint Test I: The Electronic Manual Temperature Control Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

The electronic manual temperature control module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the electronic manual temperature control module. The electronic manual temperature control module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the auxiliary audio module, the digital versatile disc (DVD) player, the driver seat module (DSM) (if equipped), the power running board module, the parking aid module (if equipped), the power liftgate module and the climate controlled seat module (if equipped). Voltage for the electronic manual temperature control module is provided by circuits CBP37 (WH) and SBP15 (WH/RD). Circuit GD133 (BK) provides ground.

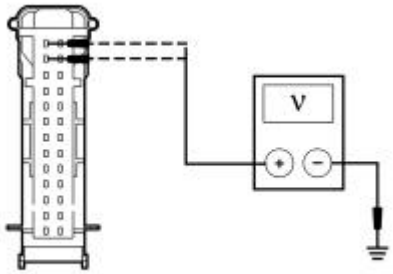
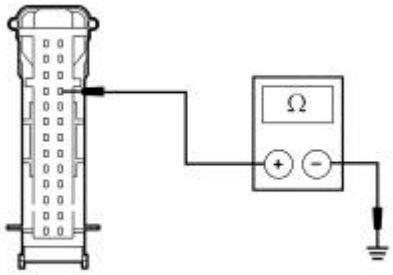
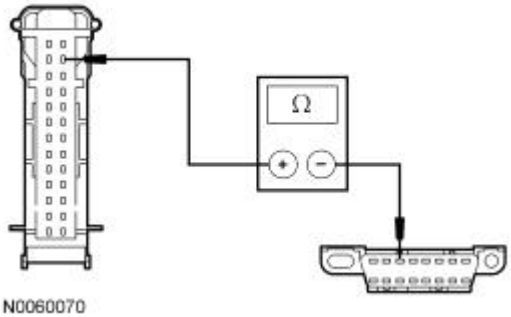
Possible Causes

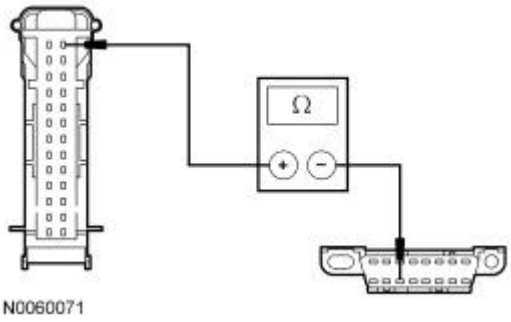
- Fuse
- Circuit CBP37 (WH) open
- Circuit GD133 (BK) open
- Circuit SBP15 (WH/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Electronic manual temperature control module

PINPOINT TEST I: THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
I1 CHECK THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: Electronic Manual Temperature Control Module C2357a. • Key in ON position. • Measure the voltage between the electronic manual temperature control module C2357a-12, circuit CBP37 (WH), and the electronic manual temperature control module C2357a-13, circuit SBP15 (WH/RD) and ground.	**Yes** GO to I2 . **No** VERIFY smart junction box (SJB) fuse 15 (10A) or 37 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0057260 • **Is the voltage greater than 10 volts?**	
I2 CHECK THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE GROUND CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the electronic manual temperature control module C2357a-23, circuit GD133 (BK) and ground.  N0057261 • **Is the resistance less than 5 ohms?**	**Yes** GO to I3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
I3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE FOR AN OPEN	
• Measure the resistance between the electronic manual temperature control module C2357a-25, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0060070 • Measure the resistance between the electronic manual temperature control module C2357a-26, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to I4 . **No** REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0060071 • **Are the resistances less than 5 ohms?**	
I4 CHECK FOR CORRECT ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE OPERATION	

• Disconnect all the electronic manual temperature control module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the electronic manual temperature control module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new electronic manual temperature control module. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test J: The Electronic Automatic Temperature Control (EATC) Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

The EATC module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the EATC module. The EATC module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the auxiliary audio module, the digital versatile disc (DVD) player, the driver seat module (DSM) (if equipped), the power running board module, the parking aid module (if equipped), the power liftgate module and the climate controlled seat module (if equipped). Voltage for the EATC module is provided by circuits CBP37 (WH) and SBP15 (WH/RD). Circuit GD133 (BK) provides ground.

DTC U0164 — sets in a module which had attempted to communicate with the EATC module and failed.

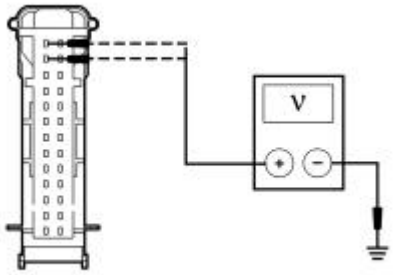
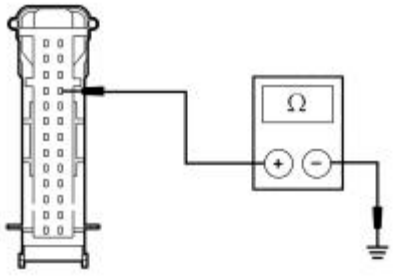
Possible Causes

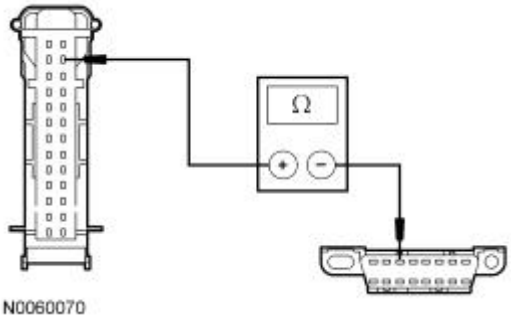
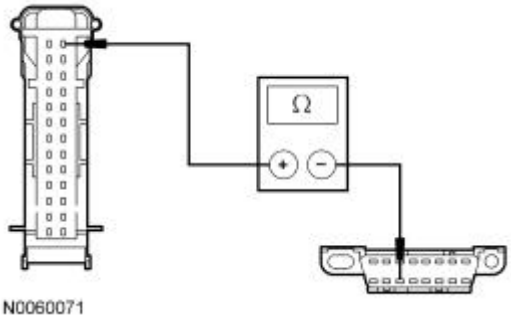
- Fuse
- Circuit CBP37 (WH) open
- Circuit GD133 (BK) open

- Circuit SBP15 (WH/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- EATC module

PINPOINT TEST J: THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
J1 CHECK THE EATC VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: EATC Module C228a. • Key in ON position. • Measure the voltage between the EATC module C228a-13, circuit SBP15 (WH/RD), and between the EATC module C228a-12, circuit CBP37 (WH) and ground.  N0057260 • **Is the voltage greater than 10 volts?**	**Yes** GO to J2 . **No** VERIFY smart junction box (SJB) fuse 15 (10A) or 37 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
J2 CHECK THE EATC GROUND CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the EATC module C228a-23, circuit GD133 (BK) and ground.  N0057261 • **Is the resistance less than 5 ohms?**	**Yes** GO to J3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
J3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE EATC MODULE FOR AN OPEN	
• Measure the resistance between the EATC module C228a-25, circuit VDB06 (GY/OG), harness side and the DLC	**Yes** GO to J4 .

C251-3, circuit VDB06 (GY/OG), harness side.  N0060070 • Measure the resistance between the EATC module C228a-26, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0060071 • **Are the resistances less than 5 ohms?**	**No** REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
J4 CHECK FOR CORRECT EATC MODULE OPERATION	

• Disconnect all the EATC module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the EATC module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new EATC module. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test K: The Audio Unit Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

There are 2 types of audio units used on this vehicle, the base audio unit (Audiophile) and the THX® audio unit (if equipped). Both audio units communicate with the scan tool through the medium speed controller area network (CAN), circuits VDB06 (GY/OG) and VDB07 (VT/OG).

Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection

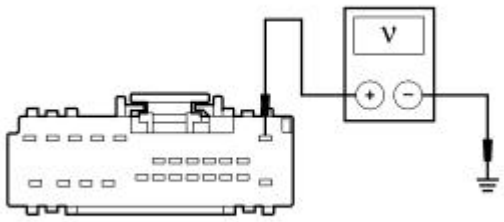
to the audio unit. The audio unit shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the auxiliary audio module, the digital versatile disc (DVD) player, the driver seat module (DSM) (if equipped), the power running board module, the parking aid module (if equipped), the power liftgate module and the climate controlled seat module (if equipped). Voltage for the audio unit is provided by circuit SBP39 (WH/RD). Circuit GD114 (BK/BU) provides ground.

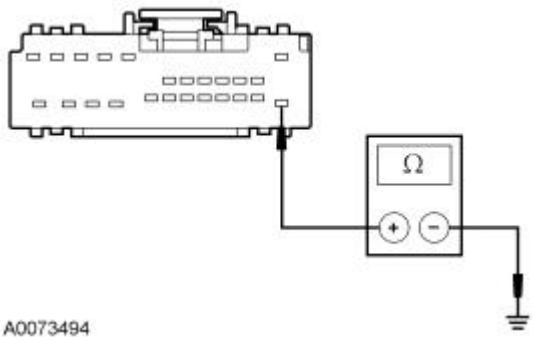
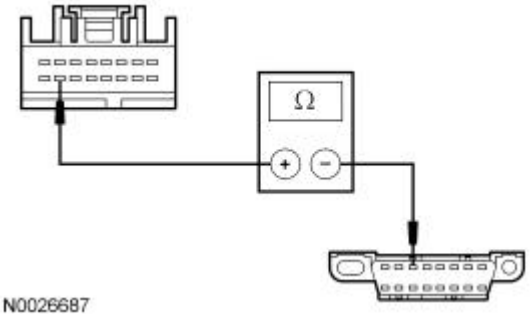
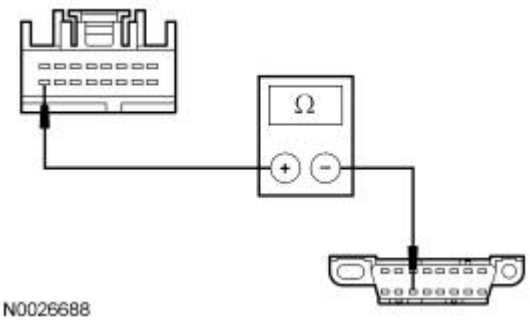
Possible Causes

- Fuse
- Circuit GD114 (BK/BU) open
- Circuit SBP39 (WH/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- THX® amplifier

PINPOINT TEST K: THE AUDIO UNIT DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
K1 CHECK THE AUDIO UNIT VOLTAGE SUPPLY CIRCUIT SBP39 (WH/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: Audio Unit C240a. • Key in ON position. • Measure the voltage between the audio unit C240a-1, circuit SBP39 (WH/RD), harness side and ground.  N0058708 • **Is the voltage greater than 10 volts?**	**Yes** GO to K2 . **No** VERIFY the smart junction box (SJB) fuse 39 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
K2 CHECK THE AUDIO UNIT GROUND CIRCUIT GD114 (BK/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the audio unit C240a-13, circuit GD114 (BK/BU), harness side and ground.	**Yes** GO to K3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

 A0073494 • **Is the resistance less than 5 ohms?**	
K3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE AUDIO UNIT FOR AN OPEN	
• Measure the resistance between the audio unit C240b-15, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026687 • Measure the resistance between the base audio unit C240b-16, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0026688 • **Are the resistances less than 5 ohms?**	**Yes** GO to K4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
K4 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new audio unit. REFER to Section 415-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test L: The THX® Amplifier Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The THX® amplifier communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the THX® amplifier. The THX® amplifier shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the satellite radio receiver (if equipped), the auxiliary audio module, the digital versatile disc (DVD) player, the driver seat module (DSM) (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the THX® amplifier is provided by circuits SBP38 (BN/RD) and SBP40 (VT/RD). Three circuits GD114 (BK/BU) provide ground.

Possible Causes

- Fuse
- Circuit GD114 (BK/BU) open
- Circuit SBP38 (BN/RD) open
- Circuit SBP40 (VT/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Audio unit

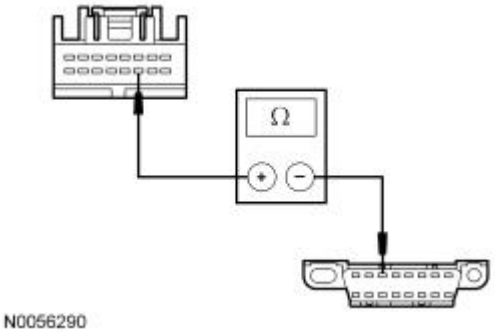
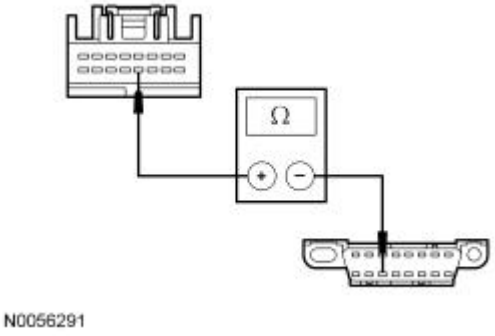
PINPOINT TEST L: THE THX® AMPLIFIER DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>L1 CHECK THE THX® AMPLIFIER VOLTAGE SUPPLY CIRCUITS FOR AN OPEN</td><td rowspan="2">Yes
GO to L2 .

No
VERIFY the smart junction box (SJB) fuse 38 (20A) or fuse 40 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: THX® Amplifier C2364a.
• Key in ON position.
• Measure the voltage between the THX® amplifier, harness side and ground as follows:

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C2364a-9</td><td>SBP38 (BN/RD)</td></tr><tr><td>C2364a-10</td><td>SBP38 (BN/RD)</td></tr><tr><td>C2364a-11</td><td>SBP40 (VT/RD)</td></tr><tr><td>C2364a-12</td><td>SBP40 (VT/RD)</td></tr></table>
• Are the voltages greater than 10 volts?</td></tr>
<tr><td>L2 CHECK THE THX® AMPLIFIER GROUND CIRCUITS FOR AN OPEN</td><td></td></tr>
</table>

• Key in OFF position. • Measure the resistance between the THX® amplifier, harness side and ground as follows: **Connector-Pin** / **Circuit** C2364a-22 / GD114 (BK/BU) C2364a-23 / GD114 (BK/BU) C2364a-24 / GD114 (BK/BU) • **Are the resistances less than 5 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
L3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE THX® AMPLIFIER FOR AN OPEN	
• Disconnect: THX® Amplifier C2364c. • Measure the resistance between the THX® amplifier C2364c-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0056290 • Measure the resistance between the THX® amplifier C2364c-12, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0056291 • **Are the resistances less than 5 ohms?**	**Yes** GO to L4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
L4 CHECK FOR CORRECT THX® AMPLIFIER OPERATION	

• Disconnect all the THX® amplifier connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the THX® amplifier connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a THX® amplifier. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

	REPEAT the network test with the scan tool.

Pinpoint Test M: The Satellite Radio Receiver Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The satellite radio receiver communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the satellite radio receiver. The satellite radio receiver shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the auxiliary audio module (if equipped), the digital versatile disc (DVD) player (if equipped), the driver seat module (DSM) (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the satellite radio receiver is provided by circuit SBP03 (BU/RD). Circuit GD114 (BK/BU) provides ground.

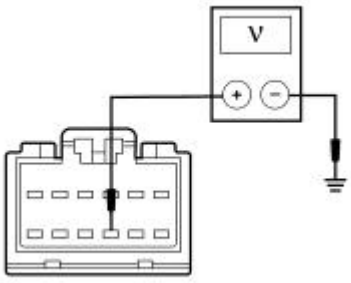
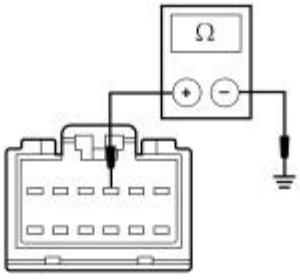
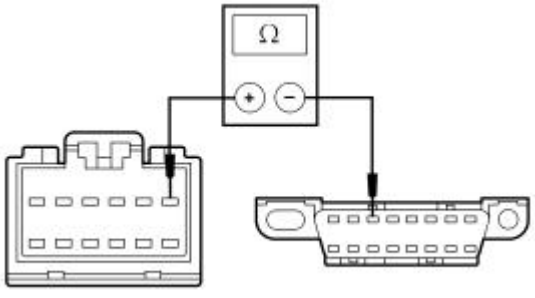
Possible Causes

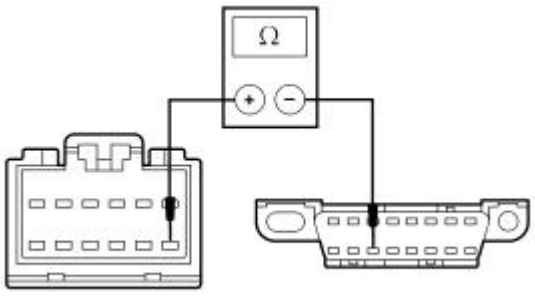
- Fuse
- Circuit GD114 (BK/BU) open
- Circuit SBP03 (BU/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Satellite radio receiver

PINPOINT TEST M: THE SATELLITE RADIO RECEIVER DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
M1 CHECK THE SATELLITE RADIO RECEIVER VOLTAGE SUPPLY CIRCUIT SBP03 (BU/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: Satellite Radio Receiver C3290. • Key in ON position. • Measure the voltage between the satellite radio receiver C3290-9, circuit SBP03 (BU/RD), harness side and ground.	**Yes** GO to M2 . **No** VERIFY the smart junction box (SJB) fuse 3 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0053245 • **Is the voltage greater than 10 volts?**	
M2 CHECK THE SATELLITE RADIO RECEIVER GROUND CIRCUIT GD114 (BK/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the satellite radio receiver C3290-3, circuit GD114 (BK/BU), harness side and ground.  N0053246 • **Is the resistance less than 5 ohms?**	**Yes** GO to M3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
M3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SATELLITE RADIO RECEIVER FOR AN OPEN	
• Measure the resistance between the satellite radio receiver C3290-1, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026834 • Measure the resistance between the satellite radio receiver C3290-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to M4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0026835 • **Are the resistances less than 5 ohms?**	
M4 CHECK FOR CORRECT SATELLITE RADIO RECEIVER OPERATION	

• Disconnect the satellite radio receiver connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the satellite radio receiver connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new satellite radio receiver. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test N: The Auxiliary Audio Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

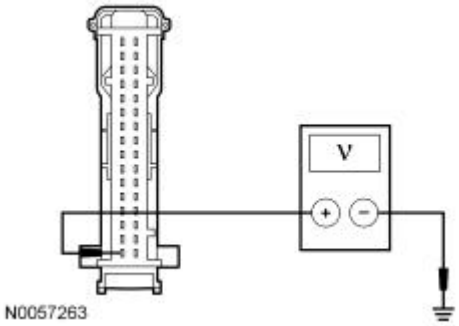
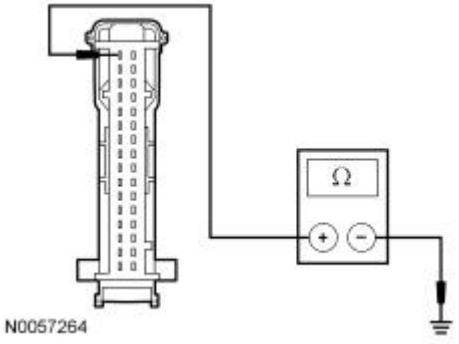
Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the auxiliary audio module. The auxiliary audio module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the driver seat module (DSM) (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the auxiliary audio module is provided by circuit SBP03 (BU/RD). Circuit GD114 (BK/BU) provides ground.

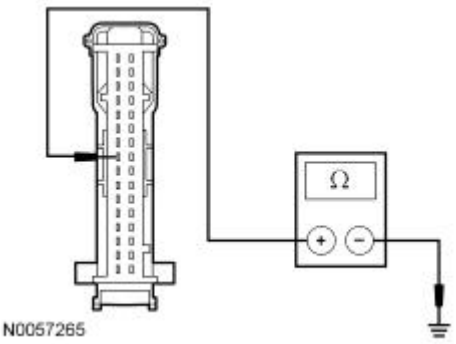
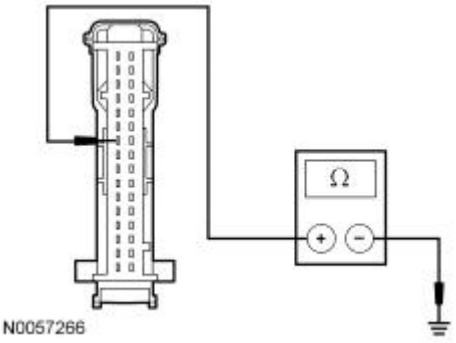
Possible Causes

- Fuse
- Circuit GD114 (BK/BU) open
- Circuit SBP03 (BU/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Auxiliary audio module

PINPOINT TEST N: THE AUXILIARY AUDIO MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
N1 CHECK THE AUXILIARY AUDIO MODULE VOLTAGE SUPPLY CIRCUIT SBP03 (BU/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: Auxiliary Audio Module C3077. • Key in ON position. • Measure the voltage between the auxiliary audio unit C3077-16, circuit SBP03 (BU/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to N2. **No** VERIFY the smart junction box (SJB) fuse 3 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
N2 CHECK THE AUXILIARY AUDIO MODULE GROUND CIRCUIT GD114 (BK/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the auxiliary audio module C3077-1, circuit GD114 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to N3. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
N3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE AUDIO UNIT FOR AN OPEN	
• Measure the resistance between the auxiliary audio module C3077-8, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.	**Yes** GO to N4. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0057265 • Measure the resistance between the auxiliary audio module C3077-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057266 • **Are the resistances less than 5 ohms?**	
N4 CHECK FOR CORRECT AUXILIARY AUDIO MODULE OPERATION • Disconnect the auxiliary audio module connector. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect the auxiliary audio module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test O: The Digital Versatile Disc (DVD) Player Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 132 , Video System for schematic and connector information.

Normal Operation

The DVD player communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DVD player. The DVD player is only on vehicles equipped with rear seat entertainment. The DVD player shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if

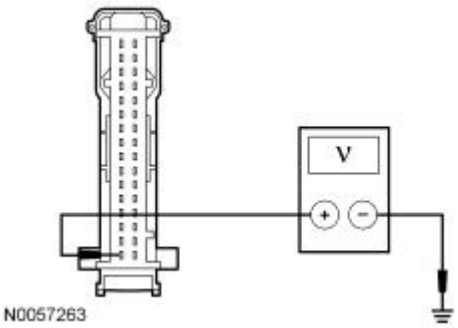
equipped), the satellite radio receiver (if equipped), the driver seat module (DSM) (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the DVD player is provided by circuit SBP03 (BU/RD). Circuit GD114 (BK/BU) provides ground.

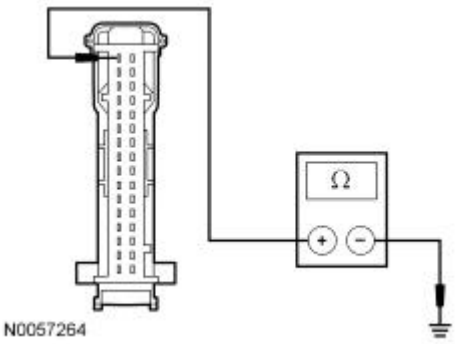
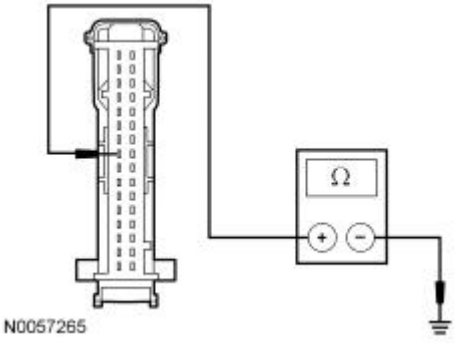
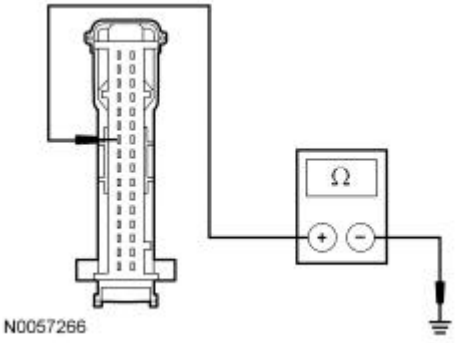
Possible Causes

- Fuse
- Circuit GD114 (BK/BU) open
- Circuit SBP03 (BU/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- DVD player

PINPOINT TEST O: THE DIGITAL VERSATILE DISC (DVD) PLAYER DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
O1 CHECK THE DVD PLAYER VOLTAGE SUPPLY CIRCUIT SBP03 (BU/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: DVD Player C949. • Key in ON position. • Measure the voltage between the DVD player C949-16, circuit SBP03 (BU/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to O2 . **No** VERIFY the smart junction box (SJB) fuse 3 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
O2 CHECK THE DVD PLAYER GROUND CIRCUIT GD114 (BK/BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the DVD player C949-1, circuit GD114 (BK/BU), harness side and ground.	**Yes** GO to O3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0057264 • **Is the resistance less than 5 ohms?**	
O3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE AUDIO UNIT FOR AN OPEN	
• Measure the resistance between the auxiliary audio module C949-8, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0057265 • Measure the resistance between the auxiliary audio module C949-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057266 • **Are the resistances less than 5 ohms?**	**Yes** GO to O4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
O4 CHECK FOR CORRECT DVD PLAYER OPERATION	
• Disconnect the DVD player connector. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect the DVD player connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DVD player. REFER to Section 415-07 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test P: The Driver Seat Module (DSM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The DSM communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DSM. The DSM shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the DSM is provided by circuit SBB45 (GY/RD). Circuit GD143 (BK/VT) provides ground.

DTC U0208 — sets in a module which had attempted to communicate with the DSM and failed.

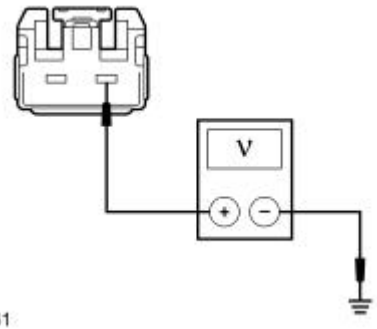
Possible Causes

- Fuse
- Circuit GD143 (BK/VT) open
- Circuit SBB45 (GY/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- DSM

PINPOINT TEST P: THE DRIVER SEAT MODULE (DSM) DOES NOT RESPOND TO THE SCAN TOOL

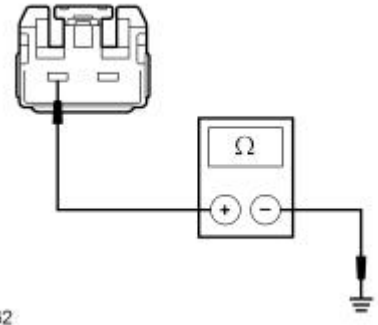
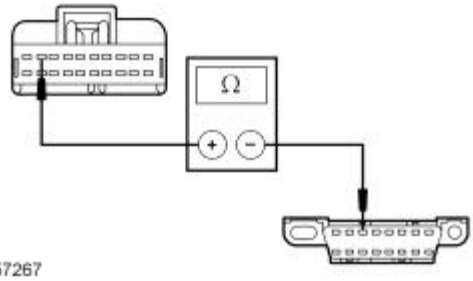
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

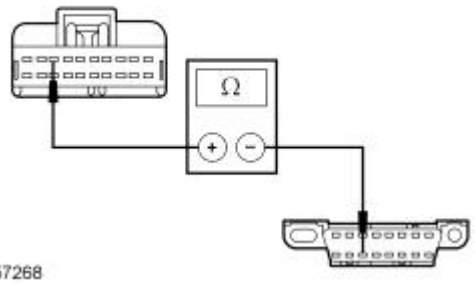
Test Step	Result / Action to Take
P1 CHECK THE DSM VOLTAGE SUPPLY CIRCUIT SBB45 (GY/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: DSM C341a. • Key in ON position. • Measure the voltage between the DSM C341c-1, circuit SBB45 (GY/RD), harness side and ground.	**Yes** GO to P2 . **No** VERIFY the smart junction box (SJB) fuse 2 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.



A0079061

- **Is the voltage greater than 10 volts?**

P2 CHECK THE DSM GROUND CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the DSM C341a-2, circuit GD143 (BK/VT), harness side and ground.  A0079062 • **Is the resistance less than 5 ohms?**	**Yes** GO to P3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
P3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE DSM FOR AN OPEN	
• Disconnect: DSM C341e. • Measure the resistance between the DSM C341e-9, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0057267 • Measure the resistance between the DSM C341e-8, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to P4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0057268 • **Are the resistances less than 5 ohms?**	
P4 CHECK FOR CORRECT DSM OPERATION	

• Disconnect all the DSM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the DSM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test Q: The Climate Controlled Seat Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

The climate controlled seat module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the climate controlled seat module. The climate controlled seat module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the power running board module (if equipped), the parking aid module (if equipped) and the power liftgate module (if equipped). Voltage for the climate controlled seat module is provided by circuit SBB08 (VT/RD). Circuit GD138 (BK/WH) provides ground.

Possible Causes

- Fuse
- Circuit GD138 (BK/WH) open
- Circuit SBB08 (VT/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Climate controlled seat module

PINPOINT TEST Q: THE CLIMATE CONTROLLED SEAT MODULE DOES NOT RESPOND TO THE SCAN TOOL

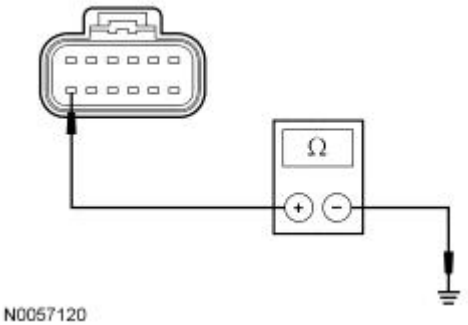
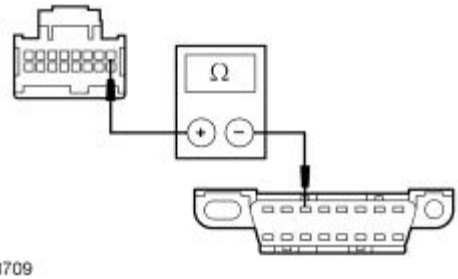
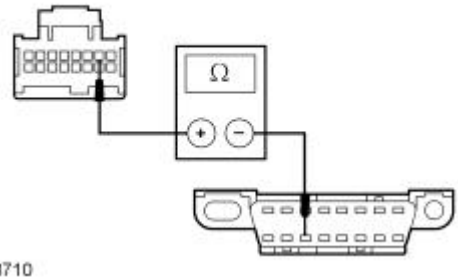
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>Q1 VERIFY VEHICLE EQUIPMENT</td><td></td></tr>
<tr><td>• Inspect the vehicle for seat side air bags.
• Is the vehicle equipped with seat side air bags?</td><td>Yes
GO to Q2 .

No
GO to Q3 .</td></tr>
<tr><td>Q2 CHECK THE CLIMATE CONTROLLED SEAT MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN — WITH SIDE AIR BAGS</td><td></td></tr>
<tr><td>NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered. Refer to Section 501-20B . NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault. NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.
• Key in OFF position.
• For vehicles with seat side air bags, carry out the following:
▪ Depower the SRS. Refer to Section 501-20B .
▪ Disconnect the driver seat side air bag module C3226.
▪ Disconnect the passenger seat side air bag module C3227.
▪ Connect the battery ground cable.
• Disconnect: Climate Controlled Seat Module C3265a.
• Key in ON position.
• Measure the voltage between the climate controlled seat module, harness side and ground as follows:
<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C3265a-E</td><td>SBB08 (VT/RD)</td></tr><tr><td>C3265a-F</td><td>SBB08 (VT/RD)</td></tr></table>• Are the voltages greater than 10 volts?</td><td>Yes
GO to Q4 .

No
VERIFY the battery junction box (BJB) fuse 8 (40A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
<tr><td>Q3 CHECK THE CLIMATE CONTROLLED SEAT MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: Climate Controlled Seat Module C3265a.
• Key in ON position.
• Measure the voltage between the climate controlled seat module, harness side and ground as follows:
<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C3265a-E</td><td>SBB08 (VT/RD)</td></tr><tr><td>C3265a-F</td><td>SBB08 (VT/RD)</td></tr></table>• Are the voltages greater than 10 volts?</td><td>Yes
GO to Q4 .

No
VERIFY the battery junction box (BJB) fuse 8 (40A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.</td></tr>
<tr><td>Q4 CHECK THE CLIMATE CONTROLLED SEAT MODULE GROUND CIRCUIT GD138 (BK/WH) FOR AN OPEN</td><td></td></tr>
</table>

• Key in OFF position. • Measure the resistance between the climate controlled seat module C3265a-M, circuit GD138 (BK/WH), harness side and ground.  N0057120 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q5 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE CLIMATE CONTROLLED SEAT MODULE FOR AN OPEN	
• Measure the resistance between the climate controlled seat module C3265c-1, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0058709 • Measure the resistance between the climate controlled seat module C3265c-2, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0058710 • **Are the resistances less than 5 ohms?**	**Yes** GO to Q6 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q6 CHECK FOR CORRECT CLIMATE CONTROLLED SEAT MODULE OPERATION	

• Disconnect all the climate controlled seat module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the climate controlled seat module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new climate controlled seat module. REFER to Section 501-10 . CLEAR the DTCs. REPEAT the network test with the scan tool.

	No The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test R: The Power Running Board Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The power running board module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the power running board module. The power running board module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the parking aid module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the power running board module is provided by circuit SBB07 (WH/RD). Circuit GD143 (BK/VT) provides ground.

DTC U0244 — sets in a module which had attempted to communicate with the power running board module and failed.

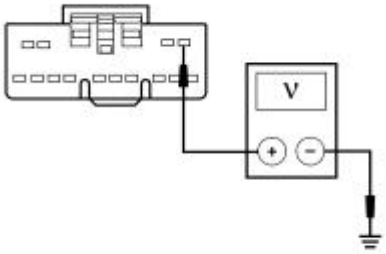
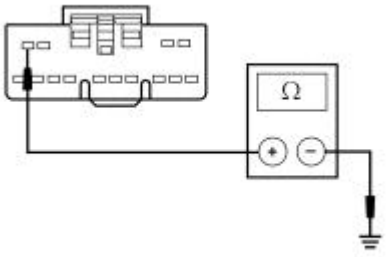
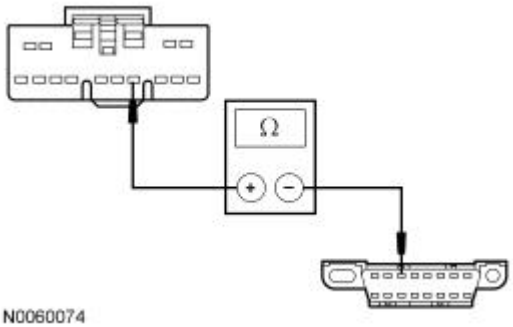
Possible Causes

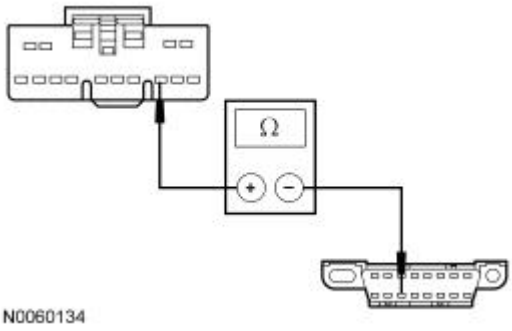
- Fuse
- Circuit GD143 (BK/VT) open
- Circuit SBB07 (WH/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Power running board module

PINPOINT TEST R: THE POWER RUNNING BOARD MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
R1 CHECK THE POWER RUNNING BOARD MODULE VOLTAGE SUPPLY CIRCUIT SBB07 (WH/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between the power running board module C3313b-1, circuit SBB07 (WH/RD), harness side	**Yes** GO to R2 . **No** VERIFY the battery junction

and ground.  N0060072 • **Is the voltage greater than 10 volts?**	box (BJB) fuse 7 (40A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
R2 CHECK THE POWER RUNNING BOARD MODULE GROUND CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the power running board module C3313b-4, circuit GD143 (BK/VT), harness side and ground.  N0060073 • **Is the resistance less than 5 ohms?**	**Yes** GO to R3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
R3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE POWER RUNNING BOARD MODULE FOR AN OPEN	
• Measure the resistance between the power running board module C3313b-8, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0060074 • Measure the resistance between the power running board module C3313b-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to R4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0060134 • **Are the resistances less than 5 ohms?**	
R4 CHECK FOR CORRECT POWER RUNNING BOARD MODULE OPERATION	

• Disconnect all the power running board module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the power running board module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new power running board module. REFER to Section 501-08 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test S: The Parking Aid Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

The parking aid module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the parking aid module. The parking aid module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the power running board module (if equipped), the power liftgate module (if equipped) and the climate controlled seat module (if equipped). Voltage for the parking aid module is provided by circuit CBP35 (YE/GY). Circuit GD133 (BK) provides ground.

DTC U0159 — sets in a module which had attempted to communicate with the parking aid module and failed.

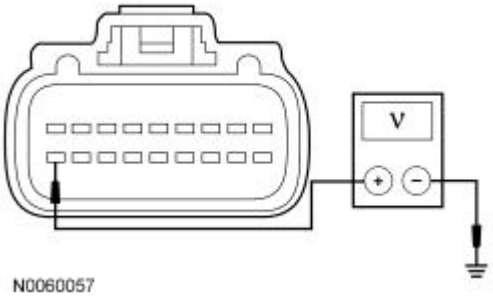
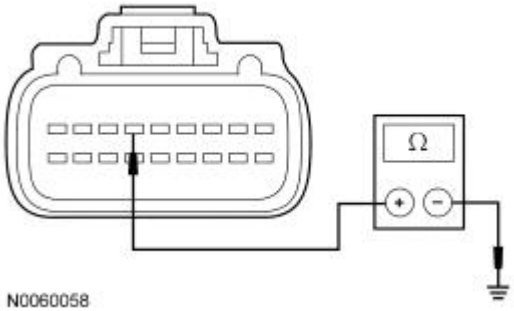
Possible Causes

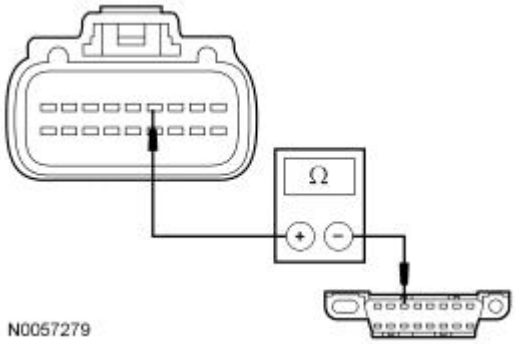
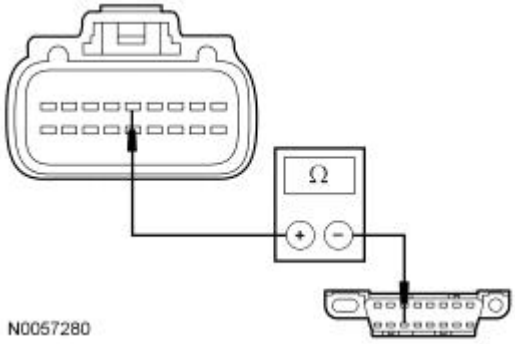
- Fuse
- Circuit CBP35 (YE/GY) open
- Circuit GD133 (BK) open

- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Parking aid module

PINPOINT TEST S: THE PARKING AID MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
S1 CHECK THE PARKING AID MODULE VOLTAGE SUPPLY CIRCUIT CBP35 (YE/GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: Parking Aid Module C4226. • Key in ON position. • Measure the voltage between the parking aid module C4226-18, circuit CBP35 (YE/GY), harness side and ground.  N0060057 • **Is the voltage greater than 10 volts?**	**Yes** GO to S2. **No** VERIFY the smart junction box (SJB) fuse 35 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
S2 CHECK THE PARKING AID MODULE GROUND CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the parking aid module C4226-6, circuit GD133 (BK), harness side and ground.  N0060058 • **Is the resistance less than 5 ohms?**	**Yes** GO to S3. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
S3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE PARKING AID MODULE FOR AN OPEN	
• Measure the resistance between the parking aid module C4226-4, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.	**Yes** GO to S4. **No**

 N0057279 • Measure the resistance between the parking aid module C4226-5, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057280 • **Are the resistances less than 5 ohms?**	REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
S4 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Section 413-13 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test T: The Power Liftgate Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

The power liftgate module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the power liftgate module. The power liftgate module shares the MS-CAN network with the instrument cluster, the smart junction box (SJB), the electronic manual temperature control

module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the power running board module (if equipped), the parking aid module (if equipped) and the climate controlled seat module (if equipped). Voltage for the power liftgate module is provided by circuits SBP14 (BN/RD) and SBB27 (BU/RD). Circuit GD149 (BK/GY) provides ground.

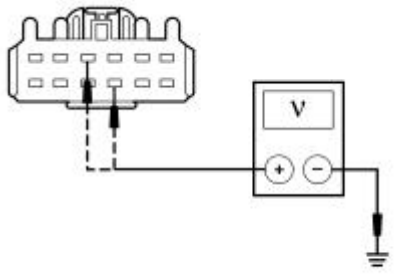
DTC U0230 — sets in a module which had attempted to communicate with the power liftgate module and failed.

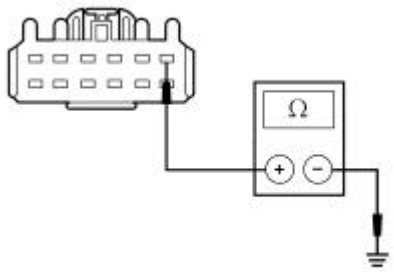
Possible Causes

- Fuse
- Circuit GD149 (BK/GY) open
- Circuit SBP14 (BN/RD) open
- Circuit SBB27 (BU/RD) open
- Circuit VDB06 (GY/OG) open (MS-CAN +)
- Circuit VDB07 (VT/OG) open (MS-CAN -)
- Power liftgate module

PINPOINT TEST T: THE POWER LIFTGATE MODULE DOES NOT RESPOND TO THE SCAN TOOL

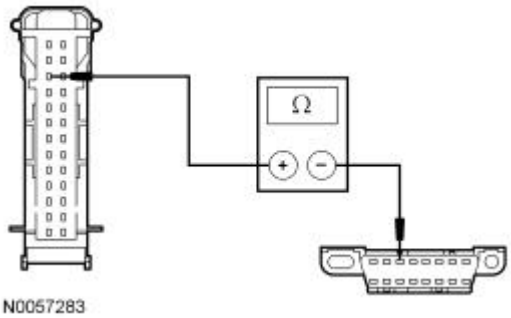
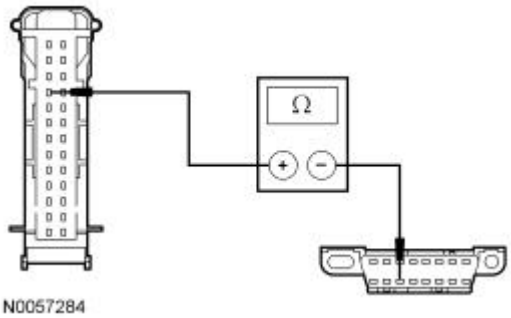
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
T1 CHECK THE POWER LIFTGATE MODULE VOLTAGE SUPPLY CIRCUIT SBP14 (BN/RD) FOR AN OPEN	
• Key in OFF position. • Disconnect: Power Liftgate Module C4174a. • Key in ON position. • Measure the voltage between the power liftgate module C4174a-4, circuit SBB27 (BU/RD), harness side and ground and between the power liftgate module C4174a-9, circuit SBP14 (BN/RD), harness side and ground.  N0057281 • **Are the voltages greater than 10 volts?**	**Yes** GO to T2 . **No** VERIFY the smart junction box (SJB) fuse 14 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
T2 CHECK THE POWER LIFTGATE MODULE GROUND CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between the power liftgate module C4174a-1, circuit GD149 (BK/GY), harness side and ground.	**Yes** GO to T3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.



N0057282

- **Is the resistance less than 5 ohms?**

T3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE POWER LIFTGATE MODULE FOR AN OPEN	
• Disconnect: Power Liftgate Module C4174b. • Measure the resistance between the power liftgate module C4174b-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0057283 • Measure the resistance between the power liftgate module C4174b-10, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057284 • **Are the resistances less than 5 ohms?**	**Yes** GO to T4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
T4 CHECK FOR CORRECT POWER LIFTGATE MODULE OPERATION	

• Disconnect all the power liftgate module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the power liftgate module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new power liftgate module. REFER to Section 501-03 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been

	caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test U: No Medium Speed Controller Area Network (MS-CAN) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The MS-CAN network uses an unshielded twisted pair cable, circuits VDB06 (GY/OG) and VDB07 (VT/OG) provide the network connection to all modules on the network. The smart junction box (SJB), the instrument cluster, the electronic manual temperature control module (if equipped), the electronic automatic temperature control (EATC) module (if equipped), the audio unit, the THX® amplifier (if equipped), the satellite radio receiver (if equipped), the auxiliary audio module (if equipped), the digital versatile disc (DVD) (if equipped), the power running board module (if equipped), the parking aid module (if equipped), the power liftgate module, the driver seat module, and the climate controlled seat module (if equipped) all communicate with the scan tool using the MS-CAN network.

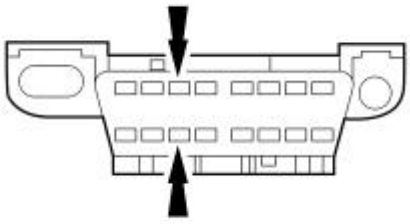
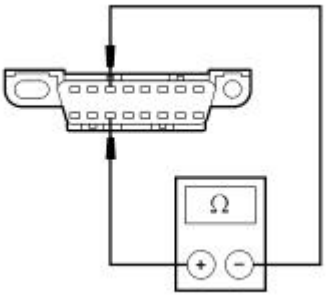
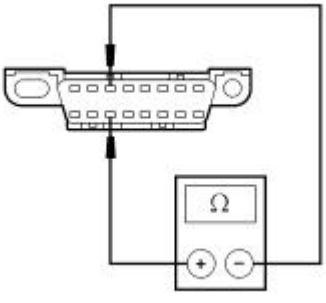
Possible Causes

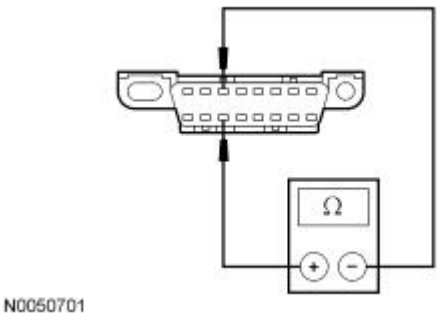
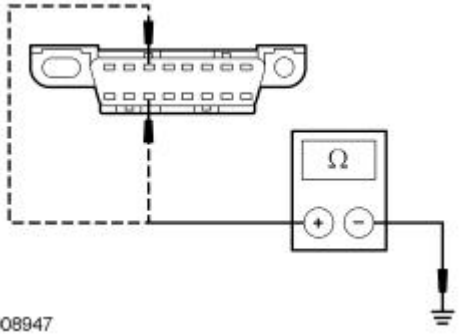
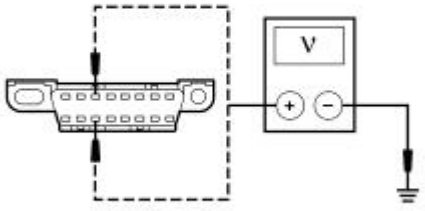
- Circuit VDB06 (GY/OG) open, short to ground or voltage (MS-CAN +)
- Circuit VDB07 (VT/OG) open, short to ground or voltage (MS-CAN -)
- Circuit VDB06 (GY/OG) (MS-CAN +) and circuit VDB07 (VT/OG) (MS-CAN -) shorted together
- SJB
- Instrument cluster
- Audio unit
- THX® amplifier (if equipped)
- EATC module (if equipped)
- Electronic manual temperature control module (if equipped)
- Auxiliary audio module (if equipped)
- DVD player (if equipped)
- Driver seat module (DSM) (if equipped)
- Climate controlled seat module (if equipped)
- Satellite radio receiver (if equipped)
- Power running board module (if equipped)
- Parking aid module (if equipped)
- Power liftgate module (if equipped)

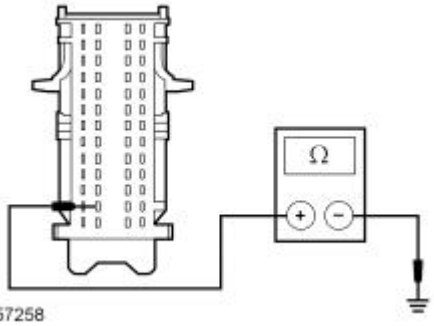
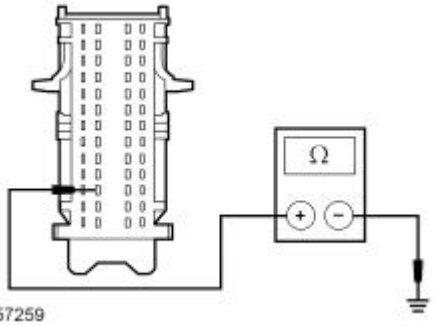
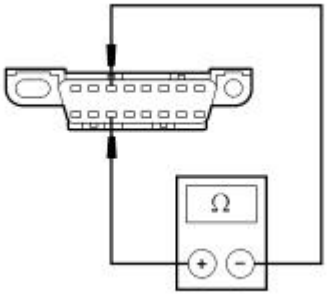
PINPOINT TEST U: NO MEDIUM SPEED CONTROLLER AREA NETWORK (MS-CAN) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

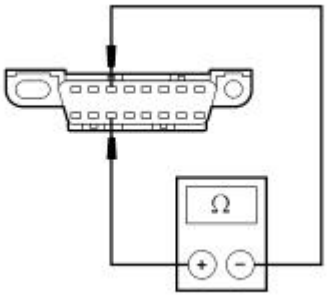
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
U1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE	
NOTE: Most faults are due to connector and/or wiring	**Yes**

concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Key in OFF position. • Disconnect the scan tool cable from the DLC. • Inspect DLC pins 3 and 11 for damage.  N0053178 • **Are DLC pins 3 and 11 OK?**	GO to U2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
U2 CHECK THE MS-CAN TERMINATION RESISTANCE	
• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. • Disconnect the battery ground cable. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to U5 . **No** GO to U3 .
U3 CHECK THE MS-CAN TERMINATION RESISTOR	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to U7 . **No** GO to U4 .
U4 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to U8 .

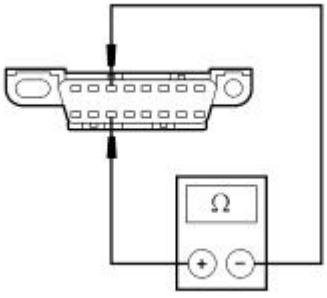
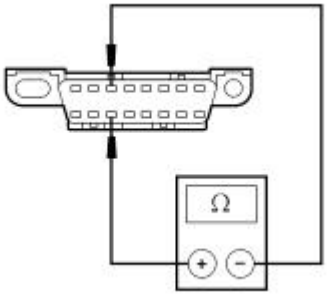
 N0050701 • **Is the resistance less than 5 ohms?**	**No** GO to U7 .
U5 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U6 . **No** GO to U33 .
U6 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Connect the battery ground cable. • Key in ON position. • Measure the voltage between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0050702 • **Is the voltage greater than 6 volts?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** VERIFY all module fuses are OK. If OK, REPEAT the network test with the scan tool.
U7 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE SJB FOR AN OPEN	
• Disconnect: SJB C2280h. • Measure the resistance between the SJB C2280h-37, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.	**Yes** VERIFY all module fuses are OK. If OK, CONNECT all modules. CONNECT the battery ground cable. REPEAT the network test with the scan

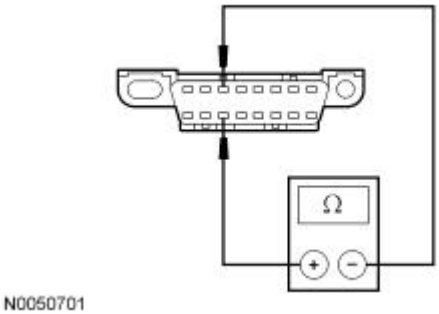
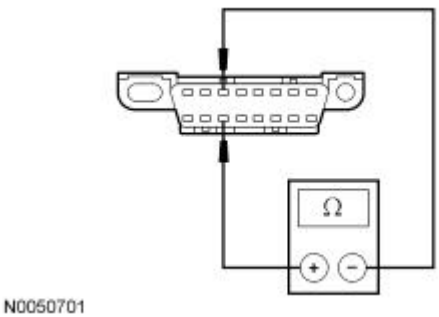
 N0057258 • Measure the resistance between the SJB C2280h-38, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0057259 • **Are the resistances less than 5 ohms?**	tool. **No** REPAIR the circuit in question. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
U8 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SJB DISCONNECTED	
• Disconnect: SJB C2280h. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U9 . **No** GO to U58 .
U9 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE INSTRUMENT CLUSTER DISCONNECTED	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to U10 . **No** GO to U59 .

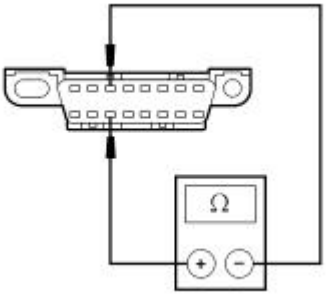
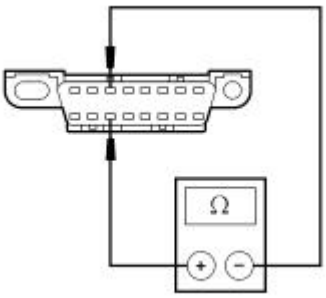


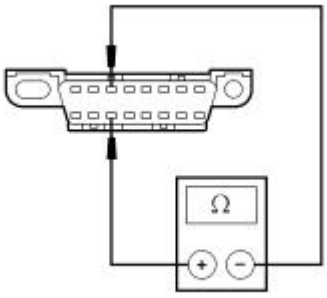
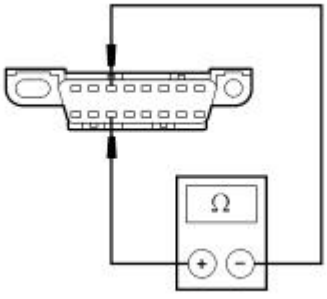
N0050701

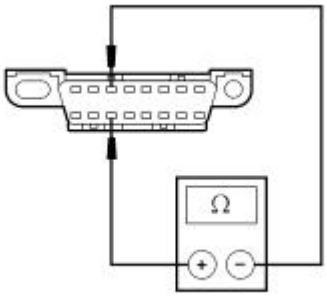
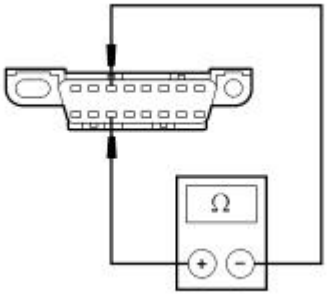
- **Is the resistance less than 5 ohms?**

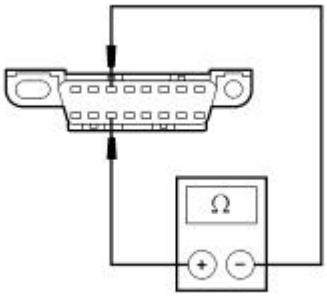
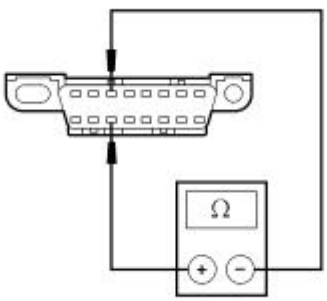
U10 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE AUDIO UNIT DISCONNECTED	
• Disconnect: Audio Unit C240b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U11 . **No** GO to U60 .
U11 VERIFY VEHICLE EQUIPMENT — THX® AMPLIFIER	
• Inspect the vehicle for THX® amplifier. • **Is the vehicle equipped with THX® amplifier?**	**Yes** GO to U12 . **No** GO to U13 .
U12 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE THX® AMPLIFIER DISCONNECTED	
• Disconnect: THX® Amplifier C2364c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U13 . **No** GO to U61 .
U13 VERIFY VEHICLE EQUIPMENT — EATC MODULE	

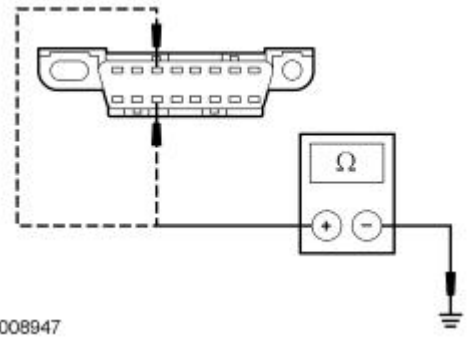
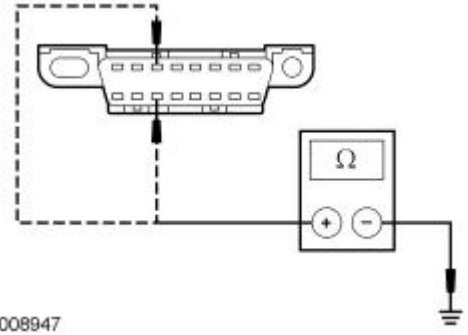
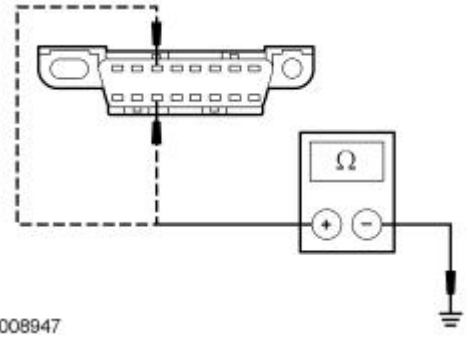
• Inspect the vehicle for EATC. • **Is the vehicle equipped with EATC?**	**Yes** GO to U14 . **No** GO to U15 .
U14 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE EATC MODULE DISCONNECTED	
• Disconnect: EATC Module C228a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U15 . **No** GO to U62 .
U15 VERIFY VEHICLE EQUIPMENT — ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE	
• Inspect the vehicle for an electronic manual temperature control module. • **Is the vehicle equipped with an electronic manual temperature control module?**	**Yes** GO to U16 . **No** GO to U17 .
U16 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE DISCONNECTED	
• Disconnect: Electronic Manual Temperature Control Module C2357a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U17 . **No** GO to U63 .
U17 VERIFY VEHICLE EQUIPMENT — AUXILIARY AUDIO MODULE	
• Inspect the vehicle for an auxiliary audio module. • **Is the vehicle equipped with an auxiliary audio module?**	**Yes** GO to U18 . **No**

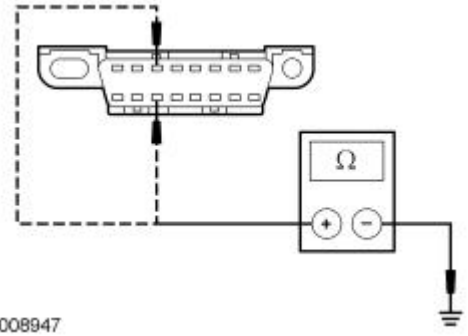
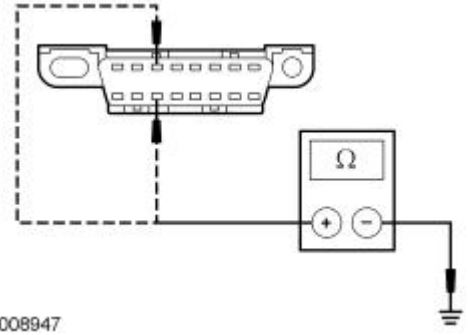
	GO to U19 .
U18 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE AUXILIARY AUDIO MODULE DISCONNECTED	
• Disconnect: Auxiliary Audio Module C3077. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U19 . **No** GO to U64 .
U19 VERIFY VEHICLE EQUIPMENT — DVD PLAYER	
• Inspect the vehicle for a DVD player. • **Is the vehicle equipped with a DVD player?**	**Yes** GO to U20 . **No** GO to U21 .
U20 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DVD PLAYER DISCONNECTED	
• Disconnect: DVD Player C949. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U21 . **No** GO to U65 .
U21 VERIFY VEHICLE EQUIPMENT — DSM	
• Inspect the vehicle for a DSM. • **Is the vehicle equipped with a DSM?**	**Yes** GO to U22 . **No** GO to U23 .
U22 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DSM DISCONNECTED	
• Disconnect: Driver Seat Module C341e. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to U23 . **No**

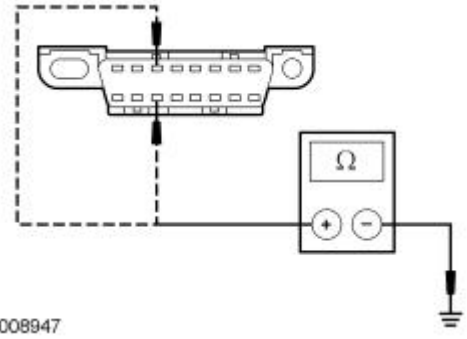
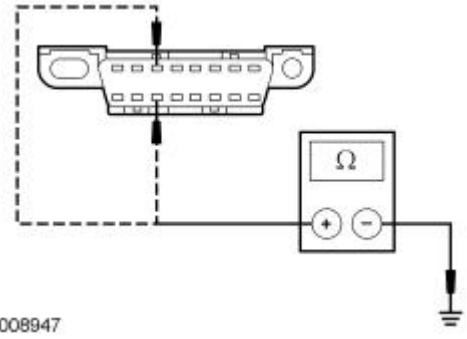
 N0050701 • **Is the resistance less than 5 ohms?**	GO to U66 .
U23 VERIFY VEHICLE EQUIPMENT — CLIMATE CONTROLLED SEAT MODULE • Inspect the vehicle for a climate controlled seat module. • **Is the vehicle equipped with a climate controlled seat module?**	**Yes** GO to U24 . **No** GO to U25 .
U24 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE CLIMATE CONTROLLED SEAT MODULE DISCONNECTED • Disconnect: Climate Controlled Seat Module C3265c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U25 . **No** GO to U67 .
U25 VERIFY VEHICLE EQUIPMENT — SATELLITE RADIO RECEIVER • Inspect the vehicle for a satellite radio receiver. • **Is the vehicle equipped with a satellite radio receiver?**	**Yes** GO to U26 . **No** GO to U27 .
U26 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SATELLITE RADIO RECEIVER DISCONNECTED • Disconnect: Satellite Radio Receiver C3290. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** GO to U27 . **No** GO to U68 .

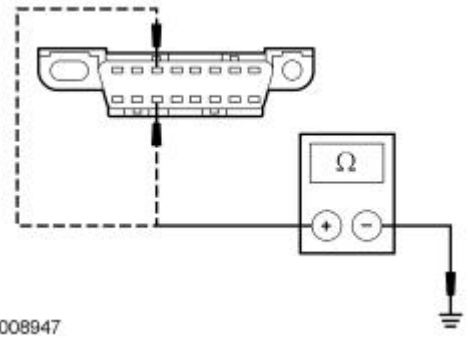
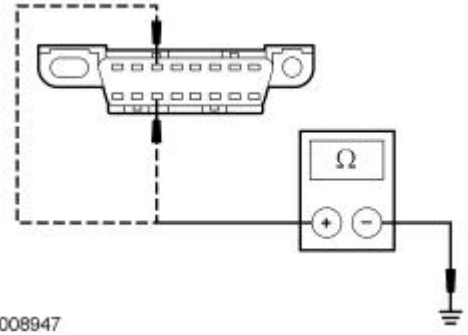
 N0050701 • **Is the resistance less than 5 ohms?**	
U27 VERIFY VEHICLE EQUIPMENT — POWER RUNNING BOARD MODULE	
• Inspect the vehicle for a power running board module. • **Is the vehicle equipped with a power running board module?**	**Yes** GO to U28 . **No** GO to U29 .
U28 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE POWER RUNNING BOARD MODULE DISCONNECTED	
• Disconnect: Power Running Board Module C3313b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to U29 . **No** GO to U69 .
U29 VERIFY VEHICLE EQUIPMENT — PARKING AID MODULE	
• Inspect the vehicle for a parking aid module. • **Is the vehicle equipped with a parking aid module?**	**Yes** GO to U30 . **No** GO to U31 .
U30 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PARKING AID MODULE DISCONNECTED	
• Disconnect: Parking Aid Module C4226. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to U70 .

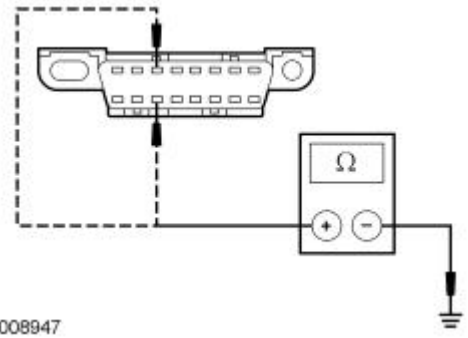
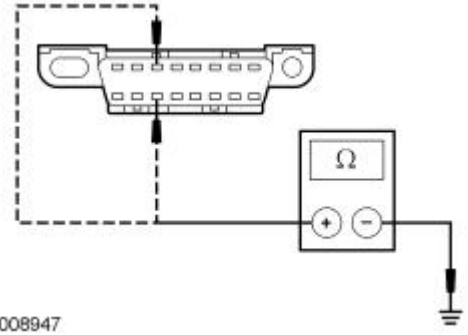
 N0050701 • **Is the resistance less than 5 ohms?**	
U31 VERIFY VEHICLE EQUIPMENT — POWER LIFTGATE MODULE • Inspect the vehicle for a power liftgate module. • **Is the vehicle equipped with a power liftgate module?**	**Yes** GO to U32 . **No** REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
U32 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE POWER LIFTGATE MODULE DISCONNECTED • Disconnect: Power Liftgate Module C4174b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to U71 .
U33 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SJB DISCONNECTED • Disconnect: SJB C2280h. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** GO to U58 . **No** GO to U34 .

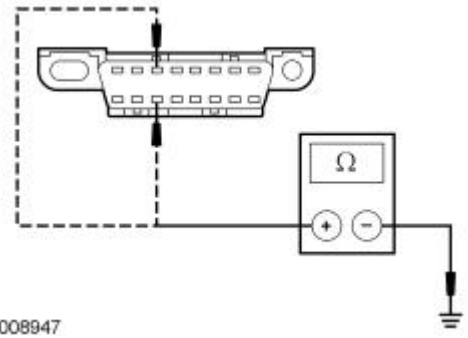
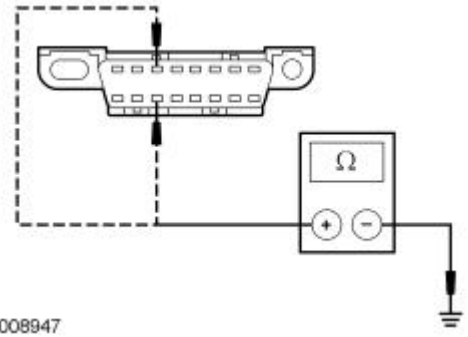
 N0008947 • **Are the resistances greater than 5,000 ohms?**	
U34 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE INSTRUMENT CLUSTER DISCONNECTED	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U59 . **No** GO to U35 .
U35 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE AUDIO UNIT DISCONNECTED	
• Disconnect: Audio Unit C240b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U60 . **No** GO to U36 .
U36 VERIFY VEHICLE EQUIPMENT — THX® AMPLIFIER	
• Inspect the vehicle for a THX® amplifier. • **Is the vehicle equipped with a THX® amplifier?**	**Yes** GO to U37 . **No** GO to U38 .

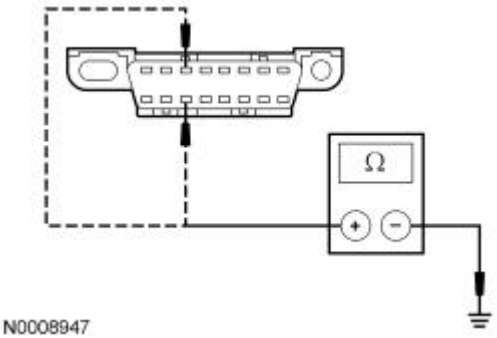
U37 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE THX® AMPLIFIER DISCONNECTED	
• Disconnect: THX® Amplifier C2364c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U61 . **No** GO to U38 .
U38 VERIFY VEHICLE EQUIPMENT — EATC MODULE	
• Inspect the vehicle for an EATC module. • **Is the vehicle equipped with an EATC module?**	**Yes** GO to U39 . **No** GO to U40 .
U39 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE EATC MODULE DISCONNECTED	
• Disconnect: EATC Module C228a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U62 . **No** GO to U40 .
U40 VERIFY VEHICLE EQUIPMENT — ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE	
• Inspect the vehicle for an electronic manual temperature control module. • **Is the vehicle equipped with an electronic manual temperature control module?**	**Yes** GO to U41 . **No** GO to U42 .
U41 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE DISCONNECTED	
• Disconnect: Electronic Manual Temperature Control	**Yes**

Module C2357a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	GO to U63 . **No** GO to U42 .
U42 VERIFY VEHICLE EQUIPMENT — AUXILIARY AUDIO MODULE	
• Inspect the vehicle for an auxiliary audio module. • **Is the vehicle equipped with an auxiliary audio module?**	**Yes** GO to U43 . **No** GO to U44 .
U43 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE AUXILIARY AUDIO MODULE DISCONNECTED	
• Disconnect: Auxiliary Audio Module C3077. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U64 . **No** GO to U44 .
U44 VERIFY VEHICLE EQUIPMENT — DVD PLAYER	
• Inspect the vehicle for a DVD player. • **Is the vehicle equipped with a DVD player?**	**Yes** GO to U45 . **No** GO to U46 .
U45 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DVD PLAYER DISCONNECTED	
• Disconnect: DVD Player C949. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** GO to U65 . **No** GO to U46 .

 N0008947 • **Are the resistances greater than 5,000 ohms?**	
U46 VERIFY VEHICLE EQUIPMENT — DRIVER SEAT MODULE	
• Inspect the vehicle for a driver seat module. • **Is the vehicle equipped with a driver seat module?**	**Yes** GO to U47 . **No** GO to U48 .
U47 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DRIVER SEAT MODULE DISCONNECTED	
• Disconnect: Driver Seat Module C341e. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U66 . **No** GO to U48 .
U48 VERIFY VEHICLE EQUIPMENT — CLIMATE CONTROLLED SEAT MODULE	
• Inspect the vehicle for a climate controlled seat module. • **Is the vehicle equipped with a climate controlled seat module?**	**Yes** GO to U49 . **No** GO to U50 .
U49 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE CLIMATE CONTROLLED SEAT MODULE DISCONNECTED	
• Disconnect: Climate Controlled Seat Module C3265c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** GO to U67 . **No** GO to U50 .

 N0008947 • **Are the resistances greater than 5,000 ohms?**	
U50 VERIFY VEHICLE EQUIPMENT — SATELLITE RADIO RECEIVER	
• Inspect the vehicle for a satellite radio receiver. • **Is the vehicle equipped with a satellite radio receiver?**	**Yes** GO to U51 . **No** GO to U52 .
U51 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SATELLITE RADIO RECEIVER DISCONNECTED	
• Disconnect: Satellite Radio Receiver C3290. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U68 . **No** GO to U52 .
U52 VERIFY VEHICLE EQUIPMENT — POWER RUNNING BOARD MODULE	
• Inspect the vehicle for a power running board module. • **Is the vehicle equipped with a power running board module?**	**Yes** GO to U53 . **No** GO to U54 .
U53 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE POWER RUNNING BOARD MODULE DISCONNECTED	
• Disconnect: Power running Board Module C3313b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** GO to U69 . **No** GO to U54 .

 N0008947 • **Are the resistances greater than 5,000 ohms?**	
U54 VERIFY VEHICLE EQUIPMENT — PARKING AID MODULE	
• Inspect the vehicle for a parking aid module. • **Is the vehicle equipped with a parking aid module?**	**Yes** GO to U55 . **No** GO to U56 .
U55 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PARKING AID MODULE DISCONNECTED	
• Disconnect: Parking Aid Module C4226. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to U70 . **No** GO to U56 .
U56 VERIFY VEHICLE EQUIPMENT — POWER LIFTGATE MODULE	
• Inspect the vehicle for a power liftgate module. • **Is the vehicle equipped with a power liftgate module?**	**Yes** GO to U57 . **No** REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
U57 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE POWER LIFTGATE MODULE DISCONNECTED	
• Disconnect: Power Liftgate Module C4174b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** GO to U71 . **No** REPAIR the circuit. CONNECT

 N0008947 • **Are the resistances greater than 5,000 ohms?**	all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U58 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U59 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
• Disconnect the instrument cluster connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U60 CHECK FOR CORRECT AUDIO UNIT OPERATION
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new audio unit. REFER to Section 415-01 . CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The

	concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U61 CHECK FOR CORRECT THX® AMPLIFIER OPERATION
• Disconnect all the THX® amplifier connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the THX® amplifier connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a THX® amplifier. REFER to Section 415-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U62 CHECK FOR CORRECT EATC MODULE OPERATION
• Disconnect all the EATC module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the EATC module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new EATC module. REFER to Section 412-01 . CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U63 CHECK FOR CORRECT ELECTRONIC MANUAL TEMPERATURE CONTROL MODULE OPERATION
• Disconnect all the electronic manual temperature control module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the electronic manual temperature control module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new electronic manual temperature control module. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U64 CHECK FOR CORRECT AUXILIARY AUDIO MODULE OPERATION	

• Disconnect the auxiliary audio module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the auxiliary audio module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new auxiliary audio module. REFER to Section 415-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U65 CHECK FOR CORRECT DVD PLAYER OPERATION	

• Disconnect the DVD player connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the DVD player connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DVD player. REFER to Section 415-07 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U66 CHECK FOR CORRECT DSM OPERATION	

• Disconnect all the DSM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the DSM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U67 CHECK FOR CORRECT CLIMATE CONTROLLED SEAT MODULE OPERATION	

• Disconnect all the climate controlled seat module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the climate controlled seat module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new climate controlled seat module. REFER to Section 501-10 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with

	the scan tool.
U68 CHECK FOR CORRECT SATELLITE RADIO RECEIVER OPERATION	

• Disconnect the satellite radio receiver connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the satellite radio receiver connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new satellite radio receiver. REFER to Section 415-00 . CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

U69 CHECK FOR CORRECT POWER RUNNING BOARD MODULE OPERATION	

• Disconnect all the power running board module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the power running board module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new power running board module. REFER to Section 501-08 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U70 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect all the parking aid module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the parking aid module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Section 413-13 . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

U71 CHECK FOR CORRECT POWER LIFTGATE MODULE OPERATION	
• Disconnect all the power liftgate module connectors. • Check for: ▪ corrosion	**Yes** INSTALL a new power liftgate module. REFER to Section

■ damaged pins ■ pushed-out pins • Connect all the power liftgate module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	501-03 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test V: No High Speed Controller Area Network (HS-CAN) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The HS-CAN uses an unshielded twisted pair cable, circuits VDB04 (WH/BU) and VDB05 (WH). The powertrain control module (PCM), the transmission control module (TCM), the anti-lock brake system (ABS) module, the restraints control module (RCM), the four wheel drive (4WD) control module (if equipped), the air suspension module (if equipped) and the instrument cluster all communicate with the scan tool using the HS-CAN.

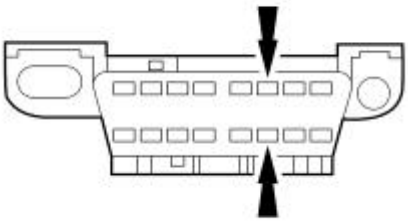
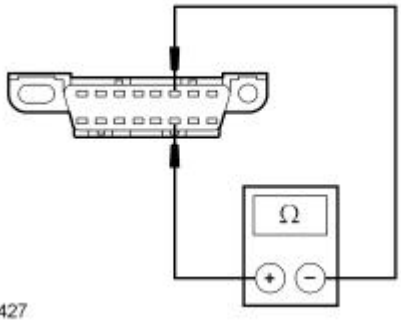
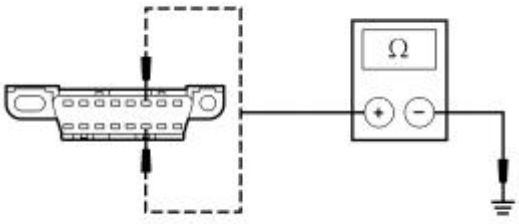
Possible Causes

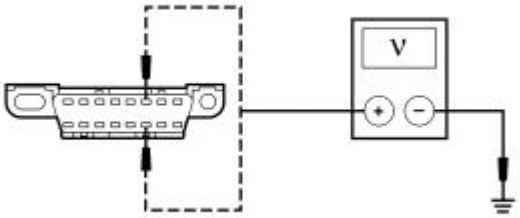
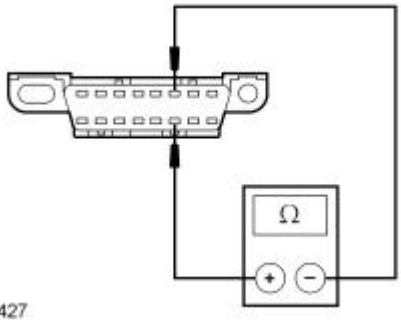
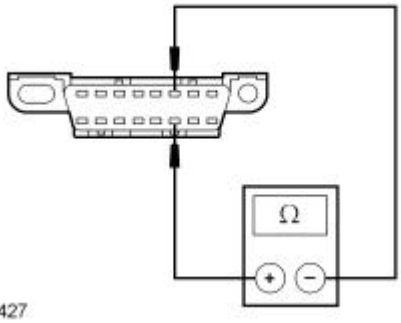
- Circuit VDB04 (WH/BU) open, short to ground or voltage (HS-CAN +)
- Circuit VDB05 (WH) open, short to ground or voltage (HS-CAN -)
- Circuit VDB04 (WH/BU) (HS-CAN +) and circuit VDB05 (WH) (HS-CAN -) shorted together
- PCM
- RCM
- TCM
- ABS module
- Instrument cluster
- 4WD control module (if equipped)
- Air suspension module (if equipped)

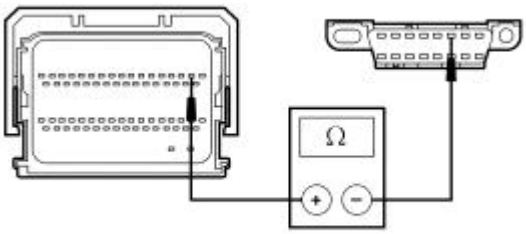
PINPOINT TEST V: NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
V1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE	
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Key in OFF position. • Disconnect the scan tool cable from the DLC.	**Yes** GO to V2 . **No** REPAIR the DLC as necessary.

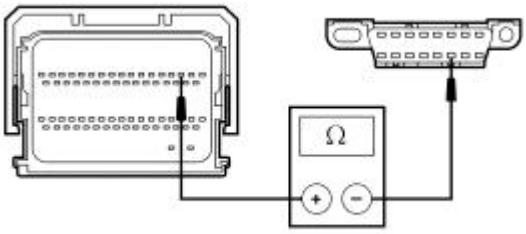
• Inspect DLC pins 6 and 14 for damage.  A0093867 • **Are DLC pins 6 and 14 OK?**	CLEAR the DTCs. REPEAT the network test with the scan tool.
V2 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. • Disconnect the battery ground cable. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to V3 . **No** GO to V5 .
V3 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V4 . **No** GO to V20 .
V4 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Connect the battery ground cable. • Key in ON position. • Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

side and ground.  N0002964 • **Is the voltage greater than 6 volts?**	**No** The CAN network has tested within specifications. VERIFY the scan tool operation on a substitute vehicle and REPEAT the network test on the suspect vehicle.
V5 CHECK THE HS-CAN TERMINATION RESISTOR	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to V6 . **No** GO to V9 .
V6 CHECK THE HS-CAN TERMINATION RESISTOR WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to V7 . **No** GO to V8 .
V7 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN	
• Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	**Yes** GO to V29 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.



N0026577

- Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.

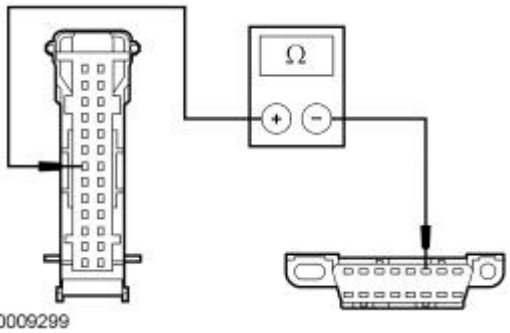


N0026578

- **Are the resistances less than 5 ohms?**

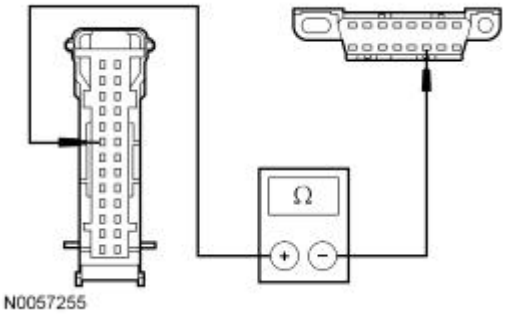
V8 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE INSTRUMENT CLUSTER FOR AN OPEN

- Measure the resistance between the instrument cluster C220-7, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0009299

- Measure the resistance between the instrument cluster C220-8, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.



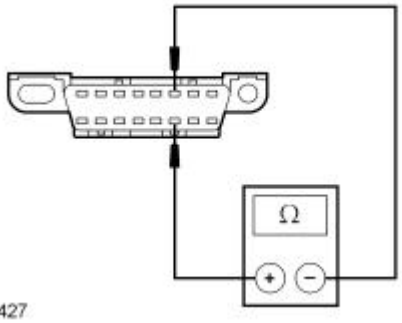
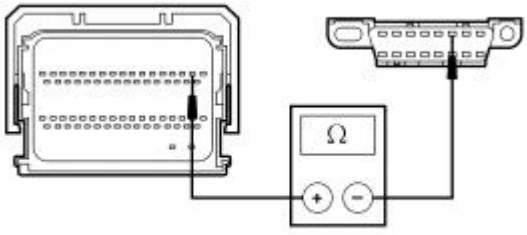
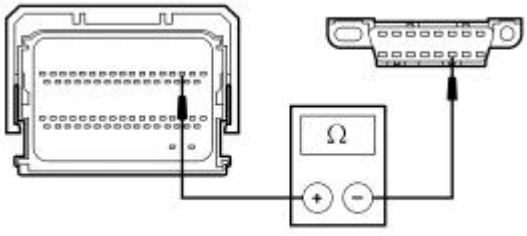
N0057255

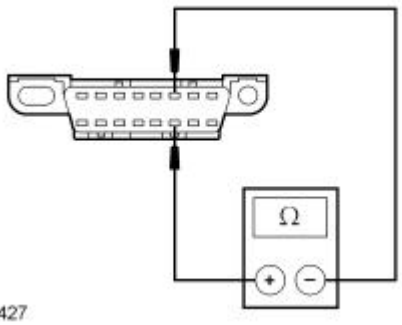
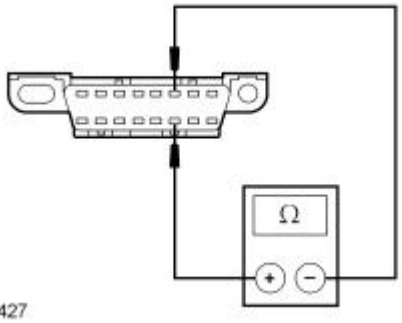
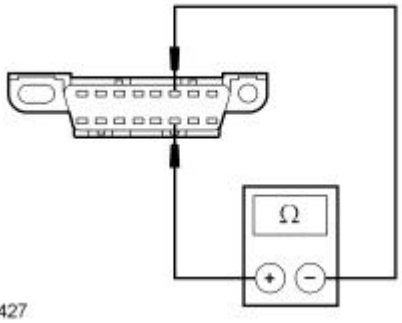
- **Are the resistances less than 5 ohms?**

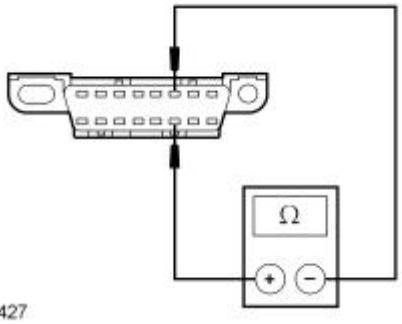
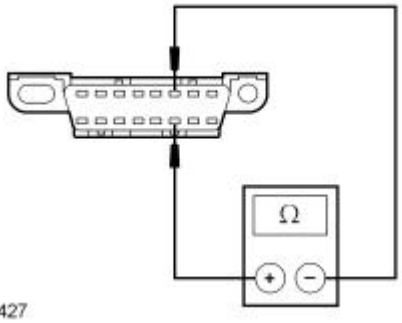
Yes
GO to V34 .

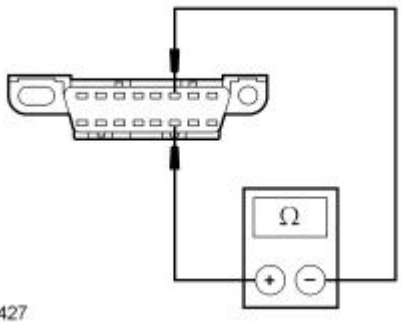
No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

V9 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER

• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to V11 . **No** GO to V10 .
V10 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN	
• Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0026577 • Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026578 • **Are the resistances less than 5 ohms?**	**Yes** The CAN network has tested within specifications. Verify the scan tool operation on a substitute vehicle, and REPEAT the network test on the suspect vehicle. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
V11 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to V12 . **No** GO to V29 .

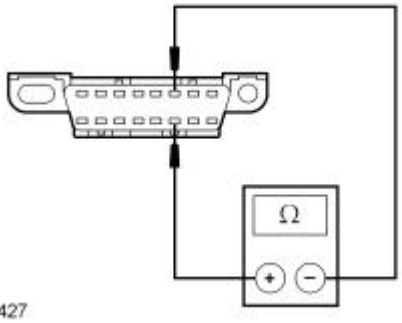
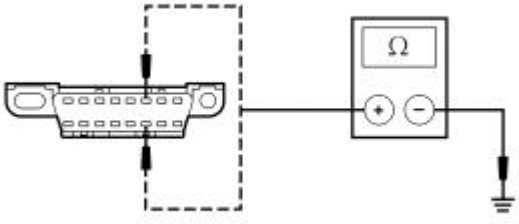
 N0026427 • **Is the resistance less than 5 ohms?**	
V12 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE ABS MODULE DISCONNECTED	
• Disconnect: ABS Module C135. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to V13 . **No** GO to V30 .
V13 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE TCM DISCONNECTED	
• Disconnect: TCM C1548 (Expedition) or C1473 (Navigator). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to V14 . **No** GO to V31 .
V14 VERIFY VEHICLE EQUIPMENT — 4WD CONTROL MODULE	
• Inspect the vehicle for 4WD. • **Is the vehicle equipped with 4WD?**	**Yes** GO to V15 . **No** GO to V16 .

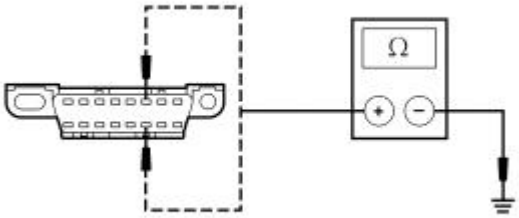
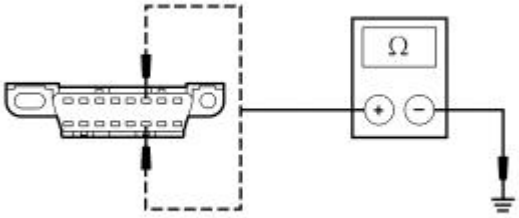
V15 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE 4WD CONTROL MODULE DISCONNECTED	
• Disconnect: 4WD Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to V16 . **No** GO to V32 .
V16 VERIFY VEHICLE EQUIPMENT — AIR SUSPENSION MODULE	
• Inspect the vehicle for air suspension. • **Is the vehicle equipped with air suspension?**	**Yes** GO to V17 . **No** GO to V18 .
V17 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE AIR SUSPENSION MODULE DISCONNECTED	
• Disconnect: Air Suspension Module C2324b (Expedition) or C2131b (Navigator). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to V18 . **No** GO to V33 .
V18 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE INSTRUMENT CLUSTER DISCONNECTED	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to V19 . **No** GO to V34 .

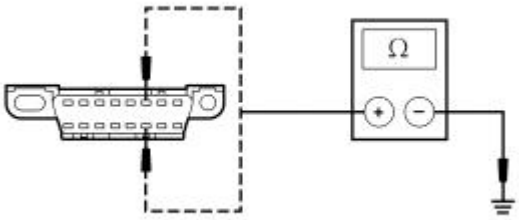
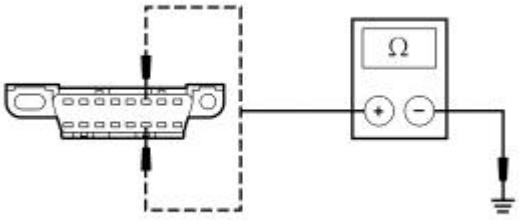
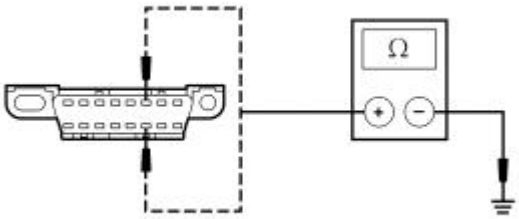


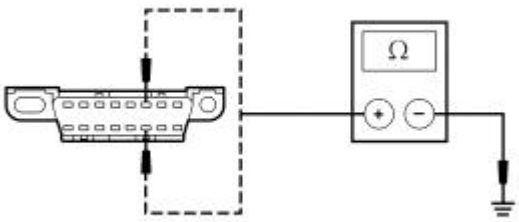
N0026427

- **Is the resistance less than 5 ohms?**

V19 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RCM DISCONNECTED	
• Depower the supplemental restraint system (SRS). Refer to Section 501-20B . • Disconnect: RCM C310b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuits. CONNECT all modules. REPOWER the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to V35 .
V20 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V29 . **No** GO to V21 .
V21 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ABS MODULE DISCONNECTED	
• Disconnect: ABS Module C135. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and	**Yes** GO to V30 .

between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**No** GO to V22 .
V22 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE TCM DISCONNECTED	
• Disconnect: TCM C1548 (Expedition) or C1473 (Navigator). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V31 . **No** GO to V23 .
V23 VERIFY VEHICLE EQUIPMENT — 4WD CONTROL MODULE	
• Inspect the vehicle for 4WD. • **Is the vehicle equipped with 4WD?**	**Yes** GO to V24 . **No** GO to V25 .
V24 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE 4WD CONTROL MODULE DISCONNECTED	
• Disconnect: 4WD Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.	**Yes** GO to V32 . **No** GO to V25 .

 N0002963 • **Are the resistances greater than 5,000 ohms?**	
V25 VERIFY VEHICLE EQUIPMENT — AIR SUSPENSION	
• Inspect the vehicle for air suspension. • **Is the vehicle equipped with air suspension?**	**Yes** GO to V26 . **No** GO to V27 .
V26 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE AIR SUSPENSION MODULE DISCONNECTED	
• Disconnect: Air Suspension Module C2324b (Expedition) or C2131b (Navigator). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V33 . **No** GO to V27 .
V27 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE INSTRUMENT CLUSTER DISCONNECTED	
• Disconnect: Instrument Cluster C220. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V34 . **No** GO to V28 .

V28 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RCM DISCONNECTED	
• Depower the SRS. Refer to Section 501-20B . • Disconnect: RCM C310b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to V35 . **No** REPAIR the circuit. CONNECT all modules. REPOWER the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
V29 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

V30 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect the ABS module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

V31 CHECK FOR CORRECT TCM OPERATION	
• Disconnect the TCM connector. • Check for:	**Yes** INSTALL a new TCM. REFER to

■ corrosion ■ damaged pins ■ pushed-out pins • Connect the TCM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Section 307-01A for the 6HP26 transmission or Section 307-01B for the 6R75. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
V32 CHECK FOR CORRECT 4WD CONTROL MODULE OPERATION	
• Disconnect the 4WD control module connector. • Check for: ■ corrosion ■ damaged pins ■ pushed-out pins • Connect the 4WD control module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4WD control module. REFER to Section 308-07A . CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
V33 CHECK FOR CORRECT AIR SUSPENSION MODULE OPERATION	
• Disconnect all the air suspension module connectors. • Check for: ■ corrosion ■ damaged pins ■ pushed-out pins • Connect all the air suspension module connectors and make sure they seat correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new air suspension module. REFER to Section 204-05 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
V34 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect the instrument cluster connector. • Check for: ■ corrosion ■ damaged pins ■ pushed-out pins • Connect the instrument cluster connector and make sure it seats correctly.	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with

• Operate the system and verify the concern is still present. • **Is the concern still present?**	the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
V35 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new RCM. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REPOWER the SRS. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test W: No Power To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

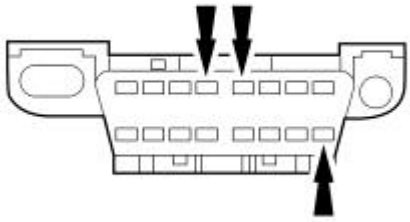
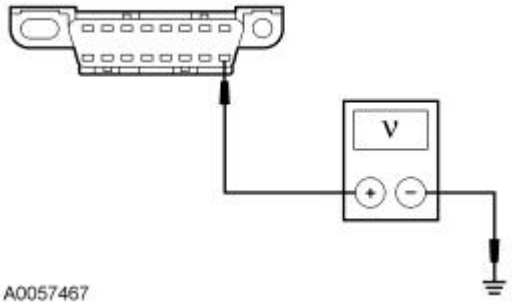
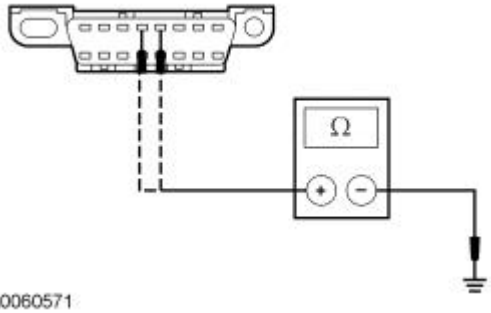
The scan tool is connected to the data link connector (DLC) to communicate with the high speed controller area network (HS-CAN) and the medium speed controller area network (MS-CAN) communications network. Voltage for the scan tool is provided by circuit SBP20 (GN/RD). Ground is provided by circuits GD113 (BK/YE) and GD138 (BK/WH).

Possible Causes

- Fuse
- Circuit SBP20 (GN/RD) open
- Circuit GD113 (BK/YE) open
- Circuit GD138 (BK/WH) open
- Scan tool

PINPOINT TEST W: NO POWER TO THE SCAN TOOL

Test Step	Result / Action to Take
W1 CHECK THE DLC PINS FOR DAMAGE	
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Disconnect the scan tool cable from the DLC. • Inspect DLC pins 4, 5 and 16 for damage.	**Yes** GO to W2 . **No** REPAIR the DLC as

 N0050767 • **Are DLC pins 4, 5 and 16 OK?**	necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
W2 CHECK THE DLC VOLTAGE SUPPLY CIRCUIT SBP20 (GN/RD) FOR AN OPEN	
• Measure the voltage between the DLC C251-16, circuit SBP20 (GN/RD), harness side and ground.  A0057467 • **Is the voltage greater than 10 volts?**	**Yes** GO to W3 . **No** VERIFY the smart junction box (SJB) fuse 20 (15A) is OK. If OK, REPAIR the circuit. REPEAT the network test with the scan tool.
W3 CHECK THE DLC GROUND CIRCUITS FOR AN OPEN	
• Measure the resistance between the DLC C251-4, circuit GD138 (BK/WH), harness side and ground; and between the DLC C251-5, circuit GD113 (BK/YE), harness side and ground.  A0060571 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the scan tool. REPEAT the network test with the scan tool. **No** REPAIR the circuit in question. REPEAT the network test with the scan tool.

Module Configuration

Printable View (103 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

Configurable modules accommodate a variety of vehicle options, eliminating the need for many unique modules for one vehicle line. These modules must be configured when replaced as part of a repair procedure.

Configurable modules should not be exchanged between vehicles since the settings are unique to each vehicle. Failure to configure a new module may result in improper operation and/or any of the following DTCs setting:

- B2477 and/or B2141 — sets when a body/chassis module is not configured.
- B2900 — sets when there is a VIN mismatch between the module with the B2900 and the PCM. Either the PCM or the body module stored VIN may be incorrect.
- P0602, P0605 and/or P1639 — sets when the powertrain control module (PCM) vehicle identification (VID) block is not configured or is configured incorrectly.
- U0300 and/or U0301 — sets when the configuration between 2 or more modules do not match.
- U2050 and/or U2051 — sets when a valid strategy/calibration is not present.

The following are the 3 different methods of configuration:

- Programmable module installation (PMI)
- Module reprogramming ("flashing")
- Programmable parameters

Some modules do not support all 3 methods.

Definition of Terms

The following are definitions of configuration terms:

Programmable Module Installation (PMI)

PMI is a scan tool process which configures settings in a new module. Data used for the PMI process is automatically downloaded from the original module and stored when a scan tool session is started. If this data cannot be retrieved from the module being replaced, the scan tool may prompt for As-Built data entry or display a list of parameter values that need to be manually selected. Some modules are reprogrammed during PMI when a strategy/calibration update is available.

NOTE: A module must be able to communicate with the scan tool in order to carry out PMI. It is

important that the scan tool identifies the vehicle and obtains configuration data prior to removing any modules.

To carry out PMI, refer to Programmable Module Installation in this section.

Module Reprogramming

Module reprogramming (also referred to as "flashing") is a scan tool process which updates the strategy/calibration in a module. Module reprogramming is automatically carried out during PMI when a later strategy/calibration is available. Reprogramming a module with the same level of software will not improve module operation or repair a hardware failure.

NOTE: Module reprogramming should be limited to circumstances where a published Technical Service Bulletin (TSB) procedure recommends doing so.

NOTE: A module cannot communicate with other modules on the communication network while being reprogrammed. Clear any network communication DTCs which may have been set in other modules during reprogramming.

Programmable Parameters

Programmable parameters are customer preference items that may be modified by the dealer via scan tool or in some cases modified by the customer following a procedure listed in the vehicle Owner's Literature. While many configuration options may exist for a module, only a few of these options are programmable parameters.

Adaptive Learning and Calibration

Some modules require a separate learning procedure be carried out if replaced as part of a repair procedure. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

Vehicle Identification (VID) Block

Some PCMs contain a memory area called a vehicle identification (VID) block. The PCM VID block commonly stores powertrain configuration items such as VIN, tire size, axle ratio, and whether or not the vehicle is equipped with speed control.

As-Built Data

As-Built data is a VIN specific module configuration record. During vehicle build, the configuration from all modules is downloaded and stored in the As-Built database. As Built data will not reflect customer preference items that have been changed from the default state. These items will need to be changed using programmable parameters after the module is configured.

NOTE: It is not necessary to obtain As-Built data unless directed to do so by the scan tool. This data may be accessed from the technician service publication website.

The following chart lists body/chassis module As-Built data addresses:

Body/Chassis Module Addresses for As-Built Entry

Module Name	Module Address
Anti-lock brake system (ABS) module	760
Audio unit	727
Auxiliary audio module	774

Climate controlled seat module (CCSM)	776
Digital versatile disc (DVD) player	771
Driver seat module (DSM)	744
Instrument cluster	720
Parking aid module	736
Restraints control module (RCM)	737
Satellite radio receiver	782
Smart junction box (SJB)	726
THX® amplifier	783

The following chart describes specific module programming information:

Module Configuration and Parameter Index

Module Name	Reprogram/ Flash Capable	Requires PMI	Requires Adaptive Learning	Requires Calibration	Available Programmable Parameters
Air suspension module	No	No	No	No	• None
Anti-lock brake system (ABS) module	No	Yes	No	Yes (with stability assist)	• Tire size
Audio unit	Yes	Yes	No	No	• Analog clock enable/disable
Auxiliary audio module	Yes	Yes	No	No	• SDARS enable/disable
Climate controlled seat module (CCSM)	Yes	Yes	No	No	• None
Driver seat module (DSM)	Yes	Yes	No	No	• Easy entry/exit
Digital versatile disc (DVD) player	Yes	Yes	No	No	• Language English/ Spanish/French • SDARS enable/disable
Electronic automatic temperature control (EATC)	No	No	No	No	• None
Four wheel drive (4WD) control module	Yes	No	No	No	• None
Instrument cluster	Yes	Yes	No	No	• Belt minder • English/Metric display • Language English/ Spanish/French • Oil life % • Overspeed warning • Reverse warning

Parking aid module	Yes	Yes	No	No	• None
Power liftgate module	No	No	No	No	• None
Power running board module	No	No	No	No	• None
Powertrain control module (PCM)	Yes	Yes	Yes	No	• Speed control enable/disable
Restraints control module (RCM)	Yes	Yes	No	No	• Belt minder enable/disable
Satellite radio receiver	Yes	Yes	No	No	• None
Smart junction box (SJB)	Yes	Yes	No	TPMS sensor training	• Autolamp delay timer • Autolock and auto un-lock mode • DRL enable/disable • Fog lamp enable/disable • Perimeter lighting mode • Perimeter anti-theft lamp and horn mode • RKE enable/disable
Transmission control module (TCM)	Yes	No	Yes	No	• None
THX® amplifier	Yes	Yes	No	No	• None

Inspection and Verification

This section provides step-by-step module configuration procedures. Carry out the programmable module installation (PMI) procedure in this section when another workshop manual section directs to carry out configuration or when DTCs from the below list are present:

Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B2477	Module Configuration Failure	• Anti-lock brake system (ABS) module • Audio unit • Auxiliary audio module • Climate controlled seat module (CCSM) • Driver seat module (DSM) • DVD player • Instrument cluster • Parking aid module • Smart junction box (SJB) • Satellite radio receiver	CARRY OUT PMI. REFER to Programmable Module Installation in this section.

		• THX®amplifier	
B2477	Module Configuration Failure	• Air suspension module	INSTALL a new air suspension module. REFER to Section 204-05 .
B2900	VIN mismatch	• ABS module • RCM	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
P0602	Powertrain Control Module Programming Error	• Powertrain control module (PCM)	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
P0605	Internal Control Module Read Only Memory (ROM) Error	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
P0605	Internal Control Module Read Only Memory (ROM) Error	• Transmission control module (TCM)	INSTALL a new TCM. REFER to Section 307-01A or Section 307-01B .
P1639	Vehicle ID Block Corrupted, Not Programmed	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
U0300	Internal Control Module Software Incompatibility	• PCM • RCM	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
U2050	No Application Present	• ABS module • Audio unit • Auxiliary audio module • CCSM • DSM • DVD player • Instrument cluster • Parking aid module • PCM • RCM • SJB • Satellite radio receiver • THX® amplifier • TCM	CARRY OUT PMI. REFER to Programmable Module Installation in this section.
U2050	No Application Present	• Air suspension module	INSTALL a new air suspension module. REFER to Section 204-05 .
U2050	No Application Present	• Electronic automatic temperature control (EATC) module	INSTALL a new EATC module. REFER to Section 412-01 .
U2050	No Application Present	• Power liftgate module	INSTALL a new power liftgate module. REFER to Section 501-03 .
U2050	No Application Present	• Power running board module	INSTALL a new power running board module. REFER to Section 501-08 .
U2050	No Application Present	• Four wheel drive (4WD) control module	INSTALL a new 4WD control module. REFER to Section 308-07A .
U2051	One or More Calibration Files Missing / Corrupt	• Audio unit • Instrument cluster • PCM • RCM • THX® amplifier	CARRY OUT PMI. REFER to Programmable Module Installation in this section.

		• Parking aid module	
U2051	One or More Calibration Files Missing / Corrupt	• Power liftgate module	INSTALL a new power liftgate module. REFER to Section 501-03 .

Programmable Module Installation

Printable View (85 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Connect the IDS and identify the vehicle as normal.
2. From the Toolbox icon, select Module Programming and press the check mark.
3. Select Programmable Module Installation.
4. Select the module that is being replaced.
5. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
6. Install the new module and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. The IDS downloads the data into the new module and displays Module Configuration Complete.
9. Test module for correct operation.

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is NOT Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Install the new module.
2. Connect the IDS and identify the vehicle as normal.

3. From the Toolbox icon, select Module Programming and press the check mark.
4. Select Programmable Module Installation.
5. Select the module that was replaced.
6. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. If the data is not available, the IDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from the technician service publication website at this time and press the check mark.
9. Enter the module data and press the check mark.
10. The IDS downloads the data into the new module and displays Module Configuration Complete.
11. Test module for correct operation.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Lower steering column cover screws	9	—	80
Steering column opening cover reinforcement bolts	15	11	—

Anti-Theft

Printable View (82 KB)

NOTE: If the instrument cluster or the PCM (or both) is installed, the parameters MUST be re-set in both modules or the vehicle will experience a passive anti-theft system (PATS) no-start. For additional information, refer to Passive Anti-Theft System (PATS) Parameter Reset in this section.

PATS consists of the following components:

- Anti-theft indicator (located in the instrument cluster)
- Encoded (the key contains a transponder) ignition key
- PATS transceiver
- Instrument cluster

PATS uses radio frequency identification technology to deter a drive-away theft. Passive means that it does not require any activity by the user.

The vehicle is equipped with 2 PATS keys. A maximum of 8 PATS keys can be programmed to start the vehicle. If additional PATS keys are desired, refer to Spare Key Programming — Unlimited Key Mode in this section.

PATS Function

The PATS function is controlled by the instrument cluster. The PATS uses the instrument cluster to carry out all of the PATS functions such as receiving the identification code from the PATS key, issuing a signal to the powertrain control module (PCM) to control the starter and fuel injectors enable, and initiates the key interrogation sequence when the ignition key is turned to the ON or START position. Because of the interaction between the instrument cluster and the PCM, there are parameters that must be set if the instrument cluster or the PCM (or both) are replaced. For additional information, refer to Passive Anti-Theft System (PATS) Parameter Reset in this section. If the instrument cluster must be replaced for any reason (PATS concerns or driveability concerns), the PATS keys also must be programmed into the new instrument cluster. For additional information, refer to Key Programming Using Diagnostic Equipment in this section. All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle will not start.

PATS is active only for a few seconds when the vehicle is starting. It is not a PATS concern if the vehicle stalls after it has been running for a minimum of 3 seconds. PATS will not disable a running vehicle.

PATS is not compatible with aftermarket remote start systems, which allow the vehicle to be started from the exterior of the vehicle. These systems may reduce the security of the vehicle, and also may be the cause of no-start concerns. Remote start systems must be removed from the vehicle before any PATS-related no-start concerns are investigated.

Unlimited Key Mode

PATS contains a feature called unlimited key mode. This feature allows a customer to program more than 8 vehicle keys, if requested. Each vehicle in unlimited key mode is set up with a special unlimited transponder security key code. This allows all the customer vehicles to share the same mechanically cut keys. For an individual customer, any randomly selected security key is acceptable. For additional information, refer to Spare Key Programming — Unlimited Key Mode in this section.

Anti-Theft

Printable View (233 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

Anti-Theft Indicator

NOTE: Replacement of the passive anti-theft system (PATS) transceiver does not require the PATS keys to be programmed into the instrument cluster again.

NOTE: Make sure any aftermarket remote start systems have been removed from the vehicle before any PATS-related no-start concerns are investigated.

NOTE: A minimum of 2 PATS keys must be programmed into the instrument cluster before the vehicle will start.

NOTE: If the instrument cluster or the powertrain control module (PCM) is being replaced (or both), the parameters must be re-set in both modules or the vehicle will experience a PATS no-start. For additional information, refer to Passive Anti-Theft System (PATS) Parameter Reset in this section.

PATS uses a visual anti-theft indicator located in the instrument cluster. The indicator proves out for 3 seconds when the ignition key is in the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily when the ignition key is turned to the ON or START position. PATS also flashes the anti-theft indicator every 2 seconds when the ignition key is in the OFF position to act as a visual theft deterrent. Refer to Section 413-01 for additional information on the PATS indicator.

Encoded PATS Keys

PATS uses a special ignition key that is larger than a conventional ignition key because it contains a

permanently installed electronic device called a transponder. Each transponder contains a unique encrypted identification code which is one of a very large number of combinations. The addition of this transponder to the key makes it an "encoded" key. The PATS key does not require batteries and should last the lifetime of the vehicle. Each PATS key must be programmed into the instrument cluster before it can be used to start the vehicle. Up to 8 PATS keys can be programmed into the instrument cluster. If additional PATS keys are desired, a standard PATS key can be used. There are special diagnostic procedures described in this section that must be carried out if a new PATS key is necessary. Refer to Key Programming Using Diagnostic Equipment in this section.

PATS Transceiver

The PATS transceiver is located under the steering column shroud and communicates with the encoded ignition key. During each vehicle start sequence, the PATS transceiver reads the encoded ignition key identification code and sends data to the instrument cluster. The instrument cluster validates the code, and if it is the correct code, will send a message to the powertrain control module (PCM) to ground the starter relay solenoid coil and to also allow the fuel injectors to operate. Refer to Passive Anti-Theft System (PATS) Transceiver in this section.

PATS Operation

The PATS function is controlled by the instrument cluster. When the PATS key is turned to the ON or START position, the instrument cluster initiates the key interrogation sequence by sending a voltage signal to the PATS transceiver. The transceiver then uses its antenna to bounce a signal off the transponder in the PATS key. This process "reads" the PATS key identification code and sends the key identification code back to the instrument cluster, which interprets it and determines if it matches one of the stored key codes. If it does match one of the stored key codes, the instrument cluster will send a message to the PCM to ground the starter relay solenoid coil and to also allow the fuel injectors to operate. If it does not match one of the stored key codes, or it is only a partial key read or no key read, the instrument cluster will send a message to the PCM to not ground the starter relay solenoid coil and not allow fuel injector operation. The anti-theft indicator in the instrument cluster will flash (or may glow steadily) and the instrument cluster will store one or more diagnostic trouble codes (DTCs). All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle will not start. If the instrument cluster must be replaced for any reason (PATS concerns or driveability concerns), the PATS keys must also be programmed into the new instrument cluster. Refer to Key Programming Using Diagnostic Equipment in this section.

PATS Parameter Identification (PIDs)

Monitoring the PATS PIDs can be very useful in determining which diagnostic steps to follow. Viewing the MASTERKEY (master key) PID (with both keys) will determine if the key is a programmed key and will also prove out the transceiver, circuitry and the instrument cluster. A master key is any key that is programmed into the instrument cluster.

Viewing the MIN_KEY (minimum number of keys) PID (this PID does not change) determines the minimum number of keys that must be programmed into the instrument cluster. There must be at least 2 keys programmed into the instrument cluster in this type of PATS before the vehicle will start.

Viewing the N_KEYCODE (number of keys programmed) PID will determine if the minimum number of keys have been programmed into the instrument cluster. If the N_KEYCODE PID reads 0 or 1, additional key(s) will need to be programmed into the instrument cluster in order to meet the minimum of 2 keys. If the N_KEYCODE PID reads 0 or 1, and the MASTERKEY PID reads NOTPREST, that particular key must be programmed into the instrument cluster. If the N_KEYCODE PID reads 1, and the MASTERKEY PID reads PRESNT, that particular key is already programmed into the instrument cluster.

If the instrument cluster was replaced, the parameters in the instrument cluster, then the parameters in the PCM will need to be reset. When the parameters in the instrument cluster are reset, that clears (erases) the PCM ID from the instrument cluster. A keep-alive memory (KAM) reset of the PCM (also termed a PCM parameter reset) will send a PCM ID to the instrument cluster that is necessary for the system to operate. Make sure to make 3-5 attempts to start the vehicle for 3-5 seconds each before attempting more procedures. The extra key cycles are necessary for the PCM ID to be sent (by the PCM) and then stored by the instrument cluster. If only a PCM parameter reset occurs, the instrument cluster may encounter 2 PCM IDs (the original one and the new one) and may cause a PATS-related

no-start. If a PCM parameter reset occurs first, then the instrument cluster parameter reset occurs, there will be no PCM ID stored in the instrument cluster, and a PATS-related no-start may occur. Carry out the instrument cluster parameter reset first, then the PCM parameter reset next. If the SERV_MOD reads STORED, the instrument cluster has a PCM ID stored. If it reads NOTSTRD, a KAM reset of the PCM may resolve this issue. If the PATSENABL reads NO, and the N_KEYCODE reads 2 or more and the MASTERKEY reads PRESNT, the instrument cluster, then the PCM will need to have their parameters reset.

If the PATSENABL reads NO, and the N_KEYCODE reads 1 and the MASTERKEY reads PRESNT, or if the N_KEYCODE reads 0 and the MASTERKEY reads NOTPRESNT, a minimum of 2 keys will need to be programmed into the instrument cluster. Refer to Key Programming Using Diagnostic Equipment in this section.

If the MASTERKEY continues to read NOTPRESNT after programming, this may indicate a defective key. The SPAREKEY (spare key) PID is defaulted to ENABLE. With the SPAREKEY PID displaying ENABLE, the instrument cluster will accept more than 2 keys (up to a maximum of 8) being programmed into the instrument cluster. Refer to Key Programming Using Two Programmed Keys in this section. It can be toggled to DISABL if the customer does not want any more than 2 keys programmed into the instrument cluster. Refer to Key Programming Switch State Control in this section. This switch state control does not affect the Key Programming Using Diagnostic Equipment procedure.

In summary for the PATS PIDs and their correct state in order for the vehicle to start:

- N_KEYCODE must read 2 or more
- MASTERKEY must read PRESNT
- SERV_MOD must read STORED
- PATSENABL must read YES

Unlimited Key Mode

PATS contains a feature called unlimited key mode and uses the PID UNL_KEY. This feature allows a customer to program more than 8 keys to their vehicle if they request it. Each vehicle in unlimited key mode is set up with a special unlimited transponder security key code. This allows all the customer vehicles to share the same keys, but no other keys from outside can be used to operate the vehicles. For an individual customer, any randomly selected security key is acceptable. Refer to Spare Key Programming — Unlimited Key Mode in this section.

PATS disables the vehicle from starting if there is:

- a damaged PATS key.
- a non-programmed PATS key.
- a non-PATS key (key has no electronics).
- damaged wiring.
- a damaged transceiver.
- a damaged instrument cluster.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Large metallic objects, a second passive anti-theft system (PATS) key on the same key ring as the PATS key, or electronic devices on the key ring that can be used to purchase gasoline or similar items • Ignition lock cylinder • PATS key • Use of a non-PATS key or incorrect PATS key • More than one PATS key on key ring • Remote start system installed	• Smart junction box (SJB) fuse(s): ▪ 26 (10A) ▪ 29 (5A) ▪ 36 (5A) • Circuitry • PATS transceiver • Ignition switch • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.

9. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Instrument Cluster Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	If DTCs B1600, B1601, B1602, B1681 or B2103 are present, they must be addressed first. If DTC B1213 is the only DTC present, PROGRAM additional keys. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
B1342	ECU is Faulted	CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster.

		REFER to Section 413-01 . CYCLE the ignition. REPEAT the self-test.
B1600	PATS Ignition Key Transponder Signal is Not Received	No PATS key has been read by the instrument cluster. Go To Pinpoint Test B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	There is an unprogrammed PATS key. Go To Pinpoint Test C .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Only a partial PATS key was read. Go To Pinpoint Test D .
B1681	PATS Transceiver Module Signal is Not Received	The instrument cluster did not receive the PATS transceiver signal. Go To Pinpoint Test E .
B2103	Antenna Not Connected	There has been a PATS transceiver antenna failure. Go To Pinpoint Test A .
B2141	NVM Configuration Failure	There is no PCM ID stored in the instrument cluster. CARRY OUT a parameter reset of the instrument cluster and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle.
B2431	Transponder Programming Failed	The ignition key was not programmed. PROGRAM the key. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the instrument cluster	• Fuse(s) • Circuitry • Instrument cluster	• REFER to Section 418-00 .
• The anti-theft indicator is always/never on	• Anti-theft indicator • Instrument cluster	• Go To Pinpoint Test G .
• The vehicle does not start	• Circuitry • Passive anti-theft system (PATS) key • PATS transceiver • Powertrain control module (PCM)	• Go To Pinpoint Test H .

Pinpoint Tests

Pinpoint Test A: DTC B2103 — No Antenna Detected

Normal Operation

The passive anti-theft system (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The control functions are contained in the instrument cluster. The instrument cluster carries out all of the PATS functions such as receiving the identification code from the PATS key and controlling engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

DTC B2103 — sets when there has been a PATS transceiver antenna failure. The PATS transceiver may need to be replaced.

Possible Causes

- PATS transceiver

PINPOINT TEST A: DTC B2103 — ANTENNA NOT CONNECTED

Test Step	Result / Action to Take
A1 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION OR PHYSICAL DAMAGE	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster again. ● Key in OFF position. ● Verify the PATS transceiver is correctly installed. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. ● Enter the following diagnostic mode on the diagnostic tool: Clear Continuous DTCs. ● Key in OFF position. ● Key in ON position. ● Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. ● **Is DTC B2103 retrieved?**	**Yes** INSTALL a new PATS transceiver. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. REPEAT the self-test. TURN the ignition OFF then back to RUN. **No** The system is OK.

Pinpoint Test B: DTC B1600 — Passive Anti-Theft System (PATS) Ignition Key Transponder Signal Is Not Received

Normal Operation

The PATS transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The control functions are contained in the instrument cluster. The instrument cluster carries out all of the PATS functions such as receiving the identification code from the PATS key and controlling engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

DTC B1600 — sets when no PATS key has been read by the instrument cluster.

Possible Causes

- PATS transceiver

- Instrument cluster
- Encoded PATS ignition key

PINPOINT TEST B: DTC B1600 — PATS IGNITION KEY TRANSPONDER SIGNAL IS NOT RECEIVED

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS ignition key may cause vehicle starting issues and record diagnostic trouble codes (DTCs) under certain conditions. If a fault cannot be identified, examine the customer's key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS ignition key while starting the engine. These objects and devices cannot damage the PATS ignition key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition OFF and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the encoded ignition key used by the customer is a Ford approved PATS key. (PATS keys from Ford, Rotunda, Strattec, HUF are approved Ford PATS keys)

Test Step	Result / Action to Take
B1 CHECK THE DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Clear Continuous Instrument Cluster DTCs. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1600 retrieved?**	**Yes** GO to B2 . **No** If other than PATS DTCs are retrieved, REFER to Section 413-01 . If other PATS DTCs are retrieved, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. If no PATS DTCs are retrieved, the system is OK.
B2 INSTALL A NEW ENCODED PATS IGNITION KEY	
NOTE: Check to make sure the customer and new encoded (contains a transponder) PATS ignition keys are Ford approved, encoded PATS ignition keys. Unapproved PATS keys do not always operate correctly over different temperature ranges. (Ford, Rotunda, Strattec and HUF are the only approved encoded PATS ignition key.) • Cut a new encoded ignition key. • Program the new encoded ignition key. Refer to Spare Key Programming — Using Diagnostic Equipment in this section. • Enter the following diagnostic mode on the diagnostic tool: Clear Instrument Cluster Continuous DTCs. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1600 present?**	**Yes** GO to B3 . **No** If other than PATS DTCs are retrieved, REFER to Section 413-01 . If other PATS DTCs are retrieved, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. If no PATS DTCs are retrieved, one (or both) of the original PATS keys are defective. REPEAT the self-test with the original keys to determine if one (or both) keys are defective.
B3 INSTALL A NEW PATS TRANSCEIVER	
NOTE: Replacement of the PATS transceiver does	**Yes**

not require the PATS keys to be programmed into the instrument cluster again. **NOTE:** Do not use the PATS key that may have been programmed in Step B2. • Key in OFF position. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Clear Instrument Cluster Continuous DTCs. • Key in OFF position. • Turn the key to the ON position using an existing customer PATS key. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1600 retrieved?**	GO to B4 . **No** The system is OK.
B4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

NOTE: When a new instrument cluster is installed, the PATS keys must be programmed into the instrument cluster. **NOTE:** When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM).
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test C: DTC B1601 — The Passive Anti-Theft System (PATS) Received an Incorrect Key-Code From The Ignition Key Transponder

Normal Operation

The PATS transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The instrument cluster will then send a message to the powertrain control module (PCM). The PCM will carry out the function of controlling engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

DTC B1601 — sets when there is an unprogrammed PATS key. The concern may not be with the PATS key itself, but possibly the key may need to be programmed into the PATS memory (unless the maximum number of keys are already programmed).

Possible Causes

- PATS key
- PATS transceiver
- Instrument cluster

PINPOINT TEST C: DTC B1601 — PATS RECEIVED INCORRECT KEY-CODE FROM IGNITION KEY TRANSPONDER

NOTE: The PCM disables the engine for 1 second every time DTC B1601 is set. The ignition must remain in the RUN position for at least 1 second before an attempt is made to start the vehicle with any encoded ignition key. Check the instrument cluster PID ANTISCAN for this unprogrammed key time-out status.

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause vehicle starting concerns and record diagnostic trouble codes (DTCs) under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition switch off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, HUF are approved Ford PATS keys).

NOTE: Only 8 PATS keys can be programmed into the instrument cluster during normal programming procedures (unless the unlimited key mode is enabled). If the N_KEYCODE PID reads more than 2 and less than 8, the concern may be the PATS key being used is an unprogrammed key. Verify this by also viewing the MASTERKEY PID. It must read PRESNT for the key to be valid.

Test Step	Result / Action to Take
C1 RETRIEVE THE DTCs • Enter the following diagnostic mode on the diagnostic tool: Clear the Instrument Cluster Continuous DTCs. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs . • **Is DTC B1601 retrieved?**	**Yes** GO to C2 . **No** The system is OK. CHECK all customer encoded PATS ignition keys by attempting to start the vehicle with each key to VERIFY all other encoded PATS ignition keys are programmed.
C2 CHECK FOR PROGRAMMED ENCODED IGNITION KEYS — MONITOR THE INSTRUMENT CLUSTER PID N_KEYCODE • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PIDs. • Monitor the instrument cluster PID N_KEYCODE. • **Does the instrument cluster PID N_KEYCODE display 8?**	**Yes** ERASE and REPROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to C3 .
C3 CHECK THE NUMBER OF PROGRAMMED ENCODED IGNITION KEYS AVAILABLE • Verify there are at least 2 currently programmed encoded PATS ignition keys available with the vehicle. • **Are at least 2 currently programmed encoded PATS ignition keys available with the vehicle?**	**Yes** GO to C4 . **No** CUT a new encoded PATS ignition key so that at least 2 encoded PATS ignition keys are available. PROGRAM the encoded PATS ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. GO to C5 .
C4 VERIFY THE INSTRUMENT CLUSTER PID	

SPAREKEY INDICATES YES	
• Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PID. • Monitor the instrument cluster PID SPAREKEY. • **Does the instrument cluster PID SPAREKEY indicate ENABLE?**	**Yes** Spare key programming is enabled. REFER to Key Programming Using Two Programmed Keys in this section. CLEAR the DTCs. REPEAT the self-test. **No** ENABLE the instrument cluster PID SPAREKEY. REFER to Key Programming Switch State Control in this section. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK THE ENCODED PATS IGNITION KEYS FOR CORRECT OPERATION	
• Key in OFF position. • Turn the key to ON for 3 seconds using the first encoded PATS ignition key. • Key in ON position. • Turn the key to ON for 3 seconds using the second PATS ignition key. • Start the vehicle using the second encoded PATS ignition key. • **Does the vehicle start?**	**Yes** The system is OK. If there are additional keys that need to be programmed, REFER to Key Programming Using Two Programmed Keys in this section. **No** GO to C6.
C6 RETRIEVE THE DTCs — CHECK FOR DTC B1601	
• Enter the following diagnostic mode on the diagnostic tool: Clear the Instrument Cluster Continuous DTCs. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1601 retrieved?**	**Yes** GO to C7. **No** If other than PATS DTCs are retrieved, REFER to Section 413-01. If other PATS DTCs are retrieved, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. If no PATS DTCs are retrieved, the system is OK.
C7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

NOTE: When a new instrument cluster is installed, the PATS keys must be programmed into the instrument cluster. **NOTE:** When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM).
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01. PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test D: DTC B1602 — PATS Received Invalid Format Of Key-Code From Ignition Key

Transponder

Normal Operation

The PATS transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The instrument cluster will then send a message to the powertrain control module (PCM) to control the engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

DTC B1602 — sets when only a partial PATS key was read. Remote starter equipment can also cause this diagnostic trouble code (DTC).

Possible Causes

- PATS key
- PATS transceiver
- Instrument cluster

PINPOINT TEST D: DTC B1602 — PATS RECEIVED INVALID FORMAT OF KEY-CODE FROM IGNITION KEY TRANSPONDER

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause vehicle starting concern and record diagnostic trouble codes (DTCs) under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, HUF are approved Ford PATS keys).

NOTE: Only 8 PATS keys can be programmed into the instrument cluster during normal programming procedures (unless the unlimited key mode is enabled). If the N_KEYCODE PID reads more than 2 and less than 8, the concern may be the PATS key being used is an unprogrammed key. Verify this by also viewing the MASTERKEY PID. It must read PRESNT for the key to be valid.

NOTE: Make sure any aftermarket remote start systems have been removed from the vehicle before any PATS-related no-start concerns are investigated.

Test Step	Result / Action to Take
D1 RETRIEVE THE DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Clear the Instrument Cluster Continuous DTCs . • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1602 retrieved?**	**Yes** GO to D2 . **No** The system is OK. CHECK all the customer PATS keys by attempting to start the vehicle with each key to VERIFY all other PATS keys are programmed.
D2 INSTALL A NEW ENCODED PATS IGNITION KEY	
NOTE: Check to make sure the customer and new encoded PATS ignition keys are approved, encoded PATS ignition keys. Unapproved PATS keys do not always operate correctly over different	**Yes** GO to D3 . **No**

temperature ranges. (PATS keys from Ford, Rotunda, Strattec, HUF are approved Ford PATS keys) • Cut a new encoded PATS ignition key. • Program a new encoded PATS ignition key. Refer to Spare Key Programming — Using Diagnostic Equipment in this section. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1602 retrieved?**	If other than PATS DTCs are retrieved, REFER to Section 413-01 . If other PATS DTCs are retrieved, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. If no PATS DTCs are retrieved, the system is OK.
D3 INSTALL A NEW PATS TRANSCEIVER	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster again. • Enter the following diagnostic mode on the diagnostic tool: Clear Instrument Cluster Continuous DTCs. • Key in OFF position. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Are any PATS DTCs retrieved?**	**Yes** GO to D4 . **No** The system is OK.
D4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

NOTE: When a new instrument cluster is installed, the PATS keys must be programmed into the new instrument cluster. **NOTE:** When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM).
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test E: DTC B1681 — PATS Transceiver Module Signal Is Not Received

Refer to Wiring Diagrams Cell 112 , Passive Anti-Theft System for schematic and connector information.

Normal Operation

The PATS transceiver receives voltage on circuit CBP36 (BU/BN) and ground on circuit GD133 (BK). The PATS transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The instrument cluster and the PATS transceiver communicate on circuits VRT07 (VT/BN) and VPL56 (BU/GY). The instrument cluster then sends a message to the powertrain control module (PCM) to

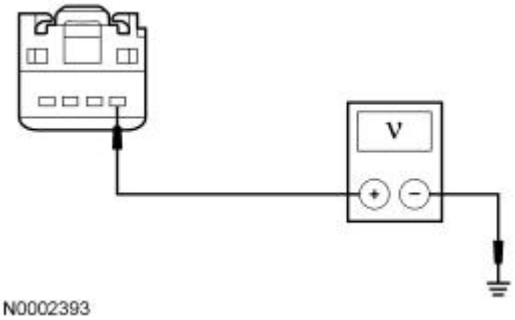
control the engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

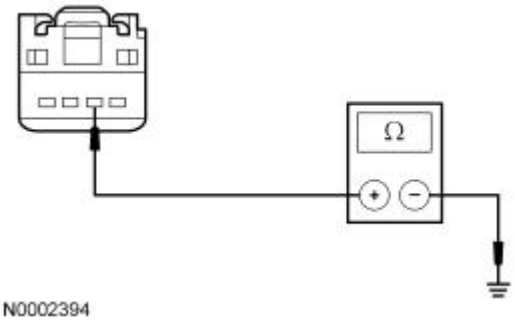
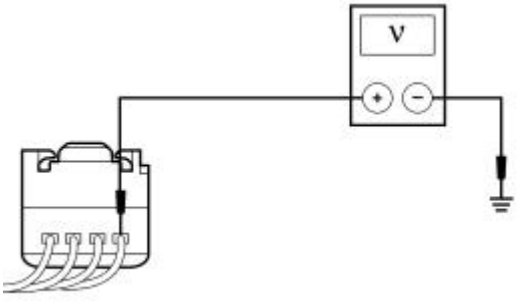
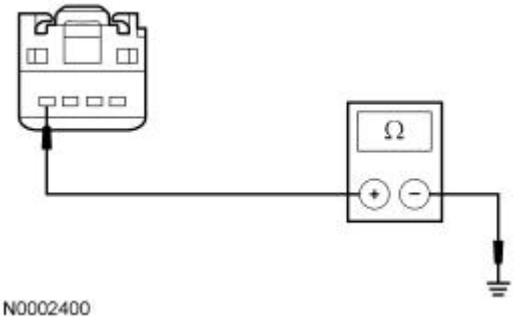
Possible Causes

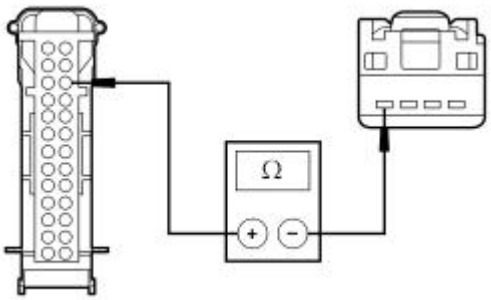
- Fuse
- Circuit GD133 (BK) open
- Circuit CBP36 (BU/BN) open
- Circuit VRT07 (VT/BN) open or short to voltage
- Circuit VPL56 (BU/GY) open or short to ground
- Encoded PATS ignition key
- PATS transceiver
- Instrument cluster

PINPOINT TEST E: DTC B1681 — PATS TRANSCEIVER MODULE SIGNAL IS NOT RECEIVED

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
E1 RETRIEVE THE DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Clear the Instrument Cluster Continuous DTCs. • Key in OFF position. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1681 retrieved?**	**Yes** GO to E2 . **No** The system is OK.
E2 CHECK THE PATS TRANSCEIVER CIRCUIT CBP36 (BU/BN) FOR VOLTAGE	
• Key in OFF position. • Disconnect: PATS Transceiver C2007. • Key in ON position. • Measure the voltage between the PATS transceiver C2007-1, circuit CBP36 (BU/BN), harness side and ground.  N0002393 • **Is the voltage greater than 10 volts?**	**Yes** GO to E3 . **No** VERIFY the smart junction box (SJB) fuse 36 (5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
E3 CHECK THE PATS TRANSCEIVER GROUND CIRCUIT GD133 (BK)	
• Key in OFF position. • Measure the resistance between the PATS transceiver C2007-2, circuit GD133 (BK), harness side and ground.	**Yes** GO to E4 . **No** REPAIR the circuit. CLEAR the DTCs. TEST the system

 N0002394 • **Is the resistance less than 5 ohms?**	for normal operation.
E4 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VPL56 (BU/GY) FOR VOLTAGE	
• Connect: PATS Transceiver C2007. • Key in ON position. • Measure the voltage by backprobing between the PATS transceiver C2007-4, circuit VPL56 (BU/GY), harness side and ground.  N0002398 • **Is the voltage greater than 9 volts?**	**Yes** GO to E6 . **No** GO to E5 .
E5 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VPL56 (BU/GY) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: PATS Transceiver C2007. • Disconnect: Instrument Cluster C220. • Measure the resistance between the PATS transceiver C2007-4, circuit VPL56 (BU/GY), harness side and ground.  N0002400 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. If the DTC sets again, GO to E13 .
E6 CHECK CIRCUIT VPL56 (BU/GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: PATS Transceiver C2007. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-24, circuit VPL56 (BU/GY), harness side and the PATS transceiver C2007-4, circuit VPL56 (BU/GY), harness side.	**Yes** GO to E7 . **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.



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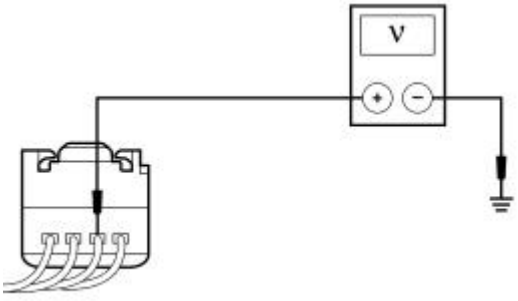
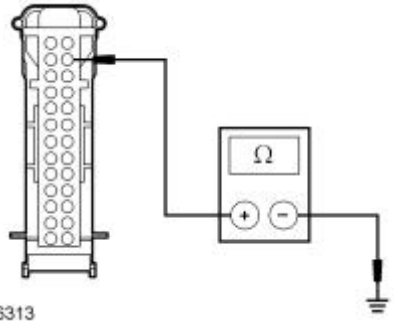
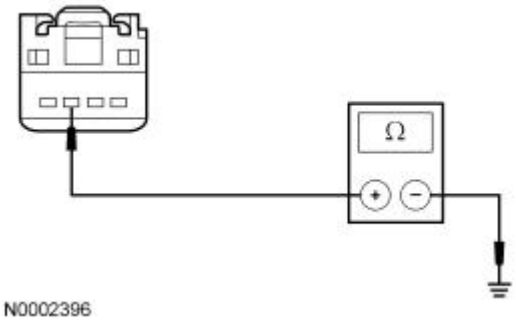
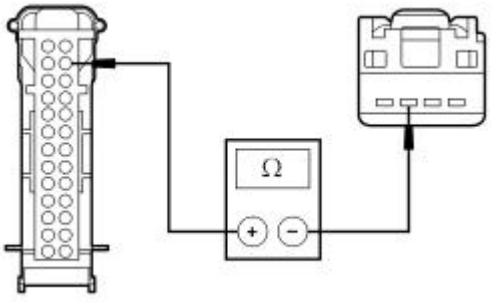
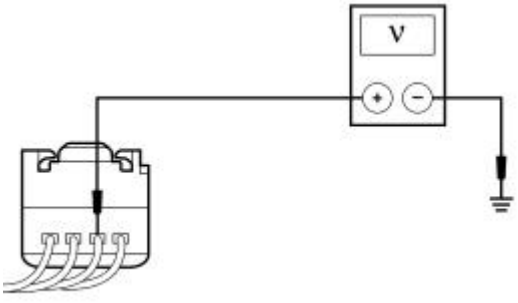
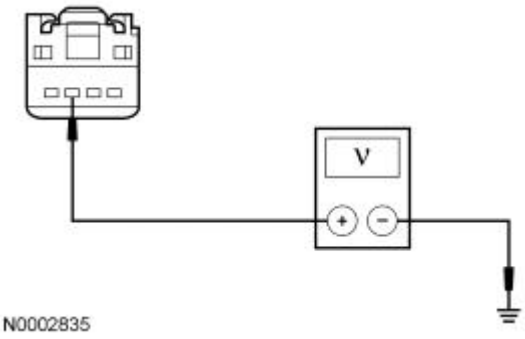
- **Is the resistance less than 5 ohms?**

E7 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT07 (VT/BN) FOR VOLTAGE	
• Key in OFF position. • Connect: PATS Transceiver C2007. • Connect: Instrument Cluster C220. • Key in ON position. • Measure the voltage by backprobing between the PATS transceiver C2007-3, circuit VRT07 (VT/BN), harness side and ground.  N0002395 • **Is the voltage greater than 9 volts?**	**Yes** GO to E11 . **No** GO to E8 .
E8 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT07 (VT/BN) FOR A SHORT TO GROUND WITH THE TRANSCEIVER CONNECTED	
• Key in OFF position. • Disconnect: Instrument Cluster C220. • Measure the resistance between the instrument cluster C220-25, circuit VRT07 (VT/BN), harness side and ground.  N0056313 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E10 . **No** GO to E9 .
E9 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT07 (VT/BN) FOR A SHORT TO GROUND WITH THE TRANSCEIVER DISCONNECTED	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster again.	**Yes** INSTALL a new PATS transceiver. REFER to

• Disconnect: PATS Transceiver C2007. • Measure the resistance between the PATS transceiver C2007-3, circuit VRT07 (VT/BN), harness side and ground.  N0002396 • **Is the resistance greater than 10,000 ohms?**	Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
E10 CHECK THE PATS TRANSMIT CIRCUIT VRT07 (VT/BN) FOR AN OPEN	
• Disconnect: PATS Transceiver C2007. • Measure the resistance between the instrument cluster C220-25, circuit VRT07 (VT/BN), harness side and the PATS transceiver C2007-3, circuit VRT07 (VT/BN), harness side.  N0027763 • **Is the resistance less than 5 ohms?**	**Yes** GO to E13 . **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
E11 CHECK THE TRANSCEIVER TRANSMIT CIRCUIT VRT07 (VT/BN) FOR VOLTAGE	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Active Command. • Select PCM active command TRANSMIT SIGNAL COMMAND. • Trigger TRANSMIT to ON. • While backprobing, measure the voltage between the PATS transceiver C2007-3, circuit VRT07 (VT/BN), harness side and ground.  N0002395 • **Is the voltage less than 5 volts?**	**Yes** INSTALL a new PATS transceiver. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. TEST the system for normal operation. **No** GO to E12 .
E12 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT07 (VT/BN) FOR A SHORT TO VOLTAGE	
• Key in OFF position.	**Yes**

• Disconnect: Instrument Cluster C220. • Disconnect: PATS Transceiver C2007. • Key in ON position. • Measure the voltage between the PATS transceiver C2007-3, circuit VRT07 (VT/BN), harness side and ground.  N0002835 • **Is voltage present?**	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. **No** GO to E13 .
E13 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

NOTE: When a new instrument cluster is installed, the PATS keys must be programmed into the new instrument cluster.
NOTE: When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM).
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test F: DTC B1213 — Anti-Theft Number Of Programmed Keys Is Below Minimum

Normal Operation

The passive anti-theft system (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the instrument cluster. The instrument cluster will then send a message to the powertrain control module (PCM) which will control the engine enable. The instrument cluster initiates the key interrogation sequence when the key is turned to the ON or START position.

DTC B1213 — sets when the number of programmed keys is below the minimum of 2 keys. If there is only 1 key or no keys programmed into the instrument cluster and the key is cycled to the ON position, DTC B1213 will set in the instrument cluster.

Possible Causes

- Encoded PATS ignition key

PINPOINT TEST F: DTC B1213 — ANTI-THEFT NUMBER OF PROGRAMMED KEYS IS BELOW MINIMUM

Test Step	Result / Action to Take
F1 RETRIEVE THE DTCs • Enter the following diagnostic mode on the diagnostic tool: Clear the Instrument Cluster Continuous DTCs . • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Retrieve the Instrument Cluster DTCs. • **Is DTC B1213 retrieved?**	**Yes** GO to F2 . **No** If other than PATS DTCs are retrieved, REFER to Section 413-01 . If other PATS DTCs are retrieved, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section. If no PATS DTCs are retrieved, the system is OK.
F2 CHECK THE NUMBER OF KEYS PROGRAMMED — MONITOR THE INSTRUMENT CLUSTER PID N_KEYCODE • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PID. • Monitor the instrument cluster PID N_KEYCODE. • **Does the instrument cluster PID N_KEYCODE display less than the instrument cluster PID MIN_KEY?**	**Yes** GO to F3 . **No** The system is OK.
F3 PROGRAM THE PATS IGNITION KEYS • **NOTE:** Two programmed encoded PATS ignition keys must be available to start the vehicle. • Cut a new encoded PATS ignition lock cylinder key. • Program the new encoded PATS ignition key. Refer to Spare Key Programming — Using Diagnostic Equipment in this section. • **Does the theft LED illuminate for 3 seconds and then go out?**	**Yes** CLEAR the DTCs. CYCLE the ignition OFF then back to RUN to VERIFY all DTCs have been cleared. CLEAR the DTCs. REPEAT the self-test. **No** GO to F4 .
F4 CHECK FOR A REPAIR MODULE — MONITOR THE PCM PID SERV_MOD • Monitor the PCM PID SERV_MOD. • **Does the PCM PID SERV_MOD indicate YES?**	**Yes** PROGRAM the encoded PATS ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. REPEAT the self-test. **No** If the LED is illuminated continuously, REPEAT Step F3 using a new encoded PATS ignition key, by cutting a new key and programming it. If the LED is flashing, RETRIEVE the instrument cluster DTC(s) stored for the new PATS fault. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Chart in this section.

Pinpoint Test G: The Anti-Theft Indicator Is Always/Never On

Normal Operation

The passive anti-theft system (PATS) uses a visual anti-theft indicator located in the instrument cluster. This indicator proves out for 3 seconds when the key is turned to ON or START under normal operation. If there is a PATS issue, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to ON or START. PATS also flashes the anti-theft indicator every 2 seconds at ignition OFF to act as a visual theft deterrent.

Possible Causes

- Anti-theft indicator
- Instrument cluster

PINPOINT TEST G: THE ANTI-THEFT INDICATOR IS ALWAYS/NEVER ON

Test Step	Result / Action to Take
G1 CHECK THE ANTI-THEFT INDICATOR FOR CORRECT OPERATION **NOTE:** When a new instrument cluster is installed, the PATS keys must be programmed into the new instrument cluster. **NOTE:** When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM). • Key in OFF position. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Active Commands. • Operate the active command ALL LAMPS to ON, then OFF. • **Does the anti-theft indicator illuminate, then turn off?**	**Yes** GO to G2 . **No** INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. CYCLE the ignition. REPEAT the self-test.

G2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION
NOTE: When a new instrument cluster is installed, the PATS keys must be programmed into the new instrument cluster. **NOTE:** When a new instrument cluster is installed, the parameters must be reset in the instrument cluster and the powertrain control module (PCM).
• Disconnect all the instrument cluster connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the PATS keys into the new instrument cluster. REFER to Key Programming Using Diagnostic Equipment in this section. CYCLE the ignition. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test H: The Vehicle Does Not Start

Refer to Wiring Diagrams Cell 112 , Passive Anti-Theft System for schematic and connector information.

Normal Operation

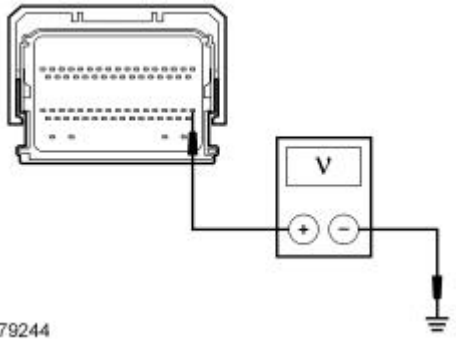
During each vehicle start sequence, the passive anti-theft system (PATS) transceiver reads the PATS key identification code and sends the data to the instrument cluster, which then sends a message to the powertrain control module (PCM) to enable the injectors and the starter. The PCM grounds the starter relay solenoid coil on circuit CDC12 (YE).

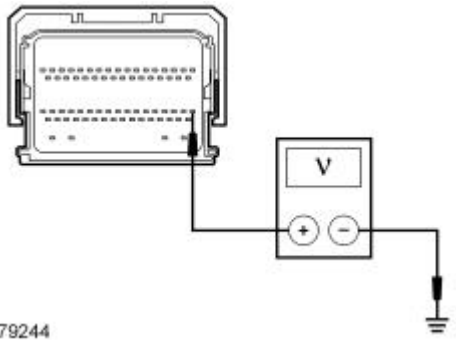
Possible Causes

- Circuit CDC12 (YE) open
- PATS transceiver
- PATS key
- PCM

PINPOINT TEST H: THE VEHICLE DOES NOT START

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK THE STARTING SYSTEM FOR CORRECT VOLTAGE	
• Key in OFF position. • Disconnect: PCM C175B. • Key in START position. • With the key in the START position, measure the voltage between the PCM C175b-34, circuit CDC12 (YE), harness side and ground.  A0079244 • **Is the voltage less than 8 volts?**	**Yes** DIAGNOSE the starting system. REFER to Section 303-06 . **No** GO to H2 .
H2 CHECK THE STARTING SYSTEM GROUND	
• Measure the voltage between the PCM C175b-34, circuit CDC12 (YE), harness side and ground.	**Yes** DIAGNOSE the starting system. REFER to Section 303-06 . **No** GO to H3 .



- **Is the voltage less than 2 volts?**

H3 CHECK FOR CORRECT POWERTRAIN CONTROL MODULE (PCM) OPERATION	

NOTE: When a new PCM is installed, the parameters must be reset in the instrument cluster and the PCM.
• Disconnect all the PCM connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . RESET the PATS parameters in the PCM and the instrument cluster. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Key Programming Using Two Programmed Keys

Printable View (81 KB)

NOTE: This procedure works only if 2 or more programmed ignition keys are available. If 2 programmed keys are not available, refer to Key Programming Using Diagnostic Equipment in this section.

NOTE: The PID SPAREKEY must be enabled for this procedure to operate. If this PID is not enabled, refer to Key Programming Switch State Control in this section, then select SPAREKEY programming switch; ENABLED. The PID SPAREKEY is set to ENABLE when the vehicle is built.

NOTE: If the programming procedure is successful, the new key(s) will start the vehicle and the anti-theft indicator will prove-out for approximately 3 seconds. If the programming procedure is not successful and the new key(s) does not start the engine, leave the key in the ON position for at least 3 seconds, then turn the key off. Repeat the key programming procedure from Step 1. If the failure repeats, refer to Anti-Theft in the Diagnosis and Testing portion of this section to review the DTCs and carry out the appropriate pinpoint tests.

NOTE: A maximum of 8 passive anti-theft system (PATS) keys can be programmed into the instrument cluster during this programming procedure, but only if the PID SPAREKEY is ENABLED.

NOTE: A minimum of 2 PATS keys must be programmed into the instrument cluster before the vehicle will start.

NOTE: If the vehicle is in unlimited key mode, this spare key programming procedure still functions. Any 2 keys that can start the vehicle can be used to program an additional unlimited key.

NOTE: If additional keys are to be programmed, and the remaining keys are with the customer, or are not available, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the PID SPAREKEY must be enabled.

NOTE: If the steps are not carried out as outlined, the programming procedure will end.

NOTE: Ignition keys must have a correct mechanical key cut for the vehicle and must be PATS encoded keys (contain a transponder).

NOTE: This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the instrument cluster.

1. Insert the first programmed key into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

2. Turn the key to the OFF position and remove the first key from the ignition lock cylinder.

3. Within 5 seconds of turning the key to the OFF position, insert the second programmed key into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

4. Turn the key to the OFF position and remove the key from the ignition lock cylinder.

5. Within 10 seconds of turning the key to the OFF position, insert the unprogrammed key (the new key) into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

6. If it is desired to program additional key(s) (only up to 8 keys total can be programmed into the

instrument cluster), repeat Steps 1 - 5 for each additional key that needs to be programmed.

7. Start the vehicle with the new key(s).

Key Programming Using Diagnostic Equipment

Printable View (86 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: This procedure is used when a customer needs keys programmed into the system and does not have 2 programmed ignition keys available. This procedure is also useful when a programmed ignition key(s) is lost or the ignition lock cylinder is replaced, and it is desired to erase key code(s) from the passive anti-theft system (PATS) memory.

NOTE: This procedure erases all programmed ignition keys from the vehicle memory. The vehicle will not start until a minimum of 2 keys are programmed to the vehicle.

NOTE: A minimum of 2 PATS keys must be programmed into the instrument cluster before the vehicle will start.

NOTE: Two PATS encoded (contains a transponder) keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the customer's original keys.

NOTE: If additional keys are to be programmed, refer to Key Programming Using Two Programmed Keys in this section. If the remaining keys are with the customer and are not available with the vehicle, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the PID SPAREKEY must be enabled.

NOTE: This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the instrument cluster.

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. From the scan tool menu select: "Ignition Key Code Erase" and press the tick mark.
4. Turn the key to the OFF position and disconnect the scan tool.
5. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.
6. Turn the first PATS key to the OFF position and remove the key from the ignition lock cylinder.
7. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.
8. The vehicle should now start with both PATS ignition keys.

9. If it is desired to program additional key(s) (only up to 8 keys total can be programmed into the instrument cluster), refer to Key Programming Using Two Programmed Keys in this section for each additional key that needs to be programmed.

Key Programming Switch State Control

Printable View (85 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: The spare key programming switch is a programmable switch which provides the capability to enable/disable the normal customer spare key programming procedure detailed in the Owner's Literature. It must read ENABLE if more than 2 keys need to be programmed into the instrument cluster. For additional information, refer to Key Programming Using Two Programmed Keys in this section. This programmable switch is provided as a convenience for rental company fleets or other fleet purchasers who may not want the spare key programming procedure available to the vehicle driver.

NOTE: The spare key programming switch state can be viewed with the instrument cluster PID SPAREKEY.

NOTE: If the SPAREKEY PID reads ENABLE, up to 8 keys total can be programmed into the instrument cluster. For additional information, refer to Key Programming Using Two Programmed Keys in this section. If the SPAREKEY PID reads DISABLED, the key programming using two programmed keys procedure will not function. This switch is set to ENABLE when the vehicle is built. This PID does not affect the key programming using diagnostic equipment procedure or the spare key programming — unlimited key mode procedure.

1. Insert a programmed passive anti-theft system (PATS) key into the ignition lock cylinder and turn the key from the OFF position to the ON position.

2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

3. **NOTE:** The default setting on delivery of all new vehicles is ENABLE.

   From the scan tool menu select: "Customer Spare Key Programming Enable" (or "Customer Spare Key Programming Disable") and press the tick mark.
   - "Customer Spare Key Programming Enable" — spare key programming procedure is accessible.
   - "Customer Spare Key Programming Disable" — spare key programming procedure is not accessible.

Spare Key Programming — Using Diagnostic Equipment

Printable View (85 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: This procedure is used when a customer needs to have an additional key programmed into the vehicle without erasing stored key codes, but does not have 2 programmed keys available. This procedure is also useful when attempting to determine if an ignition key is damaged, as a new key can be installed without erasing keys or without having 2 programmed keys available.

NOTE: Before programming, the new key must have the correct mechanical cut for the ignition lock cylinder.

NOTE: If 8 keys are already programmed, this procedure does not allow any more ignition keys to be programmed. The number of keys that are programmed into the passive anti-theft system (PATS) can be determined by viewing the N_KEYCODE PID.

1. Turn the unprogrammed PATS key from the OFF position to the ON position.
2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. **NOTE:** Make sure the selection made is "PROGRAM". If the "ERASE" selection is made, all of the keys will be erased from the system.

   From the scan tool menu select: "Program additional ignition key" and press the tick mark.
4. Turn the key to the OFF position and disconnect the scan tool.
5. Start the vehicle with the new PATS key. The vehicle will now start with the new PATS key and also with the original PATS keys.

Spare Key Programming — Unlimited Key Mode

Printable View (90 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Enabling Unlimited Key Mode

NOTE: Unlimited key mode is intended for use by those customers who need more than 8 keys for their vehicle.

NOTE: Before programming, the new key(s) must have the correct mechanical cut for the ignition lock cylinder.

NOTE: The unlimited key mode is set up by creating a special, unique unlimited transponder security key code and programming this key code into all of the vehicle keys so they contain the same key code.

1. The customer must choose an 8-digit number (except for 00000000 or 00000001) to be programmed to all of their vehicles. All customer vehicles need to use the same number. Valid digits are 0-9 and the letters A-F.

2. **NOTE:** If the PID UNL_KEY is not available, unlimited key mode is turned on, and must be turned off before viewing the stored code. At this time, unlimited keys may be programmed to the vehicle. To view/change the stored code, follow the procedure for disabling the unlimited key mode below.

   Monitor the PID UNL_KEY and compare its value against the code chosen in Step 1. It should not be the same key code.

3. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

4. Once in security access, if the unlimited transponder security key PID is 00000000 or 00000001, select: "program unlimited key code" and press the tick mark. Enter the 8-digit code chosen by the customer in Step 1 of this procedure and press the tick mark.

5. Select: "unlimited key mode ON" and press the tick mark.

6. Select: "Ignition Key Code Erase" and press the tick mark.

7. Disconnect the scan tool and turn the ignition switch to OFF.

8. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

9. Remove the first PATS key from the ignition lock cylinder.

10. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

11. If it is desired to program additional key(s), refer to Key Programming Using Two Programmed Keys in this section for each additional key that needs to be programmed.

Disabling Unlimited Key Mode

NOTE: By disabling the unlimited key mode with a random 8-digit number, the previous access code no longer operates the vehicle.

1. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

2. Select: "unlimited key mode OFF" and press the tick mark.

3. Select: "Ignition Key Code Erase" and press the tick mark.

4. Disconnect the scan tool and turn the ignition switch to OFF.

5. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

6. Turn the first PATS key to the OFF position and remove the key from the ignition lock cylinder.

7. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

8. **NOTE:** With the unlimited key mode turned off, a maximum of 8 keys can be programmed into the instrument cluster using the Key Programming Using Two Programmed Keys procedure in this section. The PID SPAREKEY must be enabled.

   If it is desired to program additional key(s), refer to Key Programming Using Two Programmed Keys in this section for each additional key that needs to be programmed. The PID SPAREKEY must be enabled.

Passive Anti-Theft System (PATS) Parameter Reset

Printable View (85 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: When using the IDS, the instrument cluster and the powertrain control module (PCM) parameters are reset at the same time.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids an additional security access procedure and the associated 10 minute time delay.

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. From the scan tool, select: Parameter Reset and press the tick mark.
4. **NOTE:** If the instrument cluster was replaced, follow Steps 4-9. If the instrument cluster and the PCM were replaced, follow Steps 4-9. If only the PCM was replaced, go to Step 9.

   From the scan tool, select: Ignition Key Code Erase and press the tick mark.
5. Turn the key to the OFF position and disconnect the scan tool.
6. Turn the key to the ON position for a minimum of 3 seconds.
7. Turn the key to the OFF position and remove the key.
8. Insert the second key into the ignition lock cylinder and turn the key to the ON position for a minimum of 3 seconds.
9. Both keys will now start the vehicle.
10. If more keys are required to be programmed, refer to Key Programming Using Two Programmed Keys in this section.

Anti-Theft Security Access

Printable View (85 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: This procedure is used to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition key codes, program ignition key codes, enable/disable unlimited key mode, set unlimited transponder key ID, reset parameters and enable/disable the spare key programming switch (PID SPAREKEY). The anti-theft security access procedure invokes a 10-minute time delay prior to granting security access during which the scan tool must remain connected to the vehicle. Once security access is granted, a security access command menu is displayed which offers various command options.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids an additional security access procedure and the associated 10 minute time delay.

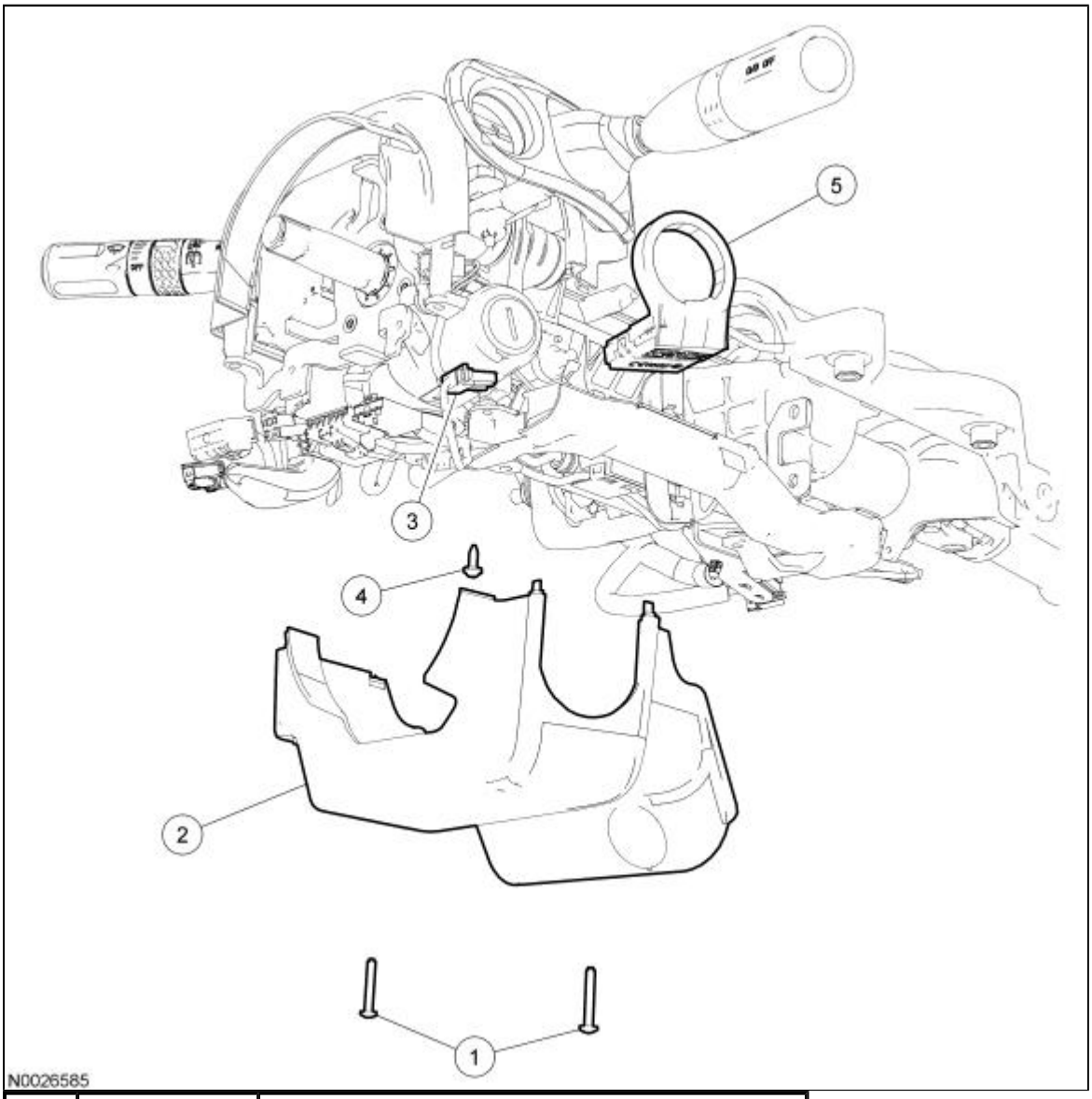
1. Turn the PATS key from the OFF position to the ON position.

2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. This procedure takes approximately 10 minutes to carry out, during which time the ignition switch must be in the ON position and the scan tool must be connected to the vehicle.

3. After the 10-minute security access procedure is completed, press the tick mark and a new menu is displayed with command options. Select only those functions required before exiting out of this menu. Do not select more functions than the procedure calls for. Once exited out of this menu, the security access procedure must be repeated again to carry out additional commands.

Passive Anti-Theft System (PATS) Transceiver

Printable View (199 KB)



Item	Part Number	Description
1	N805911-S	Steering column shroud screws (2 required)
2	3533	Lower steering column shroud
3	14401	PATS transceiver electrical connector
4	—	PATS transceiver screw
5	19A481	PATS transceiver

Removal and Installation

1. Remove the steering wheel. For additional information, refer to Section 211-04 .
2. Remove the 2 screws and the lower steering column shroud.

3. Remove the ignition lock cylinder cover.

4. Disconnect the PATS transceiver electrical connector.

5. Remove the screw and the PATS transceiver.

6. **NOTE:** Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster again.

   To install, reverse the removal procedure.

Universal Transmitter

Printable View (62 KB)

The universal transmitter is an integral part of the LH sun visor and provides a convenient way to substitute up to 3 hand-held transmitters with a single built-in device. The universal transmitter can learn the radio frequency codes of most current transmitters. The universal transmitter:

- operates garage doors, gates and home/office lighting and security systems.
- learns and transmits the radio frequency of up to 3 hand-held transmitters from any of the systems mentioned above.
- is powered by the vehicle battery and charging system.

Universal Transmitter

Printable View (68 KB)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Universal transmitter • Receiver

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, verify the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The universal transmitter is inoperative	• Universal transmitter • Receiver unit	• Go To Pinpoint Test A .

Pinpoint Tests

Pinpoint Test A: The Universal Transmitter is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The universal transmitter receives voltage on circuit CLN09 (YE/GN) and ground on circuit GD150 (BK/WH).

Possible Causes

- Receiver unit
- Universal transmitter

PINPOINT TEST A: THE UNIVERSAL TRANSMITTER IS INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK LEFT VANITY MIRROR OPERATION	
• Check the illumination of the left vanity mirror lamps. • **Do the left vanity mirror lamps illuminate?**	**Yes** GO to A2 . **No** REFER to Section 417-02 .
A2 PROGRAM A HAND-HELD TRANSMITTER INTO UNIVERSAL TRANSMITTER	
• **NOTE:** If the garage door is equipped with rolling codes, refer to Training a Garage Door Opener Equipped With "Rolling Codes" in this section. • Program the universal transmitter. Refer to Universal Transmitter Programming in this section. • **Did the universal transmitter program successfully?**	**Yes** The universal transmitter is OK. VERIFY the receiver operates correctly. **No** INSTALL a new LH sun visor assembly. REFER to Section 501-05 , Headliner. TEST the system for normal operation.

Universal Transmitter Programming

Printable View (82 KB)

WARNING: A garage door opening system that cannot stop or reverse itself after detecting an object in its path does not meet current federal safety standards. To decrease the risk of serious injury or death, do not use this universal transmitter with a door opening system that lacks stop and reverse features as required by federal standards. This includes any garage door opening system manufactured before April 1, 1982. Failure to follow these instructions may result in personal injury.

1. Verify the hand-held transmitter is operative.
2. Prepare for programming the universal transmitter by erasing all 3 channels by holding down the 2 outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.
3. Select 1 of the 3 universal transmitter channels to be programmed by pressing the desired button.
4. Hold the end of the hand-held transmitter 25-51 mm (1-2 in) from the front surface of the universal transmitter so that the red light can still be seen.
5. **NOTE:** During programming, the hand-held transmitter may automatically stop transmitting after 2 seconds, which may not be long enough to program the universal transmitter. If programming this type of hand-held transmitter, continue to hold the button on the universal transmitter while pressing the hand-held transmitter button every 2 seconds.

   Use both hands to press the hand-held transmitter button and the desired button on the universal transmitter. Do not release either button.
6. Hold down both buttons until the red light on the universal transmitter flashes, first slowly and then rapidly. Release both buttons when the rapid flashing begins. The universal transmitter has successfully learned the new frequency signal and can be used in place of the hand-held transmitter(s).
7. To operate, press the appropriate button on the universal transmitter. The red light is on while the signal is being transmitted.
8. To program additional hand-held transmitters repeat Steps 3-6.

Training a Garage Door Opener Equipped With "Rolling Codes"

1. Program the hand-held transmitter to the universal transmitter.
2. Train the garage door opener receiver to recognize the universal transmitter.
   1. Remove the cover panel from the garage door opener receiver.
   2. Locate the training button on the garage door opener receiver. Location and color of the button may vary by garage door opener manufacturer. Refer to the garage door opener instruction manual.
   3. Press the training button on the garage door opener receiver for 1-2 seconds.
   4. Press the programmed universal transmitter button for as long as the universal transmitter red light flashes (1-2 seconds). Release the button and press the button to confirm the universal transmitter is trained to the receiver.
   5. The garage door opener should recognize the universal transmitter.

Erasing Channels

1. **NOTE:** Individual channels cannot be erased, but can be reprogrammed using the procedures for programming.

   To erase all 3 programmed channels, hold down the 2 outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.

Navigation System

Printable View (62 KB)

The vehicle navigation system audibly and visually guides the user to a selected destination. The system uses a global positioning system (GPS) antenna, a vehicle speed input, and other sensor information to accurately establish the vehicle position. The audio unit provides the visual and audible instructions of the maneuvers required to arrive at the pre-entered destination.

Navigation System

Printable View (203 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C

Principles of Operation

Navigation System

The navigation module is integrated in the audio unit and controls the operation and the interface between the user, the vehicle subsystems, and the external components. The navigation audio unit is on the medium speed controller area network (MS-CAN) and can be diagnosed with a scan tool.

The vehicle navigation system guides the user to a pre-entered destination. A map digital versatile disc (DVD) stored in the navigation audio unit is used for calculating the vehicle course. The audio unit display audibly and visually instructs the user of the maneuvers required to arrive at the destination entered.

A voice recognition system allows the user to interface with the system without using the touch screen. A microphone located in the rear view mirror provides a direct input to the navigation module.

In order to calculate initial vehicle position, the global positioning system (GPS) antenna is used to track several available satellites simultaneously.

The vehicle speed signal (VSS) and transmission gear selected signal are received by the navigation audio unit through the MS-CAN. These signals are used to increase the accuracy of the displayed course.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Audio unit
• Global positioning system (GPS) antenna
• Navigation system digital versatile disc (DVD)
	• Smart junction box (SJB) fuse(s):
	  ▪ 28 (5A) (audio unit hot in START)
	  ▪ 39 (20A) (audio unit hot at all times)
	• Circuitry

3. If the fault is visually evident, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. **NOTE:** Do not press any buttons on the audio unit while the audio unit is carrying out the self-test.

   Carry out the network test:
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the audio unit.

9. If the DTCs retrieved are related to the concern, go to the Audio Unit Diagnostic Trouble Code (DTC) Chart.

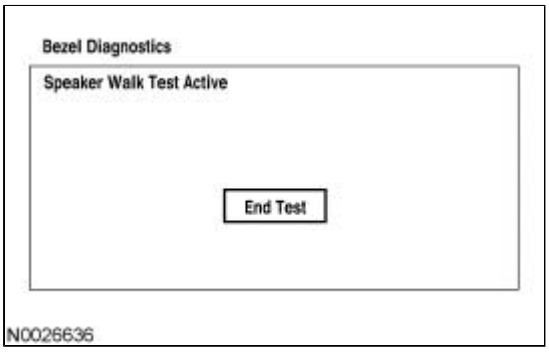
10. If no DTCs related to the concern are retrieved, go to the Navigation Audio Unit Self-Diagnostics.

Navigation Audio Unit Self-Diagnostics

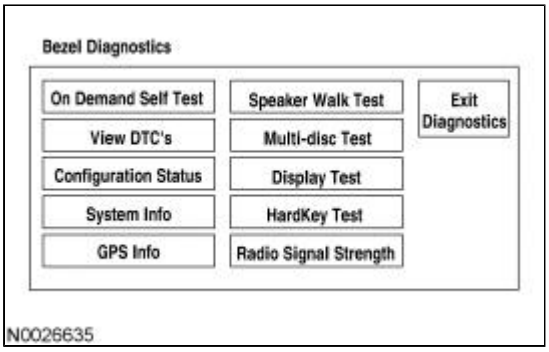
The navigation system provides on-board diagnostics to assist with diagnosing a concern. To carry out self-diagnostics, do the following:

Press and hold presets 3 and 6 simultaneously for 3 seconds.

Press the End Test button on the screen to exit the speaker walk-around test.



The following options are available using the on-screen buttons:



- On Demand Self Test: provides internal self-test diagnostics and displays all the diagnostic trouble codes (DTCs) resulting from the self-test.
- View DTC's: provides a list of all DTCs currently stored in memory.
- Configuration Status: displays the current navigation audio unit configuration.
- System Info: displays the navigation audio unit part number and software information.
- GPS Info: provides satellite and current vehicle information.
- Speaker Walk Test: performs the speaker walk-around test.
- Multi-disc Test: checks the status of the compact disc (CD) player mechanism.
- Display Test: allows checking of the screen colors, and allows checking individual sectors of the touch screen.
- Hardkey Test: provides the status (active/not active) of the audio unit buttons and touch screen.
- Radio Signal Strength: tests the antenna signal.
- Exit Diagnostics: exits diagnostics and returns to the main navigation screen.

Audio Unit Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1117	Audio Steering Wheel Button Stuck	REFER to Section 415-00 to diagnose the steering wheel controls.
B1119	Audio Disc DVD Player Thermal Shutdown	ALLOW the audio unit to cool. DISREGARD the DTC. REPEAT the self-test. CLEAR the DTCs.
B1136	Audio Steering Wheel Switch #2 Circuit Failure	REFER to Section 415-00 to diagnose the steering wheel controls.

B1140	Map Disk Invalid	INSERT a known good navigation map digital versatile disc (DVD). CLEAR the DTCs. REPEAT the self-test. If DTC B1140 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B1318	Battery Voltage Low	REPEAT the self-test. CLEAR the DTCs. If DTC B1318 is retrieved again, REFER to Section 414-00 to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2103	Antenna Not Connected	REFER to Section 415-00 to diagnose the AM/FM antenna.
B2204	GPS Antenna Connection Open or Short	Go To Pinpoint Test A .
B2274	Phone Transceiver Active Circuit Failure	DTC is not applicable. The vehicle is not equipped with cellular phone functionality. DISREGARD the DTC. REPEAT the self-test. CLEAR the DTCs.
B2384	Audio Reverse Park Aid Mute Ckt Failure	VERIFY the audio unit is configured to receive the vehicle speed signal through the medium speed controller area network (MS-CAN). REFER to Section 418-01 .
B2404	Audio Steering Wheel Switch Circuit Fault	REFER to Section 415-00 to diagnose the steering wheel controls.
B2405	Audio Disc CD Player Thermal Shutdown Fault	ALLOW the unit to cool. DISREGARD the DTC. REPEAT the self-test. CLEAR the DTCs.
B2406	Audio Disc CD Player Internal Fault	REPEAT the self-test. CLEAR the DTCs. If DTC B2406 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2477	Module Configuration Failure	REFER to Section 418-01 to diagnose the module configuration.
B2633	Driver-Front Microphone Circuit Failure	REFER to Section 415-00 to diagnose the voice recognition inoperative.
B2656	DVD (Digital Versatile Disk) Error	REPEAT the self-test. CLEAR the DTCs. If DTC B2656 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2924	Audio Button Stuck	CARRY OUT the hardkey test. VERIFY no audio unit buttons are stuck and that no audio unit button is pressed during the self-test. REPEAT the self-test. CLEAR the DTCs. If DTC B2924 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
B2965	Audio System Speaker Circuit Fault	REFER to Section 415-00 to diagnose the speakers.
C1992	Vehicle Speed Circuit Failure	VERIFY the audio unit is configured to receive the vehicle speed signal through the MS-CAN. REFER to Section 418-01 .
P0812	Reverse Input Circuit	VERIFY the audio unit is configured to receive the reverse input signal through the MS-CAN. REFER to Section 418-01 .
U0140	Lost Communication	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this

	With Body Control Module (GEM)	DTC. VERIFY the operation of the illumination system and the accessory delay. ■ If the illumination system or the accessory delay does not operate correctly, REFER to Section 413-00 (illumination) or Section 501-11 (accessory delay) to continue diagnosis. ■ If the illumination system and the accessory delay operate correctly, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	**NOTE:** Diagnose DTC B1318 (if present) before diagnosing this DTC. CARRY OUT the smart junction box (SJB) self-test. ■ If DTC U0155 is present in both the audio unit and the SJB, INSTALL a new instrument cluster. REFER to Section 413-01 . REPEAT the self-test. CLEAR the DTCs. ■ If DTC U0155 is only present in the audio unit, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U0159	Lost Communication With Parking Assist Control Module (PAM)	DISREGARD the DTC. REPEAT the self-test. CLEAR the DTCs.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	DISREGARD the DTC. REPEAT the self-test. CLEAR the DTCs.
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	REFER to Section 415-00 .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	REFER to Section 415-00 .
U2050	No Application Present	CONFIGURE the audio unit. REFER to Section 418-01 to carry out programmable module installation (PMI). REPEAT the self-test. If DTC U2050 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U2051	One or More Calibration Files Missing/Corrupt	CONFIGURE the audio unit. REFER to Section 418-01 to carry out PMI. REPEAT the self-test. If DTC U2051 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
U2473	Unexpected Vehicle	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED)

	Speed (VSS)	manual to diagnose the vehicle speed sensor (VSS) signal.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the audio unit	• Fuse • Circuitry • Audio unit	• REFER to Section 418-00 .
• Navigation system does not operate correctly — no global positioning system (GPS) antenna signal	• GPS antenna • Audio unit	• Go To Pinpoint Test A .
• Navigation system does not operate correctly — navigation system is inaccurate	• GPS antenna • Audio unit	• Go To Pinpoint Test A .
• Navigation system does not operate correctly — the position cursor is inoperative	• Circuitry • Navigation module • Anti-lock brake system (ABS) module	• CHECK the ABS module for DTCs. ▪ If any ABS module DTCs are present, REFER to Section 206-09 . ▪ If no ABS module DTCs are present, DIAGNOSE any audio unit DTCs. If the symptom is present after all audio unit DTCs have been addressed, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• Navigation system does not operate correctly — the voice guidance is inoperative/does not operate correctly	• Circuitry • Audio unit • THX® amplifier	• Go To Pinpoint Test C .
• Navigation system does not operate correctly — the display screen is inoperative	• Audio unit	• VERIFY the operation of the AM/FM audio. ▪ If the AM/FM audio system does not operate correctly, REFER to Section 415-00 to continue diagnosis of the audio unit. ▪ If the AM/FM audio system operates correctly, REMOVE the audio unit

		and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
• Voice recognition is inoperative/does not operate correctly	• Circuitry • Steering wheel controls • Microphone (part of the interior rear view mirror) • Audio unit	• REFER to Section 415-00 to continue diagnosis of the voice recognition system.
• Navigation system does not operate correctly — the audible switch feedback is inoperative	• Audible switch feedback setting • Audio unit	• Go To Pinpoint Test B .

Pinpoint Tests

Pinpoint Test A: Navigation System Does Not Operate Correctly — No Global Positioning System (GPS) Antenna Signal

Normal Operation

The GPS antenna provides information from the GPS satellite system to the GPS receiver in the audio unit. This information is used to calculate vehicle position and direction of travel.

B2204 — sets when an open, short to ground, or short to voltage is detected in the GPS antenna circuit.

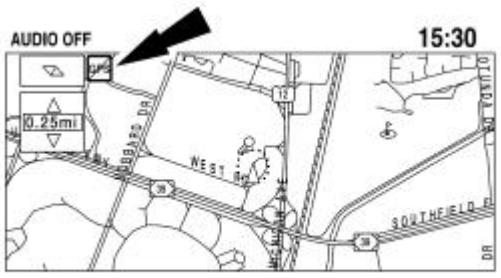
Possible Causes

- GPS antenna
- Audio unit

PINPOINT TEST A: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — NO GLOBAL POSITIONING SYSTEM (GPS) ANTENNA SIGNAL

NOTE: The vehicle must be driven outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.

Test Step	Result / Action to Take
A1 CHECK THE OPERATION OF THE NAVIGATION SYSTEM	
• Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges. • Operate the audio unit in navigation mode.	**Yes** The system is operating correctly at this time. NOTIFY the customer that obstructions to the line of sight may affect the GPS

 N0026638 • **Does the GPS icon appear, then disappear?**	antenna. **No** GO to A2 .
A2 CHECK THE AUDIO UNIT RECORDED DTCs • Check the recorded DTCs from the audio unit self-test. • **Is DTC B2204 recorded?**	**Yes** GO to A4 . **No** GO to A3 .
A3 CHECK THE GPS ANTENNA MOUNTING • Verify the GPS antenna is installed properly and no aftermarket equipment is obstructing the antenna. • **Is the GPS antenna mounted properly?**	**Yes** GO to A4 . **No** Correctly INSTALL the GPS antenna. REFER to Global Positioning System (GPS) Antenna in this section. TEST the system for normal operation.
A4 SUBSTITUTE THE GPS ANTENNA • Install a known good GPS antenna. • Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges. • Operate the audio unit in navigation mode. N0026638 • **Does the GPS icon appear, then disappear?**	**Yes** INSTALL a new GPS antenna. REFER to Global Positioning System (GPS) Antenna in this section. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL the original GPS antenna. GO to A5 .

A5 CHECK THE AUDIO UNIT FOR CORRECT OPERATION
• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly

	at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: Navigation System Does Not Operate Correctly — The Audible Switch Feedback Is Inoperative

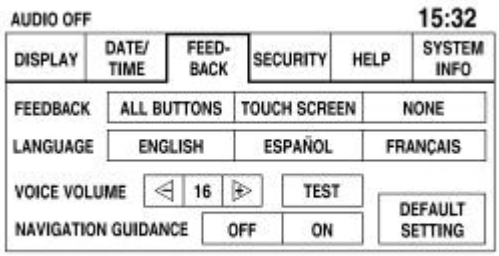
Normal Operation

The audible switch feedback settings are controlled by the audio unit. The notification can be set to ALL, TOUCH SCREEN, or NONE, depending on user preference.

Possible Causes

- Audible switch feedback setting
- Audio unit

PINPOINT TEST B: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE AUDIBLE SWITCH FEEDBACK IS INOPERATIVE

Test Step	Result / Action to Take
B1 CHECK THE SWITCH DISPLAY	
• Key in ON position. • Turn the audio unit on. • Press the MENU button. • Select the FEEDBACK tab.  N0026637 • **Is NONE highlighted on the audible feedback settings?**	**Yes** SELECT ALL BUTTONS. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK THE AUDIO UNIT FOR CORRECT OPERATION	

• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Navigation System Does Not Operate Correctly — The Voice Guidance Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

For the Audiophile navigation system, the audio unit provides voice-assisted route guidance through the front speakers.

For the THX® navigation system, the audio unit sends voice guidance audio signals to the THX® amplifier through circuits RMN14 (GY/BN) and VMN14 (WH/VT). The voice-assisted route guidance is broadcast through the instrument panel speaker.

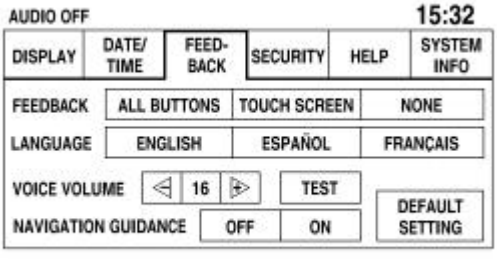
For all navigation audio systems, the volume of the voice guidance is controlled by the audio unit.

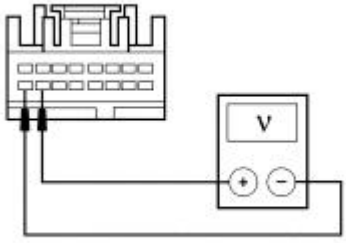
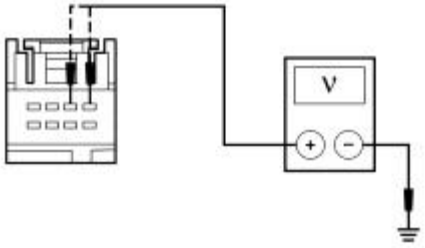
Possible Causes

- Circuit RMN14 (GY/BN) open, short to ground or voltage
- Circuit VMN14 (WH/VT) open, short to ground or voltage
- THX® amplifier
- Audio unit

PINPOINT TEST C: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE VOICE GUIDANCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK THE VOICE GUIDANCE SETTING	
• Operate the audio unit in navigation mode. • Select the FEEDBACK tab.  N0026637 • Select DEFAULT SETTING. • Verify the operation of the voice guidance. • **Does the voice guidance operate correctly?**	**Yes** The system is operating correctly at this time. The concern was caused by a customer-selected setting. **No** GO to C2 .
C2 CHECK THE INSTRUMENT PANEL SPEAKER	
• Carry out the speaker walk-around test. • **Does the instrument panel speaker operate correctly?**	**Yes** GO to C3 . **No** REFER to Section 415-00 to diagnose a single speaker inoperative.

C3 CHECK THE NAVIGATION AUDIO SIGNAL TO THE THX® AMPLIFIER	
• Key in OFF position. • Disconnect: THX® Amplifier C2364c. • Operate the audio unit in navigation mode. • While pressing the REPEAT button on the audio unit, measure the AC voltage between the THX® amplifier C2364c-15, circuit VMN14 (WH/VT), harness side and the THX® amplifier C2364c-16, circuit RMN14 (GY/BN), harness side.  N0057244 • **Is a fluctuating AC voltage present?**	**Yes** GO to C7 . **No** GO to C4 .
C4 CHECK CIRCUITS RMN14 (GY/BN) AND VMN14 (WH/VT) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Audio Unit C240c. • Key in ON position. • Measure the voltage between the audio unit C240c-1, circuit VMN14 (WH/VT), harness side and ground; and between the audio unit C240c-2, circuit RMN14 (GY/BN), harness side and ground.  N0058905 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to C5 .
C5 CHECK CIRCUITS RMN14 (GY/BN) AND VMN14 (WH/VT) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between the audio unit, harness side and the THX® amplifier, harness side; and between the audio unit, harness side and ground as follows: **Audio Unit Connector-Pin** / **THX® Amplifier Connector-Pin** / **Circuit** C240c-1 / C2364c-15 / VMN14 (WH/VT) C240c-2 / C2364c-16 / RMN14 (GY/BN) • **Is the resistance less than 5 ohms between the audio unit**	**Yes** GO to C6 . **No** REPAIR the circuit in question. TEST the system for normal operation.

and the THX® amplifier, and greater than 10,000 ohms between the audio unit and ground?	
C6 CHECK FOR CORRECT AUDIO UNIT OPERATION	

• Disconnect all the audio unit connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the audio unit connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Section 415-01 . TEST the system for normal operation after the repair.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

C7 CHECK FOR CORRECT THX® AMPLIFIER OPERATION	

• Disconnect all the THX® amplifier connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the THX® amplifier connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new THX® amplifier. REFER to Section 415-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Navigation System Calibration

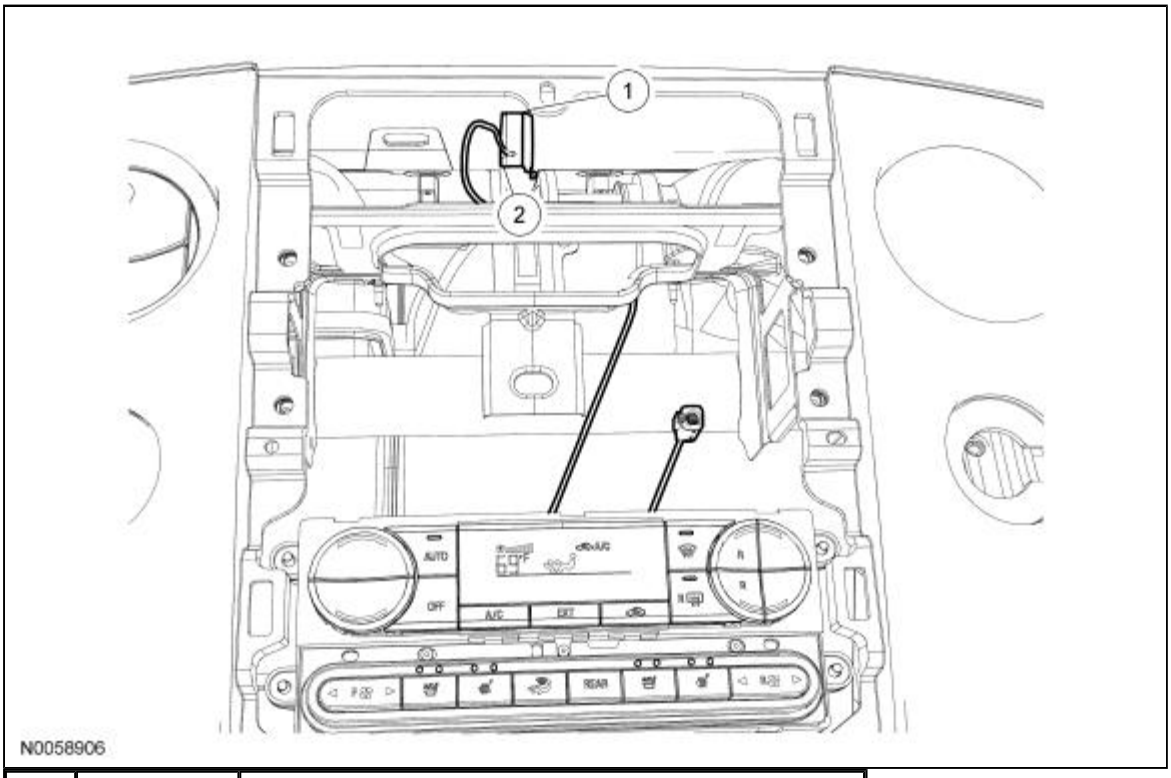
Printable View (62 KB)

1. Access the current set of regional map digital versatile discs (DVDs).
2. Start the vehicle.
3. Turn on the audio unit.
4. Insert the appropriate regional map DVD into the DVD slot in the audio unit.
5. Press the NAV button.
6. Press ACCEPT after reading the disclaimer.
7. Press the MAP button.
8. Road test the vehicle until the red compass heading indicator turns green/white.
9. Leave the map DVD in the audio unit.

Global Positioning System (GPS) Antenna

Printable View (190 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	—	Global positioning system (GPS) antenna clip (part of 10E893)
2	10E893	GPS antenna

Removal and Installation

1. Remove the audio unit. For additional information, refer to Section 415-01 .
2. Unclip the GPS antenna from the instrument panel brace and remove the GPS antenna.
3. To install, reverse the removal procedure.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-in
Smart junction box (SJB) bolts	2	18

Module Controlled Functions

Printable View (63 KB)

The 2 multifunction electronic modules on this vehicle are:

- Driver seat module (DSM)
- Smart junction box (SJB)

Driver Seat Module (DSM)

The DSM permits 2 automatic memory settings that can be recalled using the memory switches or the remote keyless entry (RKE) transmitter for the following systems:

- Adjustable brake pedal
- Driver seat
- Exterior mirrors

Smart Junction Box (SJB)

The SJB controls the following functions:

- Autolamps
- Battery saver
- Exterior lighting
- Interior lighting
- Perimeter anti-theft
- Power windows global open/close
- Power locks
- Remote keyless entry (RKE)
- Third row power-fold seat
- Tire pressure monitoring system (TPMS)
- Warning chimes and warning lamps

Diagnostic Trouble Code Chart

Printable View (290 KB)

DTC	Description	Source	Action
B1003	Mode Door Circuit Failure	Electronic Automatic Temperature Control (EATC) Module	REFER to Section 412-00 .
B1031	SDARS Satellite Antenna Open	Satellite Radio Receiver	REFER to Section 415-00 .
B1032	SDARS Satellite Antenna Short	Satellite Radio Receiver	REFER to Section 415-00 .
B103B	Thermoelectric Driver Overcurrent Low	Climate Controlled Seat Module	REFER to Section 501-10 .
B103C	Thermoelectric Driver Open Load	Climate Controlled Seat Module	REFER to Section 501-10 .
B103D	Blower Driver Overtemperature	Climate Controlled Seat Module	REFER to Section 501-10 .
B106A	TPMS Sensor Pressure Range Bit Incorrect State	Smart Junction Box (SJB)	REFER to Section 204-04 .
B106B	Tire Pressure Sensor Low Battery	SJB	REFER to Section 204-04 .
B106C	Tire Pressure Monitor System (TPMS) Low Frequency Subsystem Fault	SJB	REFER to Section 204-04 .
B106D	Tire Pressure Monitor System (TPMS) Initiators Not Configured	SJB	REFER to Section 204-04 .
B106E	Solid State Driver Disabled Due to Short Circuit	Power Liftgate Module	REFER to Section 501-03 .
B106E	Solid State Driver Disabled Due to Short Circuit	SJB	REPAIR all other DTCs. CLEAR the DTCs. REPEAT the self-test.
B106F	Module Disabled Due to External Fault	Power Liftgate Module	REFER to Section 501-03 .
B106F	Module Disabled Due to External Fault	SJB	REPAIR all other DTCs. CLEAR the DTCs. REPEAT the self-test. If all other DTCs have been repaired and the DTC B106F is still present, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section.
B107D	Obstacle Detected While Closing	Power Liftgate Module	REFER to Section 501-03 .
B109A	Driver Power Mirror Fold Inward Circuit Short to Battery	Driver Seat Module (DSM)	REFER to Section 501-09 .
B109B	Driver Power Mirror Fold	DSM	REFER to Section 501-09 .

	Inward Circuit Short to Ground		
B109C	Driver Power Mirror Fold Inward Circuit Open	DSM	REFER to Section 501-09 .
B109D	Driver Power Mirror Fold Outward Circuit Short to Battery	DSM	REFER to Section 501-09 .
B109E	Driver Power Mirror Fold Outward Circuit Short to Ground	DSM	REFER to Section 501-09 .
B109F	Driver Power Mirror Fold Outward Circuit Open	DSM	REFER to Section 501-09 .
B10A0	Passenger Power Mirror Fold Outward Circuit Short to Battery	DSM	REFER to Section 501-09 .
B10A1	Passenger Power Mirror Fold Outward Circuit Short to Ground	DSM	REFER to Section 501-09 .
B10A2	Passenger Power Mirror Fold Outward Circuit Open	DSM	REFER to Section 501-09 .
B10A3	Passenger Power Mirror Fold Inward Circuit Short to Battery	DSM	REFER to Section 501-09 .
B10A4	Passenger Power Mirror Fold Inward Circuit Short to Ground	DSM	REFER to Section 501-09 .
B10A5	Passenger Power Mirror Fold Inward Circuit Open	DSM	REFER to Section 501-09 .
B1102	Mirror Fold Switch Short to Ground	DSM	REFER to Section 501-09 .
B1105	Rear Open/Close Switch Active During Self Test	Power Liftgate Module	REFER to Section 501-03 .
B1111	Driver Thermoelectric Device Control Over Temperature Fault	Climate Controlled Seat Module	REFER to Section 501-10 .
B1113	Passenger Thermoelectric Device Control Over Temperature Fault	Climate Controlled Seat Module	REFER to Section 501-10 .
B1117	Audio Steering Wheel Button Stuck	Audio Unit	REFER to Section 415-00 .
B1119	Audio Disc DVD Player Thermal Shutdown	Audio Unit	REFER to Section 415-00 .
B1119	Audio Disc DVD Player Thermal Shutdown	Digital Versatile Disc (DVD) Player	REFER to Section 415-00 .
B111B	Passenger Thermoelectric Driver Overcurrent Low	Climate Controlled Seat Module	REFER to Section 501-10 .
B111C	Passenger Thermoelectric Driver Open Load	Climate Controlled Seat Module	REFER to Section 501-10 .
B111D	Passenger Blower Driver Overtemperature	Climate Controlled Seat	REFER to Section 501-10 .

		Module	
B111F	LCD Thermal Shutdown	DVD Player	REFER to Section 415-00 .
B1136	Audio Steering Wheel Switch #2 Circuit Failure	Audio Unit	REFER to Section 415-00 .
B1140	Map Disk Invalid	Audio Unit	REFER to Section 419-07 .
B1154	Subwoofer #1 Short to Ground	Audio Unit	REFER to Section 415-00 .
B1155	Subwoofer #1 Short to Battery	Audio Unit	REFER to Section 415-00 .
B1158	Subwoofer #2 Open	THX® Amplifier	REFER to Section 415-00 .
B1162	Power Running Board Hall Effect Sensor Power Circuit Short to Battery	Power Running Board Module	REFER to Section 501-08 .
B1163	Left Power Running Board Hall Effect Sensor Failure	Power Running Board Module	REFER to Section 501-08 .
B1164	Power Running Board Hall Effect Sensor Power Circuit Short To Ground	Power Running Board Module	REFER to Section 501-08 .
B1166	Left Power Running Board Deploy Circuit Short To Ground	Power Running Board Module	REFER to Section 501-08 .
B1167	Left Power Running Board Deploy and/or Stow Circuit Short To Battery	Power Running Board Module	REFER to Section 501-08 .
B1168	Left Power Running Board Stow Circuit Short To Ground	Power Running Board Module	REFER to Section 501-08 .
B1169	LH Motor Traveled Too Far	Power Running Board Module	REFER to Section 501-08 .
B116A	RH Motor Traveled Too Far	Power Running Board Module	REFER to Section 501-08 .
B116B	LH Power Running Board Motor Short	Power Running Board Module	REFER to Section 501-08 .
B116C	RH Power Running Board Motor Short	Power Running Board Module	REFER to Section 501-08 .
B116D	LH Power Running Board Motor Line Open	Power Running Board Module	REFER to Section 501-08 .
B116E	RH Power Running Board Motor Line Open	Power Running Board Module	REFER to Section 501-08 .
B1170	Right Power Running Board Hall Effect Sensor Failure	Power Running Board Module	REFER to Section 501-08 .
B1171	Left Power Running Board Hall Effect Signal Noisy	Power Running Board Module	REFER to Section 501-08 .
B1172	Right Power Running Board Hall Effect Signal Noisy	Power Running Board Module	REFER to Section 501-08 .
B1173	Right Power Running Board Deploy Circuit Short To Ground	Power Running Board Module	REFER to Section 501-08 .
B1175	Right Power Running Board Stow Circuit Short To Ground	Power Running Board Module	REFER to Section 501-08 .

B1178	Right Power Running Board Deploy and/or Stow Circuit Short To Battery	Power Running Board Module	REFER to Section 501-08 .
B1179	Latch Motor Circuit Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B117A	Latch Motor Circuit Short to Ground	Power Liftgate Module	REFER to Section 501-03 .
B117B	Latch Motor Circuit Open	Power Liftgate Module	REFER to Section 501-03 .
B117C	Latch Centering Switch Invalid	Power Liftgate Module	REFER to Section 501-03 .
B1200	Climate Control Pushbutton Circuit Failure	EATC Module	REFER to Section 412-00 .
B1202	Fuel Sender Circuit Open	Instrument Cluster	REFER to Section 413-01 .
B1204	Fuel Sender Circuit Short to Ground	Instrument Cluster	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	Instrument Cluster	REFER to Section 419-01 .
B1231	Event Threshold Exceeded	Restraints Control Module (RCM)	REFER to Section 501-20B .
B1251	Air Temperature Internal Sensor Circuit Open	EATC Module	REFER to Section 412-00 .
B1253	Air Temperature Internal Sensor Circuit Short to Ground	EATC Module	REFER to Section 412-00 .
B1255	Air Temperature External Sensor Circuit Open	EATC Module	REFER to Section 412-00 .
B1255	Air Temperature External Sensor Circuit Open	Instrument Cluster	REFER to Section 413-08 .
B1257	Air Temperature External Sensor Circuit Short to Ground	EATC Module	REFER to Section 412-00 .
B1257	Air Temperature External Sensor Circuit Short to Ground	Instrument Cluster	REFER to Section 413-08 .
B1302	Accessory Delay Relay Coil Circuit Failure	SJB	REFER to Section 501-11 .
B1304	Accessory Delay Relay Coil Circuit Short To Battery	SJB	REFER to Section 501-11 .
B1317	Battery Voltage High	Four Wheel Drive (4WD) Control Module	REFER to Section 414-00 .
B1317	Battery Voltage High	Air Suspension Module	REFER to Section 414-00 .
B1317	Battery Voltage High	DVD Player	REFER to Section 414-00 .
B1317	Battery Voltage High	Instrument Cluster	REFER to Section 414-00 .
B1317	Battery Voltage High	Parking Aid Module	REFER to Section 414-00 .

B1317	Battery Voltage High	Power Liftgate Module	REFER to Section 414-00 .
B1317	Battery Voltage High	Power Running Board Module	REFER to Section 414-00 .
B1317	Battery Voltage High	RCM	REFER to Section 414-00 .
B1317	Battery Voltage High	SJB	REFER to Section 414-00 .
B1317	Battery Voltage High	THX® Amplifier	REFER to Section 414-00 .
B1318	Battery Voltage Low	4WD Control Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	Air Suspension Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	Audio Unit	REFER to Section 414-00 .
B1318	Battery Voltage Low	Auxiliary Audio Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	DVD Player	REFER to Section 414-00 .
B1318	Battery Voltage Low	Instrument Cluster	REFER to Section 414-00 .
B1318	Battery Voltage Low	Parking Aid Module	REFER to Section 413-13 .
B1318	Battery Voltage Low	Power Liftgate Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	Power Running Board Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	RCM	REFER to Section 414-00 .
B1318	Battery Voltage Low	Satellite Radio Receiver	REFER to Section 414-00 .
B1318	Battery Voltage Low	SJB	REFER to Section 414-00 .
B1318	Battery Voltage Low	THX® Amplifier	REFER to Section 414-00 .
B1320	Driver Door Ajar Circuit Open	SJB	REFER to Section 417-02 .
B1328	Passenger Door Ajar Circuit Open	SJB	REFER to Section 417-02 .
B1331	Decklid Ajar Rear Door Circuit Failure	SJB	REFER to Section 417-02 .
B1336	Door Ajar RR Circuit Open	SJB	REFER to Section 417-02 .
B1342	ECU Is Faulted	4WD Control Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new 4WD control module. REFER to Section 308-07A . REPEAT the self-test.
B1342	ECU Is Faulted	Air Suspension Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new air suspension module. REFER to Section 204-05 . REPEAT the self-test.
B1342	ECU Is Faulted	Anti-Lock Brake System (ABS) Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new ABS/TC module. REFER to Section 206-09 . REPEAT the self-test.
B1342	ECU Is Faulted	Audio Unit	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new audio unit. REFER to Section 415-01 .

			REPEAT the self-test.
B1342	ECU Is Faulted	Auxiliary Audio Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new auxiliary audio module. REFER to Section 415-01 . REPEAT the self-test.
B1342	ECU Is Faulted	Climate Controlled Seat Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new climate controlled seat module. REFER to Section 501-10 . REPEAT the self-test.
B1342	ECU Is Faulted	DSM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new DSM. REFER to Driver Seat Module (DSM) in this section. REPEAT the self-test.
B1342	ECU Is Faulted	DVD Player	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new DVD player. REFER to Section 415-07 . REPEAT the self-test.
B1342	ECU Is Faulted	EATC Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new EATC module. REFER to Section 412-00 . REPEAT the self-test.
B1342	ECU Is Faulted	Instrument Cluster	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 . REPEAT the self-test.
B1342	ECU Is Faulted	Parking Aid Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new parking aid module. REFER to Section 413-13 . REPEAT the self-test.
B1342	ECU Is Faulted	Power Liftgate Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new power liftgate module. REFER to Section 501-03 . REPEAT the self-test.
B1342	ECU Is Faulted	Power Running Board Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new power running board module. REFER to Section 501-08 . REPEAT the self-test.
B1342	ECU Is Faulted	RCM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new RCM. REFER to Section 501-20B . REPEAT the self-test.
B1342	ECU Is Faulted	Satellite Radio Receiver	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new satellite radio receiver. REFER to Section 415-01 . REPEAT the self-test.
B1342	ECU Is Faulted	SJB	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. REPEAT the self-test.
B1342	ECU Is Faulted	THX® Amplifier	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new THX® amplifier. REFER to Section 415-01 . REPEAT the self-test.
B1352	Ignition Key-In Circuit Failure	SJB	REFER to Section 413-09 .

B1472	Lamp Headlamp Input Circuit Short To Ground	SJB	REFER to Section 417-01 .
B1483	Brake Pedal Input Circuit Failure	ABS Module	REFER to Section 206-09 .
B1485	Brake Pedal Input Short to Battery	SJB	REFER to Section 206-09 .
B1510	Flash To Pass Switch Circuit Short To Ground	SJB	REFER to Section 417-01 .
B1520	Hood Switch Circuit Open	SJB	DISREGARD the DTC. The vehicle is not equipped with a hood switch. CLEAR the DTCs. REPEAT the self-test. If the DTC B1520 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the programmable module installation (PMI) procedure. REFER to Section 418-01 .
B1530	Memory Set Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1534	Memory 1 Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1538	Memory 2 Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1555	Ignition Run/Start Circuit Failure	4WD Control Module	REFER to Section 308-07A .
B1566	Door Ajar Circuit Short To Ground	Air Suspension Module	REFER to Section 417-02 .
B1572	Door Ajar LR Circuit Open	SJB	REFER to Section 417-02 .
B1578	Lamp Park Input Circuit Short To Ground	SJB	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	Instrument Cluster	REFER to Section 419-01 .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01 .
B1602	PATS Received Invalid Format Of Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01 .
B1624	Lamp Keypad Output Open Circuit	SJB	REFER to Section 501-14 .
B1632	Mirror Driver Left Circuit Open	DSM	REFER to Section 501-09 .
B1633	Mirror Driver Left Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1634	Mirror Driver Left Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1636	Mirror Driver Right Circuit Open	DSM	REFER to Section 501-09 .
B1637	Mirror Driver Right Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1638	Mirror Driver Right Short To Ground	DSM	REFER to Section 501-09 .
B1640	Mirror Passenger Left	DSM	REFER to Section 501-09 .

	Circuit Open		
B1641	Mirror Passenger Left Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1642	Mirror Passenger Left Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1644	Mirror Passenger Right Circuit Open	DSM	REFER to Section 501-09 .
B1645	Mirror Passenger Right Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1646	Mirror Passenger Right Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1663	Seat Driver Front Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1664	Seat Driver Rear Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1665	Seat Driver Forward/Backward Motor Stalled	DSM	REFER to Section 501-10 .
B1666	Seat Recline Forward/Rearward Motor Stalled	DSM	REFER to Section 501-10 .
B1667	Mirror Driver Up/Down Motor Stalled	DSM	REFER to Section 501-09 .
B1668	Mirror Driver Right/Left Motor Stalled	DSM	REFER to Section 501-09 .
B1669	Mirror Passenger Up/Down Motor Stalled	DSM	REFER to Section 501-09 .
B1670	Mirror Passenger Right/Left Motor Stalled	DSM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	ABS Module	REFER to Section 206-09 .
B1676	Battery Voltage Out of Range	DSM	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	EATC Module	REFER to Section 414-00 .
B1681	PATS Transceiver Module Signal Is Not Received	Instrument Cluster	REFER to Section 419-01 .
B1685	Lamp Dome Input Circuit Failure	SJB	REFER to Section 417-02 .
B1688	Lamp Dome Input Circuit Short To Ground	SJB	REFER to Section 417-02 .
B1696	Autolamp On Circuit Short To Ground	SJB	REFER to Section 417-01 .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .

B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1735	Mirror Driver Vertical Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1739	Mirror Driver Horizontal Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1743	Mirror Passenger Vertical Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1747	Mirror Passenger Horizontal Switch Circuit Short to Battery	DSM	REFER to Section 501-09 .
B1774	Mirror Driver Up Circuit Open	DSM	REFER to Section 501-09 .
B1775	Mirror Driver Up Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1776	Mirror Driver Up Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1779	Mirror Driver Down Circuit Open	DSM	REFER to Section 501-09 .
B1780	Mirror Driver Down Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1781	Mirror Driver Down Short To Ground	DSM	REFER to Section 501-09 .
B1783	Mirror Passenger Up Circuit Open	DSM	REFER to Section 501-09 .
B1784	Mirror Passenger Up Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1785	Mirror Passenger Up Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1787	Mirror Passenger Down Circuit Open	DSM	REFER to Section 501-09 .
B1788	Mirror Passenger Down Circuit Short To Battery	DSM	REFER to Section 501-09 .
B1789	Mirror Passenger Down Circuit Short To Ground	DSM	REFER to Section 501-09 .
B1791	Autolamp Sensor Input Circuit Open	SJB	REFER to Section 417-01 .
B1793	Autolamp Sensor Input Circuit Short to Ground	SJB	REFER to Section 417-01 .

B1868	Lamp Air Bag Warning Indicator Circuit Failure	Instrument Cluster	REFER to Section 413-01 .
B1915	Air Bag Driver Circuit Failure	Instrument Cluster	REFER to Section 413-01 .
B1946	Climate Control A/C Post Evaporator Sensor Circuit Failure	EATC Module	REFER to Section 412-00 .
B1947	Climate Control A/C Post Evaporator Sensor Circuit Short To Ground	EATC Module	REFER to Section 412-00 .
B1952	Seat Rear Up/Down Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1953	Seat Rear Up/Down Position Feedback Circuit Short To Ground	DSM	REFER to Section 501-10 .
B1956	Seat Front Up/Down Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1957	Seat Front Up/Down Position Feedback Circuit Short To Ground	DSM	REFER to Section 501-10 .
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short To Battery	DSM	REFER to Section 501-10 .
B1961	Seat Recline Forward/Rearward Feedback Potentiometer Circuit Failure	DSM	REFER to Section 501-10 .
B1964	Seat Horizontal Forward/Rearward Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short To Ground	DSM	REFER to Section 501-10 .
B1987	Pedal Forward/Rearward Motor Stalled	DSM	REFER to Section 206-00 .
B1988	Pedal Position Forward Switch Circuit Short to Ground	DSM	REFER to Section 206-00 .
B1989	Pedal Position Rearward Switch Circuit Short to Ground	DSM	REFER to Section 206-00 .
B1990	Pedal Forward/Rearward Feedback Potentiometer Circuit Failure	DSM	REFER to Section 206-00 .
B1991	Pedal Forward/Rearward Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 206-00 .
B19A1	Passenger Seat Cushion Blower Speed Short to	Climate Controlled Seat	REFER to Section 501-10 .

	Battery	Module	
B19A2	Passenger Seat Back Blower Speed Short to Battery	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A3	Driver Seat Cushion Blower Speed Short to Battery	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A4	Driver Seat Back Blower Speed Short to Battery	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A5	Passenger Seat Cushion Blower Speed Short to Ground	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A6	Passenger Seat Back Blower Speed Short to Ground	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A7	Driver Seat Cushion Blower Speed Short to Ground	Climate Controlled Seat Module	REFER to Section 501-10 .
B19A8	Driver Seat Back Blower Speed Short to Ground	Climate Controlled Seat Module	REFER to Section 501-10 .
B2008	Wipers On Signal Circuit Short to Ground	SJB	DISREGARD the DTC. The vehicle is not equipped with a wipers on signal circuit. CLEAR the DTCs. REPEAT the self-test. If the DTC B2008 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2019	Liftgate Exceeded Time Allowed to Cinch Door	Power Liftgate Module	REFER to Section 501-03 .
B201A	Power System Disabled Due to High Manual Closing Speed	Power Liftgate Module	REFER to Section 501-03 .
B2031	Left Corner Lamp Output Circuit Failure	SJB	DISREGARD the DTC. The vehicle is not equipped with a left corner lamp output circuit on the SJB C2280B-17. CLEAR the DTCs. REPEAT the self-test. If the DTC B2031 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2032	Right Corner Lamp Output Circuit Failure	SJB	DISREGARD the DTC. The vehicle is not equipped with a right corner lamp output circuit on the SJB C2280B-19. CLEAR the DTCs. REPEAT the self-test. If the DTC B2032 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2044	Left Rear Stop Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2045	Left Rear Stop Lamp Circuit Open	SJB	REFER to Section 417-01 .
B2046	Right Rear Stop Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2047	Right Rear Stop Lamp	SJB	REFER to Section 417-01 .

	Circuit Open		
B2048	Left Rear Turn Lamp Circuit Short to Ground	SJB	REFER to Smart Junction Box (SJB) in this section.
B2049	Left Rear Turn Lamp Circuit Open	SJB	DISREGARD the DTC. The vehicle is not equipped with a left rear turn lamp circuit on the SJB C2280E-21. CLEAR the DTCs. REPEAT the self-test. If the DTC B2049 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2050	Right Rear Turn Lamp Circuit Short to Ground	SJB	REFER to Smart Junction Box (SJB) in this section.
B2051	Right Rear Turn Lamp Circuit Open	SJB	DISREGARD the DTC. The vehicle is not equipped with a right rear turn lamp circuit on the SJB C2280E-19. CLEAR the DTCs. REPEAT the self-test. If the DTC B2051 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2071	Hazard Switch Signal Short to Ground	SJB	REFER to Section 417-01 .
B2077	Liftgate Ajar Sw Circuit Failure	SJB	REFER to Section 417-02 .
B2084	Memory Set Indicator Short to Ground	DSM	REFER to Section 501-10 .
B208A	Memory Set Indicator Short to Ground	DSM	REFER to Section 501-10 .
B2097	Compass Module Failure	Instrument Cluster	REFER to Section 413-08 .
B2A37	Floor Lamp Output Circuit Open	SJB	DISREGARD the DTC. The vehicle is not equipped with a floor lamp output circuit on the SJB C2280G-2. CLEAR the DTCs. REPEAT the self-test. If the DTC B2A37 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2100	Door Driver Key Cylinder Switch Failure	SJB	DISREGARD the DTC. The vehicle is not equipped with a driver door key cylinder switch on the SJB C2280E-8, 9. CLEAR the DTCs. REPEAT the self-test. If the DTC B2100 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2103	Antenna Not Connected	Audio Unit	REFER to Section 415-00 .
B2103	Antenna Not Connected	Instrument Cluster	REFER to Section 419-01 .
B2108	Trunk Key Cylinder Switch Failure	SJB	DISREGARD the DTC. The vehicle is not equipped with a trunk key cylinder switch. CLEAR the DTCs. REPEAT the self-test. If the DTC B2108 is retrieved again, the SJB may be incorrectly configured. CARRY OUT the PMI procedure. REFER to Section 418-01 .
B2139	Data Mismatch (Receive Data Does Not Match What	Power Running Board Module	REFER to Section 501-08 .

	Was Expected)		
B2141	NVM Configuration Failure	Instrument Cluster	REFER to Section 419-01 .
B2143	NVM Memory Failure	Instrument Cluster	CLEAR the DTCs. REPEAT the self-test. If DTC B2143 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 . REPEAT the self-test.
B2204	GPS Antenna Connection Open or Short	Audio Unit	REFER to Section 419-07 .
B2212	Panel Dim Switch Out of Range	SJB	REFER to Section 417-02 .
B2254	Front Fog Lamp Switch Failure	SJB	REFER to Section 417-01 .
B2266	Driver Blend Door/Lower Actuator Circuit Failure	EATC Module	REFER to Section 412-00 .
B2267	Passenger Blend Door/Lower Actuator Circuit Failure	EATC Module	REFER to Section 412-00 .
B2268	Steering Wheel Climate Control Circuit Open	EATC Module	REFER to Section 412-00 .
B2269	Steering Wheel Climate Control Circuit Short to Ground	EATC Module	REFER to Section 412-00 .
B2274	Phone Transceiver Active Circuit Failure	Audio Unit	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
B2276	Less Than Two Transmitters Programmed	SJB	REFER to Section 501-14 .
B2281	Right Turn Switch Short to Ground	SJB	REFER to Section 417-01 .
B2282	Left Turn Switch Short to Ground	SJB	REFER to Section 417-01 .
B2292	Restraint System - Seatbelt Pretensioner Fault	RCM	REFER to Section 501-20B .
B2293	Restraint System - Airbag Fault	RCM	REFER to Section 501-20B .
B2294	Restraint System - Curtain Fault	RCM	REFER to Section 501-20B .
B2295	Restraint System - Side Airbag Fault	RCM	REFER to Section 501-20B .
B2296	Restraint System - Impact Sensor Fault	RCM	REFER to Section 501-20B .
B2300	Seat Driver Memory Position Error	DSM	REFER to Section 501-10 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	DSM	REFER to Section 501-09 .
B2314	Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	DSM	REFER to Section 501-09 .

B2318	Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-09 .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DSM	REFER to Section 501-09 .
B2322	Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DSM	REFER to Section 501-09 .
B2326	Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 501-09 .
B2334	Column Tilt Feedback Potentiometer Circuit Short to Battery	DSM	REFER to Section 211-00 .
B2335	Column Tilt Feedback Potentiometer Circuit Short to Ground	DSM	REFER to Section 211-00 .
B2341	Column Tilt Motor Stalled	DSM	REFER to Section 211-00 .
B236A	Chime Output Circuit Open	Power Liftgate Module	REFER to Section 501-03 .
B2384	Audio Reverse Aid Mute Input Ckt. Failure	Audio Unit	REFER to Section 415-00 .
B2401	Audio Tape Deck Mechanism Fault	Audio Unit	REFER to Section 415-00 .
B2404	Audio Steering Wheel Switch Circuit Fault	Audio Unit	REFER to Section 415-00 .
B2405	Audio Disc CD Player Thermal Shutdown Fault	Audio Unit	REFER to Section 415-00 .
B2406	Audio Disc CD Player Internal Fault	Audio Unit	REFER to Section 415-00 .
B2411	Humidity Sensor Open	EATC Module	REFER to Section 412-00 .
B2412	Humidity Sensor Short	EATC Module	REFER to Section 412-00 .
B2418	Sensor Power Short to Ground	Power Liftgate Module	REFER to Section 501-03 .
B2419	Sensor 1 Invalid	Power Liftgate Module	REFER to Section 501-03 .
B2420	Sensor 2 Invalid	Power Liftgate Module	REFER to Section 501-03 .
B2425	Remote Keyless Entry Out of Synchronization	SJB	REFER to Section 501-14 .
B2426	Passenger Solar Radiation Sensor Circuit Open	EATC Module	REFER to Section 412-00 .
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	EATC Module	REFER to Section 412-00 .
B2431	Transponder Programming Failed	Instrument Cluster	REFER to Section 419-01 .

B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2438	Passengers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2477	Module Configuration Failure	ABS Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	Air Suspension Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	Audio Unit	REFER to Section 418-01 .
B2477	Module Configuration Failure	Auxiliary Audio Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	Climate Controlled Seat Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	DSM	REFER to Section 418-01 .
B2477	Module Configuration Failure	DVD Player	REFER to Section 418-01 .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
B2477	Module Configuration Failure	Parking Aid Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	RCM	REFER to Section 418-01 .
B2477	Module Configuration Failure	Satellite Radio Receiver	REFER to Section 418-01 .
B2477	Module Configuration Failure	SJB	REFER to Section 418-01 .
B2477	Module Configuration Failure	THX® Amplifier	REFER to Section 418-01 .
B2479	Park Brake Switch Circuit Short to Ground	SJB	REFER to Section 413-01 .
B2486	Climate Controlled Module Seat Voltage Out of Range	Climate Controlled Seat Module	REFER to Section 414-00 .
B2552	Vbatt 2 Circuit Open	Power Liftgate Module	REFER to Section 501-03 .
B2572	Brake Shift Interlock Output Circuit Failure	SJB	REFER to Section 206-09 .
B2607	Harness/Configuration Mismatch	RCM	REFER to Section 501-20B .
B2627	Fuel Sender Circuit Open #2	Instrument Cluster	DISREGARD the DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the

			self-test.
B2628	Fuel Sender Circuit Short to Ground #2	Instrument Cluster	DISREGARD the DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the self-test.
B2633	Driver — Front Microphone Circuit Failure	Audio Unit	REFER to Section 419-07 .
B2656	DVD (Digital Versatile Disk) Error	Audio Unit	REFER to Section 419-07 .
B2656	DVD (Digital Versatile Disk) Error	DVD Player	REFER to Section 415-00 .
B2666	Liftgate Release Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2667	Liftglass Release Switch Circuit Failure	SJB	REFER to Section 501-11 .
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's side	RCM	REFER to Section 501-20B .
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	RCM	REFER to Section 501-20B .
B2699	Left Pinch Strip Open or Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B2700	Right Pinch Strip Open or Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B2701	Left Pinch Strip Stuck Active	Power Liftgate Module	REFER to Section 501-03 .
B2702	Right Pinch Strip Stuck Active	Power Liftgate Module	REFER to Section 501-03 .
B2703	Open/Close Switch Stuck Active	Power Liftgate Module	REFER to Section 501-03 .
B2718	Liftgate/Decklid Ajar Output Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B2721	Liftgate/Decklid Ajar Output Short to Ground or Open	Power Liftgate Module	REFER to Section 501-03 .
B2723	Glass Position Switch Active During Self-test	Power Liftgate Module	REFER to Section 501-03 .
B2729	Cushion Over-Temperature Detected	Climate Controlled Seat Module	REFER to Section 501-10 .
B272A	Passenger Cushion-Over Temp Detected	Climate Controlled Seat Module	REFER to Section 501-10 .
B272B	Passenger Back-Over Temp Detected	Climate Controlled Seat Module	REFER to Section 501-10 .
B272C	Driver Differential Temperature Fault	Climate Controlled Seat Module	REFER to Section 501-10 .
B272D	Passenger Differential Temperature Fault	Climate Controlled Seat Module	REFER to Section 501-10 .
B2730	Back-over Temperature Detected	Climate Controlled Seat	REFER to Section 501-10 .

		Module	
B273A	Liftgate Release Output Circuit Shorted to Ground	SJB	REFER to Section 501-03 .
B273B	Liftgate Release Output Circuit Open or Shorted to Battery Voltage	SJB	REFER to Section 501-03 .
B2741	Sensor Cluster Loop End	ABS Module	REFER to Section 206-09 .
B2792	Cross Link Between Firing Loops	RCM	REFER to Section 501-20B .
B2794	3rd Row Power Fold Circuit Failure	SJB	REFER to Section 501-10 .
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	EATC Module	REFER to Section 413-08 .
B2796	Driver Solar Radiation Sensor Circuit Open	EATC Module	REFER to Section 413-08 .
B2813	LH Power Running Board Stow Time Fail	Power Running Board Module	REFER to Section 501-08 .
B2814	LH Power Running Board Deploy Time Fail	Power Running Board Module	REFER to Section 501-08 .
B2816	RH Power Running Board Stow Time Fail	Power Running Board Module	REFER to Section 501-08 .
B2817	RH Power Running Board Deploy Time Fail	Power Running Board Module	REFER to Section 501-08 .
B2819	Gate Motor Circuit Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B2868	Left Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. CARRY OUT the TPMS sensor training in order to CLEAR this DTC. REFER to Section 204-04 .
B2869	Right Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. CARRY OUT the TPMS sensor training in order to CLEAR this DTC. REFER to Section 204-04 .
B2870	Right Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. CARRY OUT the TPMS sensor training in order to CLEAR this DTC. REFER to Section 204-04 .
B2871	Left Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. CARRY OUT the TPMS sensor training in order to CLEAR this DTC. REFER to Section 204-04 .
B2872	Tire Pressure Sensor Fault	SJB	REFER to Section 204-04 .
B2879	Fuel Tank Jet Pump Fault	Instrument Cluster	DISREGARD this DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the self-test.
B287A	Tire Pressure System Fault	SJB	REFER to Section 204-04 .
B2885	Spare Tire Pressure Sensor Fault	SJB	DISREGARD this DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the

			self-test.
B2900	VIN Mismatch	ABS Module	REFER to Section 206-09 .
B2900	VIN Mismatch	RCM	REFER to Section 501-20B .
B2903	Chime Output Circuit Short to Battery	Power Liftgate Module	REFER to Section 501-03 .
B2908	Latch Switch Invalid	Power Liftgate Module	REFER to Section 501-03 .
B2913	Audio Subwoofer Not Connected	Audio Unit	REFER to Section 415-00 .
B2913	Audio Subwoofer Not Connected	THX® Amplifier	REFER to Section 415-00 .
B2916	Rear Blend Door Circuit Failure	EATC Module	REFER to Section 412-00 .
B2917	Rear Mode Door Circuit Failure	EATC Module	REFER to Section 412-00 .
B2918	Aux Temp Blend Input Circuit Failure	EATC Module	REFER to Section 412-00 .
B2919	Aux Blower Motor Speed Input Circuit Failure	EATC Module	REFER to Section 412-00 .
B2924	Audio Button Stuck	Audio Unit	REFER to Section 415-00 .
B2924	Audio Button Stuck	Auxiliary Audio Module	REFER to Section 415-00 .
B2924	Audio Button Stuck	DVD Player	REFER to Section 415-00 .
B2925	Subwoofer Speaker Short Circuit	THX® Amplifier	REFER to Section 415-00 .
B292A	Subwoofer #2 Speaker Short Circuit	THX® Amplifier	REFER to Section 415-00 .
B2935	Drive Unit Failure	Power Liftgate Module	REFER to Section 501-03 .
B2936	Gate Motor Open	Power Liftgate Module	REFER to Section 501-03 .
B2937	Gate Motor Short to Ground	Power Liftgate Module	REFER to Section 501-03 .
B2939	Gate Clutch Short to Ground or Open	Power Liftgate Module	REFER to Section 501-03 .
B2940	Chime Output Circuit Short to Ground	Power Liftgate Module	REFER to Section 501-03 .
B2949	Global Opening/Closing Circuit Short to Battery	SJB	REFER to Smart Junction Box (SJB) in this section.
B2A2B	Left Corner Lamp Output Circuit Short to Ground	SJB	REFER to Smart Junction Box (SJB) in this section.
B2A2C	Right Corner Lamp Output Circuit Short to Ground	SJB	REFER to Smart Junction Box (SJB) in this section.
B2965	Audio System Speaker Circuit Fault	Audio Unit	REFER to Section 415-00 .
B2965	Audio System Speaker Circuit Fault	THX® Amplifier	REFER to Section 415-00 .
B29B7	White Lighting Output Circuit Open	SJB	REFER to Section 417-01 .

B29B8	White Lighting Output Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A1B	Hall Sensor Feed Circuit Short to Battery	DSM	REFER to Section 501-10 .
B2A1C	Hall Sensor Feed Circuit Short to Ground	DSM	REFER to Section 501-10 .
B2A1D	Potentiometer Feed Circuit Short to Battery	DSM	REFER to Section 501-10 .
B2A1E	Potentiometer Feed Circuit Short to Ground	DSM	REFER to Section 501-10 .
B2A20	Ignition Stuck in START	SJB	REFER to Section 211-05 .
B2A21	One or More Configuration Files Missing or Corrupt	SJB	CONFIGURE the module. REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test.
B2A22	Headlamp OFF Circuit Open	SJB	REFER to Section 417-01 .
B2A23	High Beam Input Circuit Short To Ground	SJB	REFER to Section 417-01 .
B2A25	Trim Panel Lock Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2A26	Keypad Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2A27	Right Front Turn Lamp Circuit Open	SJB	REFER to Section 417-01 .
B2A28	Right Front Turn Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A29	Left Front Turn Lamp Circuit Open	SJB	REFER to Section 417-01 .
B2A2A	Left Front Turn Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A2D	3rd Row Power Fold Circuit Short to Ground	SJB	REFER to Section 501-10 .
B2A2E	Right Front Lamp Low Beam Circuit Open	SJB	REFER to Section 417-01 .
B2A2F	Right Front Lamp Low Beam Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A30	Left Front Lamp Low Beam Circuit Open	SJB	REFER to Section 417-01 .
B2A31	Left Front Lamp Low Beam Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A32	LED Backlighting Output Circuit Open	SJB	REFER to Section 417-01 .
B2A33	LED Backlighting Output Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A35	Interior Lighting Output Circuit Open	SJB	REFER to Section 417-02 .
B2A36	Interior Lighting Output Circuit Short to Ground	SJB	REFER to Section 417-02 .
B2A38	Floor Lamp Output Circuit Short to Ground	SJB	REFER to Smart Junction Box (SJB) in this section.

B2A39	Puddle Lamp Output Circuit Open	SJB	REFER to Section 417-01 .
B2A3A	Puddle Lamp Output Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2A3B	TPMS Initiator Left (1) Output Circuit Open	SJB	REFER to Section 204-04 .
B2A3C	TPMS Initiator Left (1) Output Circuit Short to Ground	SJB	REFER to Section 204-04 .
B2A3D	TPMS Initiator Right (2) Output Circuit Open	SJB	REFER to Section 204-04 .
B2A3E	TPMS Initiator Right (2) Output Circuit Short to Ground	SJB	REFER to Section 204-04 .
B2A42	Steering Column Tilt Up Switch Short to Battery	DSM	REFER to Section 211-00 .
B2A43	Steering Column Tilt Down Switch Short to Battery	DSM	REFER to Section 211-00 .
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	REFER to Section 206-09 .
C1125	Brake Fluid Level Sensor Input Circuit Failure	SJB	REFER to Section 413-01 .
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS Module	REFER to Section 206-09 .
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS Module	REFER to Section 206-09 .
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS Module	REFER to Section 206-09 .
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS Module	REFER to Section 206-09 .
C1233	Speed Wheel LF Input Signal Missing	ABS Module	REFER to Section 206-09 .
C1234	Speed Wheel RF Input Signal Missing	ABS Module	REFER to Section 206-09 .
C1235	Speed Wheel RR Input Signal Missing	ABS Module	REFER to Section 206-09 .
C1236	Speed Wheel LR Input Signal Missing	ABS Module	REFER to Section 206-09 .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	ABS Module	REFER to Section 206-09 .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	ABS Module	REFER to Section 206-09 .
C1279	Yaw Rate Sensor Circuit Failure	ABS Module	REFER to Section 206-09 .
C1280	Yaw Rate Sensor Signal Fault	ABS Module	REFER to Section 206-09 .
C1281	Lateral Accelerometer Circuit Failure	ABS Module	REFER to Section 206-09 .
C1282	Lateral Accelerometer Signal Fault	ABS Module	REFER to Section 206-09 .
C1285	Booster Solenoid Circuit	ABS Module	REFER to Section 206-09 .

	Failure		
C1287	Booster Pedal Force Switch Circuit Failure	ABS Module	REFER to Section 206-09 .
C1288	Pressure Transducer Main/Primary Input Circuit Failure	ABS Module	REFER to Section 206-09 .
C1414	Incorrect Module Design Level	RCM	REFER to Section 501-20B .
C1440	Pressure Transducer Main/Primary Signal Faulted	ABS Module	REFER to Section 206-09 .
C1470	TCS Functions Temporarily Disabled (Thermal Brake Protection)	ABS Module	REFER to Section 206-09 .
C1516	Roll Rate Signal Fault	ABS Module	REFER to Section 206-09 .
C1517	Roll Rate Sensor Circuit Failure	ABS Module	REFER to Section 206-09 .
C1724	Air Suspension Height Sensor Power Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1726	Air Suspension Rear Pneumatic Failure	Air Suspension Module	REFER to Section 204-05 .
C1729	Transfer Case Unable to Transition between 4H and 4L	4WD Control Module	REFER to Section 308-07A .
C1742	Rear Sounder Circuit Failure	Parking Aid Module	REFER to Section 413-13 .
C1743	Rear Sounder Circuit Short to Vbatt	Parking Aid Module	REFER to Section 413-13 .
C1770	Air Suspension Vent Solenoid Output Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1790	Air Suspension LR Air Spring/Shock Solenoid Output Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1795	Air Suspension RR Air Spring/Shock Solenoid Output Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1805	Mismatched PCM and/or ABS-TC Module	ABS Module	REFER to Section 206-09 .
C1810	Air Suspension Height Sensor Out of Range	Air Suspension Module	REFER to Section 204-05 .
C1830	Air Suspension Compressor Relay Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1840	Air Suspension Disable Switch Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1885	Air Suspension RR Height Sensor Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1893	Air Suspension LR Height Sensor Circuit Failure	Air Suspension Module	REFER to Section 204-05 .
C1945	Park Switch Indicates Park With Vehicle Moving	Instrument Cluster	REFER to Section 413-01 .

C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	REFER to Section 501-20B .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	REFER to Section 501-20B .
C1963	Stability Control Inhibit Warning	ABS Module	REFER to Section 206-09 .
C1964	Air Susp'n Air Compressor Request Exceeded Max Timing	Air Suspension Module	REFER to Section 204-05 .
C1979	IWE Solenoid Circuit Failure	4WD Control Module	REFER to Section 308-07A .
C1980	IWE Solenoid Short to Battery	4WD Control Module	REFER to Section 308-07A .
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	REFER to Section 501-20B .
C1990	Incomplete Online Tests	Air Suspension Module	REFER to Section 204-05 .
C1991	Module Calibration Failure	ABS Module	REFER to Section 418-01 .
C1991	Module Calibration Failure	Air Suspension Module	REFER to Section 204-05 .
C1992	Vehicle Speed Circuit Failure	Audio Unit	REFER to Section 415-00 .
C1992	Vehicle Speed Circuit Failure	THX® Amplifier	REFER to Section 415-00 .
C1996	Active Yaw and Roll Stability Control Disabled	ABS Module	REFER to Section 206-09 .
C2001	Ride Height Calibration Error	Air Suspension Module	REFER to Section 204-05 .
C2002	Pneumatic Test Failure	Air Suspension Module	REFER to Section 204-05 .
C2769	Longitudinal Acceleration Sensor Circuit Failure	ABS Module	REFER to Section 206-09 .
C2770	Longitudinal Acceleration Sensor Signal Fault	ABS Module	REFER to Section 206-09 .
C2777	Sensor Cluster Bus Failure	ABS Module	REFER to Section 206-09 .
C2778	Sensor Power Supply Failure	ABS Module	REFER to Section 206-09 .
C2780	ECU in Manufacturer Sub-State	SJB	This DTC is only present when a new SJB is installed or the SJB is configured. CARRY OUT the TPMS sensor training, then CLEAR the SJB DTCs. REFER to Section 204-04 . REPEAT the SJB self-test to CONFIRM DTC C2780 has been cleared.
C2784	RAM Checksum Error	Instrument Cluster	REFER to Section 413-01 .
P0218	Transmission Fluid Overtemperature Condition	Transmission Control Module	REFER to Section 307-01A .

		(TCM)-6HP26	
P0218	Transmission Fluid Overtemperature Condition	TCM (6R75)	REFER to Section 307-01B .
P0219	Engine Overspeed Condition	TCM (6HP26)	REFER to Section 307-01A .
P0562	System Voltage Low	TCM (6HP26)	REFER to Section 307-01A .
P0562	System Voltage Low	TCM (6R75)	REFER to Section 307-01B .
P0563	System Voltage High	TCM (6HP26)	REFER to Section 307-01A .
P0563	System Voltage High	TCM (6R75)	REFER to Section 307-01B .
P0602	Powertrain Control Module Programming Error	Powertrain Control Module (PCM)	REFER to Section 418-01 .
P0603	Internal Control Module Keep Alive Memory (KAM) Error	TCM (6HP26)	REFER to Section 307-01A .
P0605	Internal Control Module Read Only Memory (ROM) Error	PCM	REFER to Section 418-01 .
P0605	Internal Control Module Read Only Memory (ROM) Error	TCM (6HP26)	REFER to Section 307-01A .
P0605	Internal Control Module Read Only Memory (ROM) Error	TCM (6R75)	REFER to Section 307-01B .
P0613	TCM Processor	TCM (6HP26)	REFER to Section 307-01A .
P0613	TCM Processor	TCM (6R75)	REFER to Section 307-01B .
P0622	Generator Field Terminal Circuit	PCM	REFER to Section 414-00 .
P062F	Internal Control Module EEPROM Error	SJB	CLEAR the DTCs. REPEAT the self-test. If DTC P062F is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section.
P062F	Internal Control Module EEPROM Error	TCM (6HP26)	REFER to Section 307-01A .
P062F	Internal Control Module EEPROM Error	TCM (6R75)	REFER to Section 307-01B .
P0634	PCM / ECM / TCM Internal Temperature Too High	TCM (6HP26)	REFER to Section 307-01A .
P0634	PCM / ECM / TCM Internal Temperature Too High	TCM (6R75)	REFER to Section 307-01B .
P0641	Sensor Reference Voltage A Circuit/Open	TCM (6HP26)	REFER to Section 307-01A .
P0641	Sensor Reference Voltage A Circuit/Open	TCM (6R75)	REFER to Section 307-01B .
P0657	Actuator Supply Voltage A Circuit / Open	TCM (6HP26)	REFER to Section 307-01A .
P0657	Actuator Supply Voltage A Circuit / Open	TCM (6R75)	REFER to Section 307-01B .
P0658	Actuator Supply Voltage A Circuit Low	TCM (6HP26)	REFER to Section 307-01A .

P0658	Actuator Supply Voltage A Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0659	Actuator Supply Voltage A Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0659	Actuator Supply Voltage A Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0667	PCM / ECM / TCM Internal Temperature Sensor Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0667	PCM / ECM / TCM Internal Temperature Sensor Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0701	Transmission Control System Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0701	Transmission Control System Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0705	Transmission Range Sensor A Circuit (PRNDL Input)	TCM (6HP26)	REFER to Section 307-01A .
P0705	Transmission Range Sensor A Circuit (PRNDL Input)	TCM (6R75)	REFER to Section 307-01B .
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0712	Transmission Fluid Temperature Sensor A Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0712	Transmission Fluid Temperature Sensor A Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0713	Transmission Fluid Temperature Sensor A Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0713	Transmission Fluid Temperature Sensor A Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0714	Transmission Fluid Temperature Sensor A Circuit Intermittent	TCM (6HP26)	REFER to Section 307-01A .
P0714	Transmission Fluid Temperature Sensor A Circuit Intermittent	TCM (6R75)	REFER to Section 307-01B .
P0715	Turbine/Input Shaft Speed Sensor A Circuit	TCM (6HP26)	REFER to Section 307-01A .
P0715	Turbine/Input Shaft Speed Sensor A Circuit	TCM (6R75)	REFER to Section 307-01B .
P0716	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .

P0716	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0717	Turbine/Input Shaft Speed Sensor A Circuit No Signal	TCM (6HP26)	REFER to Section 307-01A .
P0717	Turbine/Input Shaft Speed Sensor A Circuit No Signal	TCM (6R75)	REFER to Section 307-01B .
P0720	Output Shaft Speed Sensor Circuit	TCM (6R75)	REFER to Section 307-01B .
P0720	Output Shaft Speed Sensor Circuit	TCM (6HP26)	REFER to Section 307-01A .
P0721	Output Shaft Speed Sensor Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0721	Output Shaft Speed Sensor Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0722	Output Shaft Speed Sensor Circuit No Signal	TCM (6HP26)	REFER to Section 307-01A .
P0722	Output Shaft Speed Sensor Circuit No Signal	TCM (6R75)	REFER to Section 307-01B .
P0723	Output Shaft Speed Sensor Circuit Intermittent	TCM (6R75)	REFER to Section 307-01B .
P0729	Gear 6 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0729	Gear 6 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0731	Gear 1 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0731	Gear 1 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0732	Gear 2 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0732	Gear 2 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0733	Gear 3 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0733	Gear 3 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0734	Gear 4 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0734	Gear 4 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0735	Gear 5 Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0735	Gear 5 Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0736	Reverse Incorrect Ratio	TCM (6HP26)	REFER to Section 307-01A .
P0736	Reverse Incorrect Ratio	TCM (6R75)	REFER to Section 307-01B .
P0740	Torque Converter Clutch Solenoid Circuit / Open	TCM (6HP26)	REFER to Section 307-01A .
P0740	Torque Converter Clutch Solenoid Circuit / Open	TCM (6R75)	REFER to Section 307-01B .
P0741	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	TCM (6HP26)	REFER to Section 307-01A .
P0741	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	TCM (6R75)	REFER to Section 307-01B .
P0770	Shift Solenoid E	TCM (6HP26)	REFER to Section 307-01A .
P0770	Shift Solenoid E	TCM (6R75)	REFER to Section 307-01B .

P0781	1-2 Shift	TCM (6HP26)	REFER to Section 307-01A .
P0781	1-2 Shift	TCM (6R75)	REFER to Section 307-01B .
P0782	2-3 Shift	TCM (6HP26)	REFER to Section 307-01A .
P0782	2-3 Shift	TCM (6R75)	REFER to Section 307-01B .
P0783	3-4 Shift	TCM (6HP26)	REFER to Section 307-01A .
P0783	3-4 Shift	TCM (6R75)	REFER to Section 307-01B .
P0784	4-5 Shift	TCM (6HP26)	REFER to Section 307-01A .
P0784	4-5 Shift	TCM (6R75)	REFER to Section 307-01B .
P0812	Reverse Input Circuit	Audio Unit	REFER to Section 415-00 .
P0829	5-6 Shift	TCM (6HP26)	REFER to Section 307-01A .
P0829	5-6 Shift	TCM (6R75)	REFER to Section 307-01B .
P0960	Pressure Control Solenoid A Control Circuit / Open	TCM (6HP26)	REFER to Section 307-01A .
P0960	Pressure Control Solenoid A Control Circuit / Open	TCM (6R75)	REFER to Section 307-01B .
P0962	Pressure Control Solenoid A Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0962	Pressure Control Solenoid A Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0963	Pressure Control Solenoid A Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0963	Pressure Control Solenoid A Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0972	Shift Solenoid A Control Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0972	Shift Solenoid A Control Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0973	Shift Solenoid A Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0973	Shift Solenoid A Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0974	Shift Solenoid A Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0974	Shift Solenoid A Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0975	Shift Solenoid B Control Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0975	Shift Solenoid B Control Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0976	Shift Solenoid B Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0976	Shift Solenoid B Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0977	Shift Solenoid B Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0977	Shift Solenoid B Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0978	Shift Solenoid C Control	TCM (6HP26)	REFER to Section 307-01A .

	Circuit Range/Performance		
P0978	Shift Solenoid C Control Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0979	Shift Solenoid C Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0979	Shift Solenoid C Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0980	Shift Solenoid C Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0980	Shift Solenoid C Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0981	Shift Solenoid D Control Circuit Range/Performance	TCM (6HP26)	REFER to Section 307-01A .
P0981	Shift Solenoid D Control Circuit Range/Performance	TCM (6R75)	REFER to Section 307-01B .
P0982	Shift Solenoid D Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0982	Shift Solenoid D Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0983	Shift Solenoid D Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0983	Shift Solenoid D Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P0985	Shift Solenoid E Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .
P0985	Shift Solenoid E Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
P0986	Shift Solenoid E Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P0986	Shift Solenoid E Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P1260	Theft Detected, Vehicle Immobilized	PCM	REFER to Section 419-01 .
P1639	Vehicle ID Block Corrupted, Not Programmed	PCM	REFER to Section 418-01 .
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	TCM (6HP26)	REFER to Section 307-01A .
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	TCM (6R75)	REFER to Section 307-01B .
P1719	Engine Torque Signal	TCM (6HP26)	REFER to Section 307-01A .
P1812	Transmission Four-Wheel Drive Mode Select Circuit Failure	4WD Control Module	REFER to Section 308-07A .
P1815	Transmission Four-Wheel Drive Mode Select Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P1824	Transmission Four-Wheel Drive Clutch Relay Circuit Failure	4WD Control Module	REFER to Section 308-07A .

P1825	4-Wheel Drive Clutch Relay Open Circuit	4WD Control Module	REFER to Section 308-07A .
P1826	Transmission Four-Wheel Drive Low Clutch Relay Short Circuit to Battery	4WD Control Module	REFER to Section 308-07A .
P1827	Transmission Four-Wheel Drive Low Clutch Relay Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P183B	4-Wheel Drive Clutch Coil Return Circuit Open	4WD Control Module	REFER to Section 308-07A .
P1849	Transmission Transfer Case Contact Plate "A" Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P1853	Transmission Transfer Case Contact Plate "B" Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P1857	Transmission Transfer Case Contact Plate "C" Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P1861	Transmission Transfer Case Contact Plate "D" Short Circuit to Ground	4WD Control Module	REFER to Section 308-07A .
P1867	Transmission Transfer Case Contact Plate General Circuit Failure	4WD Control Module	REFER to Section 308-07A .
P1886	4X4 Initialization Failure	4WD Control Module	REFER to Section 308-07A .
P1891	Transmission Transfer Case Contact Plate Ground Return Open Circuit	4WD Control Module	REFER to Section 308-07A .
P1910	Reverse Lamp Control Circuit / Open	TCM (6HP26)	REFER to Section 417-01 .
P1910	Reverse Lamp Control Circuit / Open	TCM (6R75)	REFER to Section 417-01 .
P1911	Reverse Lamp Control Circuit Low	TCM (6HP26)	REFER to Section 417-01 .
P1911	Reverse Lamp Control Circuit Low	TCM (6R75)	REFER to Section 417-01 .
P1912	Reverse Lamp Control Circuit High	TCM (6HP26)	REFER to Section 417-01 .
P1912	Reverse Lamp Control Circuit High	TCM (6R75)	REFER to Section 417-01 .
P1934	Vehicle Speed Signal	TCM (6HP26)	REFER to Section 307-01B .
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High	TCM (6HP26)	REFER to Section 307-01A .
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High	TCM (6R75)	REFER to Section 307-01B .
P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low	TCM (6HP26)	REFER to Section 307-01A .

P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low	TCM (6R75)	REFER to Section 307-01B .
PXXX	All Others	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0001	High Speed CAN Communication Bus	ABS Module	REFER to Section 418-00 .
U0073	Control Module Communication Buss Off	Air Suspension Module	REFER to Section 418-00 .
U0073	Control Module Communication Buss Off	TCM (6HP26)	REFER to Section 418-00 .
U0073	Control Module Communication Buss Off	TCM (6R75)	REFER to Section 418-00 .
U0100	Lost Communication With ECM/PCM	4WD Control Module	REFER to Section 418-00 .
U0100	Lost Communication With ECM/PCM	ABS Module	REFER to Section 418-00 .
U0100	Lost Communication With ECM/PCM	Air Suspension Module	REFER to Section 418-00 .
U0100	Lost Communication With ECM/PCM	Instrument Cluster	REFER to Section 413-01 .
U0100	Lost Communication With ECM/PCM	TCM (6HP26)	REFER to Section 418-00 .
U0100	Lost Communication With ECM/PCM	TCM (6R75)	REFER to Section 418-00 .
U0101	Lost Communication with TCM	4WD Control Module	REFER to Section 418-00 .
U0101	Lost Communication with TCM	ABS Module	REFER to Section 418-00 .
U0101	Lost Communication with TCM	Instrument Cluster	REFER to Section 413-01 .
U0102	Lost Communication with Transfer Case Control Module (4x4CM)	Instrument Cluster	REFER to Section 413-01 .
U0102	Lost Communication with Transfer Case Control Module (4x4CM)	TCM (6HP26)	REFER to Section 418-00 .
U0114	Lost Communication With Four-Wheel Drive Clutch Control Module	ABS Module	REFER to Section 418-00 .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	4WD Control Module	REFER to Section 418-00 .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Instrument Cluster	REFER to Section 413-01 .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	TCM	REFER to Section 418-00 .
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	TCM (6HP26)	REFER to Section 418-00 .

U0122	Lost Communication With Vehicle Dynamics Control Module	Instrument Cluster	REFER to Section 413-01 .
U0140	Lost Communication With Body Control Module (GEM)	ABS Module	REFER to Section 418-00 .
U0140	Lost Communication With Body Control Module (GEM)	Air Suspension Module	REFER to Section 418-00 .
U0140	Lost Communication With Body Control Module (GEM)	Audio Unit	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	Auxiliary Audio Module	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	DSM	REFER to Section 418-00 .
U0140	Lost Communication With Body Control Module (GEM)	DVD Player	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	Instrument Cluster	REFER to Section 413-01 .
U0140	Lost Communication With Body Control Module (GEM)	Parking Aid Module	REFER to Section 418-00 .
U0140	Lost Communication With Body Control Module (GEM)	Power Liftgate Module	REFER to Section 501-03 .
U0151	Lost Communication With Restraints Control Module	Instrument Cluster	REFER to Section 413-01 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	ABS Module	REFER to Section 418-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Air Suspension Module	REFER to Section 418-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Audio Unit	REFER to Section 415-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	DSM	REFER to Section 501-10 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Parking Aid Module	REFER to Section 418-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Power Liftgate Module	REFER to Section 501-03 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	TCM (6HP26)	REFER to Section 418-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	TCM (6R75)	REFER to Section 418-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	THX® Amplifier	REFER to Section 415-00 .
U0159	Lost Communication With Parking Assist Control Module (PAM)	Audio Unit	REFER to Section 415-00 .

U0159	Lost Communication With Parking Assist Control Module (PAM)	Instrument Cluster	REFER to Section 413-13 .
U0164	Lost Communication With HVAC Control Module (EATC)	Instrument Cluster	REFER to Section 413-01 .
U0184	Lost Communication With Radio (ACM)	Auxiliary Audio Module	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	DVD Player	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	Satellite Radio Receiver	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	THX® Amplifier	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Audio Unit	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Auxiliary Audio Module	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	DVD Player	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Audio Unit	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	Satellite Radio Receiver	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	THX® Amplifier	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	Audio Unit	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0197	Lost Communication With Telephone Control Module	Satellite Radio Receiver	DISREGARD the DTC. CLEAR the DTCs. REPEAT the self-test.
U0208	Lost Communication With Seat Control Module (DSM)	Instrument Cluster	REFER to Section 413-01 .
U0230	Lost Communication With Rear Gate Module (LTM)	Instrument Cluster	REFER to Section 413-01 .
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	Audio Unit	REFER to Section 415-00 .
U0244	Lost Communication With Running Board Control Module (PRB)	Instrument Cluster	REFER to Section 413-01 .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	Audio Unit	REFER to Section 415-00 .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	Satellite Radio Receiver	REFER to Section 415-00 .
U0300	Internal Control Module	RCM	REFER to Section 501-20B .

	Software Incompatibility		
U0300	Internal Control Module Software Incompatibility	PCM	REFER to Section 418-01 .
U0301	Software Incompatibility with Engine/Powertrain Control Module	PCM	REFER to Section 418-01 .
U0401	Invalid Data Received from ECM/PCM A	ABS Module	RETRIEVE and FOLLOW DTCs from the PCM.
U0401	Invalid Data Received from ECM/PCM A	TCM (6HP26)	RETRIEVE and FOLLOW DTCs from the PCM.
U0402	Invalid Data Received from TCM	ABS Module	RETRIEVE and FOLLOW DTCs from the PCM.
U0414	Invalid Data Received from TCM	ABS Module	REFER to Section 206-09 .
U1900	CAN Communication Bus Fault - Receive Error	Power Running Board Module	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	RCM	REFER to Section 418-00 .
U1901	Communication Fault from Sensor Cluster	ABS Module	REFER to Section 206-09 .
U2011	Module Transmitted Invalid Data (Non SCP)	Air Suspension Module	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2013	Compass Module Not Responding	Instrument Cluster	REFER to Section 413-08 .
U2023	Fault Received From External Node	4WD Control Module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network.
U2023	Fault Received From External Node	Air Suspension Module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network.
U2023	Fault Received From External Node	Instrument Cluster	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network.
U2023	Fault Received From External Node	Parking Aid Module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network.
U2050	No Application Present	4WD Control Module	REFER to Section 418-01 .
U2050	No Application Present	ABS Module	REFER to Section 418-01 .
U2050	No Application Present	Air Suspension Module	REFER to Section 418-01 .
U2050	No Application Present	Audio Unit	REFER to Section 418-01 .
U2050	No Application Present	Auxiliary Audio Module	REFER to Section 418-01 .

U2050	No Application Present	Climate Controlled Seat Module	REFER to Section 418-01 .
U2050	No Application Present	DSM	REFER to Section 418-01 .
U2050	No Application Present	DVD Player	REFER to Section 418-01 .
U2050	No Application Present	Instrument Cluster	REFER to Section 418-01 .
U2050	No Application Present	Parking Aid Module	REFER to Section 418-01 .
U2050	No Application Present	Power Liftgate Module	REFER to Section 418-01 .
U2050	No Application Present	Power Running Board Module	REFER to Section 418-01 .
U2050	No Application Present	RCM	REFER to Section 501-20B .
U2050	No Application Present	Satellite Radio Receiver	REFER to Section 418-01 .
U2050	No Application Present	SJB	REFER to Section 418-01 .
U2050	No Application Present	THX® Amplifier	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	Audio Unit	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	Instrument Cluster	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	Parking Aid Module	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	Power Liftgate Module	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	RCM	REFER to Section 501-20B .
U2051	One or More Calibration Files Missing/Corrupt	THX® Amplifier	REFER to Section 418-01 .
U2199	Invalid 'Engine Coolant Temperature' Data	Instrument Cluster	REFER to Section 413-01 .
U2471	Unexpected PRNDL State	DSM	REFER to Section 501-10 .
U2471	Unexpected PRNDL State	Parking Aid Module	REFER to Section 413-13 .
U2471	Unexpected PRNDL State	Power Liftgate Module	REFER to Section 501-03 .
U2472	Unexpected Ignition State	Instrument Cluster	CLEAR the DTCs. REPEAT the self-test. If U2472 is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. REPEAT the self-test.
U2472	Unexpected Ignition State	Parking Aid Module	REFER to Section 413-13 .
U2472	Unexpected Ignition State	Power Liftgate Module	REFER to Section 501-03 .
U2472	Unexpected Ignition State	SJB	CLEAR the DTCs. REPEAT the self-test. If U2472 is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section.
U2473	Unexpected Vehicle Speed	Audio Unit	REFER to Section 419-07 .

	(VSS)		
U2473	Unexpected Vehicle Speed (VSS)	Parking Aid Module	REFER to Section 413-13 .
U2473	Unexpected Vehicle Speed (VSS)	Power Liftgate Module	REFER to Section 501-03 .
U2473	Unexpected Vehicle Speed (VSS)	SJB	VERIFY the VSS is at 0 km/h (0 mph). CLEAR the DTCs. REPEAT the self-test. If U2473 is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section.
U2510	CAN - Invalid data for Vehicle Security	Instrument Cluster	REFER to Section 419-01 .
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	Instrument Cluster	REFER to Section 419-01 .
U261A	CAN Data / Configuration Setup Mismatch	Instrument Cluster	REFER to Section 418-01 .

Smart Junction Box (SJB)

Printable View (116 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The smart junction box (SJB) communicates via the medium speed controller area network (MS-CAN).

The SJB controls the power door lock system. The module monitors the door lock/unlock switch inputs from the interior door lock switches. When the module receives an unlock/lock command from any door lock control switch, the module activates the door lock actuators. For additional information, refer to Section 501-14 .

The module also controls the following remote lock/unlock features:

- Remote keyless entry (RKE) transmitter lock/unlock
- Panic alarm
- Keyless entry keypad

The SJB controls the autolamp subsystem. The autolamp subsystem provides light-sensitive automatic on/off control of the headlamps and parking lamps. For additional information, refer to Section 417-01 .

The third row power-fold seat relays are also controlled by the SJB. This allows the seats to be adjusted by pressing one of the third row power-fold seat switches. For additional information, refer to Section 501-10 .

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery junction box (BJB) fuse 69 (30A)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code Chart in this section.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B106E	Solid State Driver Disabled Due to Short Circuit	Go To Pinpoint Test A .
B106F	Module Disabled Due to External Fault	Go To Pinpoint Test A .
B2048	Left Rear Turn Lamp Circuit Short to Ground	Go To Pinpoint Test B .

B2050	Right Rear Turn Lamp Circuit Short to Ground	Go To Pinpoint Test B .
B2477	Module Configuration Failure	REFER to Section 418-01 .
B2949	Global Opening/Closing Circuit Short to Battery	Go To Pinpoint Test B .
B2A2B	Left Corner Lamp Output Circuit Short to Ground	Go To Pinpoint Test B .
B2A2C	Right Corner Lamp Output Circuit Short to Ground	Go To Pinpoint Test B .
B2A38	Floor Lamp Output Circuit Short to Ground	Go To Pinpoint Test B .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	**NOTE:** Diagnose SJB or instrument cluster DTC B1318 (if present) before diagnosing this DTC. CARRY OUT the audio unit self-test using the scan tool. ● If DTC U0155 is present in both the audio unit and the SJB, INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. ● If DTC U0155 is not present in the audio unit, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. REPEAT the self-test.
U2050	No Application Present	CONFIGURE the SJB. REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test. If DTC U2050 is retrieved again, INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation.
All other DTCs	—	REFER to Diagnostic Trouble Code Chart in this section.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
● No communication with the smart junction box (SJB)	● Fuse(s) ● Circuitry ● SJB	● REFER to Section 418-00 .

Pinpoint Tests

Pinpoint Test A: DTC B106E — Solid State Driver Disabled Due To Short Circuit

Normal Operation

The smart junction box (SJB) controls the output of several vehicle systems. When a repetitive fault causing a circuit overload is detected on any of the output circuits, the SJB disables the circuit by removing voltage, or ground, to the affected circuit. The circuit remains disabled until the fault is

corrected and an on-demand self-test is run. After the on-demand self-test has been run, any DTCs related to the fault will be cleared.

DTC B106E — sets when the SJB has disabled a circuit due to a repetitive fault causing a circuit overload. A corresponding DTC for the circuit in question will also set.

DTC B106F — sets when one or more output functions are permanently disabled due to a repetitive circuit overload fault. DTC B106F will be set with DTC B106E. When DTC B106F is present, a new SJB must be installed after the fault condition has been corrected.

Possible Causes

- Output circuit short to ground or voltage
- SJB

PINPOINT TEST A: DTC B106E — SOLID STATE DRIVER DISABLED DUE TO SHORT CIRCUIT

CAUTION: If DTC B106F is present and a new SJB is to be installed, the fault condition must be corrected first. Failure to correct the fault condition first may cause damage to the new SJB, resulting in a repeat repair.

Test Step	Result / Action to Take
A1 REVIEW THE DTCs	
• Review the DTCs from the SJB self-test. • **Are only DTCs B106E and B106F present?**	**Yes** INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation. **No** CORRECT any DTCs present other than DTCs B106E and B106F. REFER to Diagnostic Trouble Code Chart in this section. After the repair, GO to A2 .
A2 CARRY OUT THE SJB SELF-TEST	
• Carry out the SJB self-test. • **Is DTC B106F present?**	**Yes** INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern was caused by a fault in one of the output circuits.

Pinpoint Test B: DTCs B2048, B2050, B2949, B2A2B, B2A2C, B2A38 — Possible Smart Junction Box (SJB) Internal Errors

Normal Operation

If the SJB is not configured correctly, these DTCs may appear in error. The SJB will need to be configured correctly, possibly using the As-Built data, in order to correct this issue and clear the DTCs. If not, then the following pinpoint test will need to be carried out to determine if the SJB is at fault.

DTC B2048 — sets when the LR turn lamp circuit (on SJB C2280D-21) is shorted to ground.

DTC B2050 — sets when the RR turn lamp circuit (on SJB C2280D-19) is shorted to ground.

DTC B2949 — sets when the global opening/closing circuit (on SJB C2280D-10) is shorted to battery.

DTC B2A2B — sets when the left corner lamp output circuit (on SJB C2280B-17) is shorted to ground.

DTC B2A2C — sets when the right corner lamp output circuit (on SJB C2280B-19) is shorted to ground.

DTC B2A38 — sets when the floor lamp output circuit (on SJB C2280G-2) is shorted to ground.

NOTE: The pins mentioned above are not populated.

Possible Causes

- SJB

PINPOINT TEST B: DTCs B2048, B2050, B2949, B2A2B, B2A2C, B2A38 — POSSIBLE SMART JUNCTION BOX (SJB) INTERNAL ERRORS

Test Step	Result / Action to Take

B1 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Enter the following diagnostic mode on the diagnostic tool: Clear the DTCs.
• Enter the following diagnostic mode on the diagnostic tool: Repeat the Self-Test.
• **Is DTC B2048, B2050, B2949, B2A2B, B2A2C, or B2A38 retrieved (or any combination of the previously mentioned DTCs)?**
	Yes
	INSTALL a new SJB. REFER to Smart Junction Box (SJB) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Driver Seat Module (DSM)

Printable View (105 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The driver seat module (DSM) is on the controller area network (CAN) communication network.

The DSM controls the memory power exterior mirrors. This feature allows the driver to program personalized mirror positions. Once the driver has stored a mirror position, the driver can recall the setting by pressing the corresponding memory switch or by using a programmed remote keyless entry (RKE) transmitter. Refer to Section 501-09 .

The memory driver seat feature allows the driver to program a personalized seat position that can be recalled using the memory switches or the RKE transmitter. Refer to Section 501-10 .

The memory adjustable pedals and memory powertilt column are also controlled by the DSM. These systems permit the adjustment of the brake, the accelerator pedals and the tilt column by pressing the desired memory set switch or by using a programmed RKE transmitter. Refer to Section 206-00 .

The power fold mirrors are also controlled by the DSM. This system permits the mirrors to be folded in or out using the power mirror switch.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery junction box (BJB) fuse 45 (30A) • Smart junction box (SJB) fuse 2 (15A)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.

9. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code Chart in this section.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

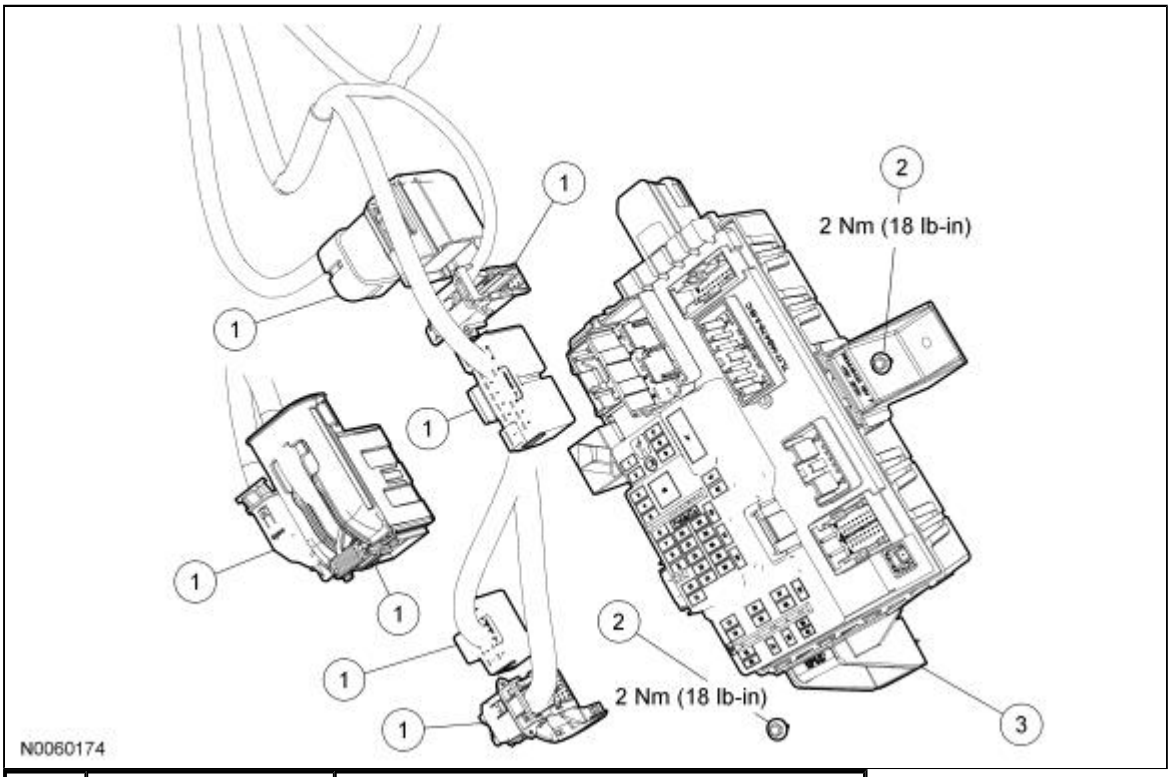
Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver seat module (DSM)	• Fuse(s) • Circuitry • DSM	• REFER to Section 418-00 .

Smart Junction Box (SJB)

Printable View (210 KB)



Item	Part Number	Description
1	—	Electrical connectors (part of 14A005)
2	W706287 - S901	SJB bolts (2 required)
3	14B207	SJB

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to a scan tool. This information must be downloaded into the new SJB after installation. For additional information, refer to Section 418-01 .

1. **NOTE:** The tire pressure monitoring system (TPMS) functionality is integral to the SJB.

   NOTE: A new SJB is delivered in "manufacturing mode" with 7 pre-set DTCs. These 7 manufacturing mode DTCs require that a successful configuration of the SJB occurs, then a successful TPMS sensor training occurs, then a successful self-test occurs, including the clearing of all DTCs. All of this is required in order to clear the 7 manufacturing mode DTCs. The 7 manufacturing mode DTCs are as follows:
   - B2477 (Module Configuration Failure)
   - B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured) This DTC is present when the SJB is not configured, even on applications that are not equipped with initiators.

- B2868 (Left Front Tire Pressure Sensor Fault)
- B2869 (Right Front Tire Pressure Sensor Fault)
- B2870 (Right Rear Tire Pressure Sensor Fault)
- B2871 (Left Rear Tire Pressure Sensor Fault)
- C2780 (ECU in Manufacturer Sub-state)

Upload the module configuration information from the SJB into the scan tool. For additional information, refer to Section 418-01 .

2. Disconnect the battery. For additional information, refer to Section 414-01 .
3. Remove the pin-type retainer and the RH A-pillar lower trim panel.
4. Remove the glove compartment. For additional information, refer to Section 501-12 .
5. Disconnect the 7 electrical connectors.
6. Remove the 2 bolts and the SJB.

Installation

1. Position the SJB and install the 2 bolts.
   - Tighten the screws to 2 Nm (18 lb-in).
2. Connect the 7 electrical connectors.
3. Position the RH A-pillar lower trim panel and install the pin-type retainer.
4. Install the glove compartment. For additional information, refer to Section 501-12 .
5. Connect the battery. For additional information, refer to Section 414-01 .
6. **NOTE:** When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B2477 and B106D. The clearing of these DTCs indicate the calibration data has been successfully downloaded to the SJB.

   Download the SJB configuration information from the scan tool to the SJB. For additional information, refer to Section 418-01 .
7. **NOTE:** When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized the tire pressure sensors during the training procedure.

   Train the tire pressure sensors. For additional information, refer to Section 204-04 .
8. **NOTE:** DTC C2780 will not clear if any other DTCs are present in the SJB.

   Carry out the SJB on-demand self-test by clearing DTCs and then retrieving DTCs to confirm all DTCs have been cleared.

Driver Seat Module (DSM)

Printable View (80 KB)

Removal and Installation

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to a scan tool. This information must be downloaded into the new DSM after installation. For additional information, refer to Section 418-01 .

1. Upload the module configuration information from the DSM into the scan tool. For additional information, refer to Section 418-01 .
2. **NOTE:** The module is accessed with the seat fully in the UP position.

   Position the DSM forward to remove it from the bracket.
3. Disconnect the battery. For additional information, refer to Section 414-01 .
4. Disconnect the electrical connectors and remove the DSM.
5. **NOTE:** Once the module is installed it is necessary to download the module configuration information from the scan tool into the new module. For additional information, refer to Section 418-01 .

   To install, reverse the removal procedure.

Printable View (78 KB)

General Specifications

Item	Specification
Adhesives	
Trim and Weatherstrip Adhesive TA-14	—
Lubricants	
Silicone Spray Lubricant XL-6	ESR-M13P4-A
Sealants	
Clear Silicone Rubber TA-32	ESB-M4G92-A
3M Strip-Caulk — Black 051135-08578	WSB-M4G32-C
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Body

Printable View (62 KB)

The body:

- is a cab-forward design.
- is constructed of lightweight, all steel welded material, with bolted removable front fenders and hinged doors.
- has an aluminum liftgate and hood with gas lift cylinders (Expedition).
- has steel fenders and a SMC hood with gas lift cylinders (Navigator).
- has roof and body side panels that are separate pieces.
- is supported by a full frame.

Insulation

Printable View (62 KB)

Insulation is installed:

- under the roof.
- above and below the instrument panel.
- at the cowl sides.
- over the transmission tunnel.
- over the floorpan areas.
- inside the quarter panels.

And has heat-bondable mastic deadeners for improved NVH characteristics (Navigator).

Body Sealer Types And Applications

Printable View (64 KB)

Clear Silicone Rubber

Clear silicone rubber TA-32 or equivalent meeting Ford specification ESB-M4G92-A:

- does not run.
- is fast-drying.
- remains semi-elastic.
- can be used for sealing water leaks and wind noise.

Caulking Cord

3M Strip-Caulk — Black 051135-08578 or equivalent commercially available product meeting Ford specification WSB-M4G32-C:

- has a plastic base with a filler.
- is heavy-bodied.
- is commonly known as perma-gum.
- is used on spot-weld holes, around mounting clips and between surfaces not sealed by a gasket.

Weatherstrip Adhesive

Trim and Weatherstrip Adhesive TA-14 or equivalent:

- is a quick-drying, strong adhesive designed to hold or repair weatherstripping on doors, bodies and the surrounding metal.

Silicone Spray Lubricant

Silicone Spray Lubricant XL-6 meeting Ford specification ESR-M13P4-A:

- is used on the door and window weatherstrip.
- should be applied to weatherstrip at every lubrication period.
- makes doors easier to close.
- avoids weatherstrip squeaks.
- retards weatherstrip wear.
- helps retain door window alignment by reducing friction between the glass frame and rubber weatherstrip.
- should not be used prior to painting.

Body System

Printable View (84 KB)

Inspection and Verification

Leaks

NOTE: Trim will reveal the location of most leaks. Use spray chalk and hose if necessary.

1. Remove any trim or carpet in the general area of the leak.
2. Road test or water hose test the vehicle.
3. Inspect for a dust pattern around the area in question. Inspect for water paths near and above the area in question.
4. Some leaks can be located by placing bright light under the vehicle, removing any necessary trim or carpet, and inspecting the interior of the body at joints and weld lines.

Noise

Wind noise, rattles and their sources are detected by driving the vehicle at highway speeds. The vehicle should be driven in 4 different directions, with all windows closed, radio off, blower motor off and all ventilation ducts open.

Most wind noise leaks will occur at the door and window seals or at the sheet metal joints in the door or the door opening.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Dust and water leaks	• Body sealer missing • Opening in welding or body joints • Components not fully installed • Components missing • Components damaged	• REMOVE trim. CHECK for leaks and SEAL with appropriate sealer. ROAD TEST or WATER TEST for leaks. RECHECK trim for leaks; USE light under vehicle with trim removed. CHECK interior of body at joints and weld lines.
• Dust/water leaks at floor pan and grommets	• Missing or damaged plugs and/or grommets	• CHECK plugs for correct installation. INSTALL new if necessary.
• Door drain holes collecting water	• Holes clogged with mud or road tar	• CLEAN drain holes of dirt and foreign material with a punch or screwdriver. CHECK drain holes regularly.

• Wind noise	• Leaks at door and window seals or sheet metal joints in doors or door openings	• SEAL leaks with Silicone Gasket and Sealant TA-30 or equivalent meeting Ford specification WSE-M2G323-A4.
	• Loose/misaligned weatherstrip	• REATTACH weatherstrip. INSTALL new pin-type retainers if damaged. Use Trim and Weatherstrip Adhesive TA-14 or equivalent as necessary.
	• Poor door fit	• ADJUST the striker or hinges as necessary. For hinge adjustment, refer to Section 501-03 . CHECK for acceptable door efforts after repair.
• Rattles	• Loose objects in door wells, pillars and quarter panels	• CHECK doors by carefully STRIKING underside of door with a rubber mallet. LISTEN for loose objects in door. REPAIR. TIGHTEN body bolts and screws.
	• Misalignment (if tightening bolts does not eliminate rattle)	• REFER to Section 501-03 .
	• Loose weatherstripping and/or anti-squeak material	• APPLY additional sealer. INSTALL in proper location to eliminate rattle.

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Fender-to-front radiator support bolts	12	9	—
Fender splash shield screws	3	—	27
Front bumper cover-to-fender bolts	11	8	—
Headlamp bolts	3	—	27
Hood hinge-to-hood bolts	30	22	—
Lower fender bolts	12	9	—
Upper fender bolts	12	9	—
Wiper pivot arm nut	35	26	—

Front End Body Panels

Printable View (62 KB)

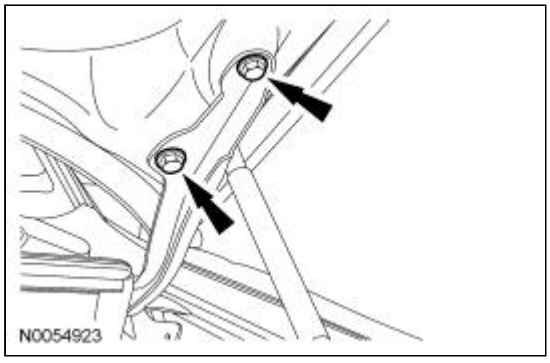
The front end body panels consist of:

- Air deflectors
- Cowl panel grilles
- Fenders
- Fender splash shields

Hood Alignment

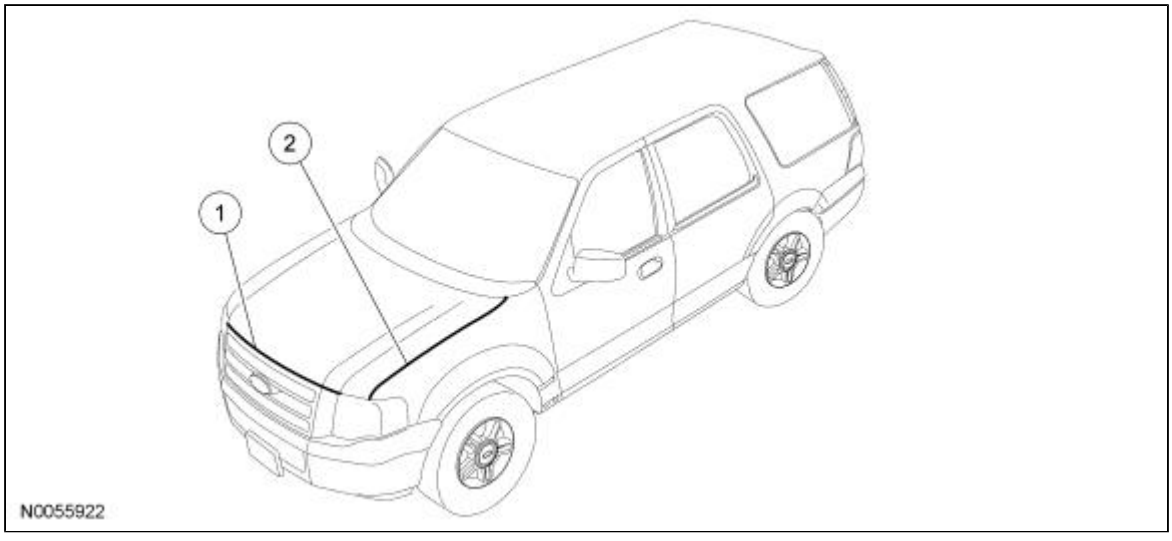
Printable View (143 KB)

1. Raise and support the hood.
2. Loosen the 2 hood hinge-to-hood bolts enough to hold the hood in place.



3. **NOTE:** Repeat Steps 2 and 3 until satisfactory alignment is achieved.

   Align the hood.
   1. Be sure the margin between the hood to grille is 1.3 mm (0.05 in) ± .08 mm (0.03 in).
   2. Be sure the margin between the hood to fender is 4.5 mm (0.17 in) ± 2 mm (0.07 in).

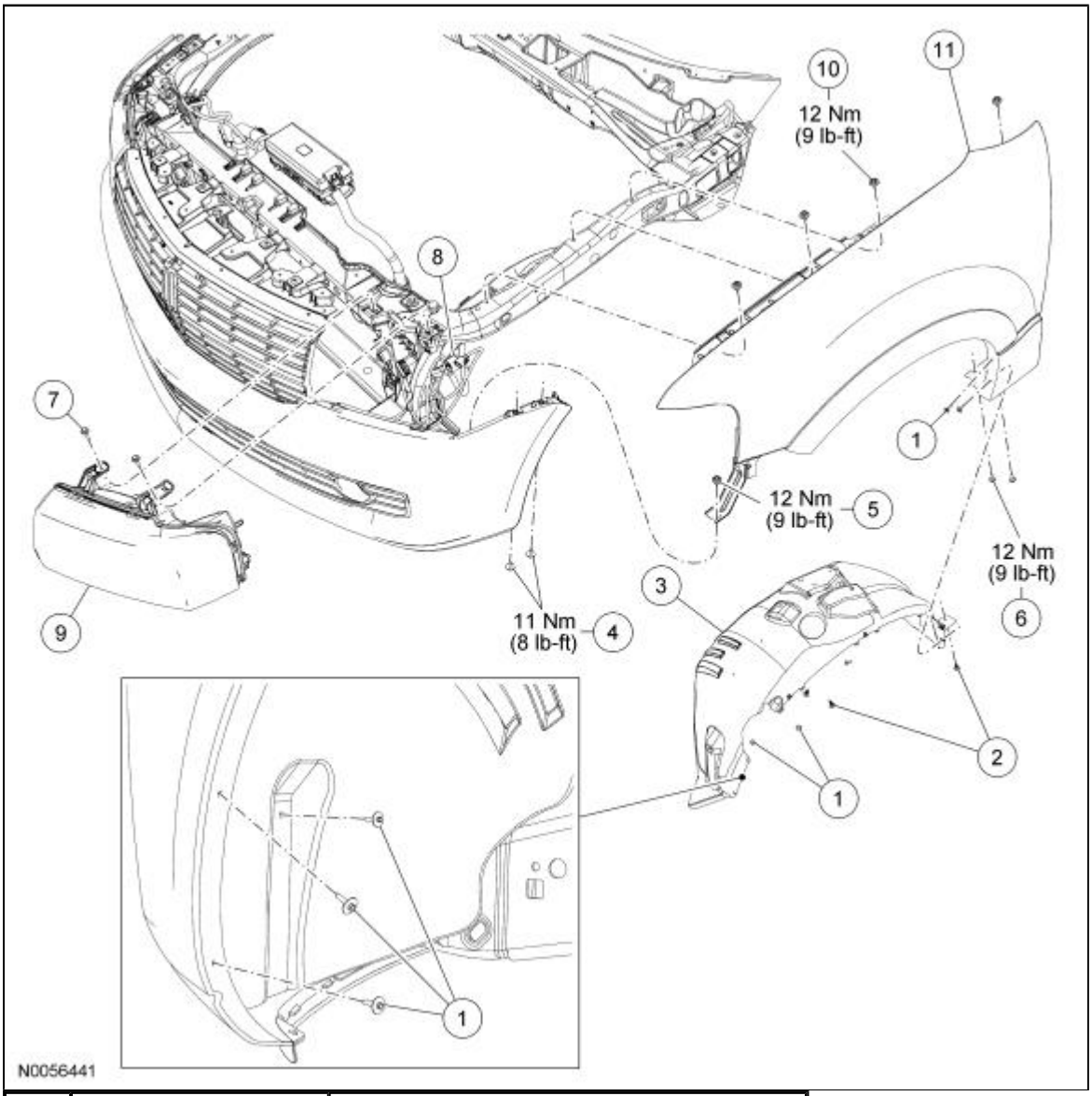


4. When correctly aligned, tighten the hood hinge-to-hood bolts to 30 Nm (22 lb-ft).

Front End Body Panels — Exploded View

Printable View (252 KB)

NOTE: Navigator shown, Expedition similar.



Item	Part Number	Description
1	W710763	Fender splash shield screws (8 required)
2	W708035	Pin-type retainers (3 required)
3	16102A RH/ 16102B LH	Fender splash shield
4	W712923	Front bumper cover-to-fender bolts (2 required)
5	W712923	Fender-to-radiator support bolt
6	N807658	Lower fender bolt (2 required)
7	W505425	Headlamp bolt (2 required)

8	13008	Headlamp
9	13A006	Headlamp electrical connector
10	W712923	Upper fender bolt (4 required)
11	16005A RH/ 16005B LH	Fender

1. For additional information, refer to the procedures in this section.

Fender Splash Shield

Printable View (62 KB)

Vehicles with power running boards

1. Lower the running board.

All vehicles

2. Remove the lower pin-type retainer from the fender.
3. Remove the 8 fender splash shield screws.
4. Remove the 2 inner pin-type retainers from the fender splash shield.
5. Remove the fender splash shield.
6. To install, reverse the removal procedure.

Fender

Printable View (63 KB)

Removal and Installation

1. Remove the fender splash shield. For additional information, refer to Fender Splash Shield in this section.

2. Remove the 2 front bumper cover-to-fender bolts.
   - To install, tighten to 11 Nm (8 lb-ft).

3. Remove the fender-to-radiator support bolt.
   - To install, tighten to 12 Nm (9 lb-ft).

4. Remove the 2 lower fender bolts.
   - To install, tighten to 12 Nm (9 lb-ft).

5. Remove the headlamp.
   - Remove the 2 headlamp bolts.
   - Disconnect the electrical connectors.

6. Remove the cowl panel grille. For additional information, refer to Cowl Panel Grille in this section.

7. Remove the 4 upper fender bolts and remove the fender.
   - To install, tighten to 12 Nm (9 lb-ft).

8. To install, reverse the removal procedure.

Cowl Panel Grille

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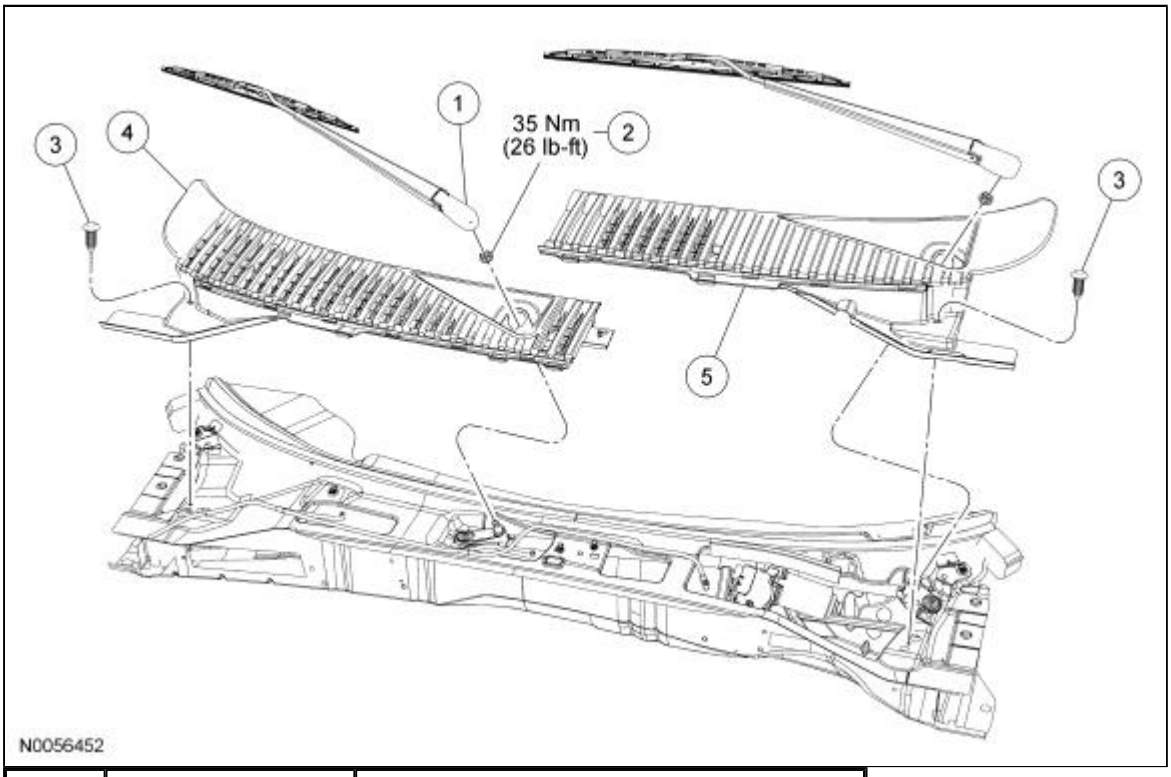


Item	Part Number	Description
1	17526	Wiper pivot arm (LH and RH)
2	W707014	Wiper pivot arm nut
3	—	Pin-type retainers
4	022A68A	Cowl panel RH
5	022A68B	Cowl panel LH

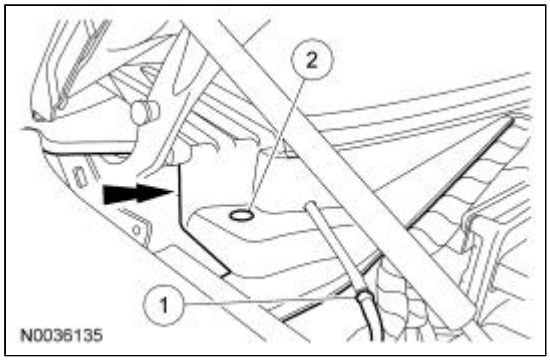
Removal and Installation

1. Remove the windshield wipers. For additional information, refer to Section 501-16 .

2. Remove the cowl grille seal.

3. Remove the pin-type retainer and left side cowl trim panel.
   - Disconnect the windshield washer tube.

4. Remove the right side cowl trim panel.
   1. Disconnect the windshield washer tube.
   2. Remove the pin-type retainer.



5. To install, reverse the removal procedure.

6. If necessary, adjust the windshield wiper arms. For additional information, refer to Section 501-16 .

Printable View (79 KB)

General Specifications

Item	Specification
Height Measurements For the Door Clearance Adjustment	
Door clearance; front and rear edge	3.0-7.0 mm (0.118-0.275 in) parallel top to bottom within 1.0 mm (0.04 in)
Door clearance; top of door to roof	3.0-7.0 mm (0.118-0.275 in) parallel top to bottom within 2.0 mm (0.08 in)
Threadlock 262 TA-26	WSK-M2G351-A6

Torque Specifications

Description	Nm	lb-ft	lb-in
Door strikers	12	9	—
Front door hinge-to-front door bolts	30	22	—
Liftgate hinge-to-liftgate bolts	28	21	—
Liftgate motor fasteners	11	8	—
Liftgate rod mounting stud	48	35	—
Liftgate rod-to-liftgate nut	11	8	—
Power liftgate module bolt	9	—	80
Rear door hinge-to-B-pillar nuts	30	22	—
Rear door hinge-to-rear door bolts	30	22	—

Body Closures

Printable View (68 KB)

The power liftgate (PLG) feature allows the customer to automatically open or close the liftgate by: activating the instrument panel control button, activating the remote keyless entry transmitter, lifting the exterior handle (open only) or activating the rear quarter trim-mounted switch. The PLG uses a power cinching system to latch the liftgate.

PLG operation requires the vehicle to be in PARK and the vehicle speed to be less than 5 Km/H (3 mph).

The PLG feature suspends a power open or power close when the ignition key is moved to the START position. The clutch will remain active to hold the liftgate in place during a start operation. Once the ignition key is no longer in the START position, the liftgate power open or power close will resume.

The PLG feature can be enabled/disabled from the message center. When the PLG feature is disabled (OFF), operation from the liftgate handle and liftgate rear control switch are disabled.

The PLG system consists of the following components:

- PLG control switch (located in the instrument panel)
- PLG rear control switch (located in the LH rear quarter trim panel)
- Exterior handle switch
- PLG motor (located behind the LH rear quarter trim panel)
- PLG rod (attached to the PLG motor assembly and liftgate mounting stud)
- Position sensor (located in the PLG motor assembly)
- Pinch strip switches (located on the body above the left and right taillamps)
- PLG latch (located in the middle lower portion of the liftgate)
- Forkbolt switches (located in the PLG latch)
- Sector gear switches (located in the PLG latch)
- Detent switch (located in the PLG latch)
- Unlatch/cinching motor (located in the PLG latch)
- PLG module (located behind the left rear quarter trim panel)

The PLG is controlled by the PLG module.

The PLG module receives inputs from the following:

- Forkbolt switch — primary (determines the position of the latch)
- Forkbolt switch — secondary (determines the position of the latch)
- Sector gear open switch — open (determines the sector gear position)
- Sector gear close switch — close (determines the sector gear position)
- Smart junction box (SJB) (exterior handle)
- Detent switch (determines the position of the latch)
- PLG control switch (located in the instrument panel)
- PLG rear control switch (located in the LH rear quarter trim panel)
- Pinch strip switches (determines if an obstacle is between the pinch strip and liftgate)
- Position sensor (determines the direction, travel speed and obstacle detection of the liftgate)
- Controller area network (CAN) serial communication link

The PLG module sends outputs to the following:

- Liftgate motor
- Liftgate clutch
- Unlatch/cinching motor
- Liftgate chime
- SJB (ajar status)

The liftgate chime sounds an audible chime (located on the PLG motor assembly) for 3 seconds whenever a powered closing operation is initiated or if conditions are not correct for closing. The chime sound serves as a warning to alert the vehicle occupants and any bystanders that the liftgate is being moved in a closing direction by a powered operation. The gate will not be moved for the first second, as a pre-warning of impending gate movement.

The PLG may not operate under the following conditions:

- Low voltage or dead battery
- Disconnected battery
- PLG that has been manually closed and left ajar

If any of these conditions have occurred, the PLG must be reset before carrying out any pinpoint tests. Refer to Power Liftgate Initialization in this section.

Power Liftgate

Printable View (570 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles Of Operation

Power and Ground Requirements

The smart junction box (SJB) fuse 14 (10A) supplies battery logic power required for the software, clutch and internal switching operations. Power is supplied to the motor by bussed electric center (BEC) fuse 27 (30A).

Ground for the PLG module is a separate single connection. Some of the continuous inputs which are at a ground state when ON are also used for logic switching.

PLG Detent Switch, Forkbolt Primary Switch and Forkbolt Secondary Switch

The PLG detent switch, forkbolt primary switch and forkbolt secondary switch provide inputs to the PLG module in order to determine liftgate latch position. The PLG module receives inputs from the PLG detent switch, forkbolt primary switch and forkbolt secondary switch in the following manner:

Latch Switch States

Latch Position	Detent Switch	Forkbolt Secondary Switch	Forkbolt Primary Switch
Fully Unlatched	Open [a]	Grounded	Grounded
In Secondary	Grounded [a]	Open	Grounded
In Primary	Grounded	Open	Open

[a] The detent switch may be in open or grounded state depending on forkbolt position. The detent switch state changes as the forkbolt rotates.

Unlatch/Cinching Motor

The latch uses a bi-directional motor to accomplish both release and cinch operations. The motor is driven in one direction to cinch and driven in the opposite direction to release.

During a cinch operation, power is supplied to the unlatch/cinching motor by the PLG module when the secondary latch position is reached during a power close operation. When the motor activates, it pulls the liftgate into the primary latch position. The PLG module removes power from the unlatch/cinching motor when the primary latch position is reached.

During an unlatch operation, power is supplied to the unlatch/cinching motor by the PLG module when a valid open command is received.

Sector Gear Switches

The sector gear open switch and sector gear close switch provide input to the PLG module in order to determine the position of the sector gear. The sector gear is part of the latch assembly. It is driven by the latch motor and in turn drives the latch mechanism. During a release operation, the PLG module deactivates the unlatch/cinching motor once the end of travel is reached. After a release operation, the PLG module keeps the latch released until the gate moves away from the vehicle. The PLG module then reverses the direction of the unlatch/cinching motor until the sector gear switches indicate the sector gear has returned to the neutral position. Refer to the following table for sector gear switch states:

Sector Gear Switch States

Sector Gear Position	Sector Gear Open Switch	Sector Gear Close Switch
End of Travel	Grounded	Grounded
Release	Open	Grounded
Cinch	Grounded	Open
Neutral	Open	Open

The drive assembly consists of the following:

Position Sensor

When awake, the PLG module supplies a 5-volt reference voltage to the position sensor on a valid open command or anytime the liftgate is in the open position (up to 6 hours). The PLG module constantly supplies the ground. The position sensor has 2 data lines that the PLG module monitors to determine the liftgate movement and position. The PLG module uses the liftgate position information to determine which direction to power the liftgate (open or close) when a valid operation command is received. The movement is monitored to identify obstructions.

Actuator Clutch

The drive assembly actuator clutch separates the drive assembly actuator motor from the liftgate drive gear. This allows manual opening and closing of the liftgate without driving the motor. The PLG module supplies power to the drive assembly actuator clutch for any valid open/close operation. The clutch connects the drive assembly actuator motor to the drive actuator, allowing the motor to turn the actuator and open or close the liftgate.

Actuator Motor

The drive assembly actuator motor is a reversible motor. Upon a valid activation, the PLG module supplies power and ground to the motor circuits depending on the liftgate position and the direction the liftgate needs to be moved.

PLG Control Switch — Instrument Panel

Pressing the instrument panel PLG control switch supplies a momentary ground signal to the PLG module which will open or close the liftgate depending on the conditions.

PLG Rear Control Switch — Quarter Trim Panel

Pressing the PLG rear control switch (located on the LH quarter trim panel) supplies a momentary ground signal to the PLG module which will operate the liftgate depending on the conditions.

Exterior Handle Switch

When the exterior handle switch is activated, the SJB sends a signal to the PLG module which will open the liftgate depending on the conditions.

Remote Keyless Entry (RKE) Operation

The SJB receives a PLG activation command (double press) from the remote keyless entry (RKE) transmitter. The SJB will send a signal on the CAN network to the PLG. The signal transmitted between the SJB and the PLG module is not specific to open or close operation. The PLG module will determine which operation to carry out depending on the liftgate position when the signal is received.

PLG Interface

PLG open operation requires the vehicle to be in PARK and the vehicle speed to be less than 5 km/h (3 mph). The PLG receives information over the CAN network from the powertrain control module (PCM) for the PRNDL position and from the instrument cluster (gateway) for the vehicle speed. These inputs have network diagnostic trouble codes (DTCs). If any vehicle speed sensor (VSS) or transmission range switch DTCs are retrieved and the PLG is not operating, repair these DTCs first.

PLG Operation

The following is a brief explanation of a normal power open cycle of the PLG.

- The power open operation will begin with one of the following methods:
  - The PLG receives a momentary ground signal from the PLG control switch
  - The SJB receives a signal from the remote transmitter key FOB (double button press)
  - The PLG module receives a signal from the SJB indicating the exterior liftgate handle has been activated.
- The PLG module checks the PARK and VSS status from the CAN communication link.
- The PLG module supplies power to the unlatch/cinching motor until the sector gear switches indicate end of travel which releases the PLG latch.
- The PLG detent switch, primary forkbolt switch and secondary forkbolt switch circuits are monitored for correct latch release signals.
- Power is supplied to the drive assembly actuator clutch and motor, opening the PLG.
- The PLG supplies power to the unlatch/cinching motor while monitoring the sector gear switches to return the sector gear to the neutral position.
- When the PLG is opening, the position sensor is monitored for liftgate position and velocity. If an obstruction is detected, the liftgate will stop.
- The PLG full open position is learned by the PLG module during the PLG initialization. When the PLG reaches the full open position, the PLG module removes the power from the drive assembly actuator motor and clutch.

The following is a brief explanation of a normal power close cycle of the PLG.

- The power close operation will begin with one of the following methods:
  - The PLG module receives a momentary ground signal from the PLG control switch
  - The PLG module receives a momentary ground signal from the PLG rear control switch (LH rear quarter panel)
  - The SJB receives a signal from the remote transmitter key FOB (double press)
- The PLG module checks the PARK and vehicle speed status from the CAN communication link.
- The PLG module will start an audible chime.

- After one second of audible chime, power is supplied to the drive assembly actuator clutch and motor as the audible chime continues 3 seconds total.
- As the PLG is powered closed, the position sensor is monitored for liftgate position and velocity. The PLG will reverse if an obstruction is detected.
- Also, as the PLG is powered closed, the pinch strips are monitored for a pinch condition. The PLG will reverse if an obstruction is detected by either pinch strip.
- The PLG detent switch, forkbolt primary switch and forkbolt secondary switch circuits are monitored for correct latch signals.
- When the PLG module receives switch signals indicating the secondary latch position is reached, power is supplied to the unlatch/cinching motor to pull the liftgate into the primary latch position. When primary latch position is reached, power is removed from the drive motor and clutch.
- When the PLG module receives switch signals indicating the primary latch position has been reached (liftgate is fully closed), the PLG module reverses the direction of the unlatch/cinching motor until the sector gear switches indicate the neutral position.

PLG Chime

The PLG module requests a chime to sound for 3 seconds when:

- the PLG module receives a request to power close.
- the liftgate reverses when closing due to an obstacle.
- the liftgate stops opening due to an obstacle.

The PLG module requests a chime to sound for one second when an open or close input is received when:

- the vehicle speed is greater than or equal to 5 km/h (3 mph).
- the ignition key is in the RUN position and the transmission is not in the PARK position.
- the battery voltage is between 8 and 9.5 volts.

The chime will sound continuously for up to 5 minutes when the transmission is shifted out of the PARK position or the vehicle speed exceeds 5 km/h (3 mph) while the liftgate is closing. The chime will stop sounding when the liftgate reaches the latch, 5 minutes has elapsed or the transmission is shifted into the PARK position and the vehicle speed is less than 5 km/h (3 mph).

The chime will sound continuously for up to 5 minutes when the liftgate fails to close to the primary latch position after 20 seconds of powering in the close direction. The chime will stop if the liftgate reaches the primary latch position or 5 minutes has elapsed.

PLG Initialization Procedure

If the PLG module loses the logic battery supply for any reason, such as battery disconnect, module disconnect or if left open for more than 6 hours, the PLG module will lose the PLG position stored in memory and will attempt to open when the liftgate switch is pressed the first time.

The PLG normal operation will not be restored until the PLG position is once again stored into memory. The initialization procedure is the learning process the PLG module uses to restore the PLG position in memory. The PLG module monitors the position sensor data received during the initial power open-and-close operation to learn the position.

Refer to Power Liftgate Initialization in this section.

PLG Awake/Sleep Status

- The PLG module is in the awake state whenever the ignition is in the RUN position.
- The PLG module is in the awake state while carrying out a close or an open operation, including cinch.

- The PLG module is in the sleep state when all of the following conditions exist:
  - The latch is not in the fully unlatched position
  - The ignition is in the OFF position
  - No power operation is active
  - No wakeup inputs have changed state for more than 20 seconds
- The PLG module is also in the sleep state when all of the following conditions exist:
  - The latch is in the unlatched position
  - The ignition is in the OFF position
  - No power operation is active
  - No wakeup inputs have changed state for more than 6 hours

The wakeup inputs for the PLG are:

- PLG open/close switch request signal
- Forkbolt primary signal
- Forkbolt secondary signal
- Detent switch signal
- Rear control switch
- Exterior handle switch
- Glass ajar switch
- CAN

Inspection and Verification

1. Verify the customer concern.

2. The battery voltage must be at normal operating levels in order for the PLG to open and close correctly. Make sure the battery and charging systems are operating correctly before proceeding with the PLG diagnosis.

3. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical	Electrical

• Power liftgate (PLG) drive assembly
• PLG rod assembly
• PLG cinching latch
• PLG pinch strip switches
• Liftgate and liftgate hinges
• Liftgate assist cylinders
• Liftgate strikers
• Exterior release handle
• Liftgate weatherstrip
• Liftgate alignment to body and striker
• Wedges
	• Smart junction box (SJB) fuse 14 (10A)
	• Bussed electrical center (BEC) fuse 27 (30A)
	• Circuitry
	• PLG control switch — instrument panel
	• PLG rear control switch — quarter trim panel
	• PLG position sensor
	• PLG latch
	  ▪ detent switch
	  ▪ primary forkbolt switch
	  ▪ secondary forkbolt switch
	  ▪ sector gear open switch
	  ▪ sector gear close switch
	  ▪ unlatch/cinching motor
	• PLG module
	• SJB

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible)

before proceeding to the next step.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

6. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the power liftgate module (PLG) or smart junction box (SJB).

8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

9. Clear the continuous DTCs and carry out the self-test diagnostics for the PLG or SJB.

10. If the DTCs retrieved are related to the concern, go to the PLG Module Diagnostic Trouble Code (DTC) Chart or the SJB Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

SJB Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1331	Decklid Ajar Rear Door Circuit Failure	REFER to Section 501-14 to diagnose the decklid ajar circuit.
B2666	Liftgate Release Switch Circuit Failure	REFER to Section 501-14 to diagnose the liftgate handle release switch.
B273A	Liftgate Release Output Circuit Short to Ground	Go To Pinpoint Test B .
B273B	Liftgate Release Output Circuit Open or Short to Battery	Go To Pinpoint Test B .

PLG Module Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B106E	Solid State Driver Disabled Due to Short Circuit	Go To Pinpoint Test A .

B106F	Module Disabled Due to External Fault	VERIFY there is no short to ground in circuit CPR57 (GN/WH) or CPR58 (GN/OG). REPAIR circuit(s) as necessary. INSTALL a new PLG module. REFER to Power Liftgate Module in this section. TEST for normal operation.
B107D	Obstacle Detected While Closing	VERIFY obstacle is not present. CLEAR the DTCs. TEST for normal operation. If DTC B107D returns, Go To Pinpoint Test D .
B1105	Rear Open/Close Switch Active During Self-Test	Go To Pinpoint Test B .
B1179	Latch Motor Circuit Short to Battery	Go To Pinpoint Test A .
B117A	Latch Motor Circuit Short to Ground	Go To Pinpoint Test A .
B117B	Latch Motor Circuit Open	Go To Pinpoint Test A .
B117C	Latch Centering Switch Invalid	If any other PLG related DTCs are present, diagnose those first. If no other PLG DTCs are present, Go To Pinpoint Test I .
B1317	Battery Voltage High	REFER to Section 414-00 to diagnose the charging system.
B1318	Battery Voltage Low	REFER to Section 414-00 to diagnose the charging system.
B1342	ECU is Defective	INSTALL a new PLG module. REFER to Power Liftgate Module in this section.
B2019	Liftgate Exceeded Time Allowed to Cinch Door	Go To Pinpoint Test C .
B201A	Power System Disabled Due to High Manual Closing Speed	INSTALL new liftgate assist cylinders. CLEAR the DTCs. TEST for normal operation. If DTC B201A returns, INSTALL a new PLG module. REFER to Power Liftgate Module in this section.
B236A	Chime Output Circuit Open	Go To Pinpoint Test E .
B2418	Sensor Power Short to Ground	Go To Pinpoint Test A .
B2419	Sensor 1 Invalid	Go To Pinpoint Test A .
B2420	Sensor 2 Invalid	Go To Pinpoint Test A .
B2552	Vbatt 2 Circuit Open	Go To Pinpoint Test A .
B2699	Left Pinch Strip Open or Short to Battery	Go To Pinpoint Test F .
B2700	Right Pinch Strip Open or Short to Battery	Go To Pinpoint Test F .
B2701	Left Pinch Strip Stuck Active	Go To Pinpoint Test G .
B2702	Right Pinch Strip Stuck Active	Go To Pinpoint Test G .
B2703	Open/Close Switch Stuck Active	Go To Pinpoint Test B .
B2718	Liftgate/Decklid Ajar Output Short to Battery	REFER to Section 417-02 to diagnose the liftgate/decklid ajar switch circuit.
B2721	Liftgate/Decklid Ajar Output Short to	REFER to Section 417-02 to diagnose the liftgate/decklid ajar switch circuit.

	Ground or Open	
B2723	Glass Position Switch Active During Self-Test	REFER to Section 417-02 to diagnose the liftgate glass ajar switch.
B2819	Gate Motor Circuit Short to Battery	Go To Pinpoint Test A .
B2903	Chime Output Circuit Short to Battery	Go To Pinpoint Test E .
B2908	Latch Switch Invalid	For an inoperative PLG, Go To Pinpoint Test A . For a PLG that stops in SECONDARY LATCH position, Go To Pinpoint Test C .
B2935	Drive Unit Failure	Go To Pinpoint Test A .
B2936	Gate Motor Open	Go To Pinpoint Test A .
B2937	Gate Motor Short to Ground	Go To Pinpoint Test A .
B2939	Gate Clutch Short to Ground or Open	Go To Pinpoint Test A .
B2940	Chime Output Circuit Short to Ground	Go To Pinpoint Test E .
U0140	Lost Communication With Body Control Module (GEM)	REFER to Section 418-00 to diagnose the lost communication with the GEM.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	REFER to Section 418-00 to diagnose the lost communication with the IC.
U2050	No Application Present	REFER to Section 418-01 to carry out Programmable Module Installation (PMI). CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new PLG module. REFER to Section 419-10 . REPEAT the self-test.
U2051	One or More Calibration Files Missing/Corrupt	REFER to Section 418-01 to carry out Programmable Module Installation (PMI). CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2051 is retrieved again, INSTALL a new PLG module. REFER to Section 419-10 . REPEAT the self-test.
U2471	Unexpected PRNDL State	VERIFY the transmission gear selector (PRNDL) is in PARK. CLEAR the DTCs. REPEAT the self-test. If DTC U2471 is retrieved again, RETRIEVE and FOLLOW non-network DTCs from the transmission control module (TCM) (if equipped) or powertrain control module (PCM) and instrument cluster module. REFER to Section 413-01 and Section 307-01A or Section 307-01B . If no DTCs are present, INSTALL a new PLG module. REFER to Power Liftgate Module in this section.
U2472	Unexpected Ignition State	VERIFY the ignition key is in the ON position. CLEAR the DTCs. REPEAT the self-test. If DTC U2472 is retrieved again, RETRIEVE and FOLLOW non-network DTCs from the generic electronic module (GEM). REFER to Section 211-05 . If no DTCs are present, INSTALL a new PLG module. REFER to Power Liftgate Module in this section.
U2473	Unexpected Vehicle Speed (VSS)	CLEAR the DTCs. REPEAT the self-test. If DTC U2473 is retrieved again, RETRIEVE and FOLLOW non-network DTCs from the instrument cluster. REFER to Section 413-01 to diagnose the vehicle speed sensor (VSS). If no related DTCs or symptoms are present, INSTALL a new PLG module. REFER to Power Liftgate Module in this section.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The power liftgate is inoperative — does not open or close	• Liftgate assist cylinders • Fuse(s) • Circuitry • Liftgate motor/clutch assembly • Liftgate position sensor • PLG latch • PLG module • PLG rod	• If DTC B201A is present, INSTALL new liftgate assist cylinders. CLEAR the DTCs. TEST for normal operation. If DTC B201A returns, INSTALL a new PLG module. REFER to Power Liftgate Module in this section. • Go To Pinpoint Test A .
• The power liftgate is inoperative from an individual switch	• Circuitry • PLG control switch (instrument panel) • PLG close switch (quarter trim panel) • Exterior handle switch • PLG module	• Go To Pinpoint Test B .
• The power liftgate does not operate from the remote transmitter	• Batteries • Remote transmitter programming • Remote transmitter • SJB	• PROGRAM the remote transmitter. REFER to Section 501-14 . INSTALL a new remote transmitter. TEST system for normal operation.
• The power liftgate does not operate correctly — stops in secondary latch position (does not pull into primary latch position)	• Circuitry • PLG latch • PLG module • Mechanical binding • PLG rod	• TURN the PLG OFF (disable) from the message center and manually operate the liftgate. If no mechanical binding exists, Go To Pinpoint Test C . If mechanical binding does exist, REFER to Liftgate in this section.
• The power liftgate stops during power open operation	• The vehicle was started or taken out of PARK during a power open operation • Mechanical binding	• Manually CLOSE the liftgate to the primary latch position and OPEN the liftgate, using the exterior handle or liftgate control switch with the vehicle in PARK and the ignition in the ON position. If mechanical binding does exist, REFER to Liftgate in this section.
• The power liftgate does not operate correctly — reverses during the power close operation	• Circuitry • PLG latch • Position sensor • PLG module • PLG rod	• Go To Pinpoint Test D .

	• Mechanical binding	
• The power liftgate chime is inoperative	• Circuitry • PLG chime • PLG module	• Go To Pinpoint Test E .
• The power liftgate has excessive noise during operation	• Alignment • Mechanical binding	• CHECK the liftgate alignment. REFER to Liftgate in this section. • TURN the PLG OFF (disable) from the message center and manually operate the liftgate. If mechanical binding does exist, REFER to Liftgate in this section.
• The power liftgate does not operate correctly — pinch strip does not stop/reverse the liftgate	• Circuitry • Pinch strip • PLG module	• Go To Pinpoint Test F .
• The power liftgate does not power close (power open OK)	• Initialization • Circuitry • Pinch strip • PLG latch • PLG module • Mechanical binding	• INITIALIZE the PLG. REFER to Power Liftgate Initialization in this section. • TURN the PLG OFF (disable) from the message center and manually operate the liftgate. If no mechanical binding exists, Go To Pinpoint Test G . If mechanical binding does exist, REFER to Liftgate in this section.
• The power liftgate does not power open (power close OK)	• Circuitry • PLG latch • Mechanical binding • PLG module	• Go To Pinpoint Test H .

Pinpoint Tests

Pinpoint Test A: The Power Liftgate is Inoperative — Does Not Open or Close

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

If the power liftgate (PLG) is operated from the PLG control switch (instrument panel), circuit CPR63 (GY/YE) is grounded by the open/close switch, which signals the PLG module of the open/close request.

If the PLG is in the closed position and the conditions are correct, the PLG module supplies 12 volts to the unlatch/cinching motor on circuit CPR62 (WH/BU), 12 volts to the clutch on circuit CPR69 (BN/BU) and 12 volts to the motor on circuit CPR57 (GN/WH). As the liftgate is moving in the open direction, the PLG module monitors the position sensor for door speed to detect obstacles.

If the PLG is in the open position and the conditions are correct, the PLG module supplies 12 volts to the

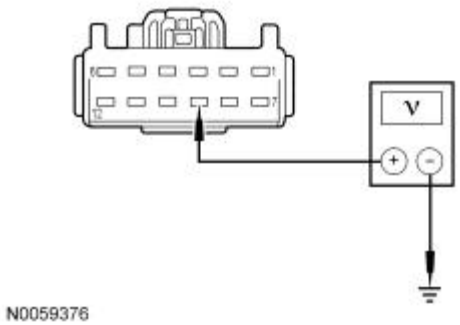
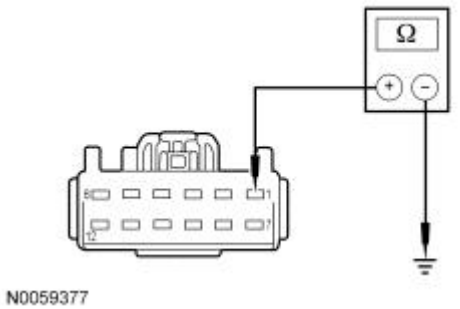
clutch on circuit CPR69 (BN/BU) and 12 volts to the motor on circuit CPR58 (GN/OG). As the liftgate is moving in the close direction, the PLG module monitors the position sensor for door speed to detect obstacles.

Possible Causes

- PLG module diagnostic trouble code (DTC) B106E solid state driver disabled due to short circuit
- PLG module DTC B106F module disabled due to external fault
- PLG module DTC B117A latch motor circuit short to ground
- PLG module DTC B117B latch motor circuit open
- PLG module DTC B1179 latch motor circuit short to battery
- PLG module DTC B2418 sensor power short to ground
- PLG module DTC B2419 sensor 1 invalid
- PLG module DTC B2420 sensor 2 invalid
- PLG module DTC B2552 vbatt 2 circuit open
- PLG module DTC B2819 gate motor circuit short to battery
- PLG module DTC B2908 latch switch invalid
- PLG module DTC B2935 drive unit failure
- PLG module DTC B2936 gate motor open
- PLG module DTC B2937 gate motor short to ground
- PLG module DTC B2939 gate clutch short to ground or open
- Open in circuit SBB27 (BU/RD), SBP14 (BN/RD), GD149 (BK/GY) or RPR55 (WH/BU)
- Open or short to ground in circuit CPR64 (VT/OG), CPR65 (BU/GN), CPR66 (GY/YE) or CPR55 (GN/BU)
- Open, short to voltage or short to ground in circuit VPR53 (BU/WH), VPR54 (BU/BN), CPR61 (BN), CPR62 (WH/BU), CPR57 (GN/WH), CPR58 (GN/OG) or CPR69 (BN/BU)
- Fuse(s)
- PLG latch
- Motor/clutch assembly
- Optical sensor
- PLG module
- PLG rod

PINPOINT TEST A: THE POWER LIFTGATE IS INOPERATIVE — DOES NOT OPEN OR CLOSE

Test Step	Result / Action to Take
A1 RETRIEVE THE DTCs FROM THE PLG MODULE	
• Use the recorded PLG module DTCs from the continuous and PLG module self-tests. • **Are any PLG module DTCs recorded?**	**Yes** For DTC B106F, REFER to the PLG Module Diagnostic Trouble Code (DTC) Chart. For DTC B2908, GO to A5 . For DTC B2418, B2419 or B2420 GO to A17 . For DTC B2935, GO to A10 . For DTC B2552, GO to A13 .

	For DTC B2936, B2819, B2937 or B2939, GO to A14 . For DTC B106E, GO to A16 . For DTC B1179, B117A, or B117B, GO to A27 . **No** GO to A2 .
A2 CHECK THE OPERATION OF THE PLG SWITCHES • Vehicle in PARK. • **NOTE:** Make sure the PLG is enabled (ON) in the vehicle message center. • Close the liftgate to the full closed position (manually if necessary). • Activate the PLG from the PLG control switch (instrument panel). • Activate the PLG from the remote transmitter. • Activate the PLG from the liftgate exterior handle. • **Does the PLG power open from any switch?**	**Yes** Go To Pinpoint Test B . **No** GO to A3 .
A3 CHECK CIRCUIT SBP14 (BN/RD) FOR AN OPEN • Disconnect PLG Module C4174A. • Measure the voltage between PLG module C4174A-9, circuit SBP14 (BN/RD), harness side and ground.  N0059376 • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** VERIFY the smart junction box (SJB) fuse 14 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN • Key in OFF position. • Measure the resistance between PLG module C4174A-1, circuit GD149 (BK/GY), harness side and ground.  N0059377 • **Is the resistance less than 5 ohms?**	**Yes** RECONNECT PLG system electrical connectors and GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK THE DETENT AND FORKBOLT SWITCH PID • Enter the following diagnostic mode on the diagnostic tool: Primary Forkbolt, Secondary Forkbolt and Detent Switch PIDs.	**Yes** GO to A10 .

- **NOTE:** The liftgate is in the primary position when the liftgate is in the full closed position. The liftgate is in the UNLATCH position when the liftgate is open and completely out of the striker. The liftgate can be placed in the unlatched position by lifting up on the liftgate handle.
- Begin with the liftgate in the open position, then slowly close the liftgate into each of the latch positions specified by the table below.

Liftgate Latch Position	Detent Switch PID	Secondary Forkbolt Switch PID	Primary Forkbolt Switch PID
Fully Unlatched	Not active [a]	Active	Active
In primary	Active	Not active	Not active

[a] If detent switch is active in the fully unlatched position, manually attempt to rotate the forkbolt towards the latched position.

- **Do the switch states agree with the table?**

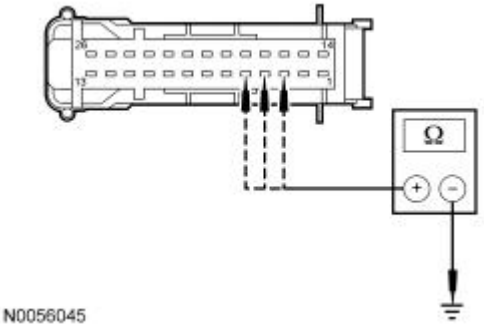
No
GO to A6 .

A6 CHECK THE OPERATION OF THE DETENT AND FORKBOLT SWITCHES

- Key in OFF position.
- Disconnect: PLG Module C4174B.
- Measure the resistance between PLG module C4174B, harness side and ground at each of the connector pins and each latch position specified by the table below.

Liftgate Latch Position	C4174B Circuit	Resistance
Fully Unlatched	Pin 3, circuit CPR66 (GY/YE)	Greater than 10,000 ohms [a]
Fully Unlatched	Pin 5, circuit CPR64 (VT/OG)	Less than 5 ohms
Fully Unlatched	Pin 4, circuit CPR65 (BU/GN)	Less than 5 ohms
Primary	Pin 3, circuit CPR66 (GY/YE)	Less than 5 ohms
Primary	Pin 5, circuit CPR64 (VT/OG)	Greater than 10,000 ohms
Primary	Pin 4, circuit CPR65 (BU/GN)	Greater than 10,000 ohms

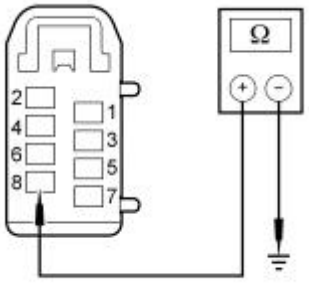
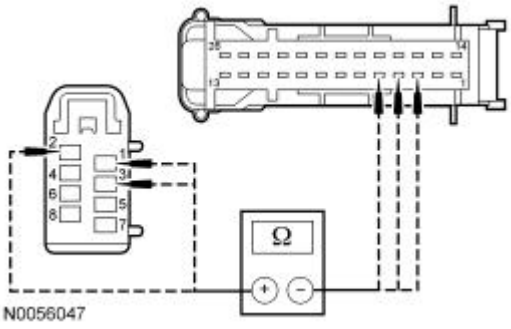
[a] If resistance measured is less than 5 ohms, manually rotate the forkbolt to the latched position and re-test.

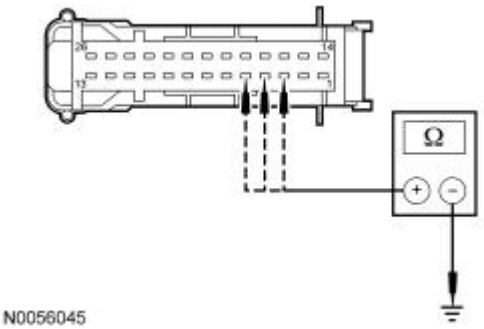


- **Do the resistance values agree with the table?**

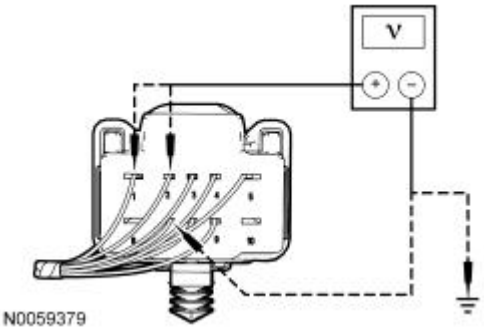
Yes
GO to A31 .

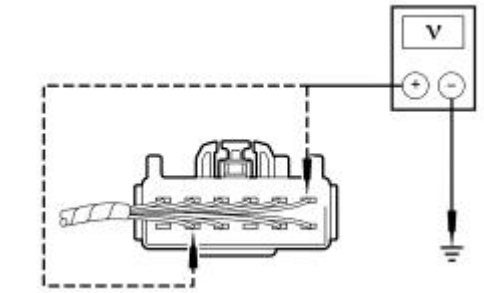
No
GO to A7 .

A7 CHECK THE DETENT AND FORKBOLT SWITCH GROUND CIRCUIT	
• Disconnect: Liftgate Latch/Unlatch Assembly C4339. • Measure the resistance between PLG latch/unlatch assembly C4339-8, circuit GD149 (BK/GY), harness side and ground.  N0056046 • **Is the resistance less than 5 ohms?**	**Yes** GO to A8 . **No** REPAIR the circuit. TEST the system for normal operation.
A8 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR AN OPEN	
• Measure the resistance between PLG latch/unlatch assembly C4339, harness side and PLG module C4174B, harness side using the following table: **C4339 Pin** / **Circuit** / **C4174B Pin** 1 / CPR64 (VT/OG) / 5 3 / CPR65 (BU/GN) / 4 2 / CPR66 (GY/YE) / 3  N0056047 • **Is the resistance less than 5 ohms on all circuits?**	**Yes** GO to A9 . **No** REPAIR the circuit. TEST the system for normal operation.
A9 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG module C4174B-5, circuit CPR64 (VT/OG), harness side and ground; between PLG module C4174B-4, circuit CPR65 (BU/GN), harness side and ground; then between PLG module C4174B-3, circuit CPR66 (GY/YE), harness side and ground.	**Yes** CHECK the PLG latch connector for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG latch. REFER to Section 501-14 . TEST the system for normal operation.

 N0056045 • **Are the resistances greater than 10,000 ohms on all circuits?**	**No** REPAIR the circuit. TEST the system for normal operation.
A10 CHECK PLG ROD OPERATION	

• Check for correct function of PLG rod and cable.
  ▪ Properly attached to motor and liftgate.
  ▪ Cable turns with actuator.
• **Is the PLG rod operating correctly?**
	Yes
	GO to A11 .
	
	No
	REPAIR as necessary. If installing a new PLG rod, REFER to Power Liftgate Rod in this section. TEST the system for normal operation.

A11 CHECK FOR VOLTAGE AT THE PLG MOTOR AND CLUTCH	
• Key in ON position. • Liftgate in the fully closed position. • With the motor/clutch connected and while activating the PLG control switch, measure the voltage between PLG motor/clutch C4332-1, circuit CPR57 (GN/WH) backprobe and ground; then between PLG motor/clutch C4332-2, circuit CPR69 (BN/BU), backprobe and PLG motor/clutch C4332-7, circuit GD149 (BK/GY), backprobe.  N0059379 • **Are both of the voltages greater than 10 volts while activating the PLG switch?**	**Yes** If no DTCs were present, GO to A18 . If DTC(s) were present, INSTALL a new PLG motor. REFER to Power Liftgate Motor in this section. TEST the system for normal operation. **No** GO to A12 .
A12 CHECK THE MOTOR AND CLUTCH VOLTAGE OUTPUTS AT THE PLG MODULE	
• With the PLG module connected, measure the voltage between PLG module C4174A-6, circuit CPR58 (GN/OG), backprobe and ground; then between PLG module C4174A-8, circuit CPR69 (BN/BU), backprobe and ground.	**Yes** GO to A14 . **No** GO to A13 .

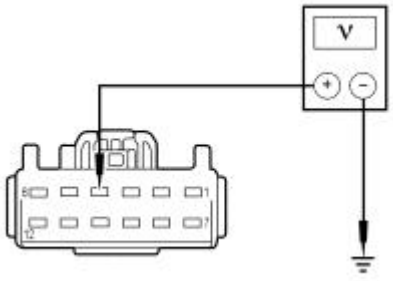


N0059620

- **Are the voltages greater than 10 volts while activating the PLG switch?**

A13 CHECK FOR VOLTAGE AT THE PLG MODULE

- Key in OFF position.
- Disconnect: PLG Module C4174A.
- Measure the voltage between PLG module C4174A-4 circuit SBB27 (BU/RD), harness side and ground.



N0056050

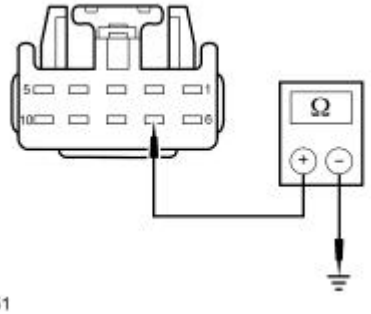
- **Is the voltage greater than 10 volts?**

Yes
If you are here because of DTC B2552, GO to A31 . Otherwise, GO to A18 .

No
VERIFY BEC fuse 27 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

A14 CHECK CIRCUIT CLUTCH GROUND CIRCUIT GD149 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: PLG Module C4174A.
- Disconnect: PLG Motor C4332.
- Measure the resistance between PLG motor C4332-7, circuit GD149 (BK/GY), harness side and ground.



N0056051

- **Is the resistances less than 5 ohms?**

Yes
GO to A15 .

No
REPAIR the circuit. TEST the system for normal operation.

A15 CHECK THE MOTOR/CLUTCH CIRCUITS FOR AN OPEN

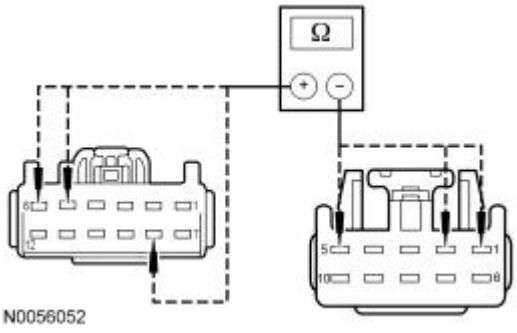
- Measure the resistance between PLG module C4174A, harness side and the PLG motor/clutch C4332, harness side, using the following chart:

C4174A Pin	Circuit	C4332 Pin
5	CPR57 (GN/WH)	1

Yes
GO to A16 .

No
REPAIR the circuit. TEST the system for normal operation.

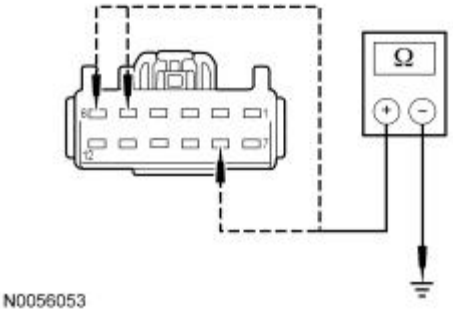
6	CPR58 (GN/OG)	5
8	CPR69 (BN/BU)	2



- **Are the resistances less than 5 ohms?**

A16 CHECK THE MOTOR/CLUTCH CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: PLG Module C4174A.
- Disconnect: PLG Motor C4332.
- Measure the resistance between PLG module C4174A-5, circuit CPR57 (GN/WH), harness side and ground; between PLG module C4174A-6, circuit CPR58 (GN/OG), harness side and ground; then between PLG module C4174A-8, circuit CPR69 (BN/BU), harness side and ground.



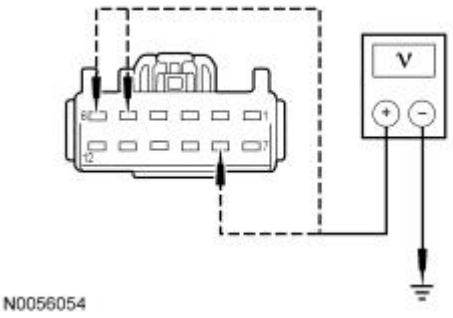
- **Are the resistances greater than 10,000 ohms?**

Yes
GO to A17 .

No
REPAIR the circuit. If DTC B106E was present, CLEAR DTCs. TEST the system for normal operation.

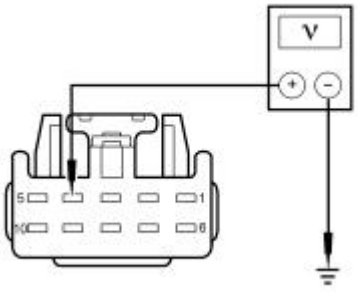
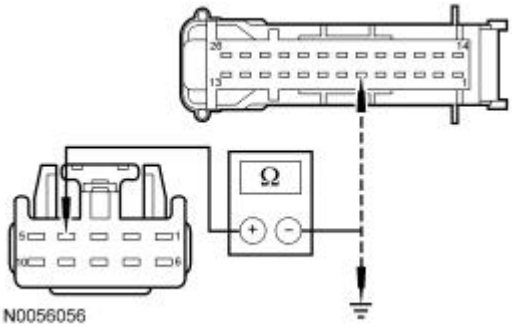
A17 CHECK THE MOTOR/CLUTCH CIRCUITS FOR A SHORT TO VOLTAGE

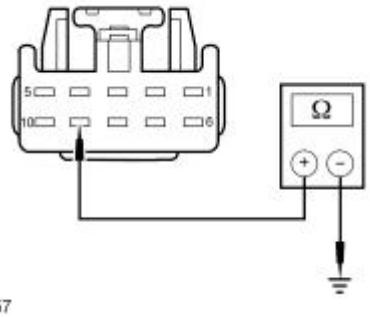
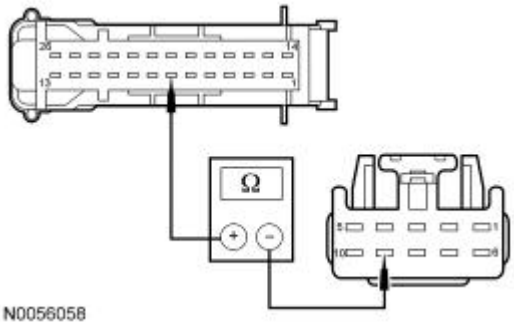
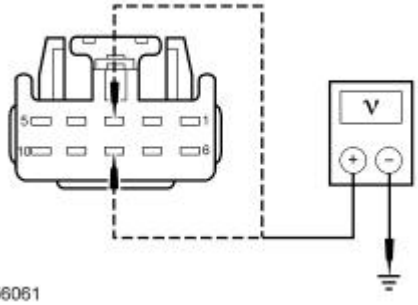
- Key in ON position.
- Measure the voltage between PLG module C4174A-5, circuit CPR57 (GN/WH), harness side and ground; between PLG module C4174A-6, circuit CPR58 (GN/OG), harness side and ground; then between PLG module C4174A-8, circuit CPR69 (BN/BU), harness side and ground.



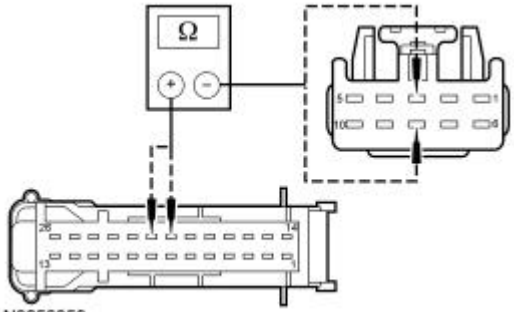
Yes
REPAIR the circuit. TEST the system for normal operation.

No
CHECK the PLG motor and clutch connectors for corrosion or pushed-out pins. REPAIR as necessary. TEST the system for normal operation.

• **Is voltage present?**	
A18 CHECK THE POSITION SENSOR PID	
• Key in OFF position. • Connect: All PLG Module Connectors. • Connect: PLG Motor C4332. • Key in ON position. • Open the liftgate to the full open position. • Enter the following diagnostic mode on the diagnostic tool: PLG Module Position Sensor PIDs. • Monitor the PLG position sensor 1 and position sensor 2 PIDs while slowly closing the liftgate. • **Do both of the PID values alternate from ACTIVE to INACTIVE while the liftgate is moving?**	**Yes** GO to A27 . **No** GO to A19 .
A19 CHECK THE POSITION SENSOR POWER CIRCUIT	
• Disconnect: PLG Motor C4332. • Key in ON position. • Measure the voltage between PLG motor C4332-4, circuit CPR55 (GN/BU), harness side and ground.  N0056055 • **Is the voltage approximately 5 volts?**	**Yes** GO to A21 . **No** GO to A20 .
A20 CHECK THE POSITION SENSOR POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-6, circuit CPR55 (GN/BU), harness side and PLG motor C4332-4, circuit CPR55 (GN/BU), harness side; and between PLG module C4174B-6, circuit CPR55 (GN/BU), harness side and ground.  N0056056 • **Is the resistance less than 5 ohms between PLG module and PLG motor; and greater than 10,000 ohms between PLG module and ground?**	**Yes** GO to A31 . **No** REPAIR the circuit. TEST the system for normal operation.
A21 CHECK THE POSITION SENSOR RETURN CIRCUIT	
• Key in OFF position. • Disconnect: PLG Motor C4332. • Key in ON position. • Measure the resistance between PLG motor C4332-9, circuit	**Yes** GO to A23 . **No**

RPR55 (WH/BU), harness side and ground.  N0056057 • **Is the resistance less than 5 ohms?**	GO to A22 .
A22 CHECK THE POSITION SENSOR RETURN CIRCUIT FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-7, circuit RPR55 (WH/BU), harness side and PLG motor C4332-9, circuit RPR55 (WH/BU), harness side.  N0056058 • **Is the resistance less than 5 ohms?**	**Yes** GO to A31 . **No** REPAIR the circuit. TEST the system for normal operation.
A23 CHECK THE POSITION SENSOR CIRCUITS FOR AN OPEN	
• Key in ON position. • Measure the voltage between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground; and between PLG motor C4332-3, circuit VPR53 (BU/WH), harness side and ground.  N0056061 • **Is the voltage approximately 5 volts for both measurements?**	**Yes** INSTALL a new PLG motor. REFER To Power Liftgate Motor in this section. TEST the system for normal operation. **No** GO to A24 .
A24 CHECK THE POSITION SENSOR CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG motor C4332, harness side and PLG module C4174B, harness side using the following chart:	**Yes** GO to A25 . **No** REPAIR the circuit. TEST the system for

C4332 Pin	Circuit	C4174B Pin
8	VPR53 (BU/WH)	21
3	VPR54 (BU/BN)	20



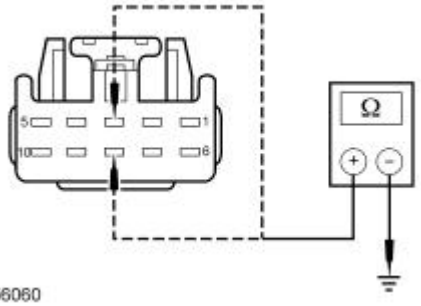
N0056059

- **Are the resistances less than 5 ohms?**

normal operation.

A25 CHECK THE POSITION SENSOR CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between PLG motor C4332-3, circuit VPR54 (BU/BN), harness side and ground; and between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground.



N0056060

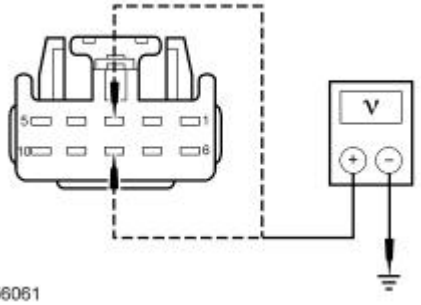
- **Are the resistances greater than 10,000 ohms?**

Yes
GO to A26 .

No
REPAIR the circuit.
TEST the system for normal operation.

A26 CHECK THE POSITION SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between PLG motor C4332-3, circuit VPR54 (BU/BN), harness side and ground; and between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground.



N0056061

- **Is voltage present?**

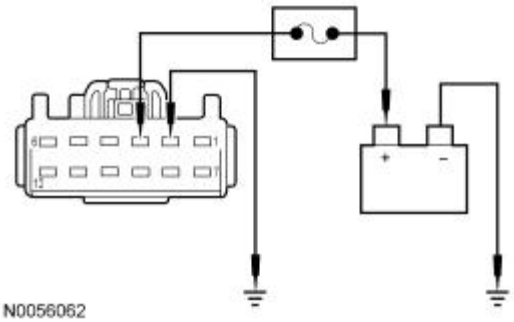
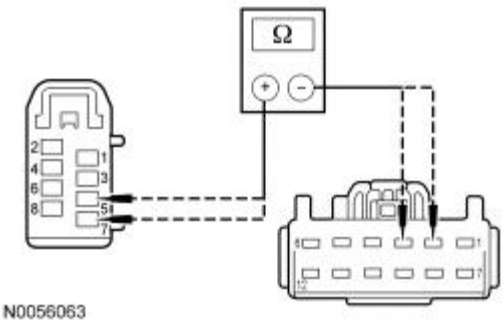
Yes
REPAIR the circuit.
TEST the system for normal operation.

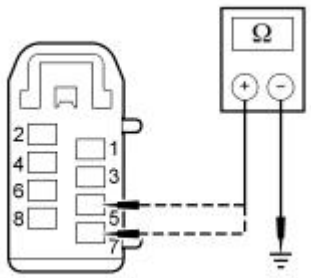
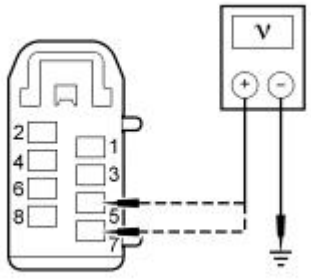
No
GO to A31 .

A27 CHECK THE UNLATCH/CINCHING MOTOR CIRCUITS

- Key in OFF position.

Yes

• Disconnect: PLG Module C4174A. • Close the PLG. • **CAUTION: Do not apply power and ground to the unlatch actuator circuits for more than a few seconds or damage to the motor may occur.** • Connect a fused (10A) jumper wire between PLG module C4174A-3, circuit CPR62 (WH/BU), harness side and the positive side of the battery; and connect a jumper between PLG module C4174A-2, circuit CPR61 (BN), harness side and ground.  N0056062 • **Does the unlatch/cinching motor activate when power and ground are applied?**	GO to A31 . **No** GO to A28 .
A28 CHECK THE UNLATCH/CINCHING MOTOR CIRCUITS FOR AN OPEN	
• Disconnect: Liftgate Latch/Unlatch Assembly C4339. • Measure the resistance between PLG latch C4339-5, circuit CPR61 (BN), harness side and PLG module C4174A-2, circuit CPR61 (BN), harness side; then between PLG latch C4339-7, circuit CPR62 (WH/BU), harness side and PLG module C4174A-3, circuit CPR62 (WH/BU), harness side.  N0056063 • **Are the resistances less than 5 ohms?**	**Yes** GO to A29 . **No** REPAIR the circuit. TEST the system for normal operation.
A29 CHECK THE UNLATCH/CINCHING MOTOR CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG latch C4339-5, circuit CPR61 (BN), harness side and ground; then between PLG latch C4339-7, circuit CPR62 (WH/BU), harness side and ground.	**Yes** GO to A30 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0056064 • **Are the resistances greater than 10,000 ohms?**	
A30 CHECK THE UNLATCH ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between PLG latch C4339-5, circuit CPR61 (BN), harness side and ground; then between PLG latch C4339-7, circuit CPR62 (WH/BU), harness side and ground.  N0056065 • **Is voltage present on either circuit?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** CHECK the PLG latch connectors for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG latch. REFER to Section 501-14 . TEST the system for normal operation.
A31 CHECK FOR CORRECT PLG MODULE OPERATION	

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test B: The Power Liftgate is Inoperative From an Individual Switch

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

If the power liftgate (PLG) is operated from the PLG control switch (instrument panel), circuit CPR63 (GY/YE) is grounded by the open/close switch, which signals the PLG module of the open/close request.

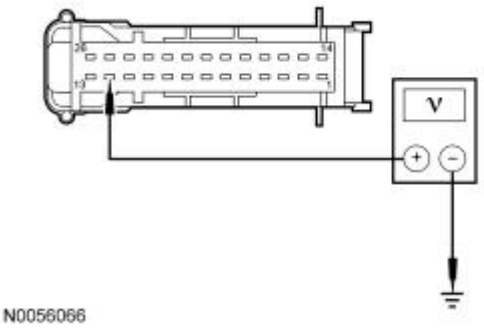
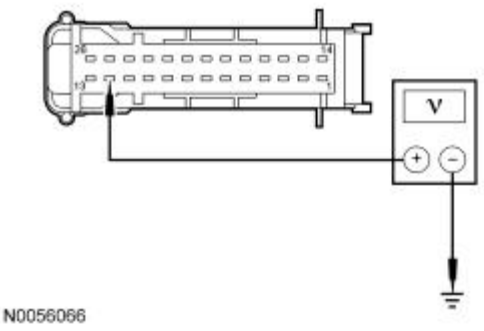
If the PLG is operated from the rear switch (quarter trim panel), circuit CPR70 (GN) is grounded by the rear switch through circuit GD149 (BK/GY). If the PLG is operated from the liftgate handle, the smart junction box (SJB) sends a voltage signal to the PLG module through circuit CPL10 (GN/WH).

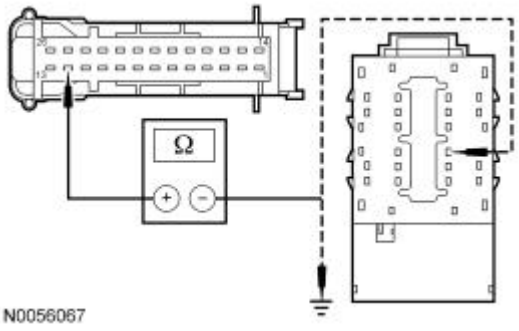
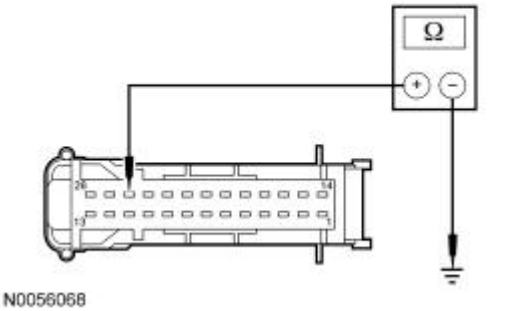
Possible Causes

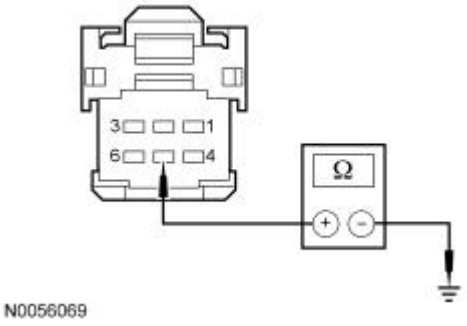
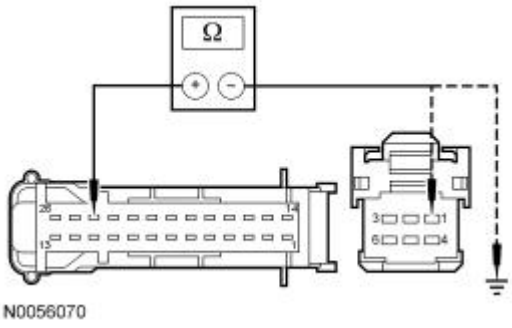
- SJB module diagnostic trouble code (DTC) B2666 liftgate release switch circuit failure
- SJB module DTC B273A liftgate release output circuit short to ground
- SJB module DTC B273B liftgate release output circuit open or short to battery
- PLG module DTC B1105 rear open/close switch active during self-test
- PLG module DTC B2703 open/close switch active during self-test
- Open, short to power or short to ground in circuit CPL10 (GN/WH)
- Open in circuit GD138 (BK/WH) or GD149 (BK/GY)
- Open or short to ground in circuit CPR70 (GN) or CPR63 (GY/YE)
- PLG control switch (instrument panel)
- PLG rear control switch (quarter trim panel)
- PLG module
- SJB

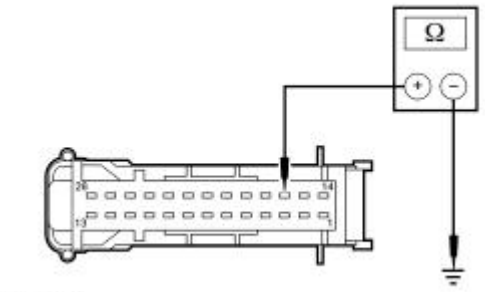
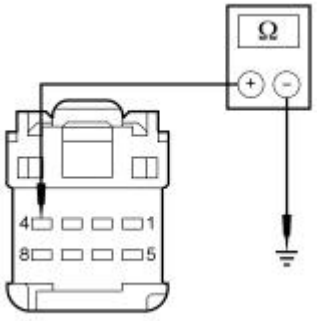
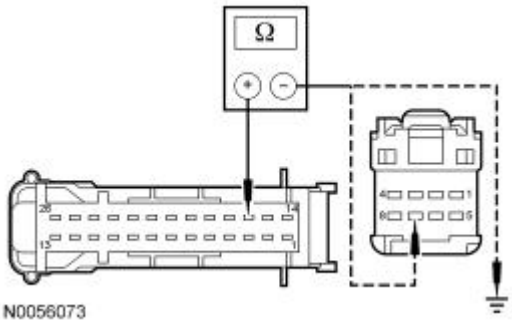
PINPOINT TEST B: THE POWER LIFTGATE IS INOPERATIVE FROM AN INDIVIDUAL SWITCH

Test Step	Result / Action to Take
B1 RETRIEVE THE DTCs FROM THE PLG MODULE AND THE SJB	
• Use the recorded PLG module DTCs and SJB DTCs from the continuous and self-tests. • **Are any PLG DTCs present?**	**Yes** For SJB DTC B2666, REFER to Section 501-14 to diagnose the liftgate handle release switch. For SJB module DTC B273A or B273B, GO to B4 . For PLG module DTC B1105, GO to B8 . For PLG module DTC B2703, GO to B12 . **No** GO to B2 .
B2 CHECK THE OPERATION OF THE PLG SWITCHES	
• **NOTE:** Make sure the PLG is ON (enabled) in the message center. • Close the liftgate to the full closed position (manually if necessary). • Electronically unlock the vehicle. • Activate the PLG from the PLG control switch (instrument panel). • Activate the PLG from the remote transmitter. • Activate the PLG from the liftgate exterior handle. • With the liftgate in the open position, activate the PLG from the PLG rear control switch (quarter trim panel). • **Does the PLG open/close from at least one switch?**	**Yes** If the PLG control switch is inoperative, GO to B12 . If the exterior handle is inoperative, GO to B3 . If the remote transmitter is inoperative, GO to Symptom Chart . If the PLG rear control switch is inoperative, GO to B8 .

	No Go To Pinpoint Test A to diagnose an inoperative PLG.
B3 CHECK THE LIFTGATE HANDLE PID • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: SJB Liftgate_Switch_Status PID. • While monitoring the SJB Liftgate_Switch_Status PID, activate the liftage release handle. • **Does the switch change states from INACTIVE to ACTIVE when the liftgate release handle is activated?**	**Yes** GO to B4 . **No** REFER to Section 501-14 to diagnose the liftgate handle release switch.
B4 CHECK THE SJB RELEASE CIRCUIT OUTPUT • Disconnect: PLG Module C4174B. • Enter the following diagnostic mode on the diagnostic tool: SJB Liftgate_Release_Ckt PID. • Measure the voltage between PLG module C4174B-12, circuit CPL10 (GN/WH), harness side and ground while commanding the SJB Liftgate_Release_Ckt PID active and inactive.  N0056066 • **Is the voltage greater than 10 volts when the Liftgate_Release_Ckt PID is active, and less than 2 volts when the Liftgate_Release_Ckt PID is inactive?**	**Yes** GO to B16 . **No** GO to B5 .
B5 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO VOLTAGE • Key in OFF position. • Disconnect: SJB Module C2280E. • Key in ON position. • Measure the voltage between PLG module C4174B-12, circuit CPL10 (GN/WH), harness side and ground.  N0056066 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to B6 .
B6 CHECK CIRCUIT CPL10 (GN/WH) FOR AN OPEN OR SHORT TO GROUND • Measure the resistance between PLG module C4174B-12, circuit CPL10 (GN/WH), harness side and SJB C2280E-15,	**Yes** GO to B7 .

circuit CPL10 (GN/WH), harness side; and between PLG module C4174B-12, circuit CPL10 (GN/WH), harness side and ground.  N0056067 • **Is the resistance less than 5 ohms between PLG module and the SJB; and greater than 10,000 ohms between PLG module and ground?**	**No** REPAIR the circuit. TEST the system for normal operation.
B7 CHECK FOR CORRECT SJB MODULE OPERATION	
• Disconnect all the SJB and PLG module connectors. • Check for: ▪ corrosion. ▪ pushed-out pins. • Connect all the SJB and PLG module connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB module. REPEAT the SJB module self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the SJB module self-test.
B8 CHECK PLG REAR SWITCH OPERATION	
• Enter the following diagnostic mode on the diagnostic tool: Rear Open/Close Switch (REAR_OC) PID. • Operate the PLG rear control switch while monitoring the REAR_OC PID. • **Does the PID state change/agree with the switch status?**	**Yes** GO to B16 . **No** GO to B9 .
B9 CHECK PLG REAR SWITCH CIRCUIT OPERATION	
• Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-24, circuit CPR70 (GN), harness side and ground while depressing and releasing the PLG rear switch.  N0056068 • **Is the resistance less than 5 ohms with the PLG rear switch depressed, and greater than 10,000 ohms when the PLG rear switch is released?**	**Yes** GO to B16 . **No** GO to B10 .
B10 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	

• Key in OFF position. • Disconnect: PLG Rear Open/Close Switch C4333. • Measure the resistance between PLG rear switch C4333-5, circuit GD149 (BK/GY), harness side and ground.  N0056069 • **Is the resistance less than 5 ohms?**	**Yes** GO to B11 . **No** REPAIR the circuit. TEST the system for normal operation.
B11 CHECK CIRCUIT CPR70 (GN) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between PLG module C4174B-24, circuit CPR70 (GN), harness side and PLG rear switch C4333-1, circuit CPR70 (GN), harness side; and between PLG module C4174B-24, circuit CPR70 (GN), harness side and ground.  N0056070 • **Is the resistance less than 5 ohms between PLG module and PLG rear switch; and greater than 10,000 ohms between PLG module and ground?**	**Yes** INSTALL a new PLG rear switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
B12 CHECK PLG SWITCH OPERATION	
• Enter the following diagnostic mode on the diagnostic tool: Open/Close Switch PID. • Operate the PLG control switch (instrument panel switch) while monitoring the OPEN/CLOSE switch PID. • **Does the PID state change/agree with the switch status?**	**Yes** GO to B16 . **No** GO to B13 .
B13 CHECK PLG CONTROL SWITCH CIRCUIT OPERATION	
• Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-16, circuit CPR63 (GY/YE), harness side and ground while depressing and releasing the PLG control switch (instrument panel).	**Yes** GO to B16 . **No** GO to B14 .

 N0056071 • **Is the resistance less than 5 ohms with the PLG control switch depressed, and greater than 10,000 ohms when the PLG control switch is released?**	
B14 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN • Key in OFF position. • Disconnect: Liftgate/Traction Control/Hazard Switch C2361. • Measure the resistance between PLG control switch C2361-4, circuit GD138 (BK/WH), harness side and ground.  N0056072 • **Is the resistance less than 5 ohms?**	**Yes** GO to B15 . **No** REPAIR the circuit. TEST the system for normal operation.
B15 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN OR SHORT TO GROUND • Measure the resistance between PLG module C4174B-16, circuit CPR63 (GY/YE), harness side and PLG control switch C2361-7, circuit CPR63 (GY/YE), harness side; and between PLG module C2361-7, circuit CPR63 (GY/YE), harness side and ground.  N0056073 • **Is the resistance less than 5 ohms between PLG module and PLG control switch; and greater than 10,000 ohms between PLG module and ground?**	**Yes** INSTALL a new liftgate/traction control/hazard switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

B16 CHECK FOR CORRECT PLG MODULE OPERATION
• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG

are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	module self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test C: The Power Liftgate Does Not Operate Correctly — Stops in Secondary Latch Position (Does Not Pull into Primary Latch Position)

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

When the power liftgate (PLG) moves in the close direction, the PLG module monitors the detent switch, secondary forkbolt switch and the primary forkbolt switch. When the combination of signals is received that indicates the liftgate has reached the secondary latch position, the PLG module supplies 12 volts to the unlatch/cinching motor on circuit CPR61 (BN) and ground on circuit CPR62 (WH/BU). The unlatch/cinching motor rotates the latch mechanism which pulls the liftgate into primary latch position.

Possible Causes

- PLG module diagnostic trouble code (DTC) B2019 liftgate exceeded time allowed to cinch door
- PLG module DTC B2908 latch switch invalid
- Liftgate alignment
- Latch striker alignment
- Circuit GD149 (BK/GY) open
- Circuit CPR64 (VT/OG), CPR65 (BU/GN) or CPR66 (GY/YE) open or short to ground
- PLG latch
- PLG module

PINPOINT TEST C: THE POWER LIFTGATE DOES NOT OPERATE CORRECTLY — STOPS IN SECONDARY LATCH POSITION (DOES NOT PULL INTO PRIMARY LATCH POSITION)

Test Step	Result / Action to Take
C1 RETRIEVE THE DTCs FROM THE PLG MODULE	
• Use the recorded PLG module DTCs from the continuous and self-tests. • **Is PLG DTC B2019 present?**	**Yes** CHECK the liftgate alignment. REFER to Hinge Adjustment — Liftgate in this section. If OK, GO to C2 . **No** GO to C2 .
C2 CHECK THE DETENT AND FORKBOLT SWITCH PID	
• Enter the following diagnostic mode on the diagnostic tool: Primary Forkbolt, Secondary Forkbolt and Detent Switch PIDs. • **NOTE:** The liftgate is in the primary position when the liftgate is in the full closed position. The liftgate is in the UNLATCH position	**Yes** GO to C7 . **No**

when the liftgate is open and completely out of the striker. The liftgate can be placed in the unlatched position by lifting up on the liftgate handle.

- Begin with the liftgate in the open position, then slowly close the liftgate into each of the latch positions specified by the table below.

Liftgate Latch Position	Detent Switch PID	Secondary Forkbolt Switch PID	Primary Forkbolt Switch PID
Fully Unlatched	Not active [a]	Active	Active
In primary	Active	Not active	Not active

[a] If detent switch is active in the fully unlatched position, manually attempt to rotate the forkbolt towards the latched position.

- **Do the switch states agree with the table?**

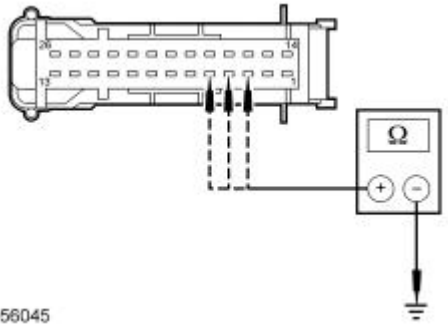
GO to C3 .

C3 CHECK THE OPERATION OF THE DETENT AND FORKBOLT SWITCHES

- Key in OFF position.
- Disconnect: PLG Module C4174B.
- Measure the resistance between PLG module C4174B, harness side and ground at each of the connector pins and each latch position specified by the table below.

Liftgate Latch Position	C4174B Circuit	Resistance
Fully Unlatched	Pin 3, circuit CPR66 (GY/YE)	Greater than 10,000 ohms [a]
Fully Unlatched	Pin 5, circuit CPR64 (VT/OG)	Less than 5 ohms
Fully Unlatched	Pin 4, circuit CPR65 (BU/GN)	Less than 5 ohms
Primary	Pin 3, circuit CPR66 (GY/YE)	Less than 5 ohms
Primary	Pin 5, circuit CPR64 (VT/OG)	Greater than 10,000 ohms
Primary	Pin 4, circuit CPR65 (BU/GN)	Greater than 10,000 ohms

[a] If resistance measured is less than 5 ohms, manually rotate the forkbolt to the latched position and re-test.

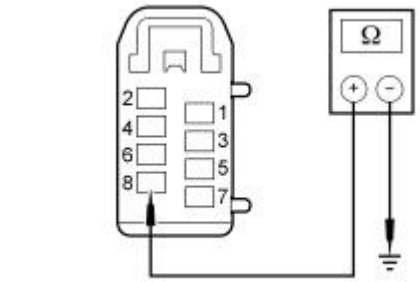
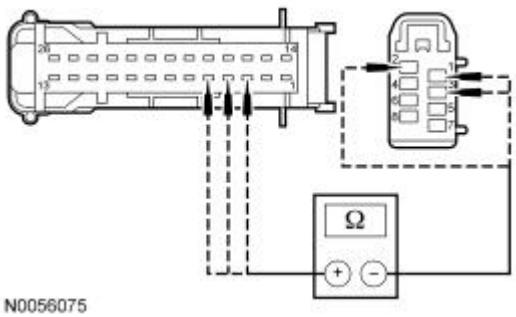


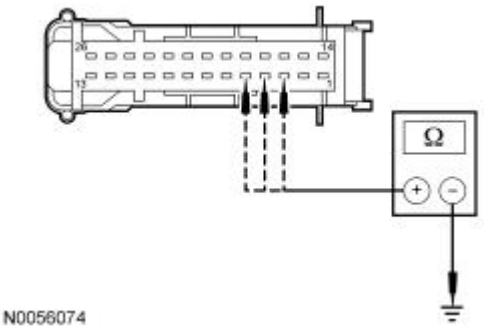
- **Do the resistance values agree with the table?**

Yes
GO to C7 .

No
GO to C4 .

C4 CHECK THE DETENT AND FORKBOLT SWITCH GROUND CIRCUIT

• Disconnect: PLG Latch/Unlatch Assembly C4339. • Measure the resistance between PLG latch C4339-8, circuit GD149 (BK/GY), harness side and ground.  N0056046 • **Is the resistance less than 5 ohms?**	**Yes** GO to C5 . **No** REPAIR the circuit. TEST the system for normal operation.
C5 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR AN OPEN	
• Measure the resistance between PLG latch C4339, harness side and PLG module C4174B, harness side, using the following table: **C4339 Pin** / **Circuit** / **C4174B Pin** 1 / CPR64 (VT/OG) / 5 3 / CPR65 (BU/GN) / 4 2 / CPR66 (GY/YE) / 3  N0056075 • **Is the resistance less than 5 ohms on all circuits?**	**Yes** GO to C6 . **No** REPAIR the circuit. TEST the system for normal operation.
C6 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG module C4174B-5, circuit CPR64 (VT/OG), harness side and ground; then between PLG module C4174B-4, circuit CPR65 (BU/GN), harness side and ground; then between PLG module C4174B-3, circuit CPR66 (GY/YE), harness side and ground.	**Yes** CHECK the PLG latch connectors for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG latch. REFER to Section 501-14 . TEST the system for normal operation. **No** REPAIR the circuit.

 • **Is the resistance greater than 10,000 ohms on all circuits?**	TEST the system for normal operation.
C7 CHECK FOR CORRECT PLG MODULE OPERATION	

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test D: The Power Liftgate Does Not Operate Correctly — Reverses During the Power Close Operation

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

When the power liftgate (PLG) moves in the close direction, the PLG module monitors the pinch strips and position sensor for obstacle detection. The PLG module uses a 5-volt reference signal on circuit CPR52 (YE/VT) and a return signal on circuit RPR52 (VT/GY) for the left pinch strip. The PLG module uses a 5-volt reference signal on circuit CPR51 (YE/OG) and a return signal on circuit RPR52 (VT/GY) for the right pinch strip. The right and left pinch strip return signal circuits are spliced together.

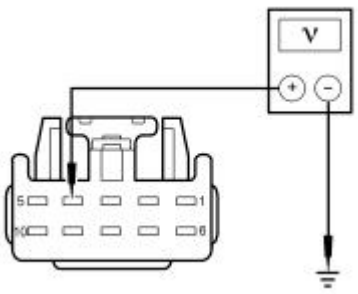
Possible Causes

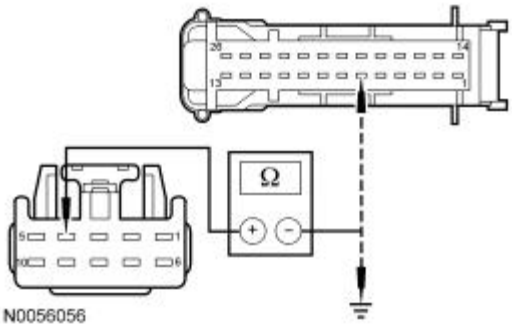
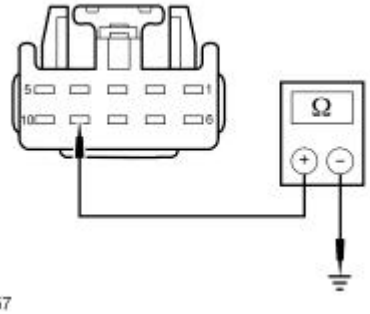
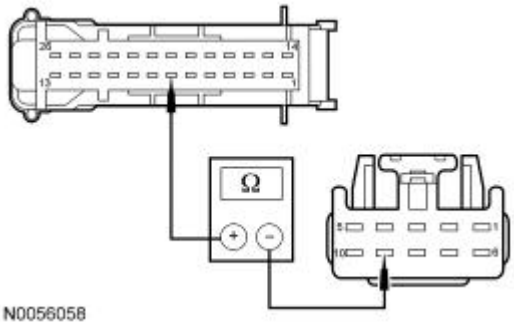
- PLG module diagnostic trouble code (DTC) B107D obstacle detected while closing
- PLG module DTC B2419 sensor 1 invalid
- PLG module DTC B2420 sensor 2 invalid
- Open, short to power or short to ground in circuit VPR54 (BU/BN) or VPR53 (BU/WH)
- Open or short to ground in circuit CPR55 (GN/BU)
- Mechanical binding
- PLG latch striker alignment
- PLG latch
- Position sensor
- PLG module
- Wedges

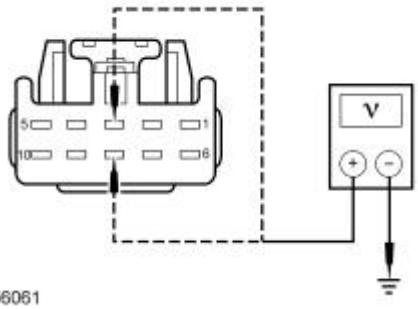
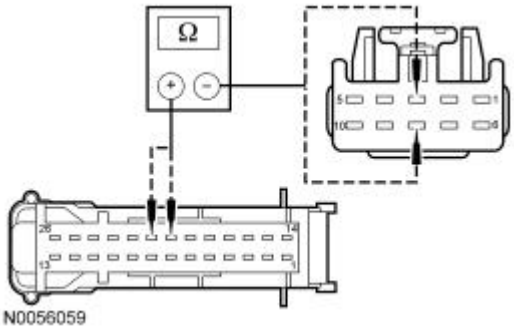
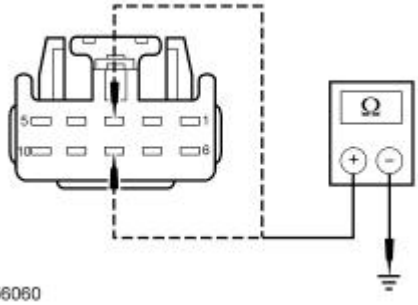
PINPOINT TEST D: THE POWER LIFTGATE DOES NOT OPERATE CORRECTLY — REVERSES DURING THE POWER CLOSE OPERATION

Test Step	Result / Action to Take

D1 CHECK THE MANUAL OPERATION OF THE LIFTGATE
• Turn the PLG OFF (disable) from the message center.
• While manually opening and closing the liftgate, check the liftgate for:
  ▪ liftgate/wedge alignment.
  ▪ strut operation (struts should push open liftgate when beyond half open).
  ▪ PLG rod (should move freely while manually opening and closing liftgate and should be securely mounted to the liftgate and bracket).
  ▪ PLG latch (should latch completely).
• **Does the liftgate open and close correctly?**
	Yes
	If the liftgate reverses near the midpoint of travel, GO to D2.
	
	If the liftgate reverses near or at the latch, GO to D10.
	
	No
	REPAIR as necessary. ALIGN as necessary. REFER to Liftgate in this section. TEST the system for normal operation.

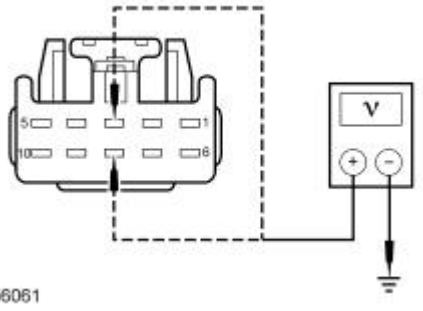
D2 CHECK THE POSITION SENSOR PID • Key in OFF position. • Connect: All PLG Module Connectors. • Connect: PLG Motor C4332. • Key in ON position. • Open the liftgate to the full open position. • Enter the following diagnostic mode on the diagnostic tool: PLG Module Position Sensor PIDs. • Monitor the PLG position sensor 1 and position sensor 2 PIDs while slowly closing the liftgate. • **Do both of the PID values alternate from ACTIVE to INACTIVE while the liftgate is moving?**	**Yes** GO to D11. **No** GO to D3.
D3 CHECK THE POSITION SENSOR POWER CIRCUIT • Disconnect: PLG Motor C4332. • Key in ON position. • Measure the voltage between PLG motor C4332-4, circuit CPR55 (GN/BU), harness side and ground.  N0056055 • **Is the voltage approximately 5 volts?**	**Yes** GO to D5. **No** GO to D4.
D4 CHECK THE OPTICAL SENSOR POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND • Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-6, circuit CPR55 (GN/BU), harness side and PLG motor C4332-4, circuit	**Yes** GO to D16. **No**

CPR55 (GN/BU), harness side; and between PLG module C4174B-6, circuit CPR55 (GN/BU), harness side and ground.  N0056056 • **Is the resistance less than 5 ohms between PLG module and PLG motor; and greater than 10,000 ohms between PLG module and ground?**	REPAIR the circuit. TEST the system for normal operation.
D5 CHECK THE POSITION SENSOR RETURN CIRCUIT	
• Key in OFF position. • Disconnect: PLG Motor C4332. • Key in ON position. • Measure the resistance between PLG motor C4332-9, circuit RPR55 (WH/BU), harness side and ground.  N0056057 • **Is the resistance less than 5 ohms?**	**Yes** GO to D7 . **No** GO to D6 .
D6 CHECK THE POSITION SENSOR RETURN CIRCUIT FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-7, circuit RPR55 (WH/BU), harness side and PLG motor C4332-9, circuit RPR55 (WH/BU), harness side.  N0056058 • **Is the resistance less than 5 ohms?**	**Yes** GO to D16 . **No** REPAIR the circuit. TEST the system for normal operation.
D7 CHECK THE POSITION SENSOR CIRCUITS FOR AN OPEN	
• Key in ON position. • Measure the voltage between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground; and between PLG motor C4332-3, circuit VPR53 (BU/WH), harness side and	**Yes** INSTALL a new PLG motor. REFER To Power Liftgate Motor in this

ground.  N0056061 • **Is the voltage approximately 5 volts for both measurements?**	section. TEST the system for normal operation. **No** GO to D8 .
D8 CHECK THE POSITION SENSOR CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG motor C4332, harness side and PLG module C4174B, harness side using the following chart: **C4332 Pin** / **Circuit** / **C4174B Pin** 8 / VPR53 (BU/WH) / 21 3 / VPR54 (BU/BN) / 20  N0056059 • **Are the resistances less than 5 ohms?**	**Yes** GO to D9 . **No** REPAIR the circuit. TEST the system for normal operation.
D9 CHECK THE POSITION SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG motor C4332-3, circuit VPR54 (BU/BN), harness side and ground; and between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground.  N0056060 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D10 . **No** REPAIR the circuit. TEST the system for normal operation.
D10 CHECK THE POSITION SENSOR CIRCUITS FOR A SHORT TO	

VOLTAGE

- Key in ON position.
- Measure the voltage between PLG motor C4332-3, circuit VPR54 (BU/BN), harness side and ground; and between PLG motor C4332-8, circuit VPR53 (BU/WH), harness side and ground.



N0056061

- **Is voltage present?**

Yes
REPAIR the circuit. TEST the system for normal operation.

No
GO to D16 .

D11 CHECK THE DETENT AND FORKBOLT SWITCH PID

- Enter the following diagnostic mode on the diagnostic tool: Primary Forkbolt, Secondary Forkbolt and Detent Switch PIDs.
- **NOTE:** The liftgate is in the primary position when the liftgate is in the full closed position. The liftgate is in the UNLATCH position when the liftgate is open and completely out of the striker. The liftgate can be placed in the unlatched position by lifting up on the liftgate handle.
- Begin with the liftgate in the open position, then slowly close the liftgate into each of the latch positions specified by the table below.

Liftgate Latch Position	Detent Switch PID	Secondary Forkbolt Switch PID	Primary Forkbolt Switch PID
Fully Unlatched	Not active [a]	Active	Active
In primary	Active	Not active	Not active

[a] If detent switch is active in the fully unlatched position, manually attempt to rotate the forkbolt towards the latched position.

- **Do the switch states agree with the table?**

Yes
GO to D16 .

No
GO to D12 .

D12 CHECK THE OPERATION OF THE DETENT AND FORKBOLT SWITCHES

- Key in OFF position.
- Disconnect: PLG Module C4174B.
- Measure the resistance between PLG module C4174B, harness side and ground at each of the connector pins and each latch position specified by the table below.

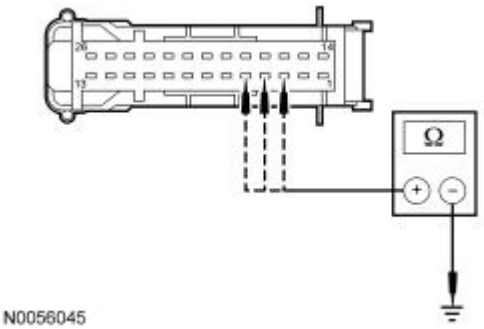
Liftgate Latch Position	C4174B Circuit	Resistance
Fully Unlatched	Pin 3, circuit CPR66 (GY/YE)	Greater than 10,000 ohms [a]
Fully Unlatched	Pin 5, circuit CPR64 (VT/OG)	Less than 5 ohms
Fully Unlatched	Pin 4, circuit CPR65 (BU/GN)	Less than 5 ohms

Yes
GO to D16 .

No
GO to D13 .

Primary	Pin 3, circuit CPR66 (GY/YE)	Less than 5 ohms
Primary	Pin 5, circuit CPR64 (VT/OG)	Greater than 10,000 ohms
Primary	Pin 4, circuit CPR65 (BU/GN)	Greater than 10,000 ohms

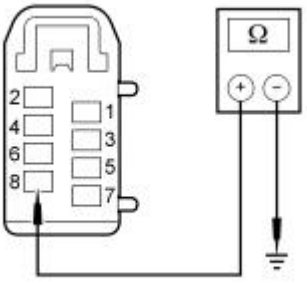
[a] If resistance measured is less than 5 ohms, manually rotate the forkbolt to the latched position and re-test.



- **Do the resistance values agree with the table?**

D13 CHECK THE DETENT AND FORKBOLT SWITCH GROUND CIRCUIT

- Disconnect: Liftgate Latch/Unlatch Assembly C4339.
- Measure the resistance between PLG latch/unlatch assembly C4339-8, circuit GD149 (BK/GY), harness side and ground.



- **Is the resistance less than 5 ohms?**

Yes
GO to D14 .

No
REPAIR the circuit.
TEST the system for normal operation.

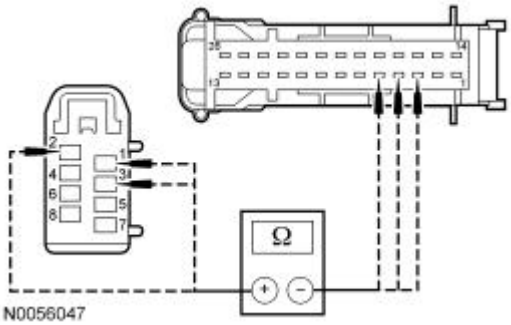
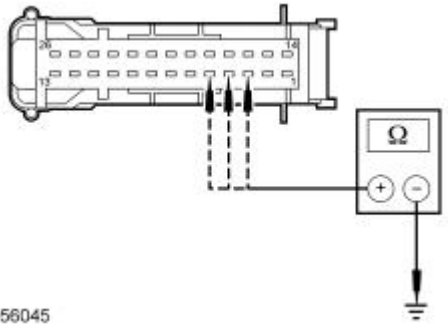
D14 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR AN OPEN

- Measure the resistance between PLG latch/unlatch assembly C4339, harness side and PLG module C4174B, harness side using the following table:

C4339 Pin	Circuit	C4174B Pin
1	CPR64 (VT/OG)	5
3	CPR65 (BU/GN)	4
2	CPR66 (GY/YE)	3

Yes
GO to D15 .

No
REPAIR the circuit.
TEST the system for normal operation.

 N0056047 • **Is the resistance less than 5 ohms on all circuits?**	
D15 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG module C4174B-5, circuit CPR64 (VT/OG), harness side and ground; between PLG module C4174B-4, circuit CPR65 (BU/GN), harness side and ground; then between PLG module C4174B-3, circuit CPR66 (GY/YE), harness side and ground.  N0056045 • **Are the resistances greater than 10,000 ohms on all circuits?**	**Yes** CHECK the PLG latch connector for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG latch. REFER to Section 501-14 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
D16 CHECK FOR CORRECT PLG MODULE OPERATION	

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test E: The Power Liftgate Chime is Inoperative

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

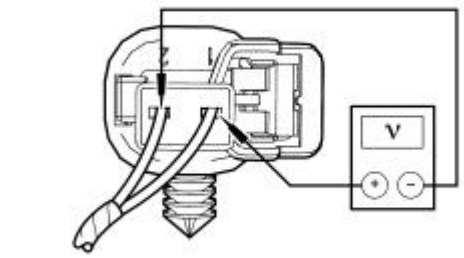
The power liftgate (PLG) chime is controlled by the PLG module. To activate the chime, the PLG module

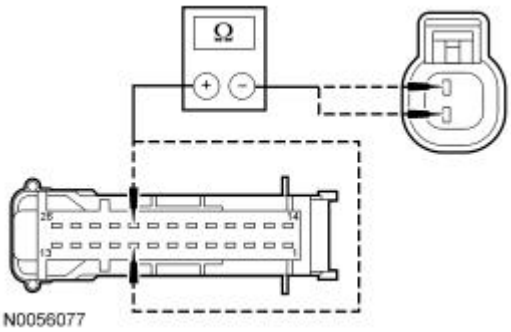
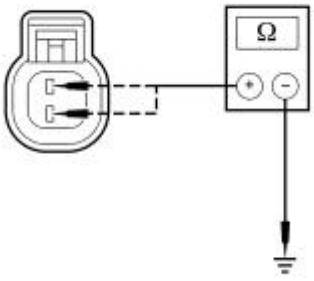
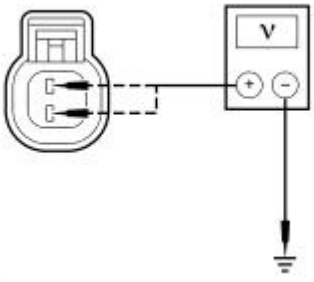
supplies a high frequency voltage output on circuit CPR56 (VT/BN) and ground on circuit RPR56 (GY/VT).

Possible Causes

- PLG module diagnostic trouble code (DTC) B236A chime output circuit open
- PLG module DTC B2903 chime output circuit short to battery
- PLG module DTC B2940 chime output circuit short to ground
- Circuit CPR56 (VT/BN) or RPR56 (GY/VT) open, short to voltage or short to ground
- Chime

PINPOINT TEST E: THE POWER LIFTGATE CHIME IS INOPERATIVE

Test Step	Result / Action to Take
E1 CHECK FOR VOLTAGE TO THE PLG CHIME • Key in ON position. • Set the parking brake to the ON position. • Open the liftgate. • **NOTE:** The PLG module applies voltage to the PLG chime for one second after the rear PLG switch is pressed, when the transmission is not in the PARK position and the liftgate is in the OPEN position. • With the PLG chime still connected, press the rear PLG switch and measure the voltage between PLG chime C4186-1, circuit CPR56 (VT/BN), back probe and PLG chime C4186-2, circuit RPR56 (GY/VT), back probe.  N0056076 • **Is any voltage present?**	**Yes** INSTALL a new PLG motor. TEST the system for normal operation. **No** GO to E2 .
E2 CHECK THE PLG CHIME CIRCUITS FOR AN OPEN • Key in OFF position. • Disconnect: PLG Chime C4186. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-9, circuit CPR56 (VT/BN), harness side and PLG chime C4186-1, circuit CPR56 (VT/BN), harness side; then between PLG module C4174B-22, circuit RPR56 (GY/VT), harness side and PLG chime C4186-2, circuit RPR56 (GY/VT), harness side.	**Yes** GO to E3 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0056077 • **Are the resistances less than 5 ohms?**	
E3 CHECK THE PLG CHIME CIRCUITS FOR A SHORT TO GROUND	**Yes** GO to E4 . **No** REPAIR the circuit. TEST the system for normal operation.
• Measure the resistance between PLG chime C4186-1, circuit CPR56 (VT/BN), harness side and ground; then between PLG chime C4186-2, circuit RPR56 (GY/VT), harness side and ground.  N0056078 • **Are the resistances greater than 10,000 ohms?**	
E4 CHECK THE PLG CHIME CIRCUITS FOR A SHORT TO VOLTAGE	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E5 .
• Measure the voltage between PLG chime C4186-1, circuit CPR56 (VT/BN), harness side and ground; then between PLG chime C4186-2, circuit RPR56 (GY/VT), harness side and ground.  N0056079 • **Is voltage present?**	
E5 CHECK FOR CORRECT PLG MODULE OPERATION	**Yes** INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test. **No** The system is operating correctly at this time. Concern may

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**	

	have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test F: The Power Liftgate Does Not Operate Correctly — Pinch Strip Does Not Stop/Reverse the Liftgate

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

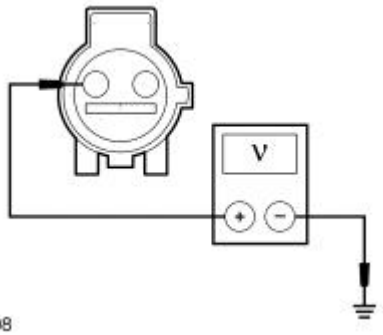
When the power liftgate (PLG) moves in the close direction, the PLG module monitors the pinch strips and position sensor for obstacle detection. The PLG module uses a 5-volt reference signal on circuit CPR52 (YE/VT) and a return signal on circuit RPR52 (VT/GY) for the left pinch strip. The PLG module uses a 5-volt reference signal on circuit CPR51 (YE/OG) and a return signal on circuit RPR52 (VT/GY) for the right pinch strip. The right and left pinch strip return signal circuits are spliced together.

Possible Causes

- PLG module diagnostic trouble code (DTC) B2699 left pinch strip open or short to battery
- PLG module DTC B2700 right pinch strip open or short to battery
- Circuit CPR51 (YE/OG), CPR52 (YE/VT) or RPR52 (VT/GY) open
- Pinch strip
- PLG module

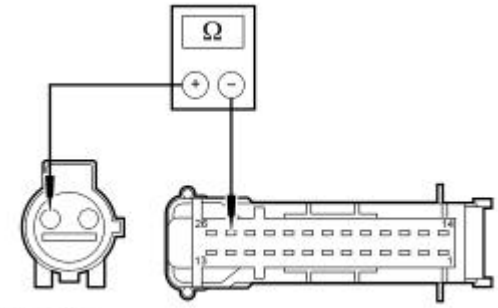
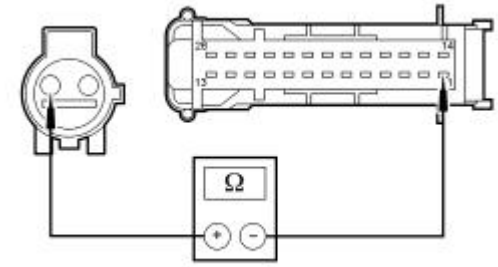
PINPOINT TEST F: THE POWER LIFTGATE DOES NOT OPERATE CORRECTLY — PINCH STRIP DOES NOT STOP/REVERSE THE LIFTGATE

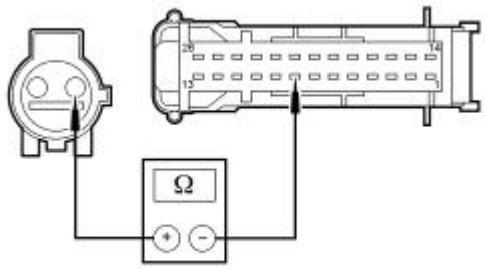
Test Step	Result / Action to Take
F1 CHECK THE PINCH STRIP OPERATION	
• Enter the following diagnostic mode on the diagnostic tool: Left Pinch Strip Status (LFT_PINCH) and Right Pinch Strip Status (RT_PINCH) PIDs. • Activate the PLG left and right pinch strips while observing the LFT_PINCH and RT_PINCH PIDs. • **Does the PID state change/agree with the pinch strip status?**	**Yes** GO to F5 . **No** GO to F2 .
F2 CHECK THE PINCH STRIP SIGNAL CIRCUITS	
• Key in OFF position. • Disconnect: Pinch Strip (Left C4172, Right C4173). • Key in ON position. • Measure the voltage between left pinch strip C4172-1, circuit CPR52 (YE/VT), harness side and ground; and between right pinch strip C4173-1, circuit CPR51 (YE/OG), harness side and ground.	**Yes** GO to F4 . **No** GO to F3 .



A0091408

- **Are the voltages approximately 5 volts?**

F3 CHECK THE PINCH STRIP SIGNAL CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between left pinch strip C4172-1, circuit CPR52 (YE/VT), harness side and PLG module C4174B-25, circuit CPR52 (YE/VT), harness side.  N0056080 • Then measure the resistance between right pinch strip C4173-1, circuit CPR51 (YE/OG), harness side and PLG module C4174B-1, circuit CPR51 (YE/OG), harness side.  N0056081 • **Are the resistances less than 5 ohms?**	**Yes** GO to F5 . **No** REPAIR the circuit. TEST the system for normal operation.
F4 CHECK THE PINCH STRIP RETURN CIRCUIT FOR AN OPEN	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between left pinch strip C4172-2, circuit RPR52 (VT/GY), harness side and PLG module C4174B-8, circuit RPR52 (VT/GY), harness side; and between right pinch strip C4173-2, circuit RPR52 (VT/GY), harness side and PLG module C4174B-8, circuit RPR52 (VT/GY), harness side.	**Yes** INSTALL a new pinch strip. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 N0056082 • **Are the resistances less than 5 ohms?**	
F5 CHECK FOR CORRECT PLG MODULE OPERATION	

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test G: The Power Liftgate Does Not Power Close (Power Open OK)

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

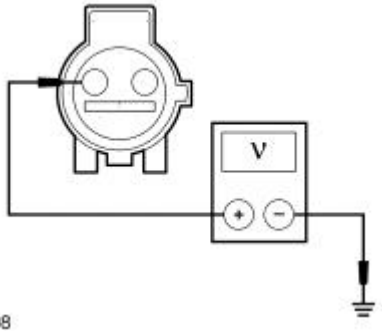
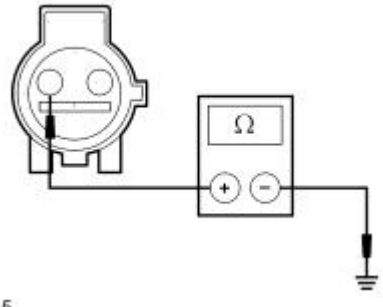
When the power liftgate (PLG) moves in the close direction, the PLG module monitors the pinch strips and position sensor for obstacle detection. The PLG module uses a 5-volt reference signal on circuit CPR52 (YE/VT) and a return signal on circuit RPR52 (VT/GY) for the left pinch strip. The PLG module uses a 5-volt reference signal on circuit CPR51 (YE/OG) and a return signal on circuit RPR52 (VT/GY) for the right pinch strip. The right and left pinch strip return signal circuits are spliced together.

NOTE: Initialize the PLG before proceeding with this pinpoint test. Refer to Power Liftgate Initialization in this section.

Possible Causes

- PLG module diagnostic trouble code (DTC) B2701 left pinch strip stuck active
- PLG module DTC B2702 right pinch strip stuck active
- Circuit GD149 (BK/GY) open
- Circuit CPR65 (BU/GN), CPR66 (GY/YE) or CPR64 (VT/OG) open or short to ground
- Circuit CPR52 (YE/VT) or CPR51 (YE/OG) short to ground
- PLG latch
- Pinch strip
- PLG module

PINPOINT TEST G: THE POWER LIFTGATE DOES NOT POWER CLOSE (POWER OPEN OK)

Test Step	Result / Action to Take
G1 CHECK THE PINCH STRIP PID • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: PLG Pinch Strip. • Check the left and right pinch strip PIDs. • **Do either of the pinch strip PIDs indicate ACTIVE?**	**Yes** GO to G2 . **No** GO to G4 .
G2 CHECK THE PINCH STRIP SIGNAL CIRCUIT • Key in OFF position. • Disconnect: Pinch Strip (Left C4172 or Right C4173). • Key in ON position. • Measure the voltage between left pinch strip C4172-1, circuit CPR52 (YE/VT), harness side and ground; and between right pinch strip C4173-1, circuit CPR51 (YE/OG), harness side and ground.  A0091408 • **Is the voltage approximately 5 volts?**	**Yes** INSTALL a new pinch strip. TEST the system for normal operation. **No** GO to G3 .
G3 CHECK THE PINCH STRIP SIGNAL CIRCUIT FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between left pinch strip C4172-1, circuit CPR52 (YE/VT), harness side and ground; or between right pinch strip C4173-1, circuit CPR51 (YE/OG), harness side and ground.  A0091415 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G9 . **No** REPAIR the circuit. TEST the system for normal operation.
G4 CHECK THE DETENT AND FORKBOLT SWITCH PID • Enter the following diagnostic mode on the diagnostic tool: Primary Forkbolt, Secondary Forkbolt and Detent Switch PIDs. • **NOTE:** The liftgate is in the primary position when the liftgate is in the full closed position. The liftgate is in the UNLATCH position when the liftgate is open and completely out of the striker. The liftgate can be placed in the unlatched position by lifting up on the liftgate handle. • Begin with the liftgate in the open position, then slowly close the	**Yes** GO to G9 . **No** GO to G5 .

liftgate into each of the latch positions specified by the table below.

Liftgate Latch Position	Detent Switch PID	Secondary Forkbolt Switch PID	Primary Forkbolt Switch PID
Fully Unlatched	Not active [a]	Active	Active
In primary	Active	Not active	Not active

[a] If detent switch is active in the fully unlatched position, manually attempt to rotate the forkbolt towards the latched position.

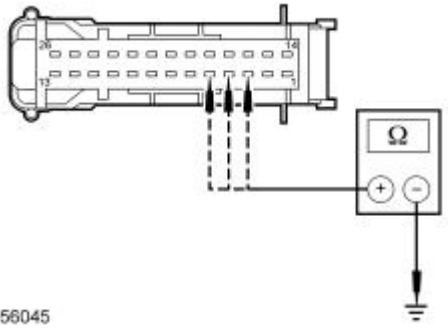
- **Do the switch states agree with the table?**

G5 CHECK THE OPERATION OF THE DETENT AND FORKBOLT SWITCHES

- Key in OFF position.
- Disconnect: PLG Module C4174B.
- Measure the resistance between PLG module C4174B, harness side and ground at each of the connector pins and each latch position specified by the table below.

Liftgate Latch Position	C4174B Circuit	Resistance
Fully Unlatched	Pin 3, circuit CPR66 (GY/YE)	Greater than 10,000 ohms [a]
Fully Unlatched	Pin 5, circuit CPR64 (VT/OG)	Less than 5 ohms
Fully Unlatched	Pin 4, circuit CPR65 (BU/GN)	Less than 5 ohms
Primary	Pin 3, circuit CPR66 (GY/YE)	Less than 5 ohms
Primary	Pin 5, circuit CPR64 (VT/OG)	Greater than 10,000 ohms
Primary	Pin 4, circuit CPR65 (BU/GN)	Greater than 10,000 ohms

[a] If resistance measured is less than 5 ohms, manually rotate the forkbolt to the latched position and re-test.



- **Do the resistance values agree with the table?**

Yes
GO to G9 .

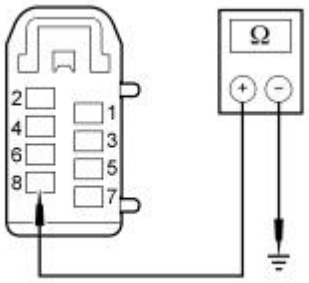
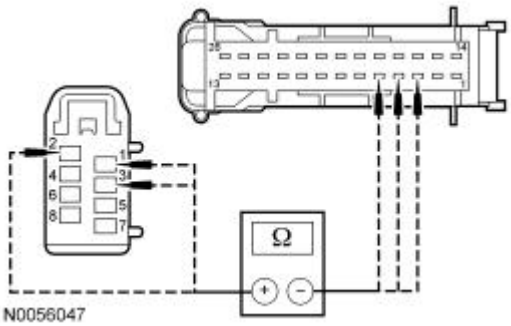
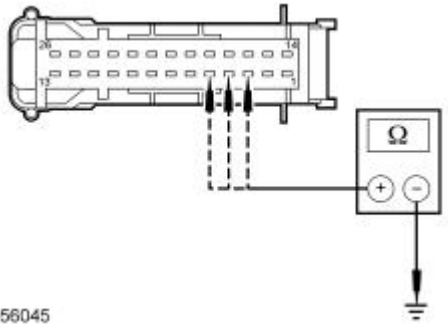
No
GO to G6 .

G6 CHECK THE DETENT AND FORKBOLT SWITCH GROUND CIRCUIT

- Disconnect: Liftgate Latch/Unlatch Assembly C4339.
- Measure the resistance between PLG latch/unlatch assembly C4339-8, circuit GD149 (BK/GY), harness side and ground.

Yes
GO to G7 .

No

 N0056046 • **Is the resistance less than 5 ohms?**	REPAIR the circuit. TEST the system for normal operation.
G7 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR AN OPEN	
• Measure the resistance between PLG latch/unlatch assembly C4339, harness side and PLG module C4174B, harness side using the following table: **C4339 Pin** / **Circuit** / **C4174B Pin** 1 / CPR64 (VT/OG) / 5 3 / CPR65 (BU/GN) / 4 2 / CPR66 (GY/YE) / 3  N0056047 • **Is the resistance less than 5 ohms on all circuits?**	**Yes** GO to G8 . **No** REPAIR the circuit. TEST the system for normal operation.
G8 CHECK THE DETENT AND FORKBOLT SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between PLG module C4174B-5, circuit CPR64 (VT/OG), harness side and ground; between PLG module C4174B-4, circuit CPR65 (BU/GN), harness side and ground; then between PLG module C4174B-3, circuit CPR66 (GY/YE), harness side and ground.  N0056045 • **Is the resistance greater than 10,000 ohms on all circuits?**	**Yes** CHECK the PLG latch connector for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG latch. REFER to Section 501-14 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
G9 CHECK FOR CORRECT PLG MODULE OPERATION	

• Disconnect all the PLG module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all the PLG module connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PLG module. REFER to Power Liftgate Module in this section. REPEAT the PLG module self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PLG module self-test.

Pinpoint Test H: The Power Liftgate Does Not Power Open (Power Close OK)

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

Normal Operation

If the power liftgate (PLG) is in the closed position and the conditions are correct, the PLG module supplies 12 volts to the unlatch/cinching motor on circuit CPR62 (WH/BU), 12 volts to the clutch on circuit CPR69 (BN/BU) and 12 volts to the motor on circuit CPR57 (GN/WH). As the liftgate is moving in the open direction, the PLG module monitors the position sensor for door speed to detect obstacles. Once the liftgate is unlatched, the motor and clutch are activated to power open the liftgate.

Possible Causes

- Mechanical binding
- PLG latch
- PLG sector gear switches
- PLG module

PINPOINT TEST H: THE POWER LIFTGATE DOES NOT POWER OPEN (POWER CLOSE OK)

Test Step	Result / Action to Take
H1 CHECK THE MANUAL OPERATION OF THE LIFTGATE	
NOTE: If any other PLG related DTCs are present, diagnose those first before proceeding with this pinpoint test. Refer to the PLG Module Diagnostic Trouble Code (DTC) Chart. • Key in ON position. • Unlock all doors. • Turn the PLG OFF (disable) from the message center. • **NOTE:** A small amount of interference during a manual operation will be amplified during a power operation and may cause the liftgate to not power open. • Manually open and close the liftgate. • **Does the liftgate unlatch, open, close and latch correctly?**	**Yes** GO to H2 . **No** If liftgate does not unlatch correctly, REFER to Section 501-14 . If liftgate does not open and close correctly, REFER to Liftgate in this section.
H2 CHECK THE LIFTGATE LATCH AND STRIKER	

ALIGNMENT	
• **NOTE:** Make sure to inspect the underside of the striker bridge for witness marks. • Inspect the striker and latch for correct alignment. • **Is the latch and striker aligned correctly?**	**Yes** Go To Pinpoint Test A . **No** ALIGN the liftgate and striker. REFER to Liftgate in this section. TEST the system for normal operation.

Pinpoint Test I: Power Liftgate (PLG) DTC B117C — Latch Centering Switch Invalid

Refer to Wiring Diagrams Cell 109 , Power Liftgate for schematic and connector information.

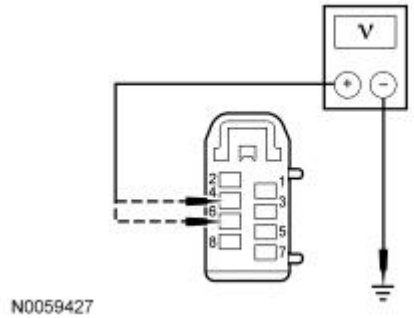
Normal Operation

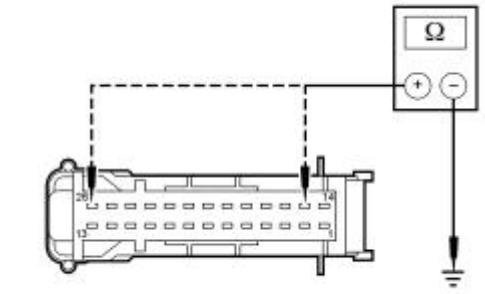
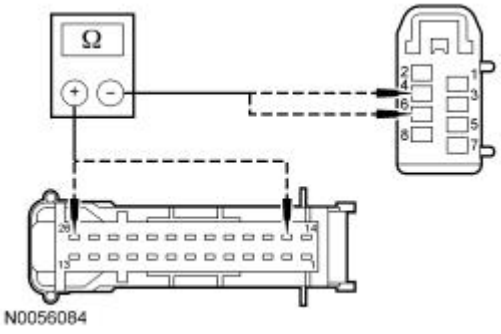
The power liftgate (PLG) module monitors the sector gear open switch, circuit CPR67 (VT) and sector gear close switch, CPR68 (YE) to determine the sector gear position.

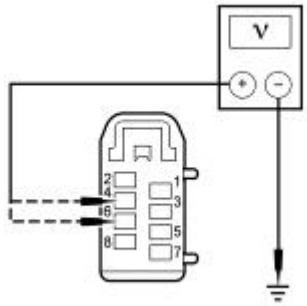
Possible Causes

- PLG diagnostic trouble code (DTC) B117C
- Open or short to ground in circuit CPR67 (VT) or CPR68 (YE)
- Short to voltage in circuit CPR67 (VT) or CPR68 (YE)
- PLG latch
- PLG module

PINPOINT TEST I: POWER LIFTGATE (PLG) DTC B117C — LATCH CENTERING SWITCH INVALID

Test Step	Result / Action to Take
I1 CHECK THE SECTOR GEAR SWITCH CIRCUITS	
NOTE: If any other PLG related DTCs are present, diagnose those first before proceeding with this pinpoint test. Refer to the PLG Module Diagnostic Trouble Code (DTC) Chart. • Disconnect: Latch/Unlatch Assembly C4339. • Key in ON position. • Measure the voltage between PLG latch/unlatch assembly C4339-4, circuit CPR67 (VT), harness side and ground; and between C4339-6, circuit CPR68 (YE), harness side and ground.  N0059427 • **Is the voltage greater than 10 volts for both measurements?**	**Yes** GO to I4 . **No** GO to I2 .
I2 CHECK CIRCUITS CPR67 (VT) AND CPR68 (YE) FOR SHORT TO GROUND	

• Key in OFF position. • Disconnect: PLG Module C4174B. • Measure the resistance between PLG module C4174B-15, circuit CPR67 (VT), harness side and ground; and between PLG module C4174B-26, circuit CPR68 (YE), harness side and ground.  N0056083 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I3 . **No** REPAIR the circuit. TEST the system for normal operation.
I3 CHECK CIRCUITS CPR67 (VT) AND CPR68 (YE) FOR AN OPEN	
• Measure the resistance between PLG module C4174B-15, circuit CPR67 (VT), harness side and PLG latch/unlatch assembly C4339-4, circuit CPR67 (VT), harness side; and between PLG module C4174B-26, circuit CPR68 (YE), harness side and PLG latch/unlatch assembly C4339-6, circuit CPR68 (YE), harness side.  N0056084 • **Is the resistance less than 5 ohms for both measurements?**	**Yes** CHECK the PLG module connector for bent or corroded connections on the component side and harness side. REPAIR as necessary. CLEAR the DTCs. REPEAT the PLG module self-test. IF DTC B117C returns, INSTALL a new PLG module. REFER to Power Liftgate Module in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
I4 CHECK CIRCUITS CPR67 (VT) AND CPR68 (YE) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: PLG Module C4174B. • Key in ON position. • Measure the voltage between PLG latch/unlatch assembly C4339-4, circuit CPR67 (VT), harness side and ground; and between C4339-6, circuit CPR68 (YE), harness side and ground.	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** CHECK the PLG latch connector for bent or corroded connections on the component side and harness side. REPAIR as necessary. INSTALL a new PLG



N0059427

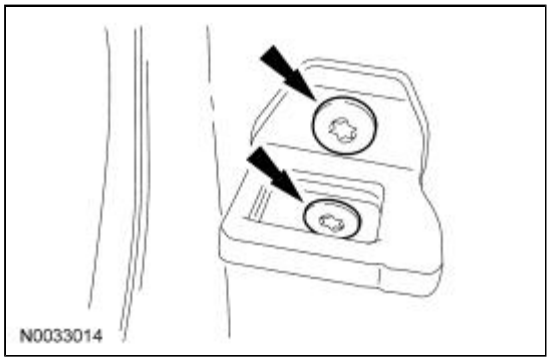
- **Is any voltage present for both measurements?**

latch. REFER to Section 501-14 . TEST the system for normal operation.

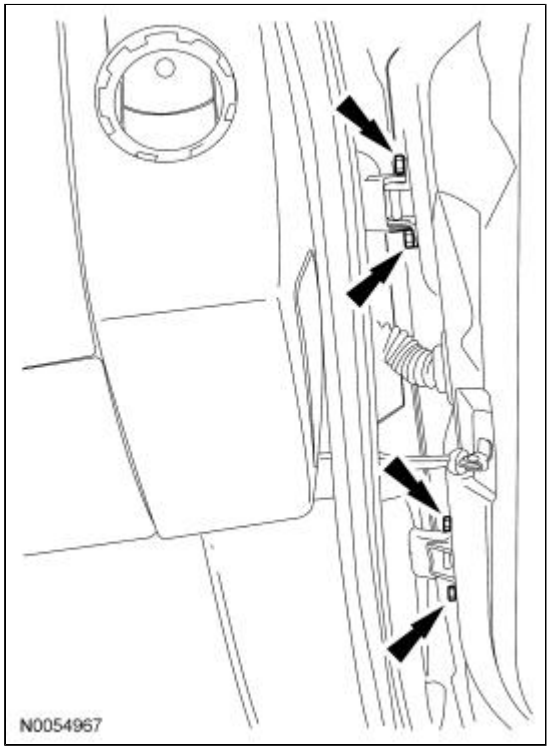
Hinge Adjustment — Front Door, Horizontal and Vertical

Printable View (125 KB)

1. Remove the 2 door striker bolts and the door striker.



2. Loosen the front door hinge-to-front door bolts enough to allow movement of the door.



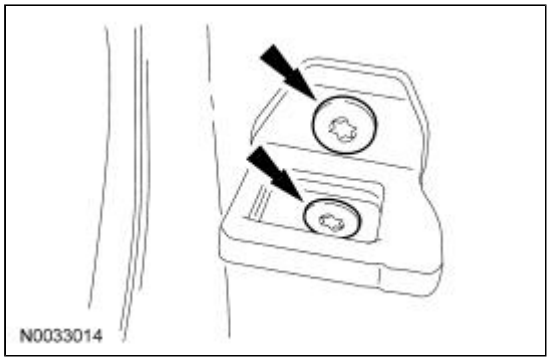
3. Adjust the front door.
4. Tighten the front door hinge-to-front door bolts to 30 Nm (22 lb-ft).
5. Install and adjust the door striker.
   - Tighten to 12 Nm (9 lb-ft).

Hinge Adjustment — Front Door, Fore and Aft

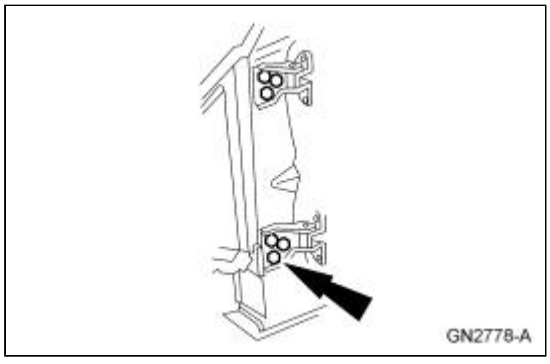
Printable View (104 KB)

NOTE: Check the rear door hinge adjustment before adjusting the front door hinge.

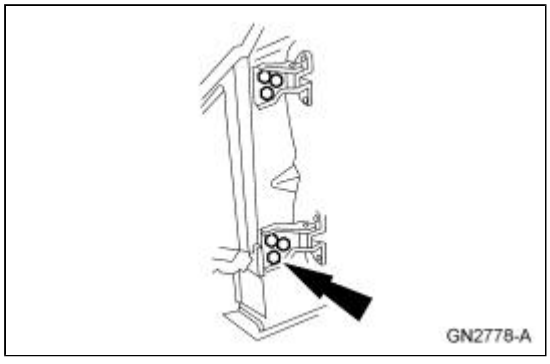
1. Remove the 2 door striker bolts and door striker.



2. Remove the front fender. For additional information, refer to Section 501-02 .
3. Loosen the front door hinge-to-body bolts.

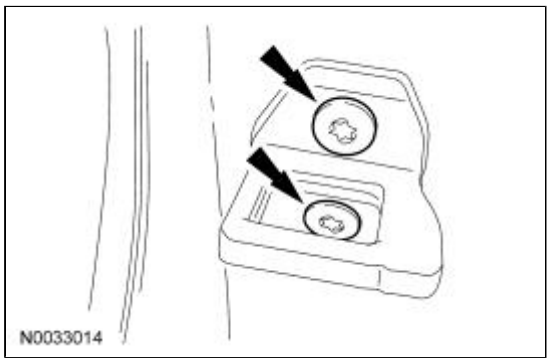


4. Adjust the front door alignment to specification.
5. Tighten the front door hinge-to-body bolts to 30 Nm (22 lb-ft).



6. Install the front fender. For additional information, refer to Section 501-02 .
7. Install and adjust the door striker.

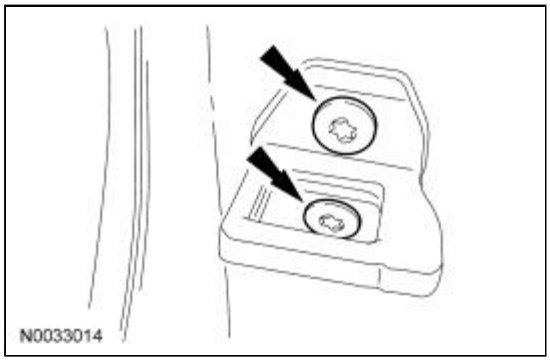
- Tighten to 12 Nm (9 lb-ft).



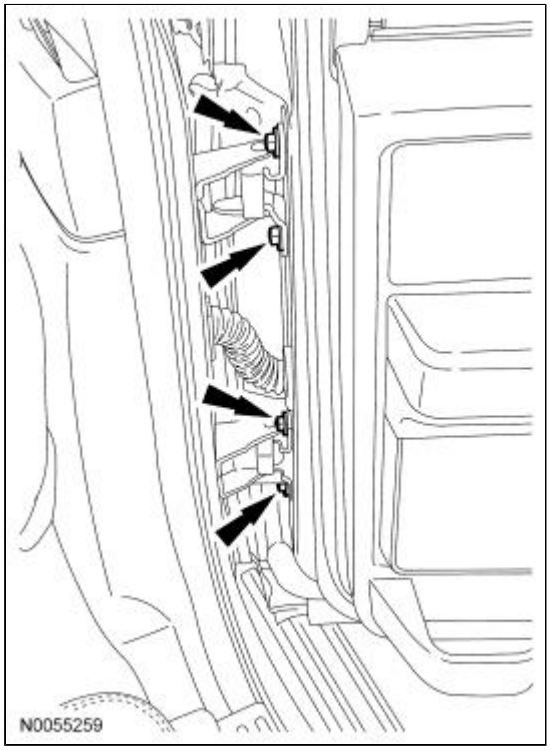
Hinge Adjustment — Rear Door, In, Out, Up and Down

Printable View (133 KB)

1. Remove the 2 door striker bolts and the door striker.



2. Loosen the rear door hinge-to-rear door bolts enough to allow movement of the door.

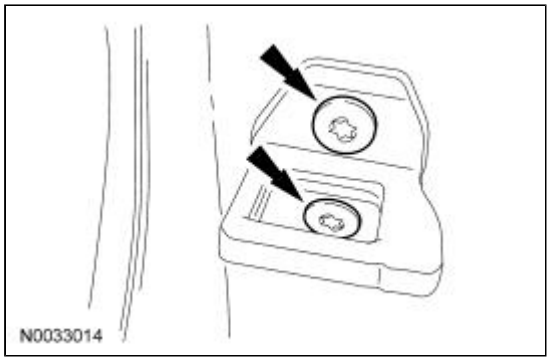


3. Adjust the rear door.
4. Tighten the rear door hinge-to-rear door bolts to 30 Nm (22 lb-ft).
5. Install and adjust the door striker.
   - Tighten to 12 Nm (9 lb-ft).

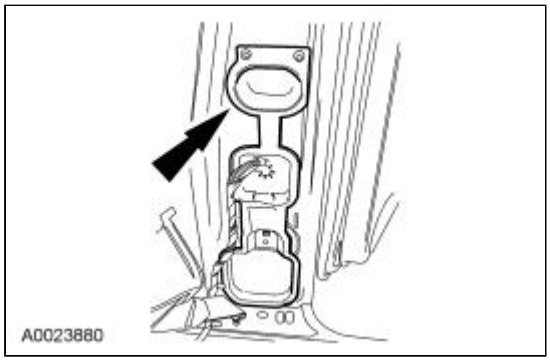
Hinge Adjustment — Rear Door, Fore, Aft and Tilt

Printable View (117 KB)

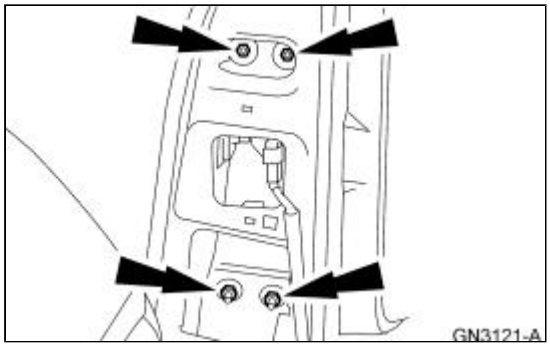
1. Position the front seat in the full forward position.
2. Remove the 2 door striker bolts and the door striker.



3. Remove the front seat belt retractor. For additional information, refer to Section 501-20A .
4. Remove the B-pillar weathershield.



5. Loosen the rear door hinge-to-B-pillar nuts enough to allow movement of the rear door.



6. Adjust the rear door.
7. Tighten the rear door hinge-to-B-pillar nuts to 30 Nm (22 lb-ft).
8. Install the B-pillar weathershield.

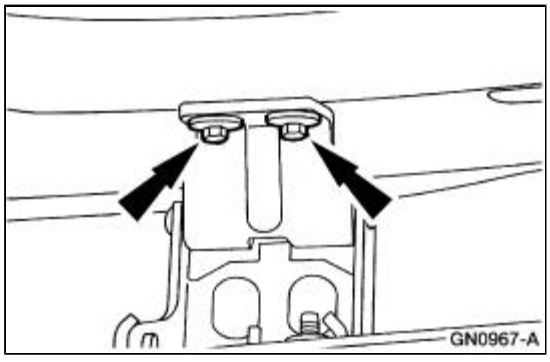
9. Install the front seat belt retractor. For additional information, refer to Section 501-20A .

10. Install and adjust the door striker.
    - Tighten to 12 Nm (9 lb-ft).

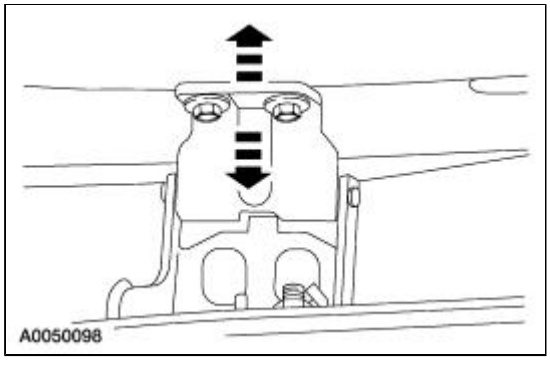
Hinge Adjustment — Liftgate

Printable View (98 KB)

1. Loosen the liftgate hinge to liftgate bolts.

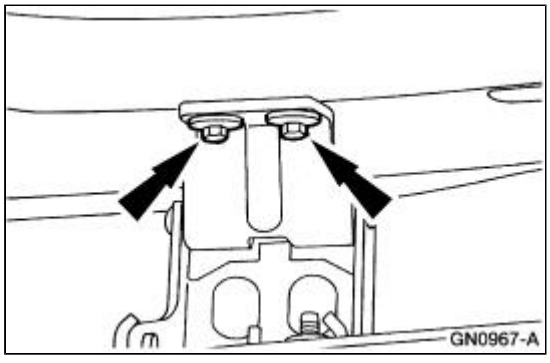


2. Adjust the liftgate alignment.



3. **NOTE:** The bolt washers must make full contact with the liftgate bracket when tightened.

   Tighten the liftgate hinge-to-liftgate bolts to 28 Nm (21 lb-ft).



Power Liftgate Initialization

Printable View (78 KB)

NOTE: If the power liftgate system is turned OFF in the message center, the system cannot be activated with any switches or with the liftgate handle. The system will need to be turned ON for any power operation to occur.

NOTE: The power liftgate may not operate under the following conditions:

- A low voltage or dead battery
- A disconnected battery

If any of these conditions has occurred, the power liftgate must be reset.

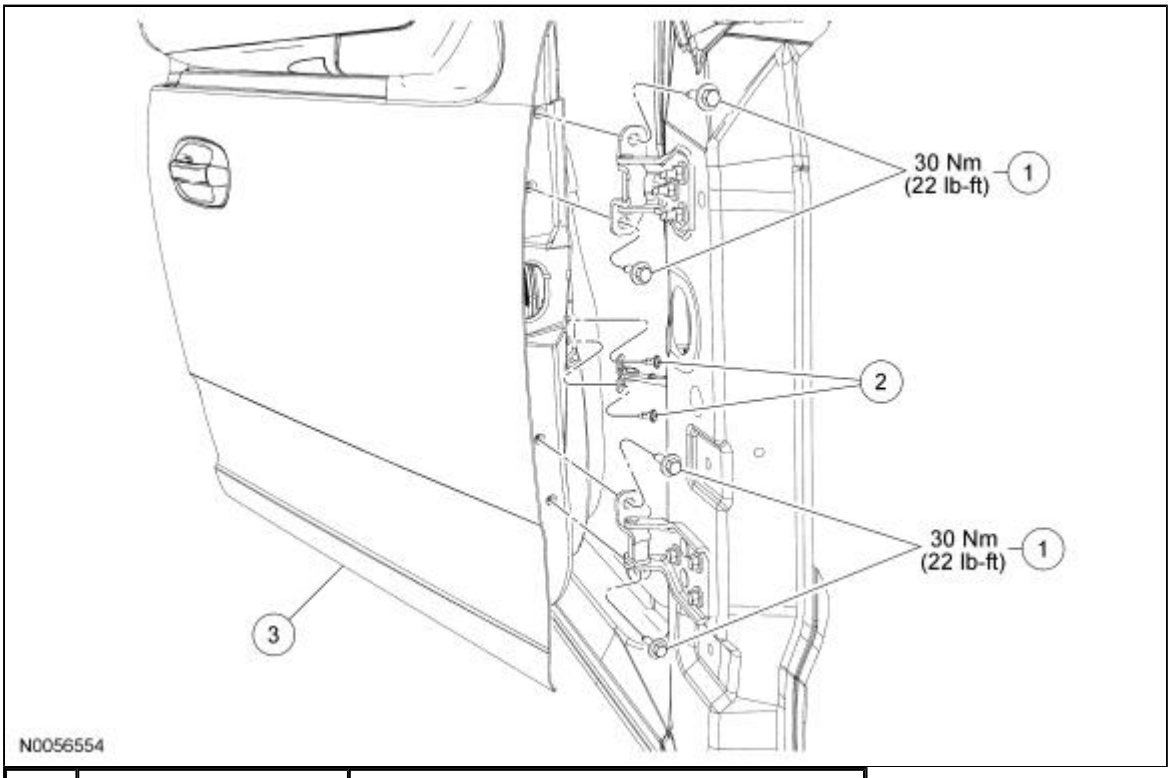
1. Manually close and fully latch the power liftgate.
2. **NOTE:** If the power liftgate does not open during this step, refer to the symptom chart to diagnose the power liftgate for no operation.

   Power open the power liftgate by using the key fob or control switch.
3. Once the power liftgate is fully open, close the power liftgate by using the key fob or control switch.

Door

Printable View (160 KB)

NOTE: Right front door shown, all other doors similar.



Item	Part Number	Description
1	N806738	Door hinge-to-door bolts (4 required)
2	W702788	Door check arm-to-door bolts (2 required)
3	20124 RH/ 20125 LH	Front door
3	24630 RH/ 24631 LH	Rear door

Removal and Installation

1. Remove the door speaker. For additional information, refer to Section 415-03 .
2. Partially remove and position aside the door weather shield.
3. Disconnect the electrical connectors.
   - Disconnect the window switch electrical connector.
   - Disconnect the door lock switch electrical connector.
   - Disconnect the door speaker electrical connector.
   - If equipped, disconnect the outside rearview mirror switch electrical connector.
4. Remove the wiring harness from the door.
5. If equipped, remove the 2 door check arm-to-door bolts.
6. **NOTE:** An assistant is necessary for the removal of the door.

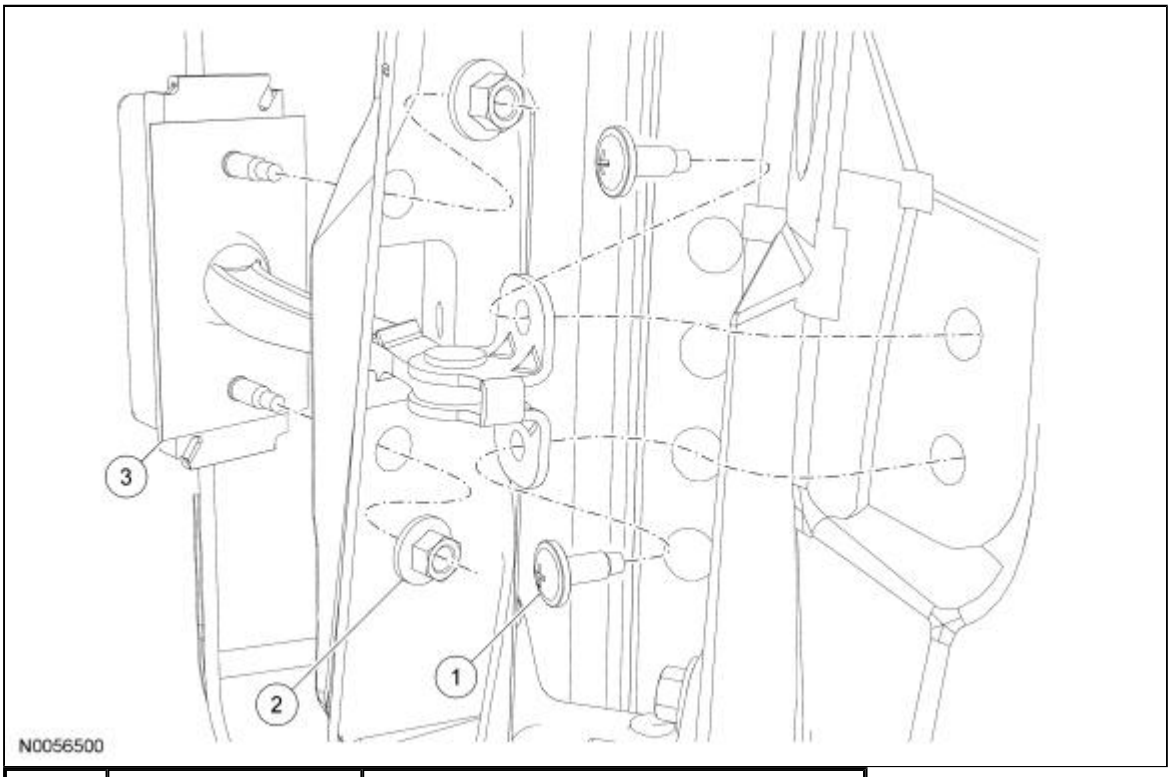
Remove the 4 door hinge-to-door bolts.

- To install, tighten to 30 Nm (22 lb-ft).

7. To install, reverse the removal procedure.

Door Check Arm

Printable View (194 KB)



Item	Part Number	Description
1	W702788	Door check arm-to-door bolt
2	—	Door check arm nut
3	23552	Door check arm

Left and right sides

1. Remove the lower cowl trim panel.
   - Remove the door scuff plate.

Left side

2. Remove the parking brake control assembly and position aside. For additional information, refer to Section 206-05 .

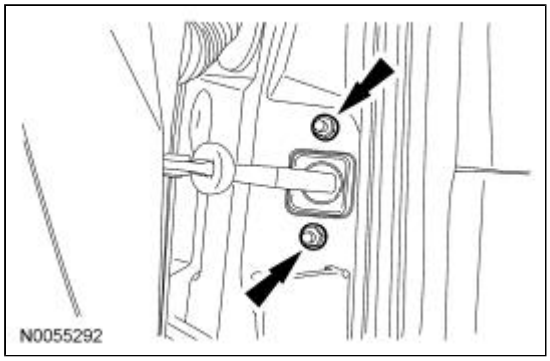
Left and right sides

3. Remove the lower cowl panel weather shield.

4. Remove the 2 door check arm-to-door bolts.

5. **NOTE:** Left side shown, right side similar.

   Remove the 2 door check arm nuts.



6. Remove the door check arm from the opening in the lower cowl panel.
7. To install, reverse the removal procedure.

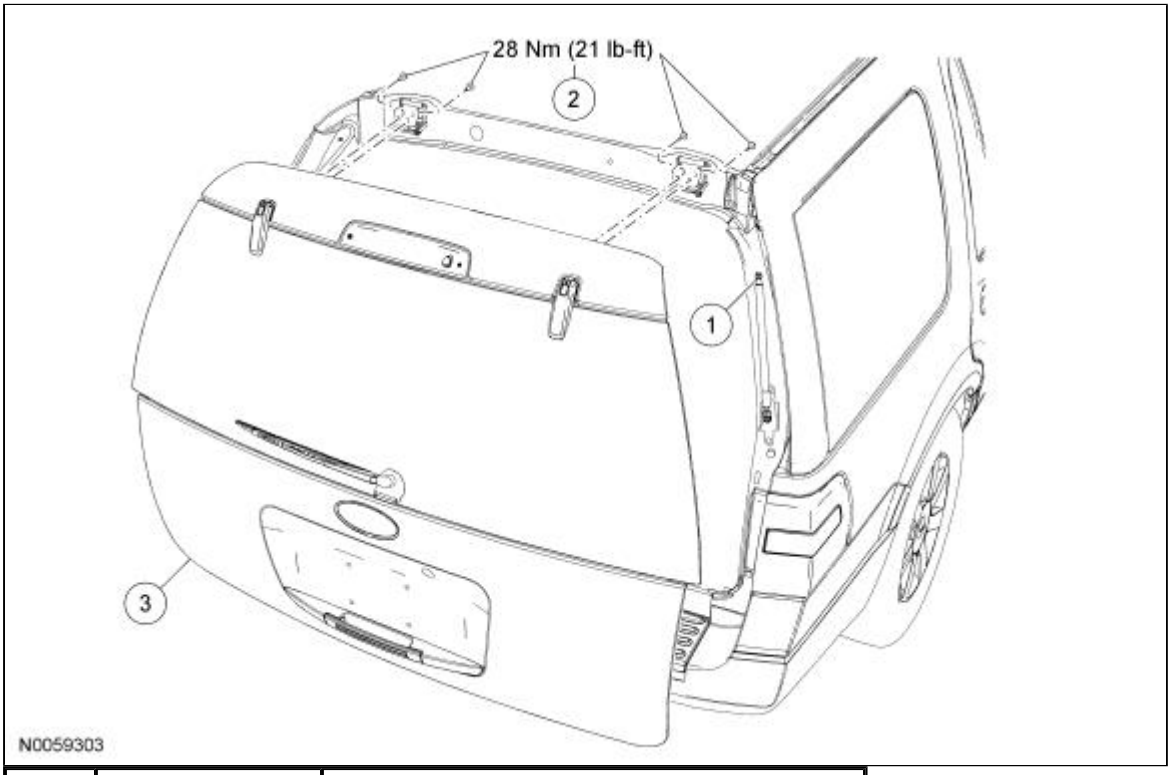
Liftgate

Printable View (304 KB)

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	406A10	Liftgate assist cylinder (2 required)
2	N807260	Liftgate hinge bolts (4 required)
3	40010	Liftgate assembly

All vehicles

1. Remove the D-pillar panels. For additional information, refer to Section 501-05 .

Vehicles with safety canopies

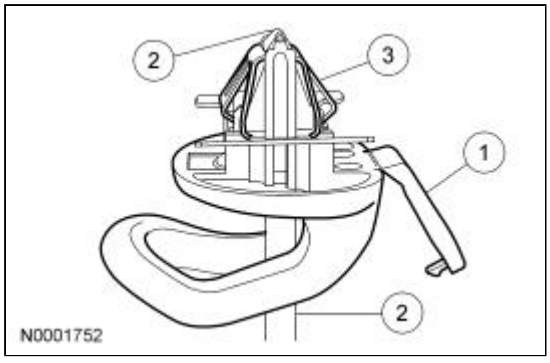
2. Remove the 2 rear garment hangers.
   - Open the access panel.
   - remove the garment hanger screws.

Vehicles without safety canopies

3. **CAUTION: To prevent damage to the garment hanger retainer, use a 3/16-inch flat blade screwdriver for this step.**

   NOTE: The garment hanger is shown without the roof sheet metal to show the metal retainer clip. The metal retainer clip will remain engaged in the sheet metal after the garment hanger is removed.

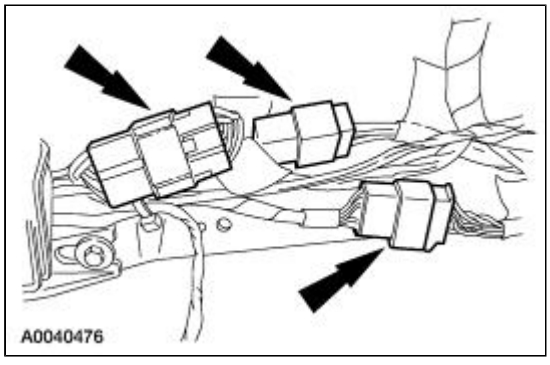
   Remove the 2 rear garment hangers.
   1. Open the access cover.
   2. Insert the flat-blade screwdriver fully into the garment slot.
   3. Rotate the screwdriver 90 degrees so that the screwdriver spreads the metal retainer clip. Remove the plastic garment hanger.



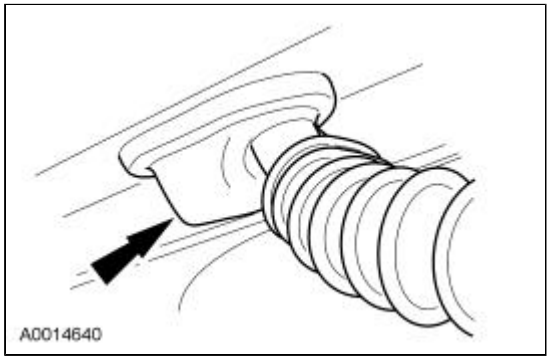
All vehicles

4. Remove the headliner rear pin-type retainers and partially lower the rear of the headliner.

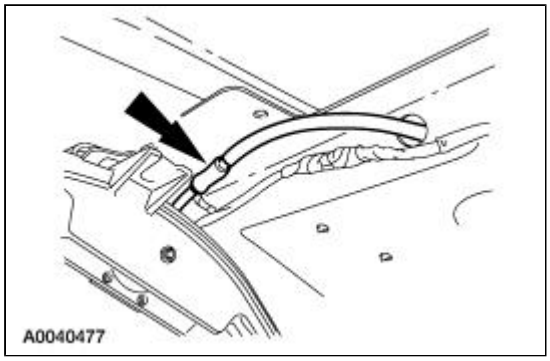
5. Disconnect the liftgate electrical connectors.



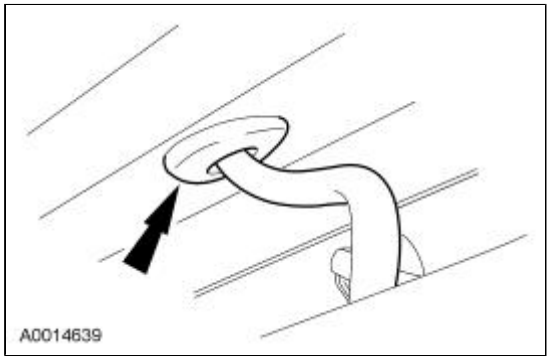
6. Remove the wire harness grommet and route the wire harness out from the roof.



7. Disconnect the rear washer tube.

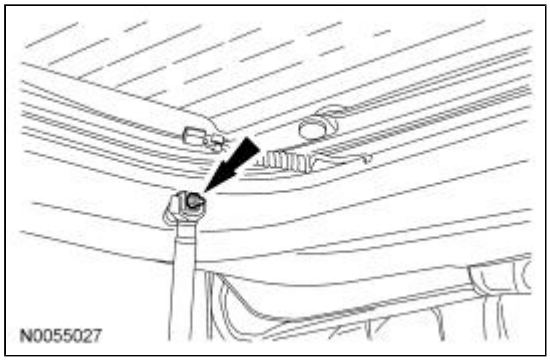


8. Remove the rear washer tube grommet and route the rear washer tube out from the roof.



Vehicles with power liftgate

9. Remove the power liftgate rod-to-liftgate cover and nut.
    - To install, tighten to 11 Nm (8 lb-ft).



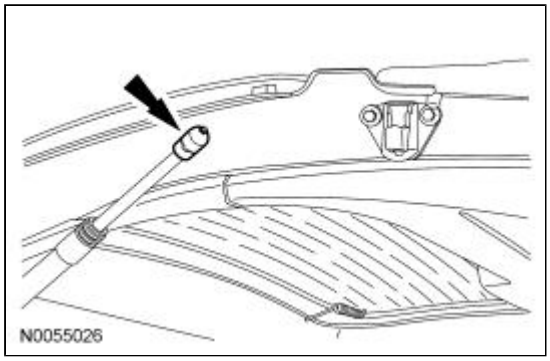
10. Remove the power liftgate rod from the liftgate.
    - To install, apply Threadlock 262 to the threads of fastener and tighten to 11 Nm (8 lb-ft).

All vehicles

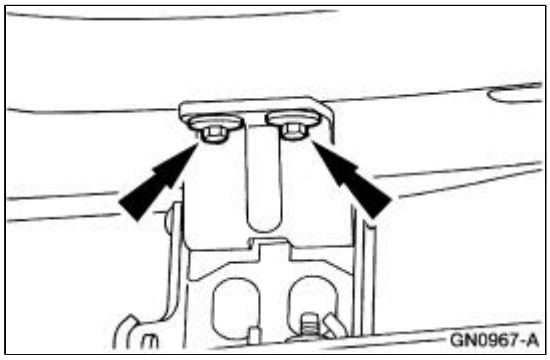
11. **NOTE:** Left side shown, right side similar.

    NOTE: An assistant is necessary for the removal of the liftgate.

    Disconnect the assist cylinders at the side of the liftgate.



12. Remove the 4 liftgate hinge bolts and remove the liftgate.
    - To install, tighten to 28 Nm (21 lb-ft).

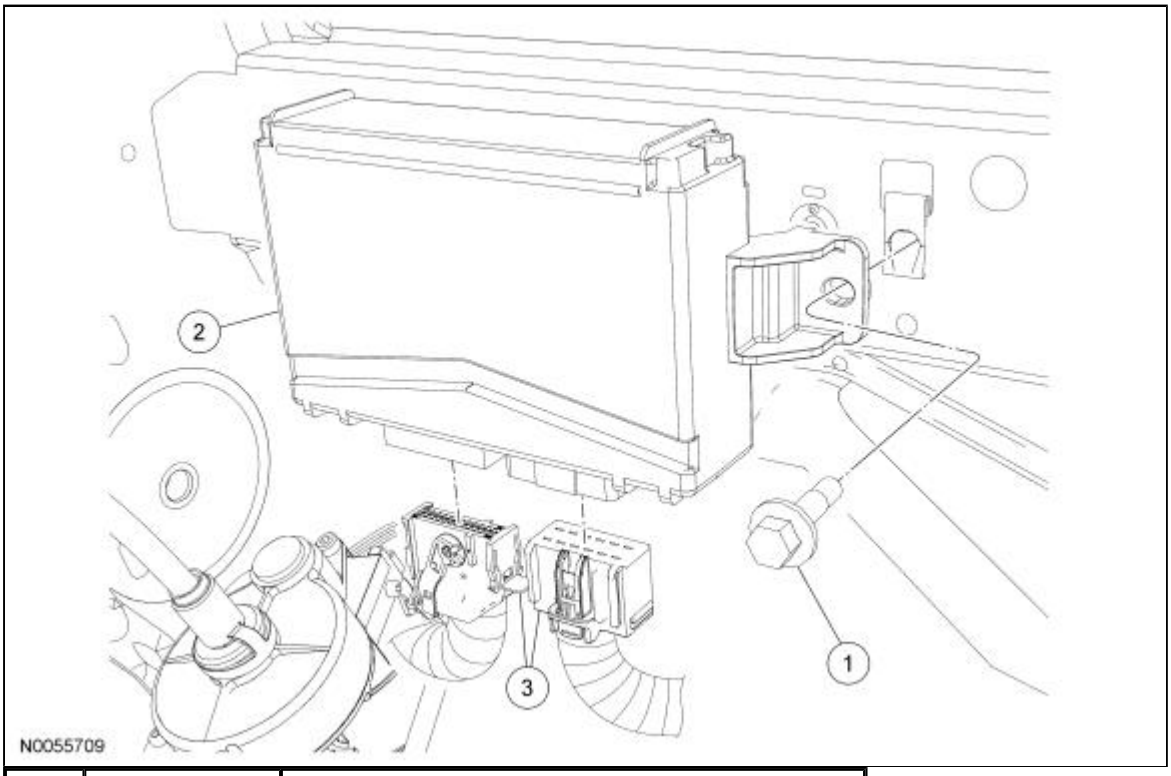


13. To install, reverse the removal procedure.
    - If equipped with power liftgate, initialize the power liftgate system. Refer to Power Liftgate Initialization in this section.

Power Liftgate Module

Printable View (180 KB)

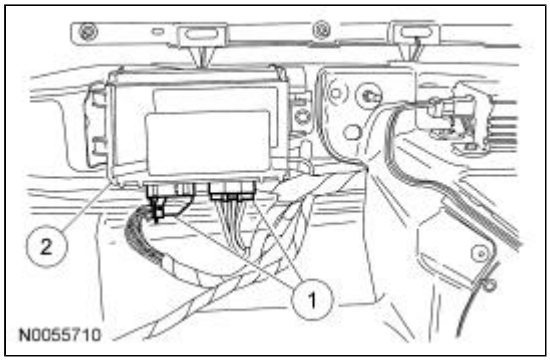
Removal and Installation



Item	Part Number	Description
1	W506013	Power liftgate module retaining bolt
2	404D06	Power liftgate module
3	—	Power liftgate module electrical connectors

1. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .

2. Remove the power liftgate module.
   1. Disconnect the electrical connectors.
   2. Remove the bolt.
      - To install, tighten to 9 Nm (80 lb-in).



3. To install, reverse the removal procedure.

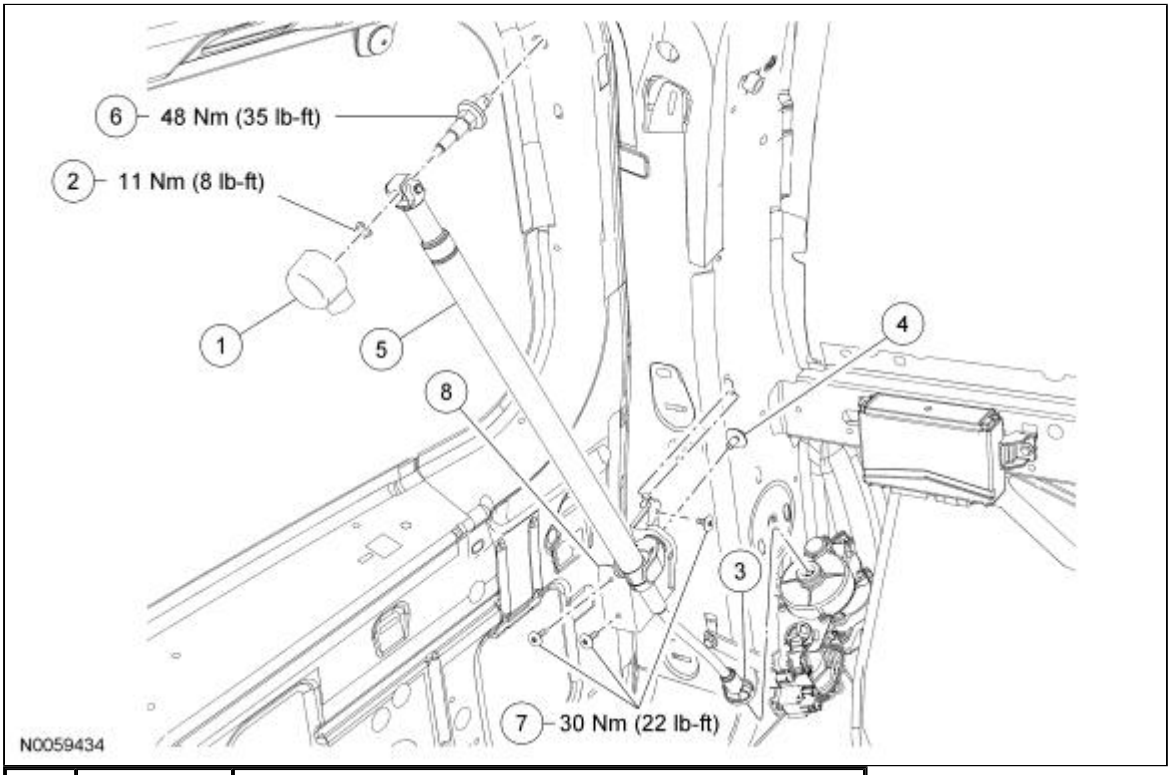
Power Liftgate Rod

Printable View (222 KB)

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6

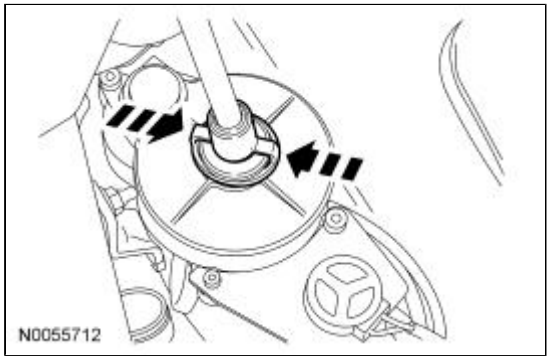
Removal and Installation



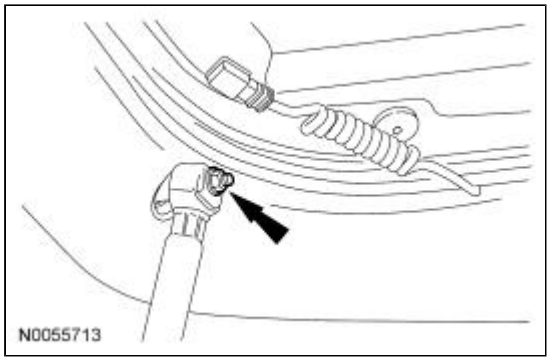
Item	Part Number	Description
1	410B00	Power liftgate rod end cover
2	W520412	Power liftgate rod-to-liftgate retaining nut
3	—	Power liftgate rod-to-motor retaining clip (part of the power liftgate rod assembly)
4	—	Power liftgate rod-to-bracket bolt
5	404B45	Power liftgate rod assembly
6	404E48	Power liftgate rod mounting stud
7	—	Power liftgate rod bracket-to-pillar bolts (3 required)
8	—	Power liftgate rod bracket (PIA)

1. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .
2. Unclip the power liftgate rod from the motor assembly.

- Squeeze the clip as shown to release and position upward on the rod assembly.



3. Remove the cover and the power liftgate rod-to-liftgate retaining nut.
    - To install, apply Threadlock 262 to the threads of fastener and tighten to 11 Nm (8 lb-ft).



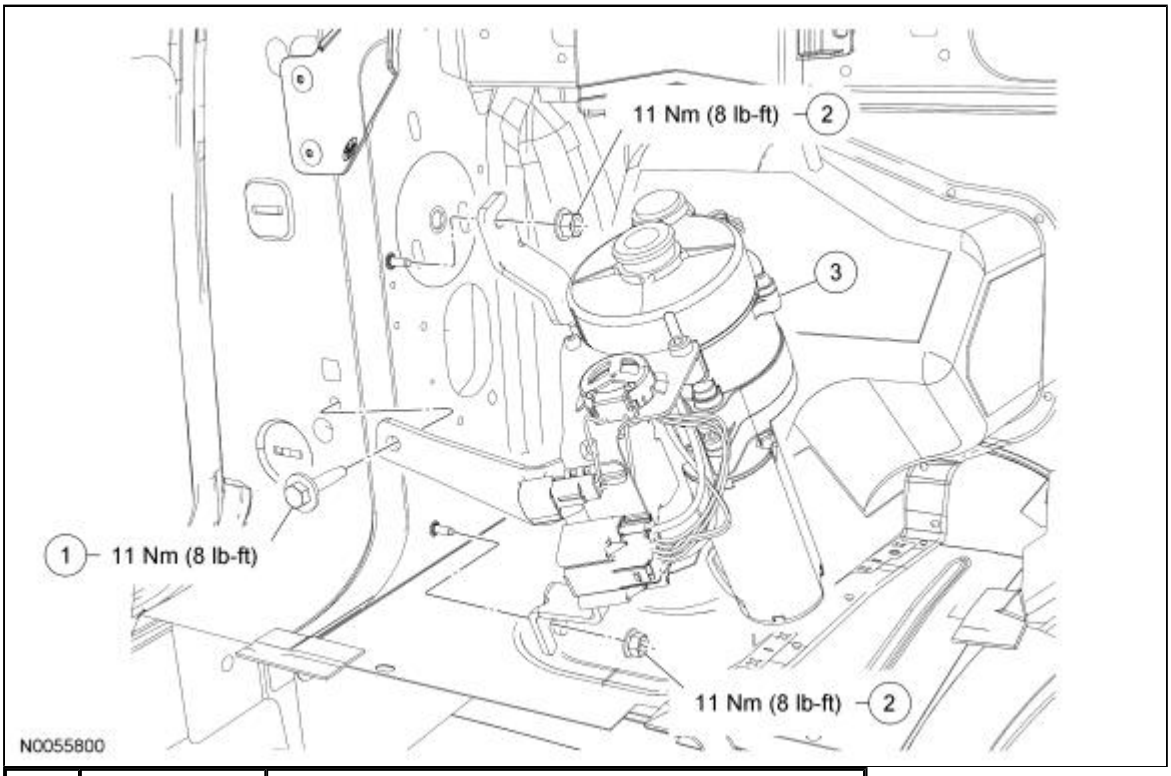
4. Remove the power liftgate rod-to-bracket bolt and the power liftgate rod assembly.

5. To install, reverse the removal procedure.

Power Liftgate Motor

Printable View (240 KB)

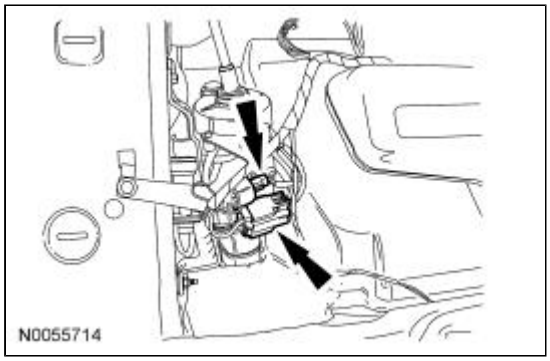
Removal and Installation



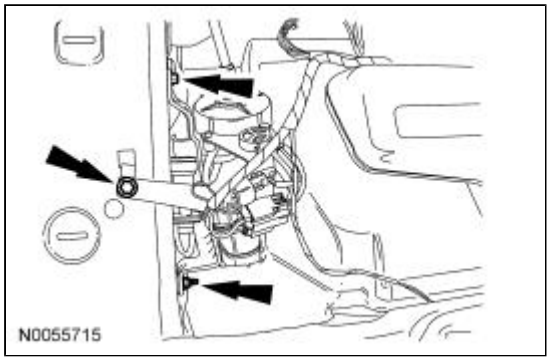
Item	Part Number	Description
1	W505425	Power liftgate motor retaining bolt
2	W520111	Power liftgate motor retaining nuts (2 required)
3	404C85	Power liftgate motor assembly

1. Remove the power liftgate rod assembly. For additional information, refer to Power Liftgate Rod in this section.

2. Disconnect the power liftgate motor electrical connectors.



3. Remove the power liftgate retaining fasteners and the power liftgate motor assembly.
   - To install, tighten to 11 Nm (8 lb-ft).

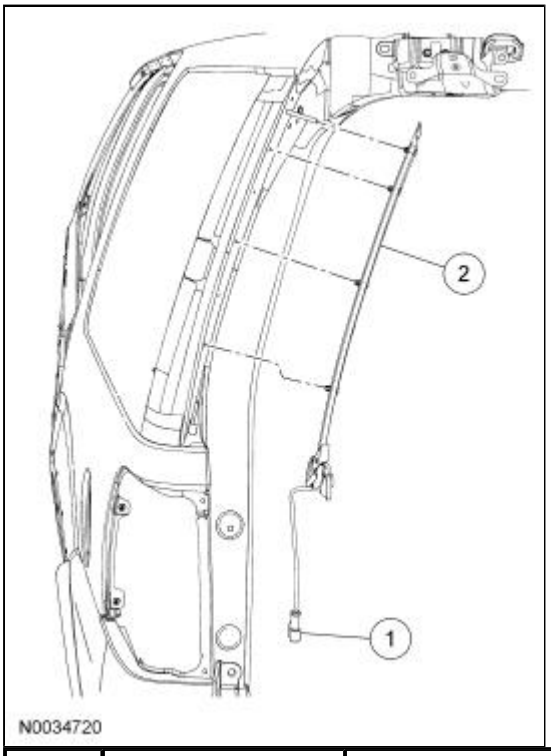


4. To install, reverse the removal procedure.

Pinch Strip Switch

Printable View (200 KB)

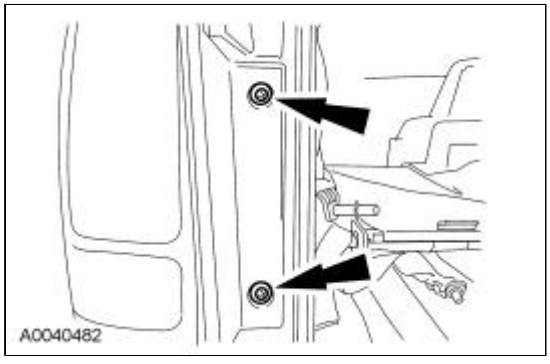
Removal and Installation



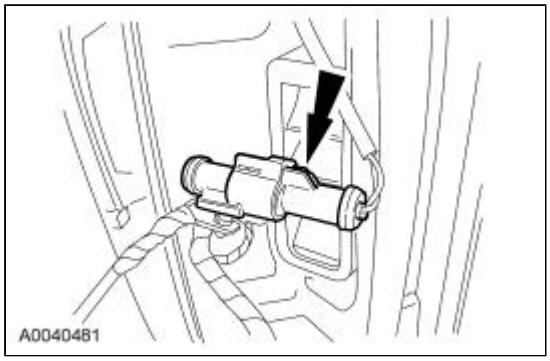
Item	Part Number	Description
1	—	Pinch strip electrical connector
2	42430B	Pinch strip

NOTE: Left side shown, right side similar.

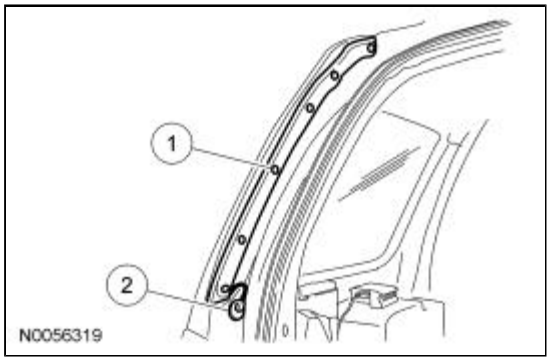
1. Remove brake light.
   - Remove the screws.



2. Disconnect the pinch strip electrical connector.



3. Remove the pinch strip.
    1. Remove the pin-type retainers.
    2. Remove the grommet and route the harness out of the vehicle.



4. To install, reverse the removal procedure.

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
A-pillar assist handle bolts	5	—	44
B-pillar and C-pillar trim panel bolts	8	—	71
C-pillar trim panel nuts	8	—	71
Door handle screw	3	—	27
Door trim panel armrest screws	3	—	27
Door trim panel screws	1	—	9
Liftgate assist handle screws	5	—	44
Lower door trim panel screws	1	—	9
Power liftgate rod-to-liftgate nut	11	8	—
Safety belt anchor bolts	40	30	—
Safety belt guide bolts	40	30	—
Sun visor screws	2	—	18

Interior Trim

Printable View (62 KB)

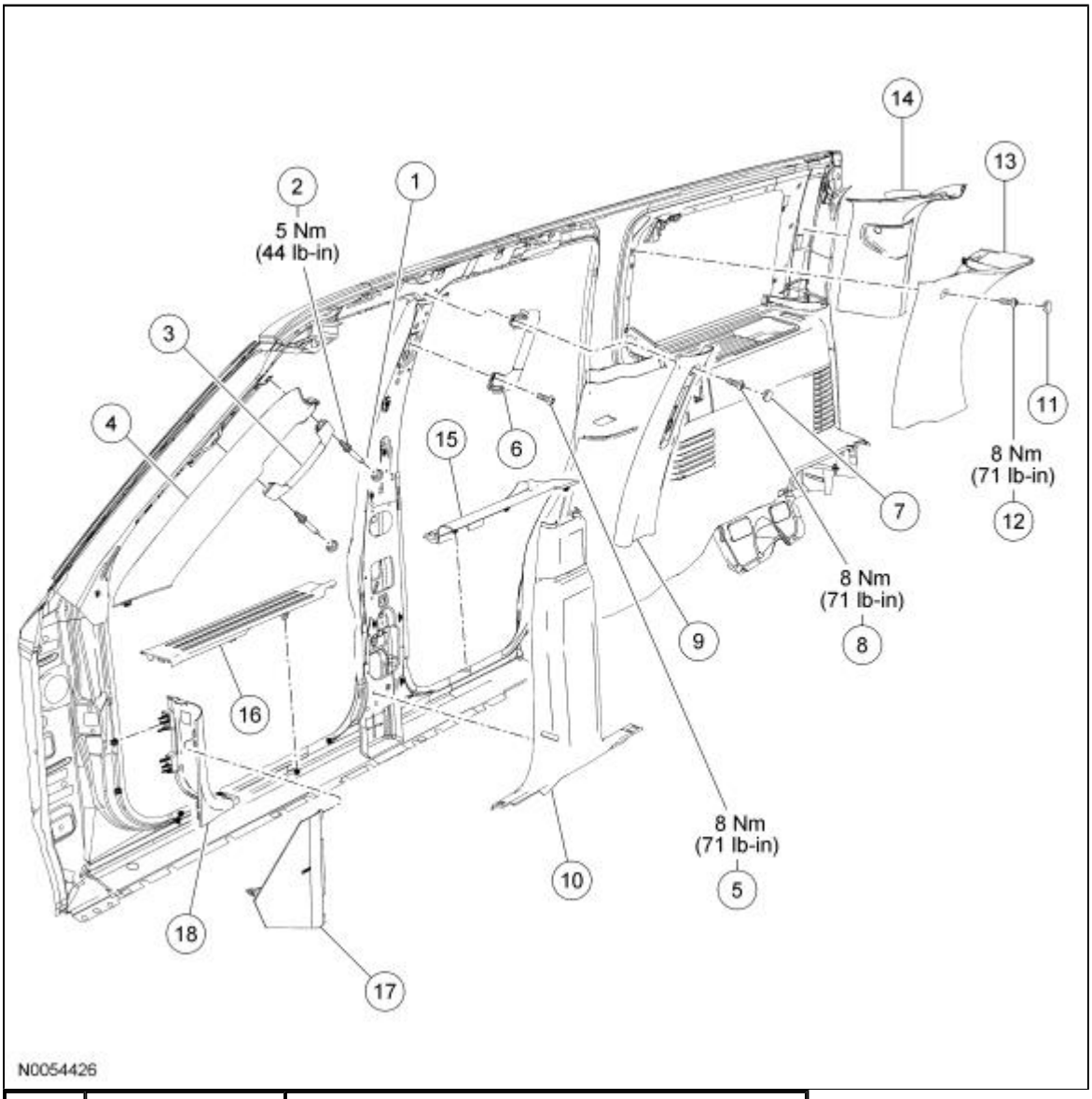
The interior trim consists of the following components:

- A-pillar trim panels
- B-pillar trim panels
- C-pillar trim panels
- D-pillar trim panels
- Front door trim panels
- Rear door trim panels
- Rear quarter trim panels
- Door handle bezels
- Liftgate trim panel
- Headliner
- Sun visors
- Scuff plates
- Coat hooks
- Assist handles

Interior Trim — Exploded View

Printable View (227 KB)

NOTE: Expedition/Navigator shown, Expedition EL/Navigator L similar.



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	W709040	Assist handle bolt (2 required)
3	31406A	Assist handle
4	03598	A-pillar trim panel
5	N611176	Rear assist handle bolt (2 required)
6	31406B	Rear assist handle
7	248A55	B-pillar trim panel bolt cover
8	N808544	B-pillar trim panel bolt

9	243A52B	B-pillar upper trim panel
10	243A52A	B-pillar lower trim panel
11	248A55	C-pillar trim panel fastener cover
12	N808544	C-pillar trim panel bolt
12	—	C-pillar trim panel nut (Expedition EL)
13	31004	C-pillar trim panel
14	31010	D-pillar trim panel
15	13228A	Rear door scuff plate
16	13208	Front door scuff plate
17	02348	Cowl panel side trim
18	023A98	Cowl panel cover

1. For additional information, refer to the procedures in this section.

A-Pillar Trim Panel

Printable View (78 KB)

Removal and Installation

1. Remove the 2 front assist handle bolt covers.
2. Remove the 2 assist handle bolts.
   - To install, tighten to 5 Nm (44 lb-in).
3. **NOTE:** Carefully rotate the A-pillar trim panel during this step.

   Pry the A-pillar trim panel to remove.
4. To install, reverse the removal procedure.

B-Pillar Trim Panel

Printable View (176 KB)

Removal and Installation

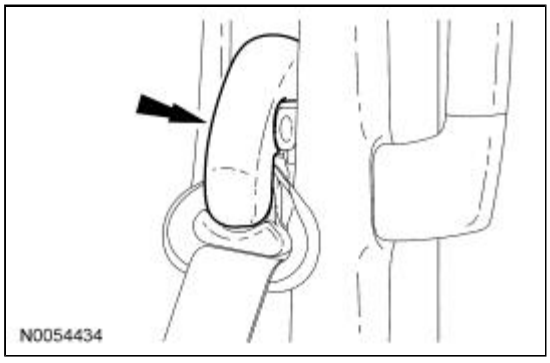
Upper and lower

1. Move the front seat to the full forward position.

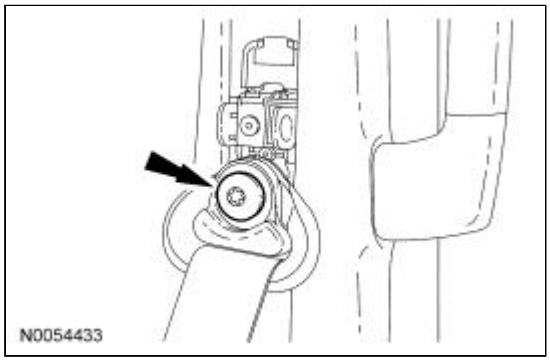
2. **NOTE:** Position the shoulder safety belt guide to the lowest position.

   NOTE: Inspect the shoulder safety belt guide cover for damage. If the shoulder safety belt guide cover is damaged or the cover does not remain closed, install a new shoulder safety belt guide cover.

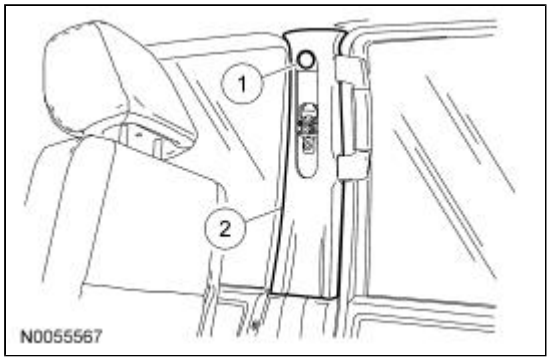
   Remove the shoulder safety belt guide cover.
   - Detach the top of the shoulder safety belt guide cover.
   - Rotate the shoulder safety belt guide cover 90 degrees and remove from the safety belt guide bolt.



3. Remove the shoulder safety belt guide.
   - Remove the shoulder safety belt guide bolt.
     - To install, tighten to 40 Nm (30 lb-ft).
   - Remove the shoulder safety belt guide.



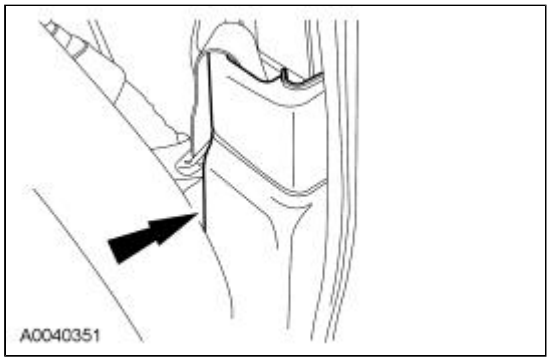
4. Remove the upper B-pillar trim panel.
   1. Remove the bolt cover and bolt.
      - To install, tighten to 8 Nm (71 lb-in).
   2. Remove the upper B-pillar trim panel by pulling outward to release the clips.



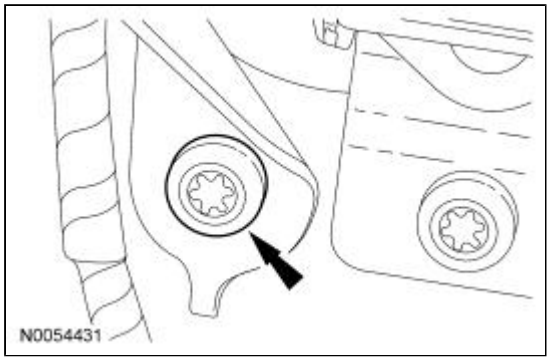
Lower

5. Remove the front and rear door scuff plates.

6. Position the lower B-pillar trim panel aside.



7. Remove the front safety belt anchor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).



8. Feed the safety belt through the lower B-pillar trim panel and remove.

Upper and lower

9. To install, reverse the removal procedure.
    - When installing the upper B-pillar trim panel, insert the safety belt guide slide into the upper B-pillar trim panel.

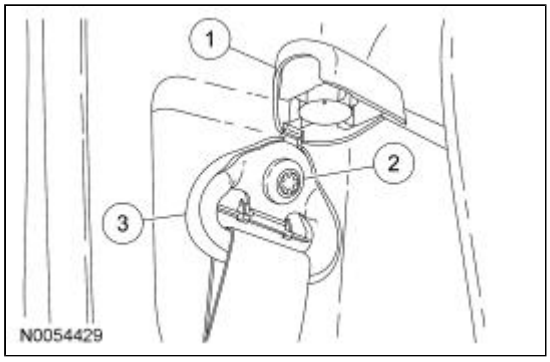
C-Pillar Trim Panel

Printable View (132 KB)

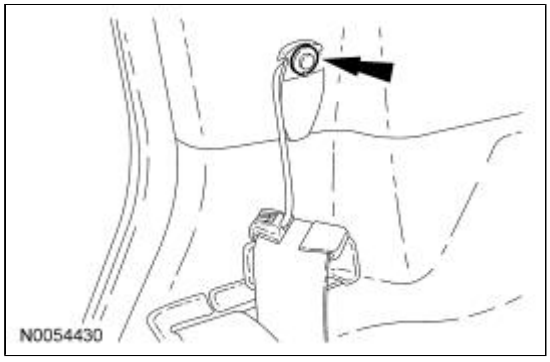
All vehicles

1. **NOTE:** Inspect the shoulder safety belt guide cover for damage. If the shoulder safety belt guide cover is damaged or the cover does not remain closed, install a new shoulder safety belt guide cover.

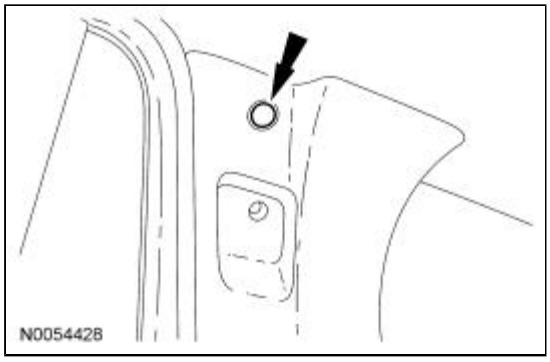
   Remove the shoulder safety belt guide.
   1. Position the shoulder safety belt cover up.
   2. Remove the safety belt guide bolt.
      - To install, tighten to 40 Nm (30 lb-ft).
   3. Remove the shoulder safety belt guide.



2. Detach the safety belt holder pin-type retainer.



3. Remove the C-pillar trim panel fastener cover.



Expedition EL/Navigator L only

4. Remove the C-pillar trim panel nut.
    - To install, tighten to 8 Nm (71 lb-in).

All vehicles except Expedition EL

5. Remove the C-pillar trim panel bolt.
    - To install, tighten to 8 Nm (71 lb-in).

All vehicles

6. Remove the C-pillar trim panel.
    - Remove the C-pillar trim panel by pulling outward to release the retainers.

7. To install, reverse the removal procedure.

D-Pillar Trim Panel

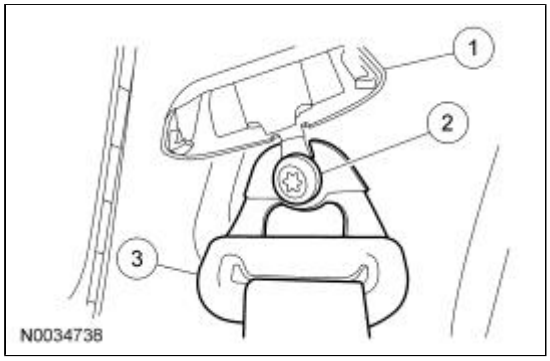
Printable View (137 KB)

All vehicles except Expedition EL/Navigator L

NOTE: Right side with power vent windows shown, all others similar.

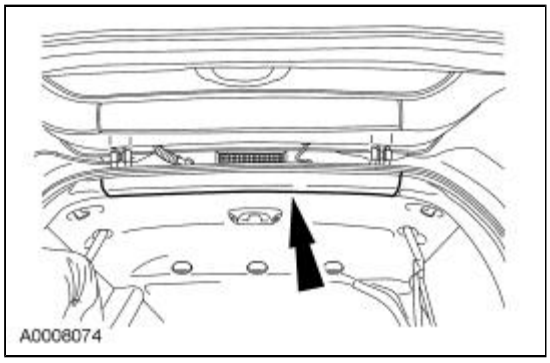
1. **NOTE:** Inspect the shoulder safety belt guide cover for damage. If the shoulder safety belt guide cover is damaged or cover does not remain closed, install a new shoulder safety belt guide cover.

   Remove the shoulder safety belt guide.
   1. Position the shoulder safety guide cover up.
   2. Remove the shoulder safety belt guide bolt.
      - To install, tighten to 40 Nm (30 lb-ft).
   3. Remove the shoulder safety belt guide.

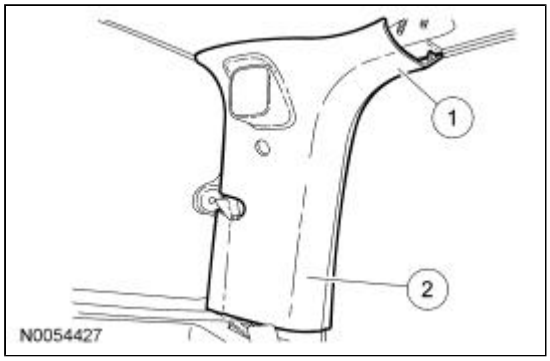


All vehicles

2. Remove rear upper headliner trim panel.



3. Remove the D-pillar trim panel.
   1. Disengage the upper clip by pulling downward.
   2. Unseat the D-pillar trim panel and rotate forward to remove.
   - If equipped, disconnect the speaker electrical connector.

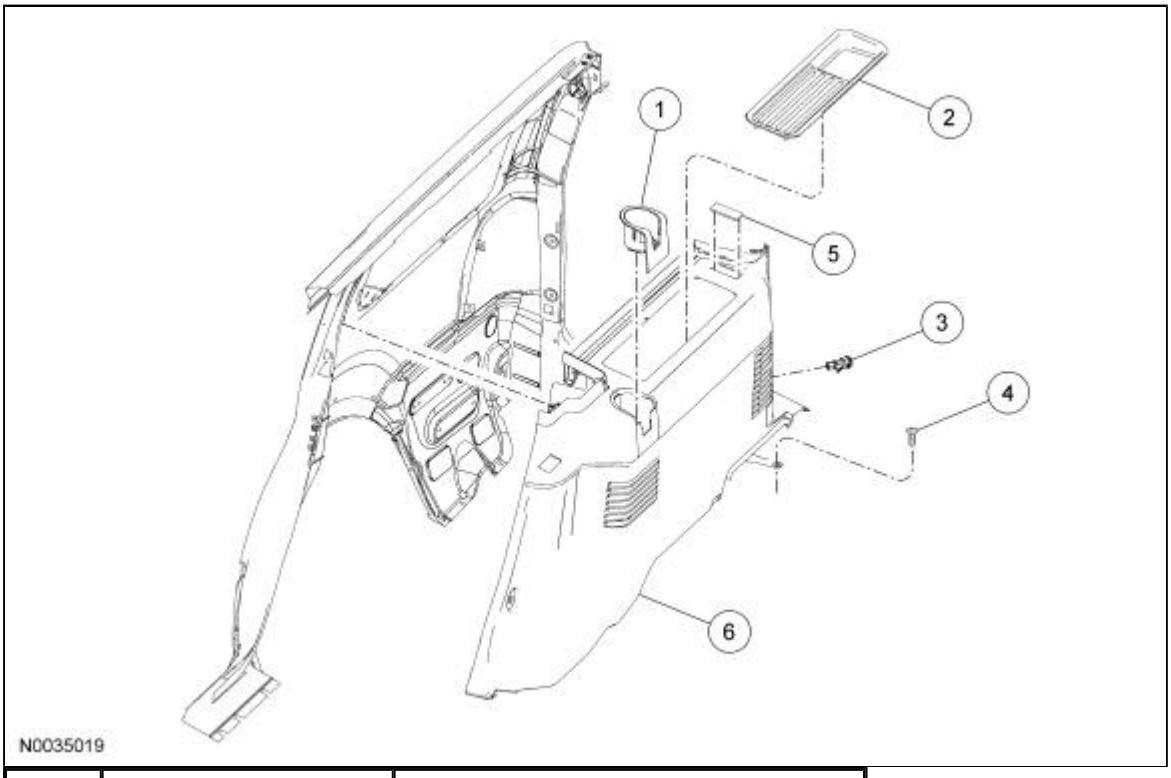


4. To install, reverse the removal procedure.

Quarter Trim Panel

Printable View (439 KB)

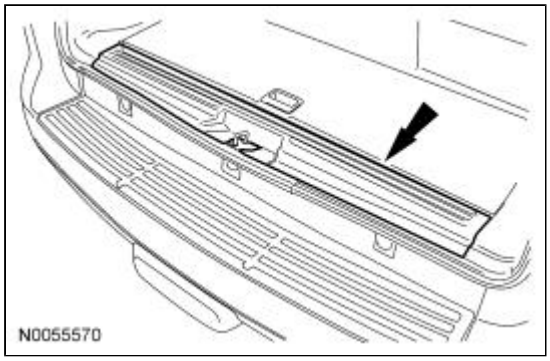
NOTE: Navigator shown, Expedition and Expedition EL/Navigator L similar.



Item	Part Number	Description
1	13560A	Cup holder
2	13530A	Utility tray
3	19N236B	Auxiliary power point socket
4	—	Pin-type retainer
5	601B32	Cover
6	31012A/ 31012B	Rear quarter trim panel

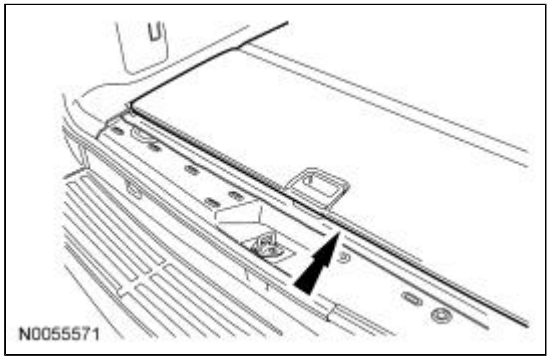
All vehicles

1. Remove the C-pillar trim panel. For additional information, refer to C-Pillar Trim Panel in this section.
2. Remove the D-pillar trim panel. For additional information, refer to D-Pillar Trim Panel in this section.
3. Remove the liftgate scuff plate by pulling upward.



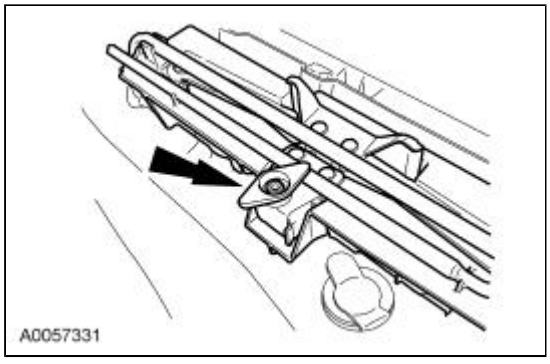
All vehicles except Expedition EL/Navigator L

4. Remove the rear floor cargo space trim panel.



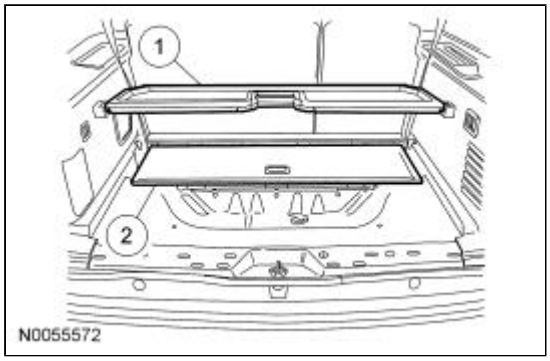
All vehicles

5. Remove the floor jack assembly.



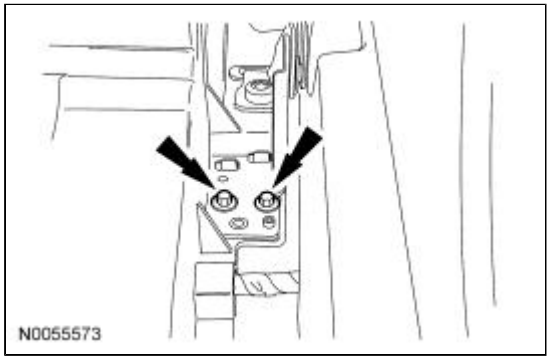
Expedition EL/Navigator L

6. Remove the cargo space trim panel.
    1. Move the cargo shelf to the upright position.
    2. Remove the cargo space trim panel.



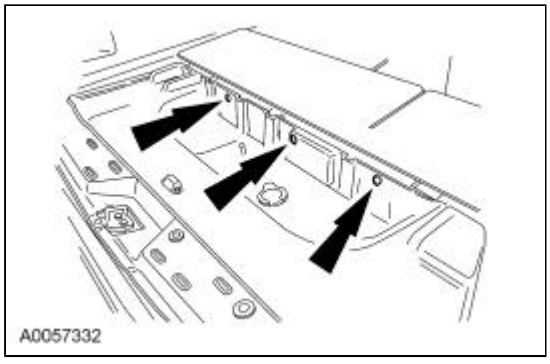
7. **NOTE:** RH cargo shelf bracket shown, LH similar.

   Remove the 4 cargo shelf bracket bolts.

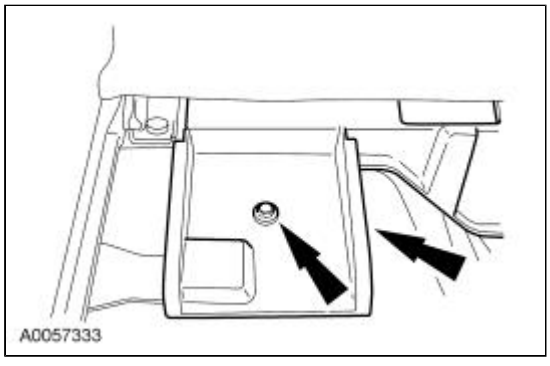


All vehicles

8. Remove the pin-type retainers and pull back the carpeting.

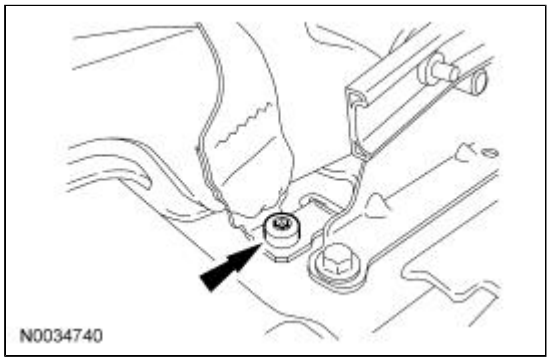


9. Remove the 2 bolts and the cargo space panel by pulling upward.



All vehicles except Expedition EL/Navigator L

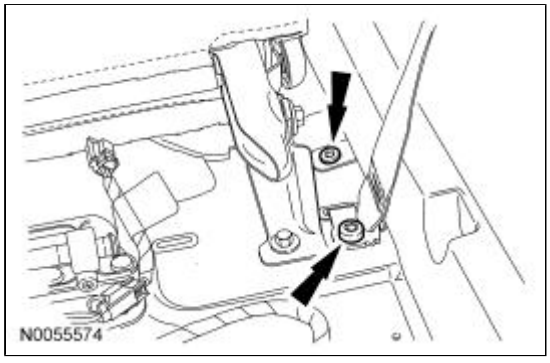
10. Remove the third row seat safety belt anchor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).



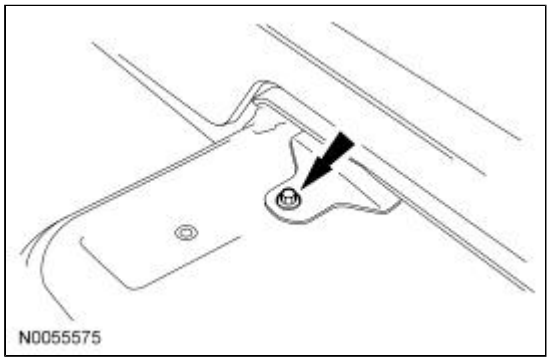
11. Remove the rear quarter trim panel pin-type retainer.

Expedition EL/Navigator L

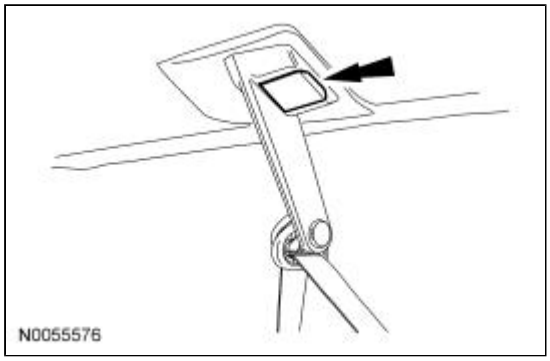
12. Remove the third row seat safety belt anchor and scrivet.
    - To install, tighten to 40 Nm (30 lb-ft).



13. Remove the rear quarter trim panel bolt.

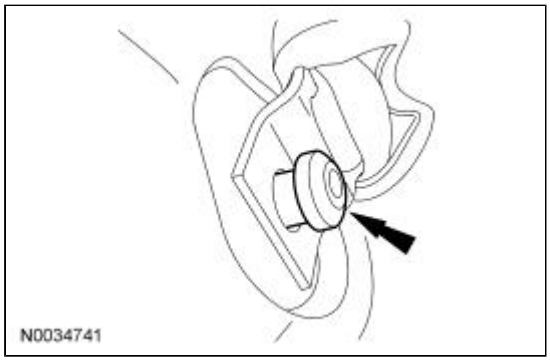


14. Open the third row seat safety belt guide bolt cover and remove the safety belt guide bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

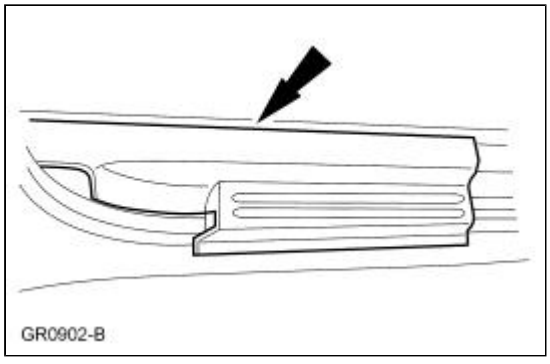


All vehicles

15. Remove the second row safety belt anchor.
    - To install, tighten to 40 Nm (30 lb-ft).

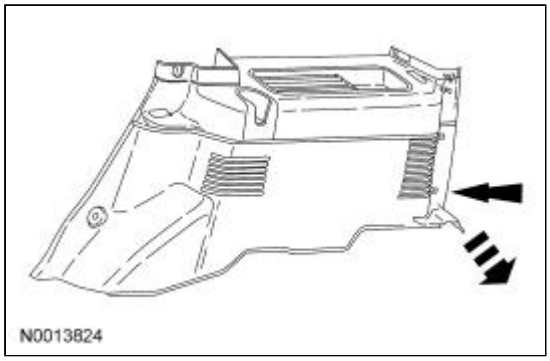


16. Remove the rear door scuff plate by pulling upward.



17. Fold the seat back of the third row seat to the full down position.

18. Remove the rear quarter trim panel.
    - Disengage the rear clip on the base of the trim panel first, by pulling the bottom rear edge toward the center of the vehicle.
    - Disengage the remaining clips.
    - If equipped, disconnect the power point, power liftgate switch or the power third row seat switch electrical connector at the rear.

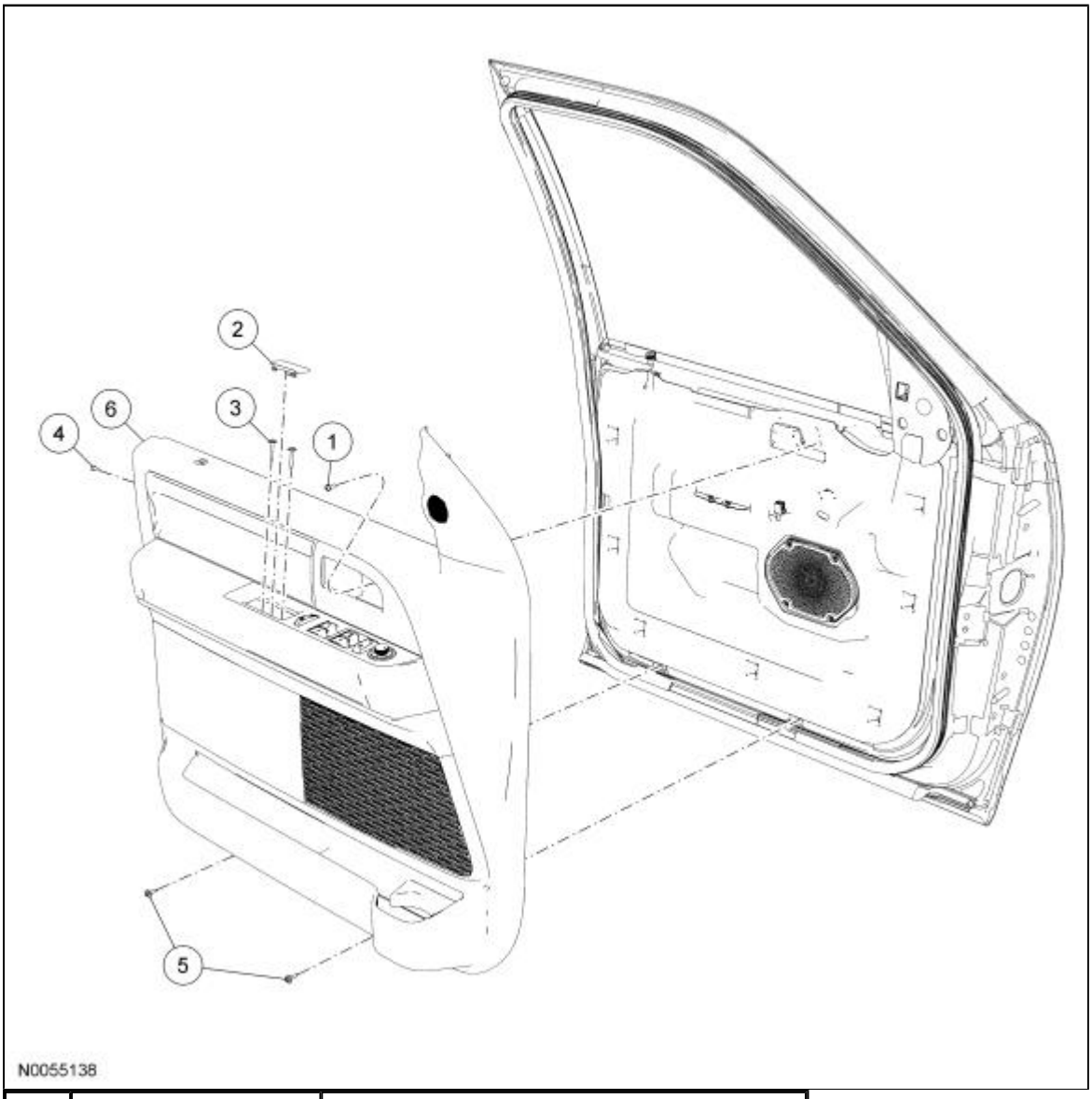


19. To install, reverse the removal procedure.

Door Trim Panel — Front

Printable View (240 KB)

NOTE: Expedition shown, Navigator similar.

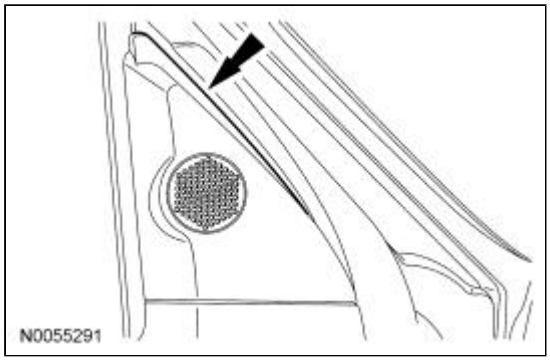


Item	Part Number	Description
1	W505156	Door handle screw
2	237W10	Front door trim panel finish cover
3	W505156	Door trim panel armrest screw (2 required)
4	W708412	Door trim panel screw
5	W708392	Lower door trim panel screws (2 required)
6	23942 RH/ 23943 LH	Front door trim panel

Removal and Installation

NOTE: Left front door shown, right front door similar.

1. Remove the door handle screw cover.
    - Use the service notch.
2. Remove the door handle screw.
3. Remove the front door trim panel finish cover.
4. Remove the 2 door trim panel screws.
5. Remove the door trim panel screw.
6. Remove the 2 lower door trim panel screws.
7. Disengage the sail panel clip.



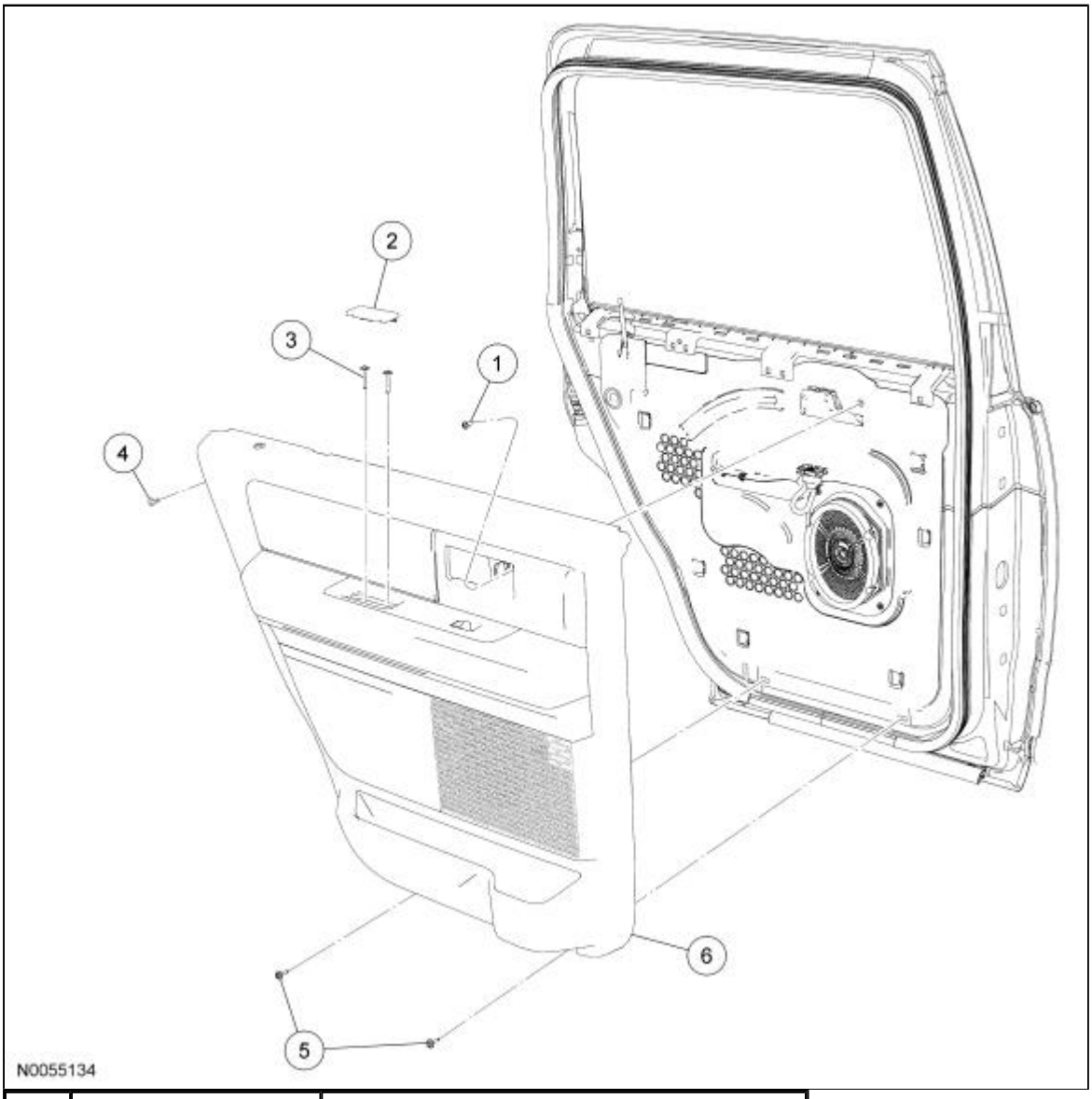
8. **CAUTION: To avoid damage to the door trim panel, lift the door trim panel by pulling directly upward on the armrest to disengage the panel clips.**

   Remove the front door trim panel.
    - Disconnect the electrical connectors.
9. To install, reverse the removal procedure.

Door Trim Panel — Rear

Printable View (216 KB)

NOTE: Expedition shown, Expedition EL and Navigator similar.



Item	Part Number	Description
1	W505156	Door handle screw
2	237W10	Rear door trim panel finish cover
3	W505156	Door trim panel armrest screw (2 required)
4	W708412	Door trim panel screw
5	W708392	Lower door trim panel screws (2 required)
6	27406 RH/ 27407 LH	Rear door trim panel

Removal and Installation

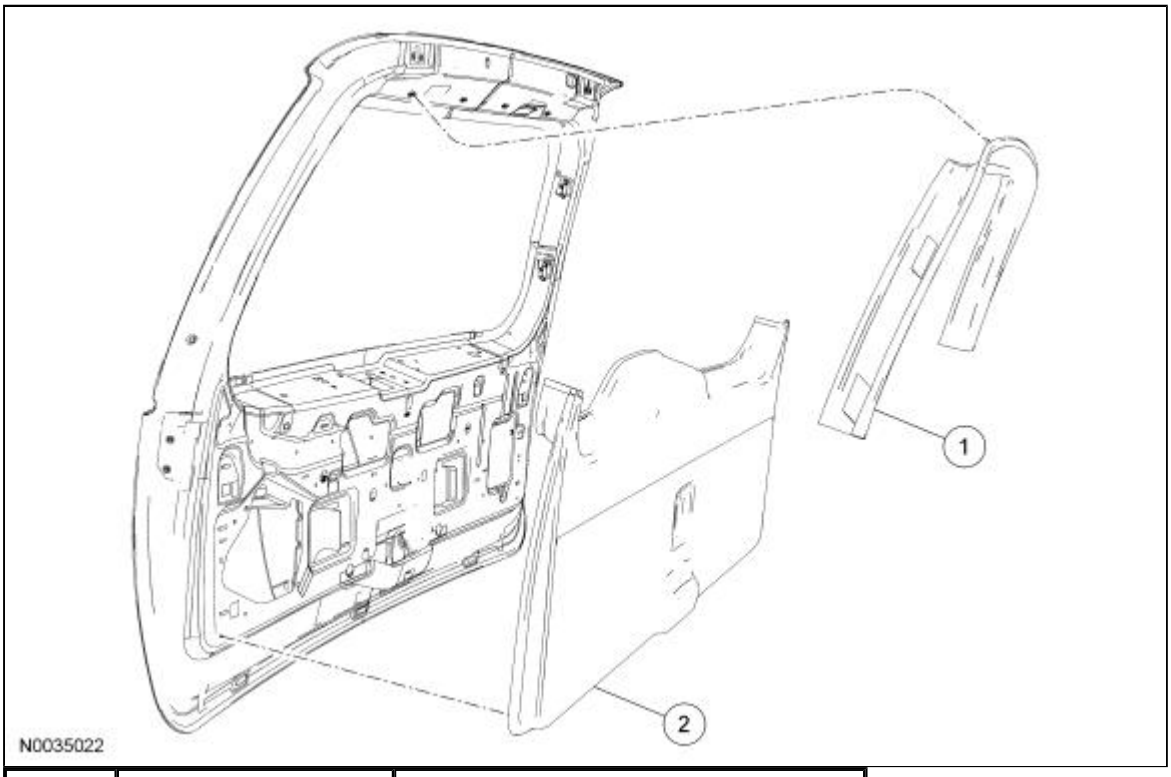
NOTE: Left rear door shown, right rear door similar.

1. Remove the door handle screw cover.
    - Use the service notch.
2. Remove the door handle screw.
3. Remove the rear door trim panel finish cover.
4. Remove the 2 door trim panel screws.
5. Remove the door trim panel screw.
6. Remove the 2 lower door trim panel screws.
7. **CAUTION: To avoid damage to the door trim panel, lift the door trim panel by pulling directly upward on the armrest to disengage the panel clips.**

   Remove the rear door trim panel.
    - If equipped, disconnect the electrical connectors.
8. To install, reverse the removal procedure.

Liftgate Trim Panel

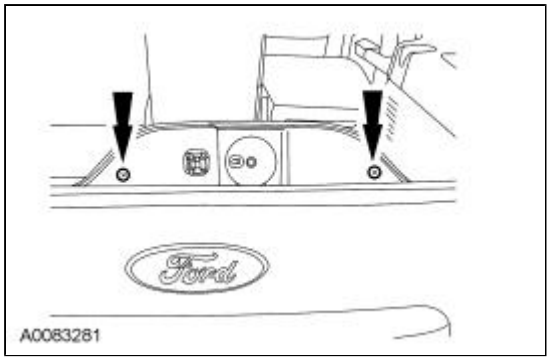
Printable View (212 KB)



Item	Part Number	Description
1	42410	Upper liftgate trim panel
2	46404	Lower liftgate trim panel

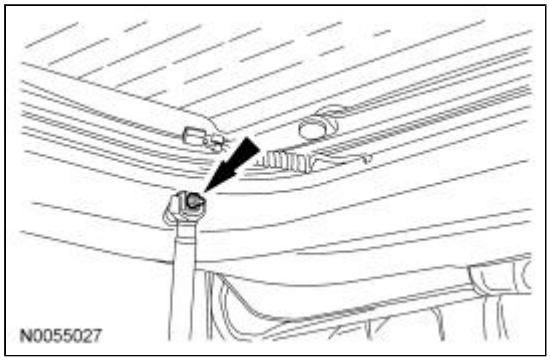
All vehicles

1. Open the liftgate and remove the scrivets.



Vehicles with power liftgate

2. Remove the power liftgate rod-to-liftgate cover and nut.
   - To install, tighten to 11 Nm (8 lb-ft).

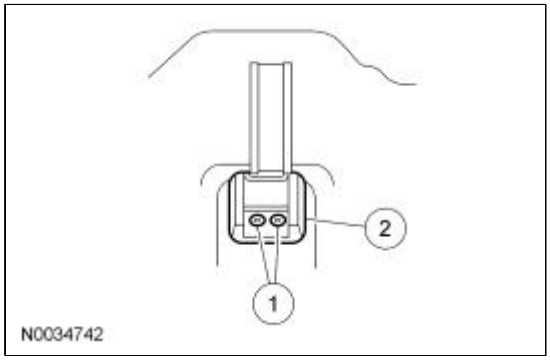


3. Remove the power liftgate rod.

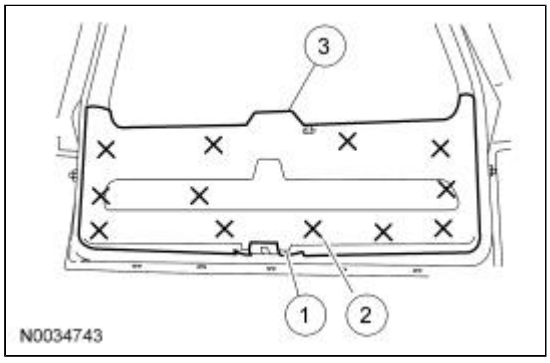
All vehicles

4. Open the liftgate and remove the upper liftgate trim panel.
    - Pull lower corners toward the center on both sides and pull down along the top.

5. Remove the assist handle.
    1. Remove the screws.
    2. Remove the assist handle.



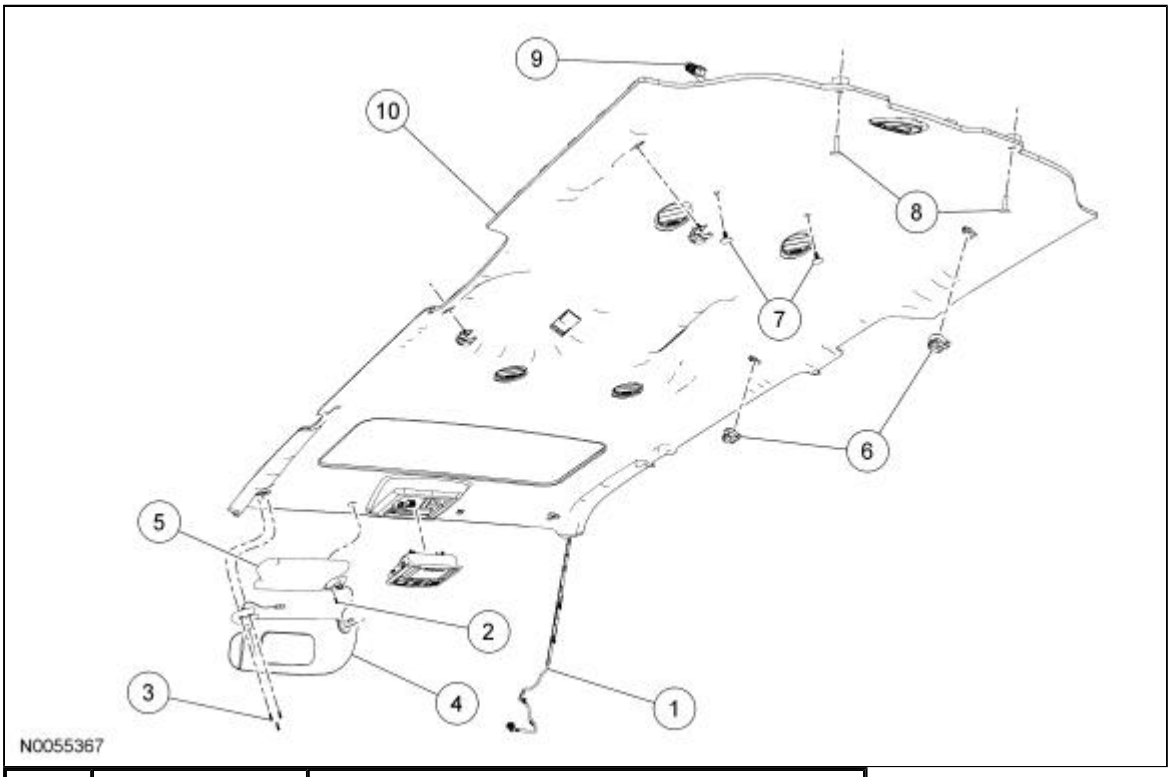
6. Remove the lower liftgate trim panel.
    1. Hold the trim panel at the center area and slightly pull on the center clips to allow a tool to access the clips.
    2. Release the 12 clips 2 to 3 at a time, starting from the right side working to the left side.
    3. Once all the clips are released, slide the liftgate trim panel forward and down, away from the sheet metal.



7. To install, reverse the removal procedure.

Headliner

Printable View (355 KB)

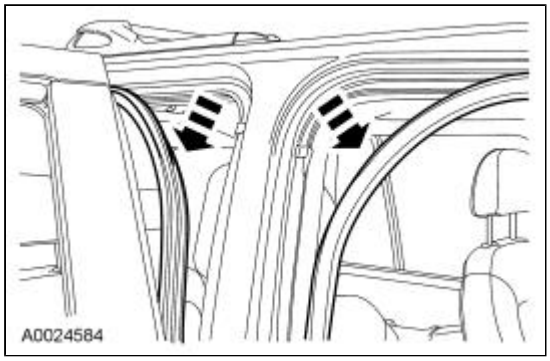


Item	Part Number	Description
1	17C712	Front headliner wiring harness
2	—	Sun visor screw
3	—	Sun visor screw (3 required)
4	04104	Sun visor
5	—	Auxiliary sun visor
6	29024	Garment hangers (4 required)
7	50908B	Center pin-type retainers (2 required)
8	50908A	Lower pin-type retainers (2 required)
9	13A409	Rear headliner wiring harness
10	51944	Headliner

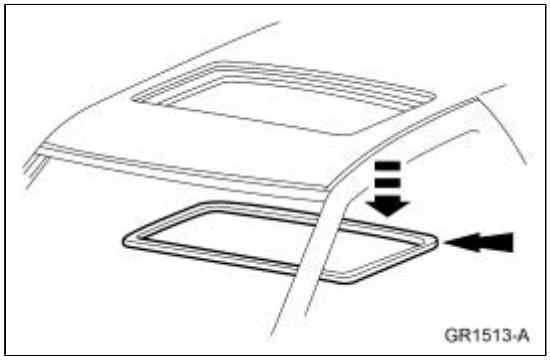
All vehicles

1. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to Section 414-01 .

2. Position aside the front and rear door seals.

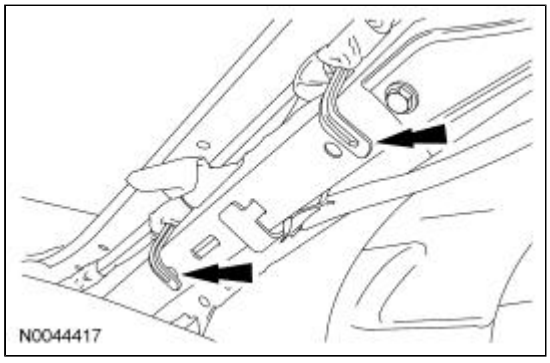


3. If equipped, remove the roof opening panel trim.

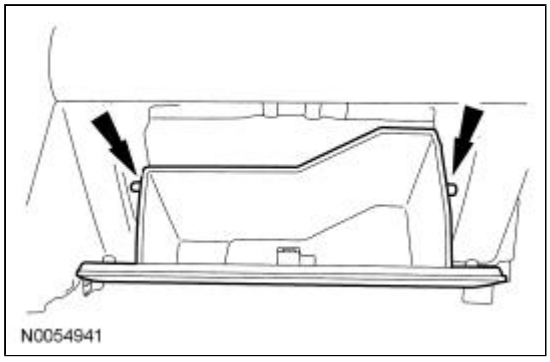


4. Remove the LH and RH A-pillar trim panels. For additional information, refer to A-Pillar Trim Panel in this section.

5. Remove the 2 wiring harness pin-type retainers from the A-pillar.

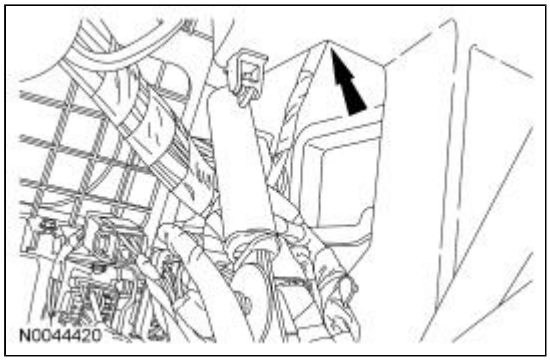


6. Open and fully lower the glove compartment.
    - Release the glove compartment tabs.



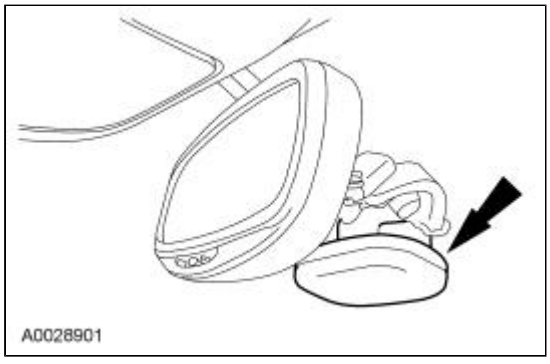
7. If equipped, disconnect the satellite radio antenna.

8. Remove the pin-type retainer and disconnect the electronic compass/auto-dimming rearview mirror electrical connector.

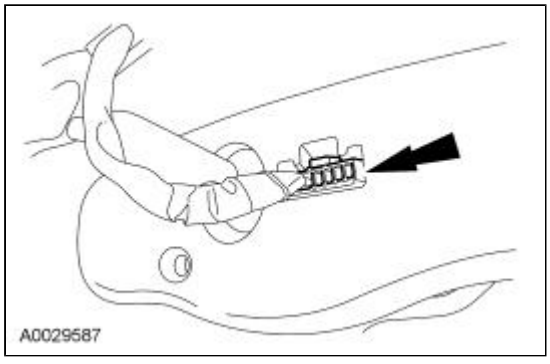


9. If equipped, separate the satellite antenna cable from the wiring harness.

10. If equipped, remove the electronic compass sensor.



11. If equipped, disconnect the auto-dimming mirror electrical connector.



12. Remove the LH and RH sun visor clips.
    - Remove the 8 screws.
    - Remove the sun visors and visor clips.
        - If equipped, disconnect the electrical connectors.

13. If equipped, remove the overhead console.
    - Disconnect the electrical connectors.

14. If equipped, remove the DVD player. For additional information, refer to Section 415-07 .

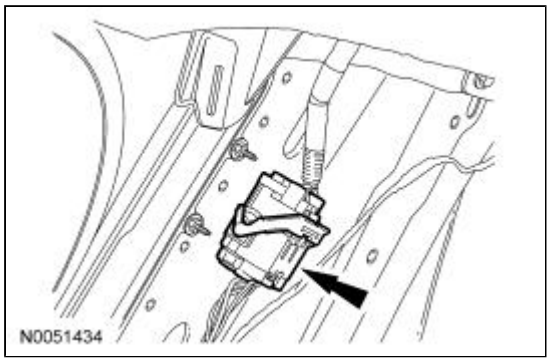
15. Remove the LH and RH B-pillar trim panels. For additional information, refer to B-Pillar Trim

Panel in this section.

16. Remove the LH and RH C-pillar trim panels. For additional information, refer to C-Pillar Trim Panel in this section.

17. Remove the LH and RH D-pillar trim panels. For additional information, refer to D-Pillar Trim Panel in this section.

18. Disconnect the rear electrical connector.



Vehicles with safety canopies

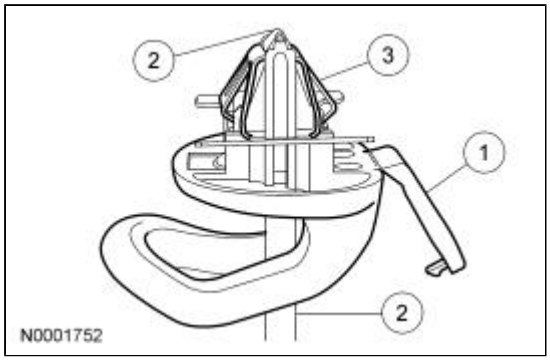
19. Remove the 4 garment hangers.
    - Open the access panel.
    - Remove the garment hanger screws.

Vehicles without safety canopies

20. **CAUTION: To prevent damage to the garment hanger retainer, use a 3/16-inch flat-blade screwdriver for this step.**

    NOTE: The garment hanger is shown without the roof sheet metal to show the metal retainer clip. The metal retainer clip will remain engaged in the sheet metal after the garment hanger is removed.

    Remove the 2 garment hangers.
    1. Open the access cover.
    2. Insert the flat-blade screwdriver fully into the garment slot.
    3. Rotate the screwdriver 90 degrees so that the screwdriver spreads the metal retainer clip. Remove the plastic garment hanger.



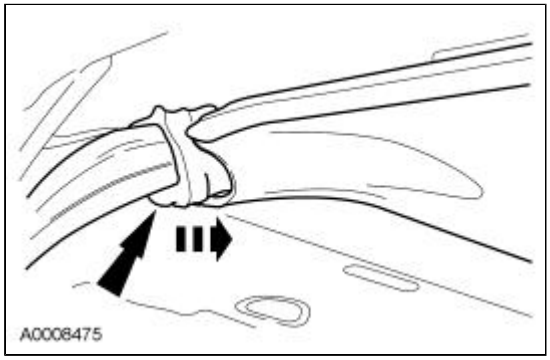
All vehicles

21. Remove the center pin-type retainers.

22. Remove the rear pin-type retainers.

Vehicles with rear climate control

23. Tilt the headliner to release the vent duct.



All vehicles

24. Remove the headliner.

25. To install, reverse the removal procedure.
    - Transfer parts as necessary.

Printable View (62 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Running board retaining bolts	23	17	—
Retractable running board step screws	12	9	—
Retractable running board wedge screw	8	—	71

Exterior Trim

Printable View (63 KB)

The exterior trim and ornamentation consists of the:

- rear door finish panel.
- body side opening moulding.
- front fender wheel opening moulding.
- grille assembly.
- front fender side finish panel.
- front door side finish panel.
- front door window outside rear moulding.
- body side window outside front moulding.
- running boards.
- power running boards (PRBs) (if equipped).

If equipped, the PRBs automatically move when the doors are opened to assist entering and exiting the vehicle.

The PRB feature may be enabled/disabled through the message center.

When the PRB is disabled (OFF), the PRB will immediately move to the stowed position regardless of the position of the doors.

When the PRB is enabled (AUTO), the PRBs will extend when the doors are opened and return to the stowed position when the doors are closed or vehicle speed is greater than 8 kph (5 mph).

When the PRBs are manually set to the deployed position (OUT), they will return to the stowed position and AUTO mode when the vehicle speed is greater than 8 kph (5 mph).

Retractable Running Board

Printable View (289 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The power running boards (PRBs) are controlled by the PRB module. The PRB motors receive motor + and - from the PRB module. The PRB module receives the door ajar messages from the controller area network (CAN) bus to determine motor function (deploy or stow).

When in AUTO mode, the PRBs will deploy when a door on the same side of the vehicle is opened. When both doors on the same side are closed, the PRBs will retract.

When in OUT mode, both PRBs will stay deployed until OUT mode is deselected, reset to AUTO mode or vehicle speed is greater than 5 mph. Mode will automatically switch back to AUTO once above 5 mph.

When an obstacle is detected, the PRB will reverse direction. If a second obstacle is detected, the PRB will reverse direction again. If a third obstacle is detected, the PRB will stop against the third obstacle until the following conditions are met:

- Change in door ajar status
- Change in the message center status (AUTO, OUT, OFF)
- Vehicle speed greater than 5 mph

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection Chart

Mechanical	Electrical

• Power running board (PRB)	• Battery junction box (BJB) fuse 7 (40A)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PRB module.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the PRB module.

9. If the DTCs retrieved are related to the concern, go to Power Running Board Module Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Power Running Board Module (PRB) Diagnostic Trouble Code (DTC) Chart

Power Running Board Module (PRB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1162	PRB Hall-Effect Sensor Power Circuit Short to Battery	Go To Pinpoint Test E .
B1163	Left PRB Hall-Effect Sensor Failure	Go To Pinpoint Test E .
B1164	PRB Hall-Effect Sensor Power Circuit Short to Ground	Go To Pinpoint Test E .
B1167	Left PRB Deploy and/or Stow Circuit Short to Battery	Go To Pinpoint Test D .
B1168	Left PRB Motor Circuit	Go To Pinpoint Test D .

	Short to Ground	
B1169	LH Motor Traveled Too Far	LH motor is freewheeling (broken geartrain linkage). INSTALL a new LH PRB motor. REFER to Retractable Running Board Motor in this section.
B116A	RH Motor Traveled Too Far	RH motor is freewheeling (broken geartrain linkage). INSTALL a new RH PRB motor. REFER to Retractable Running Board Motor in this section.
B116B	LH PRB Motor Short	Go To Pinpoint Test D .
B116C	RH PRB Motor Short	Go To Pinpoint Test D .
B116D	LH PRB Motor Line Open	Go To Pinpoint Test D .
B116E	RH PRB Motor Line Open	Go To Pinpoint Test D .
B1170	Right PRB Hall-Effect Sensor Failure	Go To Pinpoint Test E .
B1171	Left PRB Hall-Effect Signal Noisy	INSTALL a new LH PRB motor. REFER to Retractable Running Board Motor in this section.
B1172	Right PRB Hall-Effect Signal Noisy	INSTALL a new RH PRB motor. REFER to Retractable Running Board Motor in this section.
B1175	Right PRB Motor Circuit Short to Ground	Go To Pinpoint Test D .
B1178	Right PRB Deploy and/or Stow Circuit Short to Battery	Go To Pinpoint Test D .
B1317	Battery Voltage High	REFER to Section 414-00 .
B1318	Battery Voltage Low	REFER to Section 414-00 .
B1342	ECU is Faulted	INSTALL a new PRB module. REFER to Retractable Running Board Module in this section.
B2139	Data Mismatch (receive data does not match what was expected)	REFER to Section 419-10 .
B2813	LH PRB Stow Time Fail	Go To Pinpoint Test F .
B2814	LH PRB Deploy Time Fail	Go To Pinpoint Test F .
B2816	RH PRB Stow Time Fail	Go To Pinpoint Test F .
B2817	RH PRB Deploy Time Fail	Go To Pinpoint Test F .
U1900	CAN Communication Bus Fault - Receive Error	Do not install a new PRB module as part of the repair for a PRB DTC U1900 fault. The PRB is not the source of the fault when DTC U1900 is present. REFER to Section 418-00 to diagnose the MS-CAN network concern.
U2050	No Application Present	REFER to Section 418-01 to carry out programmable module installation (PMI). CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again. INSTALL a new PRB module. REFER to Section 419-10 . REPEAT the self-test.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the power running board module	• Fuse • Circuitry • Power running board (PRB) module ▪ Communication with cluster	• REMOVE battery junction box (BJB) fuse 7 (40A) and verify it is OK. If OK, CHECK circuit SBB07 (WH/RD) and ground circuit GD143 (BK/VT) for short or open. If OK, REINSTALL fuse (to drive a logic reset) and CLEAR the DTCs. REPEAT the self-test. If still unable to communicate with the PRB module, INSTALL a new PRB module. REFER to Retractable Running Board Module in this section.
• The retractable running board does not operate correctly — both running boards	• Fuse • Circuitry • Smart junction box (SJB) • PRB module • Powertrain control module (PCM) (5 mph function only) • Instrument cluster module (ICM)	• Go To Pinpoint Test A .
• The retractable running board does not operate correctly — left running board	• Circuitry • PRB mechanical assembly • PRB motor • PRB module • SJB	• Go To Pinpoint Test B .
• The retractable running board does not operate correctly — right running board	• Circuitry • PRB mechanical assembly • PRB motor • PRB module • SJB	• Go To Pinpoint Test C .

Pinpoint Tests

Pinpoint Test A: The Retractable Running Board Does Not Operate Correctly — Both Running Boards

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

The power running board (PRB) module receives power through circuit SBB07 (WH/RD) and ground through circuit GD143 (BK/VT). The LH and RH PRB motor Hall-effect sensors receive a regulated 10-volt power supply from the PRB module through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module receives door ajar and vehicle speed status over the controller area network (CAN).

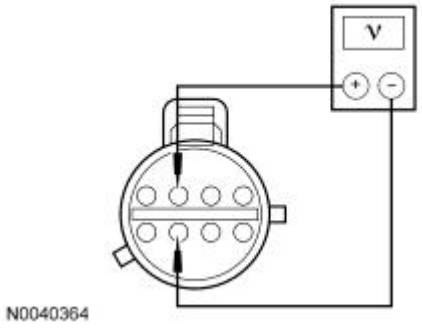
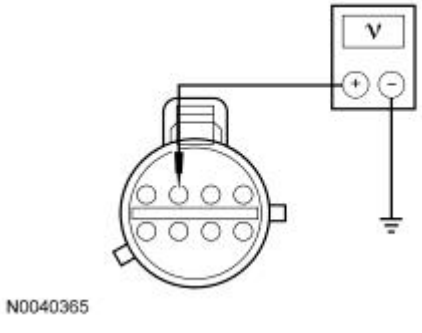
Possible Causes

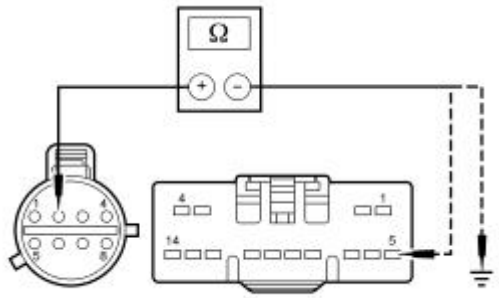
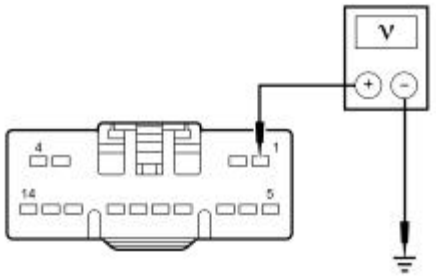
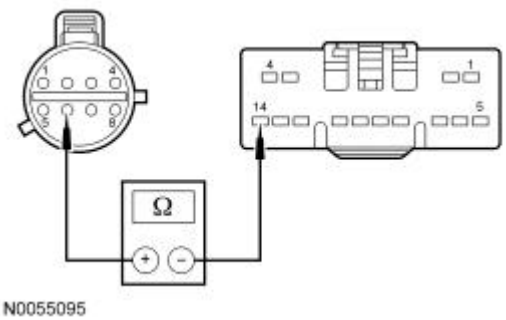
- Fuse
- Open in circuit CPR47 (GY/BN), RPR47 (BU/GN), GD143 (BK/VT) or SBB07 (WH/RD)
- Short to battery in circuit CPR47 (GY/BN)
- Short to ground in circuit CPR47 (GY/BN)
- PRB module
- Smart junction box (SJB)

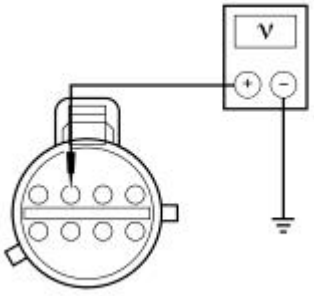
NOTE: If any door ajar or VSS-related DTCs are present, diagnose the door ajar and VSS-related DTCs before performing this pinpoint test.

PINPOINT TEST A: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — BOTH RUNNING BOARDS

Test Step	Result / Action to Take
A1 CHECK THE OPERATION OF THE POWER RUNNING BOARDS — AUTOMATIC MODE	
• Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the LH rear door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH rear door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Did both PRBs operate correctly, with no reversal of motion or noise while in motion?**	**Yes** The system is operating as designed. REVIEW operation of the PRB system with the customer. **No** GO to A2.
A2 CHECK THE OPERATION OF THE POWER RUNNING BOARDS — MANUAL MODE	
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 5 mph. • **Did both PRBs deploy?**	**Yes** GO to A4. **No** GO to A3.
A3 CHECK THE POWER RUNNING BOARDS FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce back, stops in mid travel, noisy or will not deploy or stow completely, check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the owner guide for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the LH and RH PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed.	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the owner guide for correct cleaning instructions. **No** GO to A4.

• Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Does the PRB system operate normally during all test steps?**	
A4 VERIFY THE DOOR AJAR OPERATION	
• Open and close each door, verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened and OFF when the door is closed?**	**Yes** GO to A5 . **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the PRB concern.
A5 CHECK CIRCUIT CPR47 (GY/BN) FOR VOLTAGE AND CIRCUIT RPR47 (BU/GN) FOR GROUND	
• Disconnect: Power Running Board LH Motor C3185. • Disconnect: Power Running Board RH Motor C3186. • Key in ON position. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and C3186-6, circuit RPR47 (BU/GN).  N0040364 • Open door associated with side tested. • Voltage signal will only be present for approximately one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to A11 . **No** If the voltage was less than 7 volts, GO to A6 . If the voltage was greater than 10.5 volts, GO to A10 .
A6 CHECK CIRCUIT CPR47 (GY/BN) FOR VOLTAGE	
• Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.  N0040365 • Open door associated with side tested. • Voltage signal will only be present for approximately one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to A9 . **No** GO to A7 .
A7 CHECK CIRCUIT CPR47 (GY/BN) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position.	**Yes** GO to A8 .

• Disconnect: Power Running Board Module C3313b. • Measure the resistance between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and PRB module C3313b-5, circuit CPR47 (GY/BN); and between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.  N0055094 • **Is the resistance less than 5 ohms and greater than 10,000 ohms to ground?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A8 CHECK CIRCUIT SBB07 (WH/RD) FOR VOLTAGE	
• Measure the voltage between PRB module C3313b-1, circuit SBB07 (WH/RD) and ground.  N0055096 • **Is battery voltage present?**	**Yes** GO to A11 . **No** VERIFY battery junction box (BJB) fuse 7 (40A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A9 CHECK CIRCUIT RPR47 (BU/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Measure the resistance between RH PRB motor C3186-6, circuit RPR47 (BU/GN) and PRB module C3313b-14, circuit RPR47 (BU/GN).  N0055095 • **Is the resistance less than 5 ohms?**	**Yes** GO to A11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A10 CHECK CIRCUIT CPR47 (GY/BN) FOR A SHORT TO BATTERY	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.	**Yes** REPAIR the circuit. **No** GO to A11 .

 N0040365 ● Open door associated with side tested. ● Voltage signal will only be present for approximately one second. ● **Is the voltage greater than 10.5 volts?**	
A11 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION	
● Connect: Power Running Board LH Motor C3185. ● Connect: Power Running Board RH Motor C3186. ● Visually inspect all PRB module connectors. ● Check for: ■ corrosion. ■ pushed-out pins. ● Connect all PRB module connectors and make sure they seat correctly. ● Operate the system and verify the concern is still present. ● **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Retractable Running Board Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Retractable Running Board Does Not Operate Correctly — Left Running Board

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

The power running board (PRB) module receives door ajar, operating configuration from the cluster and vehicle speed status over the controller area network (CAN). During LH PRB deployment, the PRB module supplies power to the LH PRB motor through circuit CPR41 (BU/WH) and ground through circuit CPR42 (WH). The PRB stows the LH PRB by supplying power to the LH PRB motor through circuit CPR42 (WH) and ground through circuit CPR41 (BU/WH). The PRB module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the LH PRB Hall-effect signal through circuit VPR43 (GY/BU). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

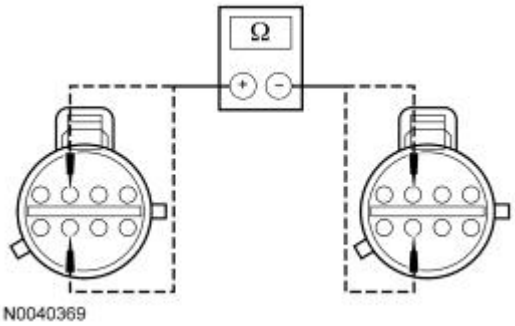
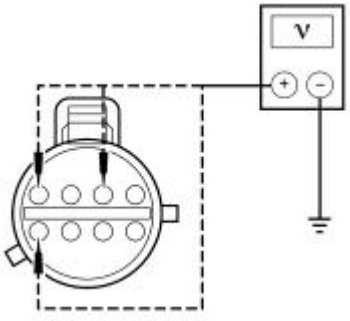
Possible Causes

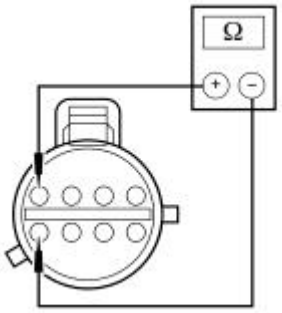
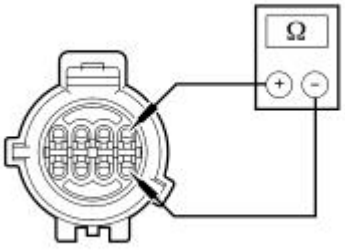
- Open in circuit CPR47 (GY/BN), RPR47 (BU/GN), VPR43 (GY/BU), CPR41 (BU/WH) or CPR42 (WH)
- Short to ground in circuit VPR43 (GY/BU), CPR41 (BU/WH) or CPR42 (WH)
- Short to battery in circuit VPR43 (GY/BU), CPR41 (BU/WH) or CPR42 (WH)

- Short circuit between CPR41 (BU/WH) and CPR42 (WH)
- PRB module
- LH PRB mechanical assembly
- LH PRB motor

PINPOINT TEST B: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — LEFT RUNNING BOARD

Test Step	Result / Action to Take
B1 CHECK THE OPERATION OF THE POWER RUNNING BOARDS — MANUAL MODE	
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 5 mph. • **Did both PRBs deploy?**	**Yes** GO to B3. **No** GO to B2.
B2 CHECK THE POWER RUNNING BOARDS FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce back, stops in mid travel, noisy or will not stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the owner guide for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the LH PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • **Does the LH PRB operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the owner guide for correct cleaning instructions. **No** GO to B3.
B3 VERIFY THE DOOR AJAR OPERATION	
• Open and close the LH front and LH rear door, and verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened, and OFF when the door is closed?**	**Yes** GO to B4. **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the PRB concern.
B4 CHECK CONTINUITY BETWEEN LH AND RH MOTORS ON CIRCUIT CPR47 (GY/BN) AND CIRCUIT RPR47 (BU/GN)	
• Disconnect: Power Running Board LH Motor C3185. • Disconnect: Power Running Board RH Motor C3186. • Key in OFF position. • Measure the resistance between LH PRB motor C3185-2, circuit CPR47 (GY/BN) and RH PRB motor C3186-2, circuit CPR47	**Yes** GO to B5. **No** REPAIR the circuit.

(GY/BN) harness side; and between LH PRB motor C3185-6, circuit RPR47 (BU/GN) and RH running PRB motor C3186-6, circuit RPR47 (BU/GN) harness side.  N0040369 • **Are the resistances less than 5 ohms between the LH and RH PRB motor connectors?**	CLEAR the DTCs. REPEAT the self-test.
B5 CHECK FOR A SHORT TO BATTERY IN CIRCUIT VPR43 (GY/BU), CPR41 (BU/WH) OR CPR42 (WH)	
• Key in OFF position. • Disconnect: Power Running Board Module C3313a. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between LH PRB motor C3185-3, circuit VPR43 (GY/BU) and ground; and between LH PRB motor C3185-5, circuit CPR41 (BU/WH) and ground; and between C3185-1, circuit CPR42 (WH) and ground.  N0040370 • **Is battery voltage present on any of the circuits tested?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .
B6 CHECK FOR AN OPEN OR SHORT TO GROUND IN CIRCUIT VPR43 (GY/BU), CPR41 (BU/WH) OR CPR42 (WH)	
• Key in OFF position. • Measure the resistances between PRB module C3313a or C3313b, harness side and LH PRB motor C3185, harness side; and between the LH PRB motor C3185, harness side and ground as follows: **LH Motor Connector** / **PRB Module Connector** / **Circuit** C3185-3 / C3313b-9 / VPR43 (GY/BU) C3185-5 / C3313a-1 / CPR41 (BU/WH) C3185-1 / C3313a-2 / CPR42 (WH) • **Are the resistances less than 5 ohms between the LH PRB motor and PRB module; and greater than 10,000 ohms between the LH PRB motor and ground?**	**Yes** GO to B7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK FOR A SHORT BETWEEN CIRCUIT CPR41 (BU/WH)	

AND CIRCUIT CPR42 (WH)	
• Measure the resistance between LH PRB motor C3185-5, circuit CPR41 (BU/WH) and C3185-1, circuit CPR42 (WH).  N0040371 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B8 CHECK THE LH RUNNING BOARD MOTOR FOR AN OPEN CIRCUIT	
• Measure the resistance between LH PRB motor C3185-5, circuit CPR41 (BU/WH), component side and C3185-1, circuit CPR42 (WH) component side.  N0055108 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new LH PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to B9 .
B9 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION	

• Connect: Power Running Board LH Motor C3185.
• Connect: Power Running Board RH Motor C3186.
• Visually inspect all PRB module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all PRB module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PRB module. REFER to Retractable Running Board Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Retractable Running Board Does Not Operate Correctly — Right Running Board

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

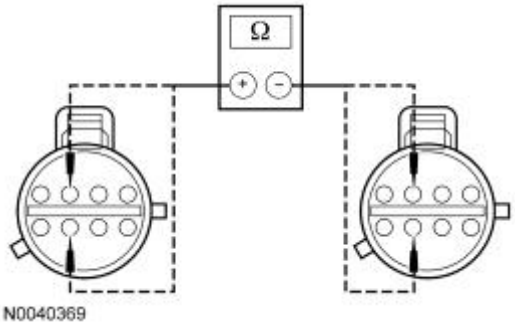
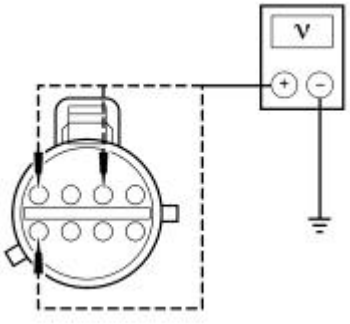
The power running board (PRB) module receives door ajar, operating configuration from the cluster and vehicle speed status over the controller area network (CAN). During RH PRB deployment, the PRB module supplies power to the RH PRB motor through circuit CPR44 (BN/WH) and ground through circuit CPR45 (VT/GY). The PRB module stows the RH PRB by supplying power to the RH PRB motor through circuit CPR45 (VT/GY) and ground through circuit CPR44 (BN/WH). The PRB module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the RH PRB Hall-effect signal through circuit VPR46 (GY/OG). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

Possible Causes

- Open in circuit CPR47 (GY/BN), RPR47 (BU/GN), VPR46 (GY/OG), CPR44 (BN/WH) or CPR45 (VT/GY)
- Short to ground in circuit VPR46 (GY/OG), CPR44 (BN/WH) or CPR45 (VT/GY)
- Short to battery in circuit VPR46 (GY/OG), CPR44 (BN/WH) or CPR45 (VT/GY)
- Short circuit between CPR44 (BN/WH) and CPR45 (VT/GY)
- PRB module
- RH PRB mechanical assembly
- RH PRB motor

PINPOINT TEST C: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — RIGHT RUNNING BOARD

Test Step	Result / Action to Take
C1 CHECK THE OPERATION OF THE POWER RUNNING BOARDS — MANUAL MODE	
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 5 mph. • **Did both PRBs deploy?**	**Yes** GO to C3 . **No** GO to C2 .
C2 CHECK THE POWER RUNNING BOARDS FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce back, stops in mid travel, noisy or will not stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the owner guide for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the RH PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Does the RH PRB operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the owner guide for correct cleaning instructions. **No** GO to C3 .
C3 VERIFY THE DOOR AJAR OPERATION	

• Open and close the RH front and RH rear door, and verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened, and OFF when the door is closed?**	**Yes** GO to C4 . **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the PRB concern.
C4 CHECK CONTINUITY BETWEEN LH AND RH MOTORS ON CIRCUIT CPR47 (GY/BN) AND CIRCUIT RPR47 (BU/GN)	
• Disconnect: Power Running Board LH Motor C3185. • Disconnect: Power Running Board RH Motor C3186. • Key in OFF position. • Measure the resistance between LH PRB motor C3185-2, circuit CPR47 (GY/BN) and RH PRB motor C3186-2, circuit CPR47 (GY/BN) harness side; and between LH PRB motor C3185-6, circuit RPR47 (BU/GN) and RH PRB motor C3186-6, circuit RPR47 (BU/GN) harness side.  N0040369 • **Are the resistances less than 5 ohms between the LH and RH PRB motor connectors?**	**Yes** GO to C5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK FOR A SHORT TO BATTERY IN CIRCUIT VPR46 (GY/OG), CPR44 (BN/WH) OR CPR45 (VT/GY)	
• Key in OFF position. • Disconnect: Power Running Board Module C3313a. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between RH PRB motor C3186-3, circuit VPR46 (GY/OG) and ground; and between RH PRB motor C3186-5, circuit CPR44 (BN/WH) and ground; and between C3186-1, circuit CPR45 (VT/GY) and ground.  N0040370 • **Is battery voltage present on any of the circuits tested?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C6 .
C6 CHECK FOR AN OPEN OR SHORT TO GROUND IN CIRCUIT VPR46 (GY/OG), CPR44 (BN/WH) OR CPR45 (VT/GY)	
• Key in OFF position. • Measure the resistances between PRB module C3313a or	**Yes** GO to C7 .

C3313b, harness side and RH PRB motor C3185, harness side; and between the RH PRB motor C3185, harness side and ground as follows:

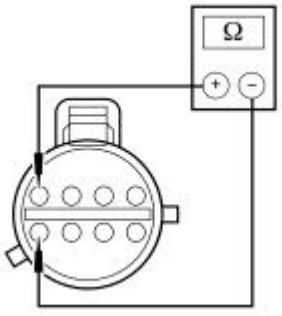
RH Motor Connector	PRB Module Connector	Circuit
C3186-3	C3313b-10	VPR46 (GY/OG)
C3186-5	C3313a-4	CPR44 (BN/WH)
C3186-1	C3313a-3	CPR45 (VT/GY)

- **Are the resistances less than 5 ohms between the RH PRB motor and PRB module; and greater than 10,000 ohms between the RH PRB motor and ground?**

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK FOR A SHORT BETWEEN CIRCUIT CPR44 (BN/WH) AND CIRCUIT CPR45 (VT/GY)

- Measure the resistance between RH PRB motor C3186-5, circuit CPR44 (BN/WH) and C3186-1, circuit CPR45 (VT/GY).



N0040371

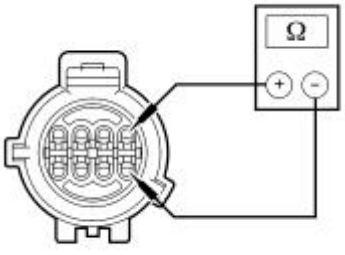
- **Is the resistance greater than 10,000 ohms?**

Yes
GO to C8.

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE RH RUNNING BOARD MOTOR FOR AN OPEN CIRCUIT

- Measure the resistance between RH PRB motor C3186-5, circuit CPR44 (BN/WH), component side and C3186-1, circuit CPR45 (VT/GY) component side.



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- **Is the resistance greater than 10,000 ohms?**

Yes
INSTALL a new RH PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test.

No
GO to C9.

C9 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION

- Connect: Power Running Board LH Motor C3185.
- Connect: Power Running Board RH Motor C3186.
- Visually inspect all PRB module connectors.
- Check for:
  - corrosion.
  - pushed-out pins.

Yes
INSTALL a new PRB module. REFER to Retractable Running Board Module in this section. CLEAR the

• Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Retractable Running Board Does Not Operate Correctly — DTC B1167, B1168, B1178, B1175, B116B, B116D, B116C or B116E

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

During power running board (PRB) deployment, the PRB module supplies power to the PRB motor through circuit CPR41 (BU/WH) (LH) or CPR44 (BN/WH) (RH) and ground through circuit CPR42 (WH) (LH) or CPR45 (VT/GY) (RH). The PRB module stows the PRB by supplying power to the PRB motor through circuit CPR42 (WH) (LH) or CPR45 (VT/GY) (RH) and ground through circuit CPR41 (BU/WH) (LH) or CPR44 (BN/WH) (RH). The PRB module provides a regulated 10 volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the PRB Hall-effect signal through circuit VPR43 (GY/BU) (LH) or VPR46 (GY/OG) (RH). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

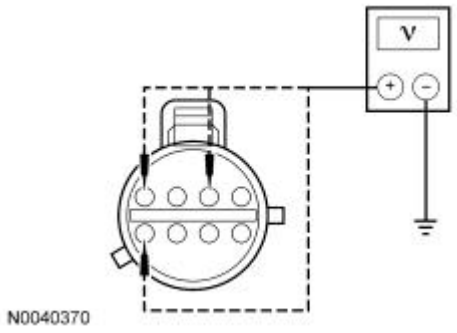
Possible Causes

- Open in circuit CPR47 (GY/BN), RPR47 (BU/GN), VPR43 (GY/BU), VPR46 (GY/OG), CPR41 (BU/WH), CPR44 (BN/WH), CPR42 (WH) or CPR45 (VT/GY)
- Short to ground in circuit VPR43 (GY/BU), VPR46 (GY/OG), CPR44 (BN/WH) or CPR45 (VT/GY)
- Short to battery in circuit VPR43 (GY/BU), VPR46 (GY/OG), CPR41 (BU/WH), CPR44 (BN/WH), CPR42 (WH) or CPR45 (VT/GY)
- Short circuit between CPR41 (BU/WH) and CPR42 (WH) or CPR44 (BN/WH) and CPR45 (VT/GY)
- LH or RH PRB motor assembly
- PRB module

PINPOINT TEST D: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — DTC B1167, B1168, B1178, B1175, B116B, B116D, B116C OR B116E

Test Step	Result / Action to Take
D1 CHECK FOR A SHORT TO BATTERY IN CIRCUIT VPR43 (GY/BU), VPR46 (GY/OG), CPR41 (BU/WH), CPR44 (BN/WH), CPR42 (WH) OR CPR45 (VT/GY)	
• Key in OFF position. • Disconnect: Power Running Board Module C3313a. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • For DTCs B1167, B1168, B116B or B116D, measure the voltage	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

between LH PRB motor C3185-3, circuit VPR43 (GY/BU) and ground; and between LH PRB motor C3185-5, circuit CPR41 (BU/WH) and ground; and between C3185-1, circuit CPR42 (WH) and ground.



- For DTCs B1178 or B1175, B116C or B116E, measure the voltage between RH PRB motor C3186-3, circuit VPR46 (GY/OG) and ground; and between RH PRB motor C3186-5, circuit CPR44 (BN/WH) and ground; and between C3186-1, circuit CPR45 (VT/GY) and ground.
- **Is battery voltage present on any of the circuits tested?**

No
GO to D2 .

D2 CHECK FOR AN OPEN OR SHORT TO GROUND IN CIRCUIT VPR43 (GY/BU), VPR46 (GY/OG), CPR41 (BU/WH), CPR44 (BN/WH), CPR42 (WH) OR CPR45 (VT/GY)

- Key in OFF position.
- For DTCs B1167, B1168, B116B or B116D, measure the resistances between PRB module C4322a or C4322b, harness side and LH PRB motor C3185, harness side; and between the LH PRB motor C3185, harness side and ground as follows:

LH Motor Connector	PRB Module Connector	Circuit
C3185-3	C3313b-9	VPR43 (GY/BU)
C3185-5	C3313a-1	CPR41 (BU/WH)
C3185-1	C3313a-2	CPR42 (WH)

- B1178 or B1175, B116C or B116E, measure the resistances between PRB module C4322a or C4322b, harness side and RH PRB motor C3186, harness side; and between the RH PRB motor C3186, harness side and ground as follows:

RH Motor Connector	PRB Module Connector	Circuit
C3186-3	C3313b-10	VPR46 (GY/OG)
C3186-5	C3313a-4	CPR44 (BN/WH)
C3186-1	C3313a-3	CPR45 (VT/GY)

- **Are the resistances less than 5 ohms between the PRB motor and PRB module; and greater than 10,000 ohms between the PRB motor and ground?**

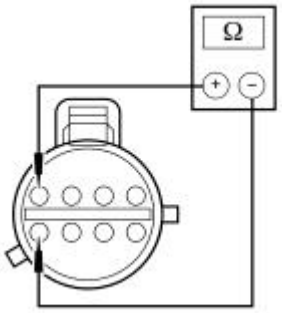
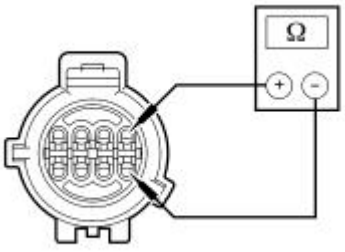
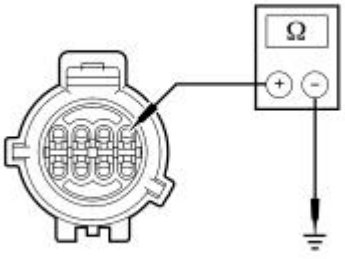
Yes
GO to D3 .

No
REPAIR the circuit.
CLEAR the DTCs.
REPEAT the self-test.

D3 CHECK FOR A SHORT BETWEEN CIRCUIT CPR41 (BU/WH) AND CPR42 (WH) OR CIRCUIT CPR44 (BN/WH) AND CPR45 (VT/GY)

- Measure the resistance between LH PRB motor C3185-5, circuit

Yes

CPR41 (BU/WH) and C3185-1, circuit CPR42 (WH); and between RH PRB motor C3186-5, circuit CPR44 (BN/WH) and C3186-1, circuit CPR45 (VT/GY).  N0040371 • **Are the resistances greater than 10,000 ohms for both measurements?**	GO to D4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK THE RUNNING BOARD MOTOR FOR AN OPEN CIRCUIT	
• Measure the resistance between LH PRB motor C3185-5, circuit CPR41 (BU/WH), component side and C3185-1, circuit CPR42 (WH), component side or between RH PRB motor C3186-5, circuit CPR44 (BN/WH), component side and C3186-1, circuit CPR45 (VT/GY) component side.  N0055108 • **Is the measured resistance greater than 10,000 ohms?**	**Yes** INSTALL a new PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to D5 .
D5 CHECK THE RUNNING BOARD MOTOR FOR A SHORT TO GROUND	
• Measure the resistance between LH PRB motor C3185-1, circuit CPR 42 (WH), component side or RH motor C3186-1, circuit CPR45 (VT/GY), component side and ground.  N0055109 • **Is the measured resistance greater than 10,000 ohms?**	**Yes** GO to D6 . **No** INSTALL a new PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION	
• Connect: Power Running Board LH Motor C3185. • Connect: Power Running Board RH Motor C3186. • Visually inspect all PRB module connectors. • Check for: ▪ corrosion.	**Yes** INSTALL a new PRB module. REFER to Retractable Running Board Module in this

■ pushed-out pins. ● Connect all PRB module connectors and make sure they seat correctly. ● Operate the system and verify the concern is still present. ● **Is the concern still present?**	section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Retractable Running Board Does Not Operate Correctly — DTC B1162, B1163, B1164 or B1170

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

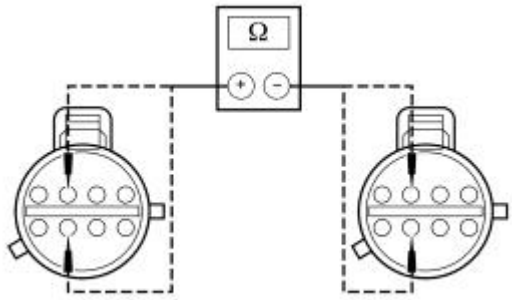
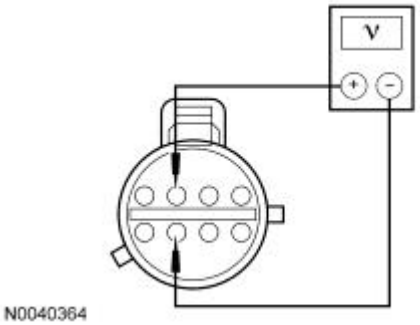
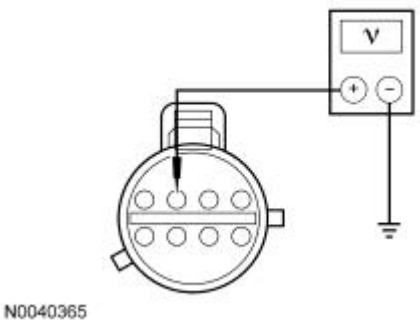
The power running board (PRB) module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the PRB Hall-effect signal through circuit VPR43 (GY/BU) (LH) or VPR46 (GY/OG) (RH). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

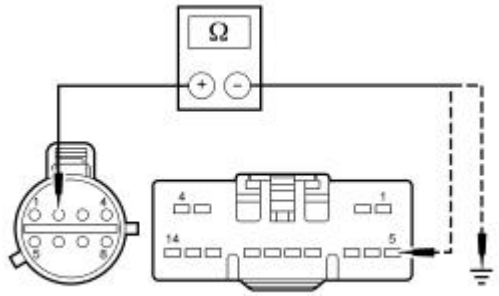
Possible Causes

- Open in circuit CPR47 (GY/BN), RPR47 (BU/GN), VPR43 (GY/BU) or VPR46 (GY/OG)
- Short to ground in circuit VPR43 (GY/BU), VPR46 (GY/OG) or CPR47 (GY/BN)
- Short to battery in circuit VPR43 (GY/BU), VPR46 (GY/OG) or CPR47 (GY/BN)
- PRB module
- LH or RH PRB motor assembly

PINPOINT TEST E: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — DTC B1162, B1163, B1164 OR B1170

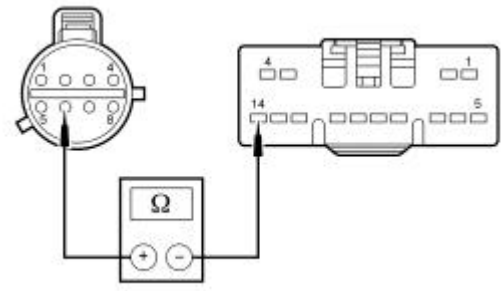
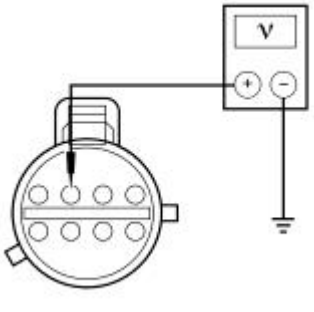
Test Step	Result / Action to Take
E1 CHECK CONTINUITY BETWEEN LH AND RH MOTORS ON CIRCUIT CPR47 (GY/BN) AND RPR47 (BU/GN)	
● Disconnect: Power Running Board LH Motor C3185. ● Disconnect: Power Running Board RH Motor C3186. ● Key in OFF position. ● Measure the resistance between LH PRB motor C3185-2, circuit CPR47 (GY/BN) and RH PRB motor C3186-2, circuit CPR47 (GY/BN) harness side; and between LH PRB motor C3185-6, circuit RPR47 (BU/GN) and RH running PRB motor C3186-6, circuit RPR47 (BU/GN) harness side.	**Yes** GO to E2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

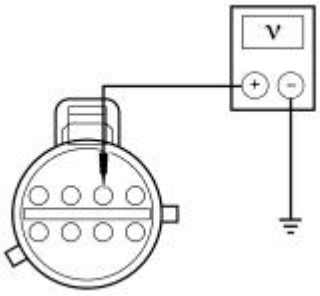
 N0040369 • **Are the resistances less than 5 ohms between the LH and RH PRB motor connectors?**	
E2 CHECK CIRCUIT CPR47 (GY/BN) FOR VOLTAGE AND CIRCUIT RPR47 (BU/GN) FOR GROUND	
• Key in ON position. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and C3186-6, circuit RPR47 (BU/GN).  N0040364 • Open door associated with side tested. • Voltage signal will only be present for approximately one second. • **Is the measured voltage between 7 and 10.5 volts?**	**Yes** GO to E7 . **No** If the voltage was less than 7 volts, GO to E3 . If the voltage was greater than 10.5 volts, GO to E6 .
E3 CHECK CIRCUIT CPR47 (GY/BN) FOR VOLTAGE	
• Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.  N0040365 • Open door associated with side tested. • Voltage signal will only be present for approximately one second. • **Is the measured voltage between 7 and 10.5 volts?**	**Yes** GO to E5 . **No** GO to E4 .
E4 CHECK CIRCUIT CPR47 (GY/BN) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Measure the resistance between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and PRB module C3313b-5, circuit CPR47 (GY/BN); and between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.	**Yes** GO to E9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



N0055094

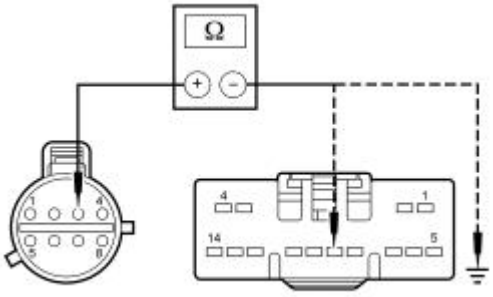
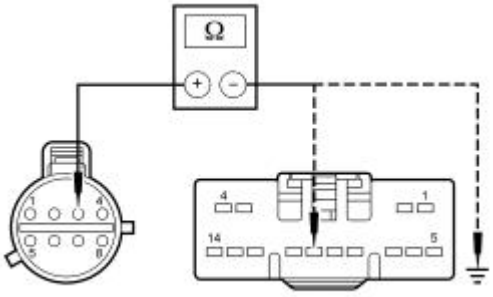
- **Is the measured resistance less than 5 ohms and greater than 10,000 ohms to ground?**

E5 CHECK CIRCUIT RPR47 (BU/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Measure the resistance between RH PRB motor C3186-6, circuit RPR47 (BU/GN) and PRB module C3313b-14, circuit RPR47 (BU/GN).  N0055095 • **Is the measured resistance less than 5 ohms?**	**Yes** GO to E9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E6 CHECK CIRCUIT CPR47 (GY/BN) FOR A SHORT TO BATTERY	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN) and ground.  N0040365 • **Is the measured voltage greater than 10.5 volts?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to E9 .
E7 CHECK FOR A SHORT TO BATTERY IN CIRCUIT VPR43 (GY/BU) OR CIRCUIT VPR46 (GY/OG)	
• Key in OFF position. • Disconnect: Power Running Board Module C3313b. • Key in ON position. • Measure the voltage between LH PRB motor C3185-3, circuit VPR43 (GY/BU) and ground; and between RH PRB motor C3186-3, circuit VPR46 (GY/OG) and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to E8 .



N0040374

- **Is battery voltage present on any of the circuits tested?**

E8 CHECK CIRCUIT VPR43 (GY/BU) AND CIRCUIT VPR46 (GY/OG) FOR AN OPEN OR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between LH PRB motor C3185-3, circuit VPR43 (GY/BU) and PRB module C3313b-9, circuit VPR43 (GY/BU); and between LH PRB motor C3185-3, circuit VPR43 (GY/BU) and ground.  N0055097 • Measure the resistance between RH PRB motor C3186-3, circuit VPR46 (GY/OG) and PRB module C3313b-10, circuit VPR46 (GY/OG); and between RH PRB motor C3186-3, circuit VPR46 (GY/OG) and ground.  N0055098 • **Are the resistances less than 5 ohms between the LH and RH PRB motor connectors and PRB module; and greater than 10,000 ohms between LH and RH PRB motor connectors and ground?**	**Yes** GO to E10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E9 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION	

• Connect: Power Running Board LH Motor C3185.
• Connect: Power Running Board RH Motor C3186.
• Disconnect all PRB module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all PRB module connectors and make sure they seat correctly.
	Yes
	INSTALL a new PRB module. REFER to Retractable Running Board Module in this section. CLEAR the DTCs. REPEAT the self-test.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
E10 CHECK THE POWER RUNNING BOARD MODULE FOR CORRECT OPERATION	

• Connect: Power Running Board LH Motor C3185.
• Connect: Power Running Board RH Motor C3186.
• Disconnect all PRB module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all PRB module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to E11 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

E11 CHECK THE POWER RUNNING BOARDS FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce back, stops in mid travel, noisy or will not deploy or stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the owner guide for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Do the LH and RH PRBs operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the pivot areas or track guides. REFER the customer to the owner guide for correct cleaning instructions. **No** INSTALL a new PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Retractable Running Board Does Not Operate Correctly — DTC B2813, B2814, B2816 or B2817

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

Normal Operation

During self-test, the power running board (PRB) module monitors the length of time it takes to deploy and stow the LH and RH PRBs. If the time exceeds 4 seconds, DTC B2813, B2814, B2816 or B2817 will be generated.

Possible Causes

- Mechanical resistance due to foreign material
- LH or RH PRB motor assembly

NOTE: Very cold weather conditions may also affect length of time to stow or deploy PRBs.

PINPOINT TEST F: THE RETRACTABLE RUNNING BOARD DOES NOT OPERATE CORRECTLY — DTC B2813, B2814, B2816 OR B2817

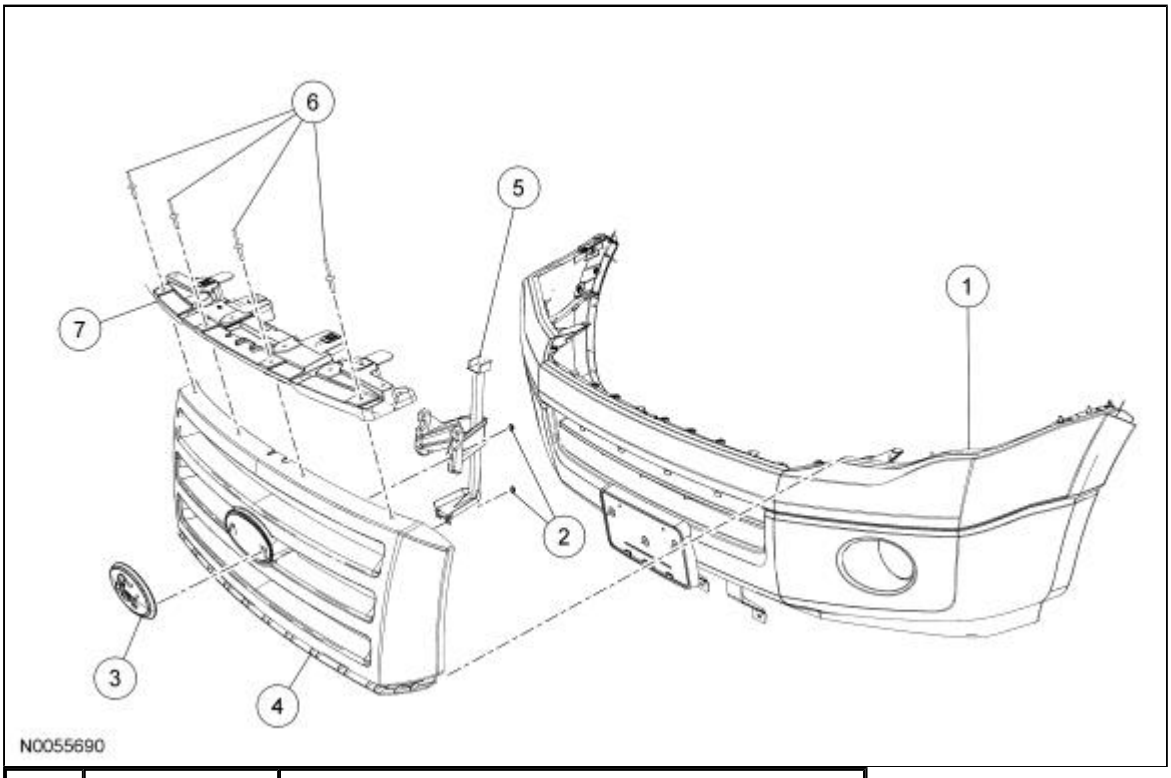
Test Step	Result / Action to Take
F1 CHECK THE OPERATION OF THE POWER RUNNING BOARDS — AUTOMATIC MODE	
• Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the LH rear door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH rear door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Did both PRBs operate correctly, with no reversal of motion, or noise while in motion?**	**Yes** The system is operating as designed. REVIEW operation of the PRB system with the customer. **No** GO to F2 .
F2 CHECK THE POWER RUNNING BOARDS FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce back, stops in mid travel, noisy or will not deploy or stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the owner guide for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the LH and RH PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door id closed. • **Does the PRB system operate normally during all**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the owner guide for correct cleaning instructions. **No** GO to F3 .

test steps?	
F3 CHECK THE POWER RUNNING BOARD MECHANICAL ASSEMBLY FOR SMOOTH OPERATION	
• Remove the PRB motor. Refer to Retractable Running Board Motor in this section. • With the PRB motor removed, check for smooth movement of PRB mechanical assembly. • **Does the PRB mechanical assembly operate smoothly?**	**Yes** Install a new PRB motor. REFER to Retractable Running Board Motor in this section. CLEAR the DTCs. REPEAT the self-test. **No** Install a new PRB mechanical assembly. REFER to Retractable Running Board in this section. CLEAR the DTCs. REPEAT the self-test.

Radiator Grille

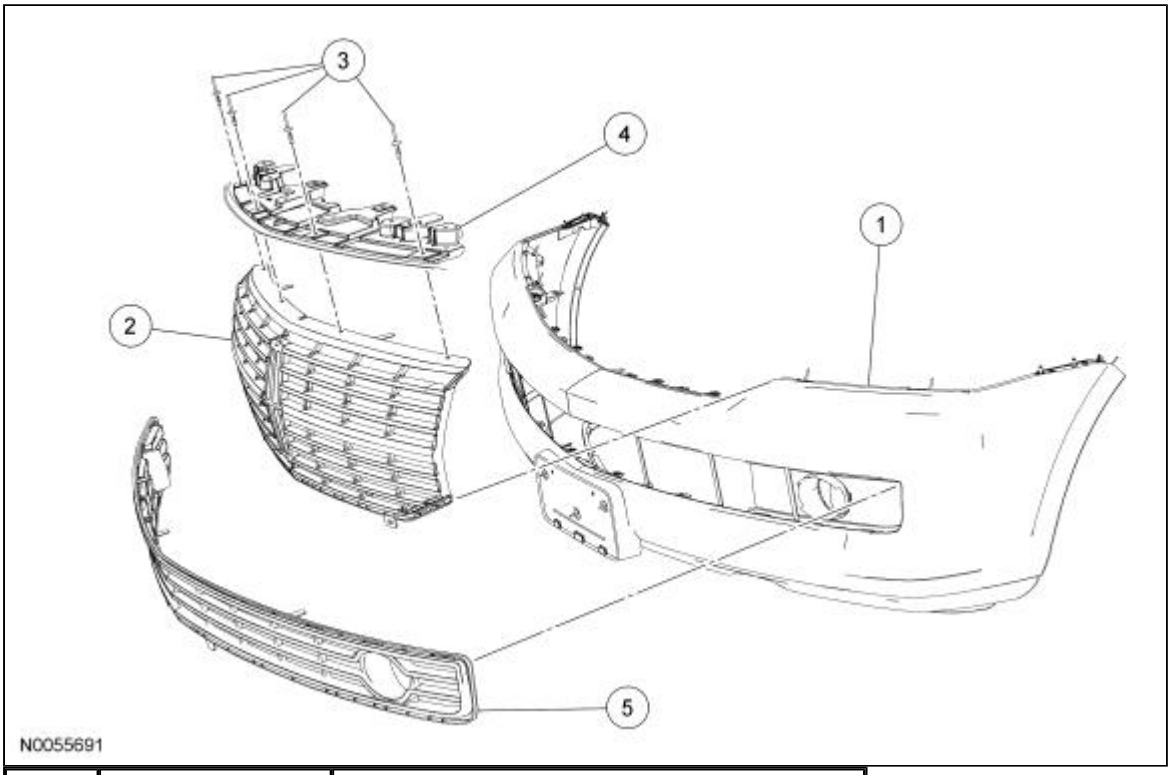
Printable View (319 KB)

Expedition



Item	Part Number	Description
1	17D957	Front bumper cover assembly
2	N800488	Bumper assembly-to-grille nuts (4 required)
3	1542528	Emblem
4	8200	Radiator grille assembly
5	16758	Bumper assembly-to-grille bracket
6	—	Rivets (4 required)
7	—	Radiator grille upper air deflector

Navigator



Item	Part Number	Description
1	17D957	Front bumper cover assembly
2	8200	Radiator grille assembly
3	—	Rivets (4 required)
4	—	Radiator grille upper air deflector
5	17D635	Lower radiator grille assembly

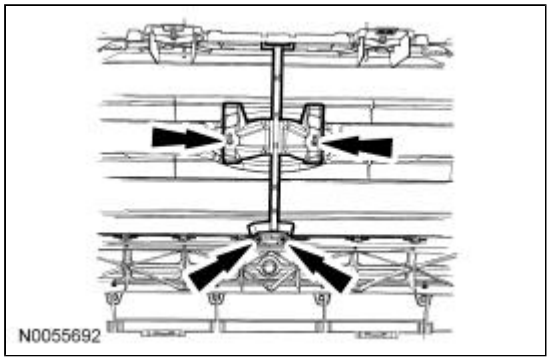
Removal and Installation

All vehicles

1. Remove the front bumper cover. For additional information, refer to Section 501-19 .

Expedition only

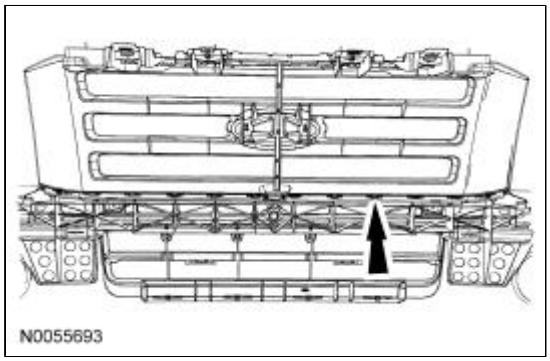
2. Remove the 4 bumper assembly-to-grille bracket retainer nuts and the bumper assembly-to-grille bracket.



All vehicles

3. **NOTE:** Expedition shown, Navigator similar.

   Remove the clips and remove the front grille.

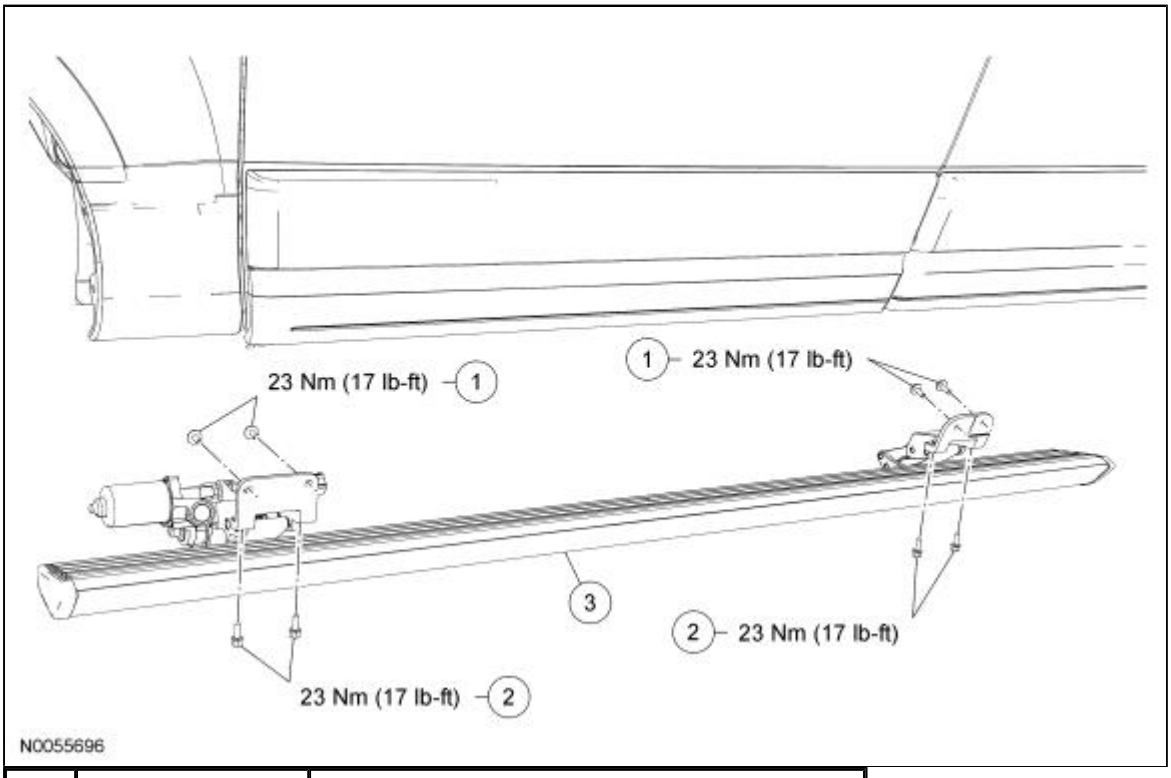


4. To install, reverse the removal procedure.

Retractable Running Board

Printable View (205 KB)

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	W701834	Retractable running board retaining upper bolts (4 required per side)
2	W701834	Retractable running board retaining lower bolts (4 required per side)
3	16B467 LH/ 16B468 RH	Retractable running board assembly

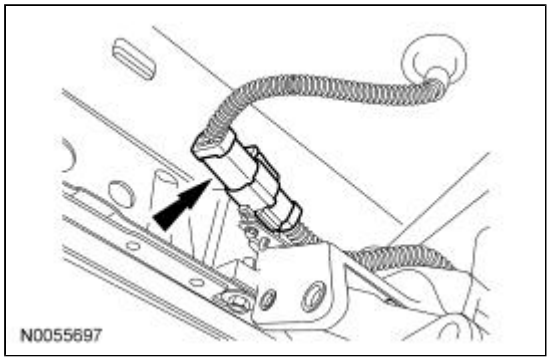
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** If the retractable running board cannot be extracted, extend the running board by hand.

   Extend the retractable running board.

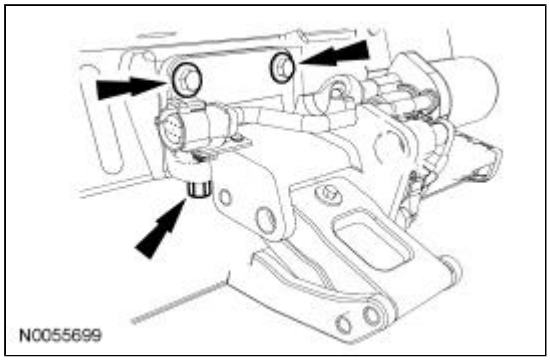
3. Disconnect the retractable running board motor electrical connector.



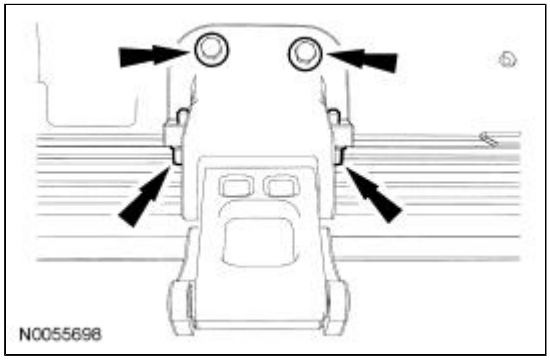
4. **CAUTION: An assistant is required to hold the retractable running board before removing the lower bolts.**

   NOTE: Only 3 bolts shown.

   Remove the front retractable running board upper and lower bolts.
   - To install, tighten to 23 Nm (17 lb-ft).



5. Remove the rear retractable running board upper and lower bolts and remove the retractable running board assembly.
   - To install, tighten to 23 Nm (17 lb-ft).



6. To install, reverse the removal procedure.

Retractable Running Board Motor

Printable View (63 KB)

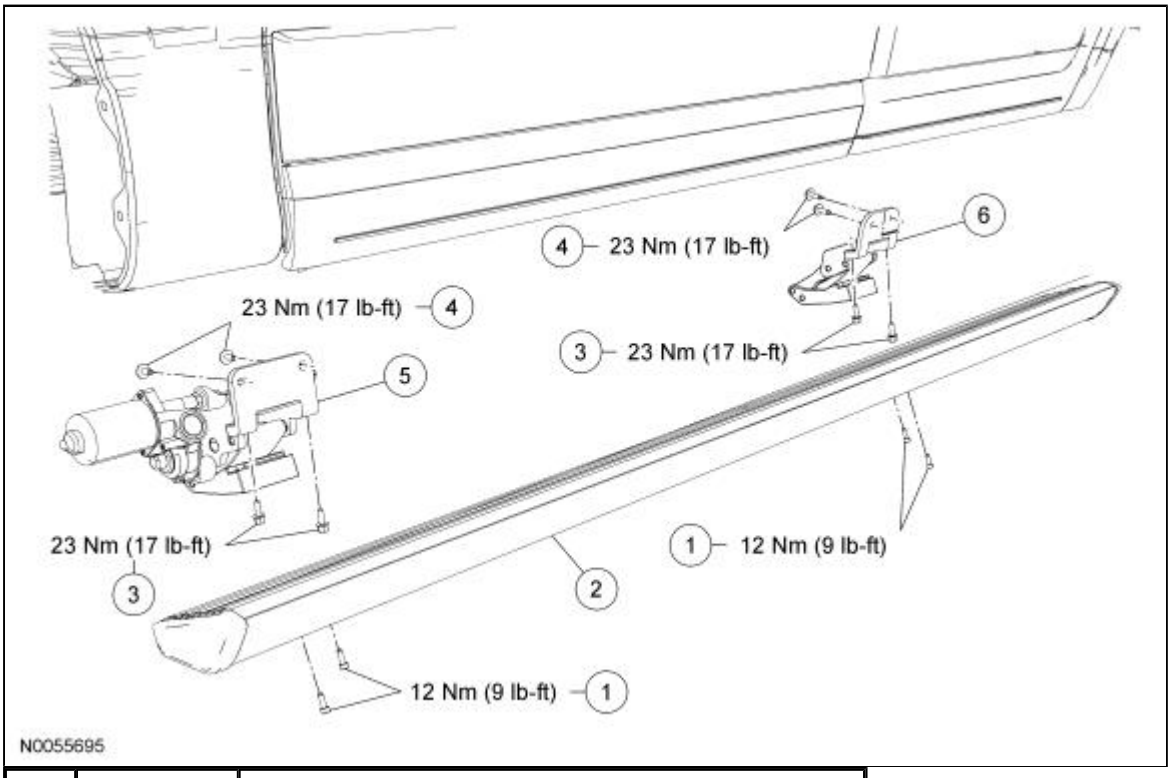
Removal and Installation

1. The retractable running board motor is serviced by installing a new retractable running board front bracket assembly. Refer to Retractable Running Board Bracket in this section.

Retractable Running Board Bracket

Printable View (222 KB)

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	—	Retractable running board step screws (4 required per side)
2	16490	Retractable running board step assembly
3	W701834	Retractable running board retaining lower bolts (4 required per side)
4	W701834	Retractable running board retaining upper bolts (4 required per side)
5	—	Retractable running board bracket assembly — front
6	—	Retractable running board bracket assembly — rear

Removal and Installation

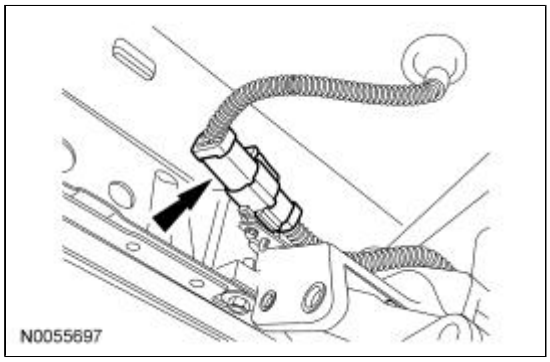
All brackets

1. Remove the retractable running board step. For additional information, refer to Retractable Running Board Step in this section.

Front bracket

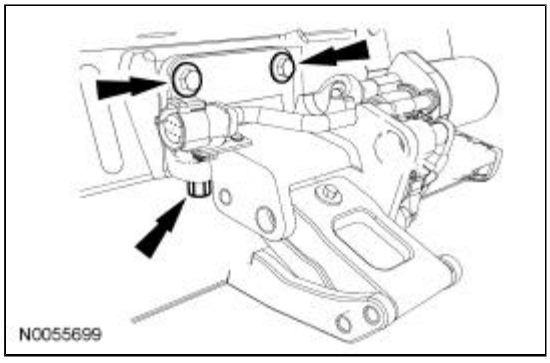
2. **NOTE:** The retractable running board motor is part of the front bracket assembly.

   Disconnect the retractable running board motor electrical connector.



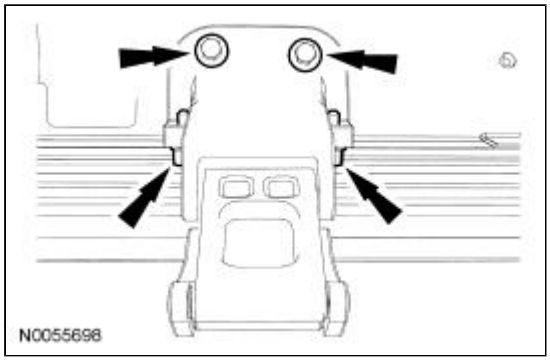
3. **NOTE:** Only 3 bolts shown.

   Remove the retractable running board front bracket 2 upper and 2 lower bolts and the front bracket assembly.
   - To install, tighten to 23 Nm (17 lb-ft).



Rear bracket

4. Remove the retractable running board rear bracket 2 upper and 2 lower bolts and the rear bracket assembly.
   - To install, tighten to 23 Nm (17 lb-ft).

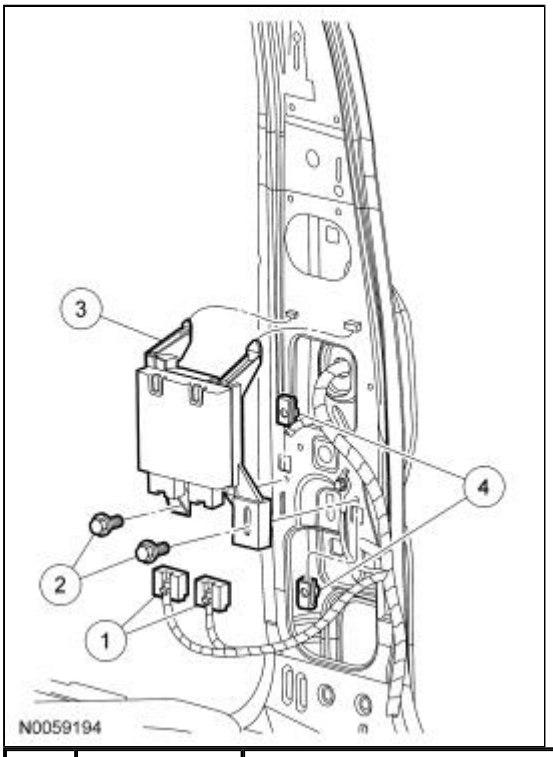


All brackets

5. To install, reverse the removal procedure.

Retractable Running Board Module

Printable View (116 KB)



Item	Part Number	Description
1	—	Electrical connectors
2	W506404	Retractable running board module retaining bolts (2 required)
3	14C177	Retractable running board module assembly
4	W520821	U-nut (2 required)

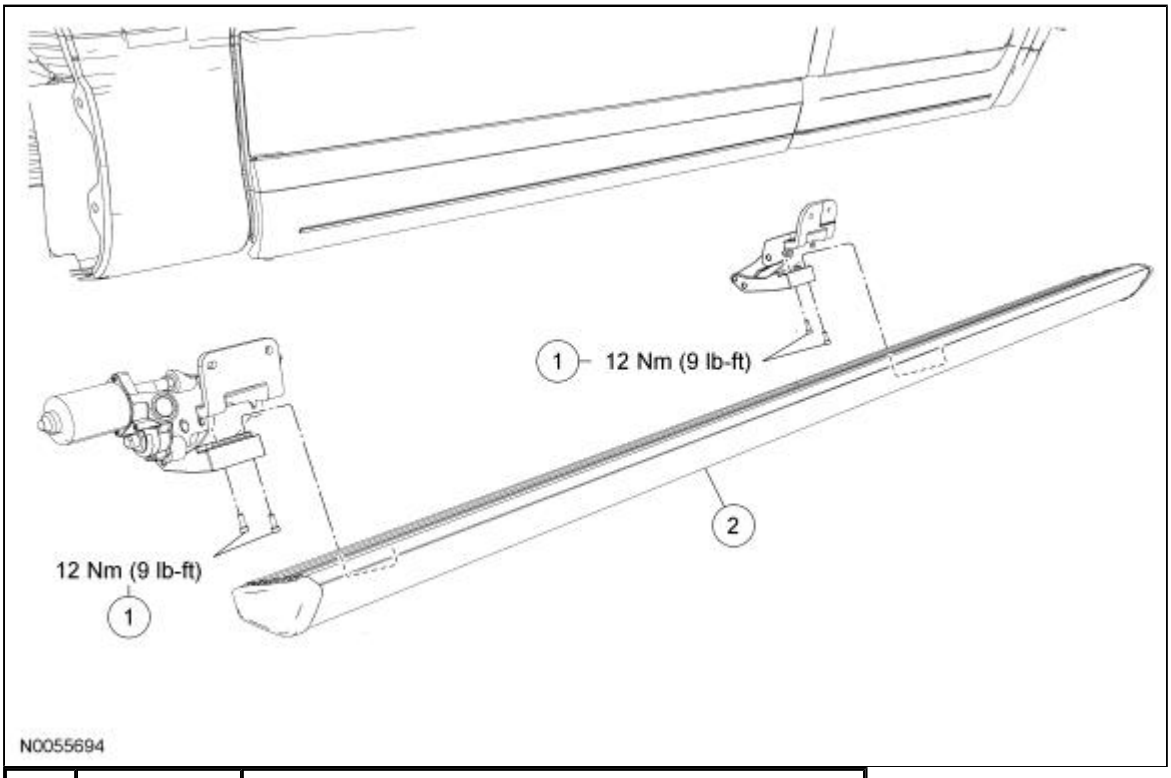
Removal and Installation

1. Remove the LH B-pillar trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the retractable running board module electrical connectors.
3. Remove the 2 bolts and the retractable running board module assembly.
4. To install, reverse the removal procedure.

Retractable Running Board Step

Printable View (159 KB)

NOTE: LH shown, RH similar.



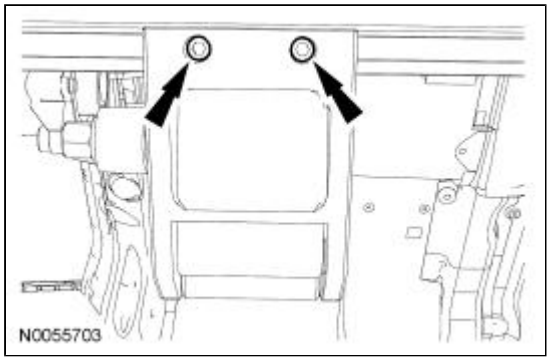
Item	Part Number	Description
1	—	Retractable running board step screws (4 required per side)
2	16490	Retractable running board step assembly

Removal and Installation

1. Extend the retractable running board.

2. **CAUTION: An assistant is required to hold the retractable running board before removing the bracket-to-step screws.**

   Remove the 2 front and 2 rear bracket-to-step screws and the retractable running board step.
   - To install, tighten to 12 Nm (9 lb-ft).



3. To install, reverse the removal procedure.

Printable View (62 KB)

General Specifications

Item	Specification
Rear View Mirror Adhesive TA-17	—

Torque Specifications

Description	Nm	lb-in
Exterior mirror nuts	7	62

Rear View Mirrors

Printable View (63 KB)

The rear view mirror components consist of:

- the interior mirror.
- the auto-dimming mirror (optional).
- the exterior power folding mirror (optional).
- the exterior mirror.
- the exterior mirror glass.
- the exterior mirror cover.
- the exterior mirror motor.
- the exterior mirror control switch.
- the memory set switch.

The interior mirror:

- is windshield mounted.
- is a manually-positioned day/night or an optional auto-dimming interior mirror.

The exterior mirrors:

- are controlled by power controls on the LH front door trim panel.
- are of a fold-away design.
- may contain turn signal indicators.
- may contain puddle or approach lamps.
- may be heated when the heated back window glass is activated.
- may have a programmable recall memory option.
- may have a power fold feature.

If equipped with power folding mirrors, they must be synchronized any time the mirrors are folded or unfolded without using the mirror control switch, or if a new power folding mirror has been installed. Refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

Rear View Mirrors

Printable View (433 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057

Principles of Operation

Auto-Dimming Interior Mirror

The interior rear view mirror may be equipped with an auto-dimming option. This feature automatically reduces the glare caused by headlamps reflecting in the mirror. The auto-dimming feature is disabled when the vehicle is in REVERSE. Power is supplied to the auto-dimming interior mirror when the ignition is in the RUN or ACC position.

The auto-dimming interior mirror has 2 photoelectric sensors that detect forward and rear light conditions. Based on these inputs, the automatic dimming feature adjusts the reflectance level of the mirror glass to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior mirror.

When the forward sensor detects daytime conditions, the rear sensor is inactive and the mirror stays in a high reflectance mode. When the forward sensor detects nighttime conditions, the rear sensor is active and detects glare from the headlights of vehicles approaching from the rear or other glare-producing light sources. To provide increased visibility when backing up, the mirror will automatically return to a high reflectance mode whenever the shifter is placed in REVERSE.

If the forward or rear sensors are blocked, the automatic dimming interior mirror might not work correctly.

Driver Seat Module

The power driver seat and power exterior mirrors are controlled by the driver seat module (DSM) only when the vehicle is equipped with the programmable/recall memory option.

On the Expedition Limited, the power fold exterior mirror option is controlled by the DSM. Before running a self-test or retrieving codes, the power fold switch must be inactive for at least 30 seconds.

The DSM system consists of the following components:

- DSM
- Driver memory seat switch
- Memory mirror switch
- Memory set switch
- Front vertical seat motor
- Rear vertical seat motor
- Driver horizontal seat motor

- Memory tilt column
- LH memory mirror
- RH memory mirror
- LH power fold motor
- RH power fold motor

The DSM incorporates multiple functions into one module and offers diagnostics to easily locate and repair concerns affecting the subsystems that it controls. If equipped with heated memory mirrors, the heated glass portion of the memory mirror is controlled by the heated back window system and is not monitored by the DSM for electrical concerns.

Power Exterior Mirror Operation Without Memory

The power exterior mirrors are controlled by the power exterior mirror switch and are operational all the time, whether the ignition switch is on or off. Using the power exterior mirror switch, the driver can adjust the driver and passenger exterior mirrors 4 ways.

Up/Down Motion

The power exterior mirrors can be moved up and down under motor control by actuating the power mirrors up/down switch. The power mirror control switch will power the driver or passenger mirror up/down motor until the switch is released or until the travel limit is reached.

Left/Right Motion

The power exterior mirrors can be moved left and right under motor control by actuating the power mirrors left/right switch. The power mirror control switch will power the driver or passenger mirror left/right motor until the switch is released or until the travel limit is reached.

Power Exterior Mirror Operation With Memory

The memory power exterior mirrors feature allows the driver to program personalized mirror positions that can be recalled using the memory switches or remote transmitter. There are 2 memory settings possible. The power driver seat positions are also stored and recalled with the memory exterior mirror positions.

The power exterior mirrors are controlled by the DSM and are operational all the time, whether the ignition switch is on or off. Using the power exterior mirror switch, the driver can adjust the driver and passenger exterior mirrors 4 ways.

Up/Down Motion

The power exterior mirrors can be moved up and down under motor control by actuating the power mirrors up/down switch. The DSM will power the driver or passenger mirror up/down motor until the switch is released or until the travel limit is reached.

Left/Right Motion

The power exterior mirrors can be moved left and right under motor control by actuating the power mirrors left/right switch. The DSM will power the driver or passenger mirror left/right motor until the switch is released or until the travel limit is reached.

Mirror Selection — Driver/Passenger

The driver can select the driver or passenger mirror to be adjusted by setting the mirror select switch to the appropriate position.

Turn Signal Mirror

The exterior mirror may be equipped with a mirror-mounted turn signal assembly. For Diagnosis and Testing or service procedures, refer to Section 417-01 .

Puddle/Approach Lamps

The exterior mirrors may be equipped with approach or puddle lamps, which will illuminate when the interior lights are turned on by opening a door or by pressing the unlock button on the remote transmitter, if equipped. For diagnosis and testing of the puddle or approach lamps, refer to Section 417-02 .

Power Folding Exterior Mirrors

Power Folding Mirrors

The power folding exterior mirrors are controlled by the driver seat module (DSM). The power folding mirror switch, which is integral to the exterior mirror control switch, sends a signal to the DSM which then supplies power and ground to the exterior mirrors to extend or retract the mirrors.

If the power folding mirrors have been folded or unfolded without using the mirror switch, they must be synchronized. Refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

Inspection and Verification

1. Verify the customer concern by operating the power exterior mirrors or memory mirrors.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Exterior mirror(s) • Interior mirror	• Central junction box (CJB) fuse 3 (7.5A) • Circuitry • Exterior mirror control switch • Exterior mirror motor • Interior mirror • Driver seat module (DSM) • Memory set switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to Section 418-00 to diagnose no response from the driver seat module (DSM).

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.

9. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DSM Diagnostic Trouble Code (DTC) Chart

DSM Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B109A	Driver Power Mirror Fold Inward Circuit Short to Battery	Go To Pinpoint Test E .
B109B	Driver Power Mirror Fold Inward Circuit Short to Ground	Go To Pinpoint Test E .
B109C	Driver Power Mirror Fold Inward Circuit Open	Go To Pinpoint Test E .
B109D	Driver Power Mirror Fold Outward Circuit Short to Battery	Go To Pinpoint Test E .
B109E	Driver Power Mirror Fold Outward Circuit Short to Ground	Go To Pinpoint Test E .
B109F	Driver Power Mirror Fold Outward Circuit Open	Go To Pinpoint Test E .
B10A0	Passenger Power Mirror Fold Inward Circuit Short to Battery	Go To Pinpoint Test E .
B10A1	Passenger Power Mirror Fold Inward Circuit Short to Ground	Go To Pinpoint Test E .
B10A2	Passenger Power Mirror Fold Inward Circuit Open	Go To Pinpoint Test E .
B10A3	Passenger Power Mirror Fold Outward Circuit Short to Battery	Go To Pinpoint Test E .
B10A4	Passenger Power Mirror Fold Outward Circuit Short to Ground	Go To Pinpoint Test E .
B10A5	Passenger Power Mirror Fold Outward Circuit Open	Go To Pinpoint Test E .
B1102	Mirror Fold Switch Circuit Short to Ground	Go To Pinpoint Test E .
B1342	ECU Is Defective	Refer to Section 419-10 .
B1530	Memory Set Switch Circuit Short	If the memory seats are also inoperative, refer to Section

	to Ground	501-10 to diagnose the seats first. If the memory seats operate correctly, Go To Pinpoint Test D .
B1534	Memory 1 Switch Circuit Short to Ground	If the memory seats are also inoperative, refer to Section 501-10 to diagnose the seats first. If the memory seats operate correctly, Go To Pinpoint Test D .
B1538	Memory 2 Switch Circuit Short to Ground	If the memory seats are also inoperative, refer to Section 501-10 to diagnose the seats first. If the memory seats operate correctly, Go To Pinpoint Test D .
B1667	Mirror Driver Up/Down Motor Stalled	Go To Pinpoint Test D .
B1668	Mirror Driver Right/Left Motor Stalled	Go To Pinpoint Test D .
B1669	Mirror Passenger Up/Down Motor Stalled	Go To Pinpoint Test D .
B1670	Mirror Passenger Right/Left Motor Stalled	Go To Pinpoint Test D .
B1735	Mirror Driver Vertical Switch Circuit Short to Battery	Go To Pinpoint Test D .
B1739	Mirror Driver Horizontal Switch Circuit Short to Battery	Go To Pinpoint Test D .
B1743	Mirror Passenger Vertical Switch Circuit Short to Battery	Go To Pinpoint Test D .
B1747	Mirror Passenger Horizontal Switch Circuit Short to Battery	Go To Pinpoint Test D .
B2312	Mirror Horizontal Feedback Potentiometer Circuit Failure	Go To Pinpoint Test D .
B2314	Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	Go To Pinpoint Test D .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	Go To Pinpoint Test D .
B2318	Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	Go To Pinpoint Test D .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	Go To Pinpoint Test D .
B2322	Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	Go To Pinpoint Test D .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	Go To Pinpoint Test D .
B2326	Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	Go To Pinpoint Test D .
B1632	Mirror Driver Left Circuit Open	Go To Pinpoint Test D .
B1633	Mirror Driver Left Circuit Short to Battery	Go To Pinpoint Test D .
B1634	Mirror Driver Left Circuit Short to Ground	Go To Pinpoint Test D .
B1636	Mirror Driver Right Circuit Open	Go To Pinpoint Test D .

B1637	Mirror Driver Right Circuit Short to Battery	Go To Pinpoint Test D .
B1638	Mirror Driver Right Circuit Short to Ground	Go To Pinpoint Test D .
B1640	Mirror Passenger Left Circuit Open	Go To Pinpoint Test D .
B1641	Mirror Passenger Left Circuit Short to Battery	Go To Pinpoint Test D .
B1642	Mirror Passenger Left Circuit Short to Ground	Go To Pinpoint Test D .
B1644	Mirror Passenger Right Circuit Open	Go To Pinpoint Test D .
B1645	Mirror Passenger Right Circuit Short to Battery	Go To Pinpoint Test D .
B1646	Mirror Passenger Right Circuit Short to Ground	Go To Pinpoint Test D .
B1774	Mirror Driver Up Circuit Open	Go To Pinpoint Test D .
B1775	Mirror Driver Up Circuit Short to Battery	Go To Pinpoint Test D .
B1776	Mirror Driver Up Circuit Short to Ground	Go To Pinpoint Test D .
B1779	Mirror Driver Down Circuit Open	Go To Pinpoint Test D .
B1780	Mirror Driver Down Circuit Short to Battery	Go To Pinpoint Test D .
B1781	Mirror Driver Down Circuit Short to Ground	Go To Pinpoint Test D .
B1783	Mirror Passenger Up Circuit Open	Go To Pinpoint Test D .
B1784	Mirror Passenger Up Circuit Short to Battery	Go To Pinpoint Test D .
B1785	Mirror Passenger Up Circuit Short to Ground	Go To Pinpoint Test D .
B1787	Mirror Passenger Down Circuit Open	Go To Pinpoint Test D .
B1788	Mirror Passenger Down Circuit Short to Battery	Go To Pinpoint Test D .
B1789	Mirror Passenger Down Circuit Short to Ground	Go To Pinpoint Test D .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The mirrors are inoperative	• Fuse • Circuitry open/shorted • Exterior mirror control switch	• Go To Pinpoint Test A .

• A single mirror is inoperative	• Circuitry open • Exterior mirror control switch • Exterior mirror motor • Exterior mirror	• Go To Pinpoint Test B .
• A single mirror does not function with switch logic	• Circuitry open/shorted • Exterior mirror motor • Exterior mirror control switch • Exterior mirror	• CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, Go To Pinpoint Test C .
• The memory mirror is inoperative	• Circuitry open/shorted • Fuse • Exterior mirror control switch • Exterior mirror motor • Exterior mirror	• Go To Pinpoint Test D .
• The power folding mirrors do not operate	• Circuitry open/shorted • Exterior mirror control switch • Exterior mirror • Driver seat module (DSM)	• Go To Pinpoint Test E .
• The heated mirror does not defrost	• Circuitry open • Exterior mirror glass	• Go To Pinpoint Test F .

• The auto-dimming mirror does not operate correctly	• Obstructed rear-facing sensor:
	  ▪ Stickers, window decals, tags
	  ▪ Non-OEM window tinting
	• Obstructed forward-facing sensor:
	  ▪ Stickers, window decals, tags
	  ▪ Non-OEM window tinting
		• If possible, REMOVE the obstruction. If the obstruction cannot be removed, Go To Pinpoint Test G to test the auto-dimming mirror for correct function.

	• Light source near or inside of vehicle	• None. Any light source the rear-facing sensor is exposed to can be considered glare.
	• Vehicle inside garage or tunnel	• None. Ambient light conditions are similar to nighttime.
	• Circuitry open • Auto-dimming	• Go To Pinpoint Test G .

	interior mirror	

Pinpoint Tests

Pinpoint Test A: The Mirrors Are Inoperative

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

NOTE: For vehicles with memory mirrors, Go To Pinpoint Test D .

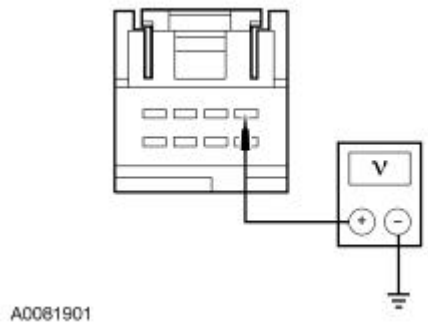
Normal Operation

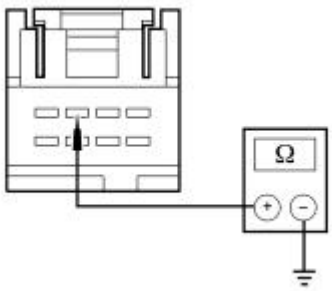
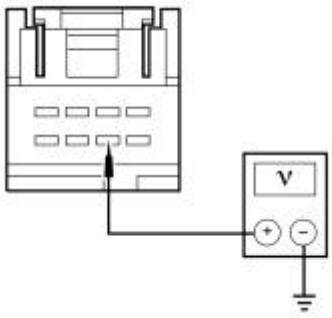
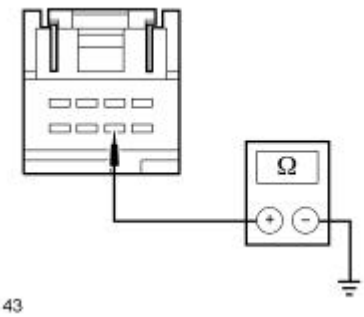
The exterior mirror control switch receives power through circuit SBP12 (GN/RD) and ground through circuit GD143 (BK/VT). The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

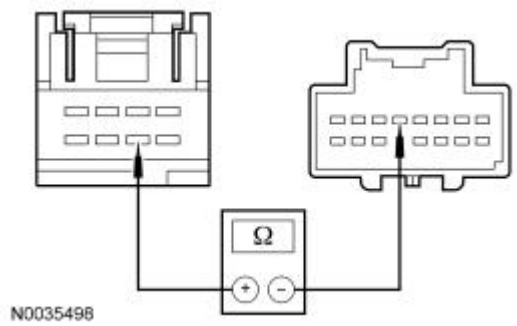
Possible Causes

- Fuse
- An open in circuits CPM23 (GY), SBP12 (GN/RD) or GD143 (BK/VT)
- A short to ground in circuit CPM23 (GY)
- A short to voltage in circuit CPM23 (GY)
- Exterior mirror control switch

PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK THE VOLTAGE TO THE EXTERIOR MIRROR CONTROL SWITCH — CIRCUIT SBP12 (GN/RD)	
• Key in OFF position. • Disconnect: Exterior Mirror Control Switch C527. • Key in ON position. • Measure the voltage between ground and exterior mirror control switch C527-1, circuit SBP12 (GN/RD).  • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR circuit SBP12 (GN/RD) for an open. TEST the system for normal operation.
A2 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between ground and exterior mirror control switch C527-3, circuit GD143 (BK/VT).	**Yes** GO to A3 . **No** REPAIR circuit GD143

 A0081902 • **Is the resistance less than 5 ohms?**	(BK/VT) for an open. TEST the system for normal operation.
A3 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO VOLTAGE • Key in ON position. • Measure the voltage between ground and exterior mirror control switch C527-6, circuit CPM23 (GY).  A0073142 • **Is voltage indicated?**	**Yes** REPAIR circuit CPM23 (GY) for a short to voltage. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO GROUND • Key in OFF position. • Measure the resistance between ground and exterior mirror control switch C527-6, circuit CPM23 (GY).  A0073143 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A5 . **No** REPAIR circuit CPM23 (GY) for a short to ground. TEST the system for normal operation.
A5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN • Disconnect: LH Exterior Mirror C516. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) and LH exterior mirror C516-4, circuit CPM23 (GY) harness side.	**Yes** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPM23 (GY) for an open. TEST the system for normal operation.



- **Is the resistance less than 5 ohms?**

Pinpoint Test B: A Single Mirror is Inoperative

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

NOTE: For vehicles with memory mirrors, Go To Pinpoint Test D .

Normal Operation

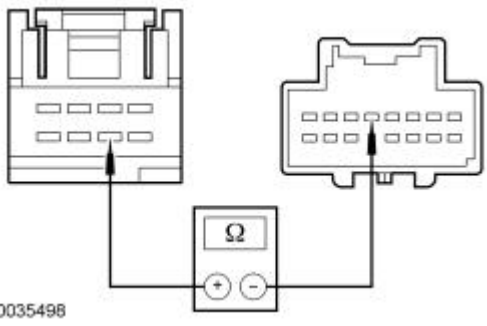
The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

Possible Causes

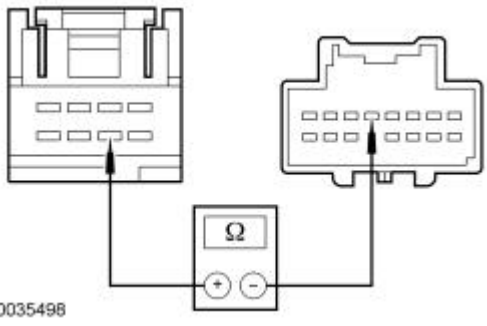
- An open in circuit CPM23 (GY)
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE

Test Step	Result / Action to Take
B1 CHECK THE LH EXTERIOR MIRROR	
• Set the exterior mirror control switch to the LH mirror position. • Use the exterior mirror control switch to operate the LH exterior mirror. • **Does the LH exterior mirror operate?**	**Yes** GO to B2 . **No** GO to B4 .
B2 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: LH Exterior Mirror C516. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) and LH exterior mirror C516-4, circuit CPM23 (GY).	**Yes** GO to B3 . **No** REPAIR circuit CPM23 (GY) for an open. TEST the system for normal operation.



- **Is the resistance less than 5 ohms?**

B3 CHECK THE EXTERIOR MIRROR CONTROL SWITCH	
• Carry out the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the exterior mirror control switch OK?**	**Yes** CHECK the RH exterior mirror jumper harness between the vehicle harness and the RH exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new RH mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new RH exterior mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation. **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation.
B4 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: LH Exterior Mirror C516. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) and LH exterior mirror C516-4, circuit CPM23 (GY) harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR circuit CPM23 (GY) for an open. TEST the system for normal operation.
B5 CHECK THE EXTERIOR MIRROR CONTROL SWITCH	
• Carry out the exterior mirror control switch component test.	**Yes** CHECK the LH exterior mirror jumper harness between the vehicle harness and the LH exterior mirror motor for

Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Is the exterior mirror control switch OK?**	open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new LH mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new LH exterior mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation. **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation.

Pinpoint Test C: A Single Mirror Does Not Function With Switch Logic

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

NOTE: For vehicles equipped with memory mirrors, Go To Pinpoint Test D .

Normal Operation

The exterior mirror control switch uses circuits CPM16 (BN/BU), CPM17 (BU/GN) and CPM23 (GY) to control LH exterior mirror movement. For the RH exterior mirror, the exterior mirror switch uses circuits CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY) to control the exterior mirror movement.

Mirror Movement

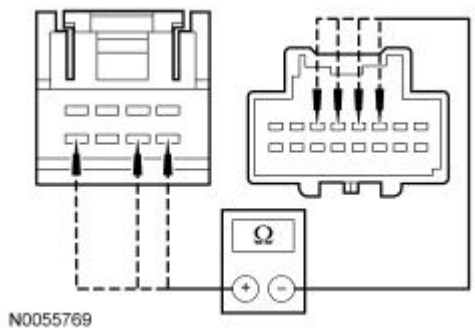
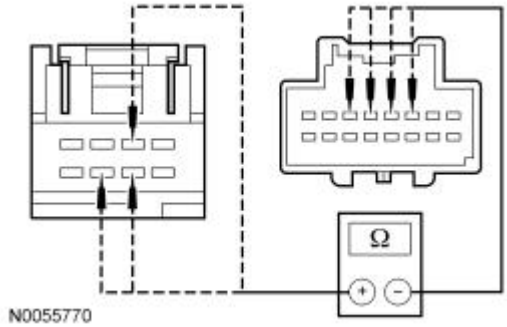
- When ground is received through circuit CPM16 (BN/BU)/CPM20 (BN/WH) and power through circuit CPM23 (GY), the LH/RH exterior mirror will operate left.
- When power is received through circuit CPM16 (BN/BU)/CPM20 (BN/WH) and ground through circuit CPM23 (GY), the LH/RH exterior mirror will operate right.
- When ground is received through circuit CPM17 (BU/GN)/CPM21 (YE/VT) and power through circuit CPM23 (GY), the LH/RH exterior mirror will operate up.
- When power is received through circuit CPM17 (BU/GN)/CPM21 (YE/VT) and ground through circuit CPM23 (GY), the LH/RH exterior mirror will operate down.

Possible Causes

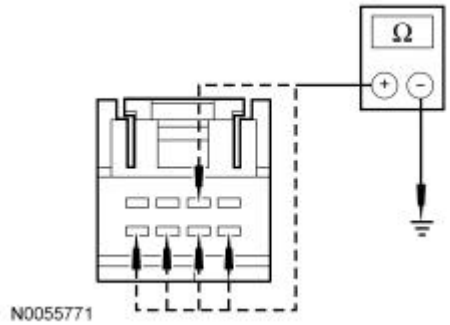
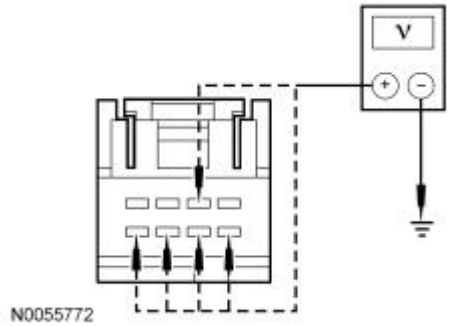
- An open in circuits CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) or CPM23 (GY)
- A short to ground in circuits CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) or CPM23 (GY)
- A short to voltage in circuits CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) or CPM23 (GY)
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST C: A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC

Test Step	Result / Action to Take
C1 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR AN OPEN	

• Key in OFF position.
• Disconnect: Inoperative Exterior Mirror (LH) C516/(RH) C622.
• **NOTE:** LH only.
• Measure the resistance between exterior mirror control switch:
  ▪ C527-6, circuit CPM23 (GY) and LH exterior mirror C516-4, circuit CPM23 (GY).
  ▪ C527-6, circuit CPM23 (GY) and LH exterior mirror C516-5, circuit CPM23 (GY).
  ▪ C527-8, circuit CPM16 (BN/BU) and LH exterior mirror C516-6, circuit CPM16 (BN/BU).
  ▪ C527-5, circuit CPM17 (BN/GN) and LH exterior mirror C516-3, circuit CPM17 (BN/GN).
 
 	
N0055769
• **NOTE:** RH only.
• Measure the resistance between exterior mirror control switch:
  ▪ C527-6, circuit CPM23 (GY) and RH exterior mirror C622-4, circuit CPM23 (GY).
  ▪ C527-6, circuit CPM23 (GY) and RH exterior mirror C622-5, circuit CPM23 (GY).
  ▪ C527-7, circuit CPM20 (BN/WH) and RH exterior mirror C622-6, circuit CPM20 (BN/WH).
  ▪ C527-2, circuit CPM21 (YE/VT) and RH exterior mirror C622-3, circuit CPM21 (YE/VT).
 
 	
N0055770
• **Are the resistances less than 5 ohms?**
	Yes
	GO to C2 .
	
	No
	REPAIR the circuit(s) for an open. TEST the system for normal operation.

C2 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between ground and	**Yes**

exterior mirror control switch: ■ C527-8, circuit CPM16 (BN/BU). ■ C527-5, circuit CPM17 (BU/GN). ■ C527-6, circuit CPM23 (GY). ■ C527-7, circuit CPM20 (BN/WH). ■ C527-2, circuit CPM21 (YE/VT).  N0055771 • **Are the resistances greater than 10,000 ohms?**	GO to C3 . **No** REPAIR the circuit(s) for a short to ground. TEST the system for normal operation.
C3 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between ground and exterior mirror control switch: ■ C527-8, circuit CPM16 (BN/BU). ■ C527-5, circuit CPM17 (BU/GN). ■ C527-6, circuit CPM23 (GY). ■ C527-7, circuit CPM20 (BN/WH). ■ C527-2, circuit CPM21 (YE/VT).  N0055772 • **Is any voltage indicated?**	**Yes** REPAIR the circuit(s) for a short to voltage. TEST the system for normal operation. **No** CHECK the suspect exterior mirror jumper harness between the vehicle harness and the suspect exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. INSTALL a new exterior rear view mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation.

Pinpoint Test D: The Memory Mirror is Inoperative

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch receives power from circuit SBP12 (GN/RD) and ground from circuit GD133 (BK). The exterior mirror control switch sends input to the driver seat module (DSM) for the LH exterior mirror by switching power and ground to circuits CPM15 (VT/OG), CPM14 (GY/BN) and CPM23 (GY) and for the RH exterior mirror by switching power and ground to circuits CPM19 (GY/OG), CPM18 (GN/BN) and CPM23 (GY). The DSM will then send the appropriate power and ground for the LH exterior mirror motor up/down circuits CPM29 (GN), CPM26 (WH) and left/right circuits CPM28 (BU/BN) and CPM27 (GY/BU) or the RH exterior mirror motor up/down circuits CPM34 (WH/BN), CPM31 (YE/GY) and left/right circuits CPM32 (WH/BU), CPM33 (WH/VT).

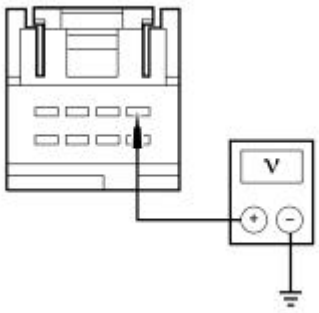
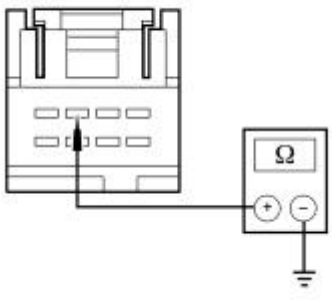
The DSM supplies the LH and RH exterior mirror feedback potentiometer reference voltage through circuit LPP06 (YE/BU) and ground through circuit RPP06 (GN). The DSM recieves feedback from the LH exterior mirror feedback potentiometer through circuit (up/down) VPM35 (YE/BU) and circuit (left/right) VPM36 (BN/YE).The DSM recieves feedback from the RH exterior mirror feedback potentiometer through circuit (up/down) VPM37 (WH/BU) and circuit (left/right) VPM38 (BN/GN).

Possible Causes

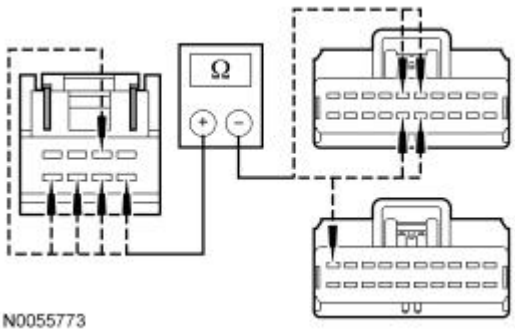
- Fuse
- An open in circuits SBP12 (GN/RD), GD133 (BK), CPM18 (GN/BN), CPM15 (VT/OG), CPM23 (GY), CPM19 (GY/OG), CPM14 (GY/BN), CPM32 (WH/BU), CPM33 (WH/VT), CPM34 (WH/BN), CPM31 (YE/GY), CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN), CPM29 (GN),VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG), VPM38 (BN/GN), LPP06 (YE/BU) or RPP06 (GN)
- A short to ground in circuits: CPM18 (GN/BN), CPM15 (VT/OG), CPM23 (GY), CPM19 (GY/OG), CPM14 (GY/BN), CPM32 (WH/BU), CPM33 (WH/VT), CPM34 (WH/BN), CPM31 (YE/GY), CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN), CPM29 (GN),VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG), VPM38 (BN/GN), LPP06 (YE/BU) or RPP06 (GN)
- A short to voltage in circuits CPM18 (GN/BN), CPM15 (VT/OG), CPM23 (GY), CPM19 (GY/OG), CPM14 (GY/BN), CPM32 (WH/BU), CPM33 (WH/VT), CPM34 (WH/BN), CPM31 (YE/GY), CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN), CPM29 (GN),VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG), VPM38 (BN/GN), LPP06 (YE/BU) or RPP06 (GN)
- A short together in circuits CPM18 (GN/BN), CPM15 (VT/OG), CPM23 (GY), CPM19 (GY/OG), CPM14 (GY/BN), CPM32 (WH/BU), CPM33 (WH/VT), CPM34 (WH/BN), CPM31 (YE/GY), CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN), CPM29 (GN),VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG), VPM38 (BN/GN), LPP06 (YE/BU) or RPP06 (GN)
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST D: THE MEMORY MIRROR IS INOPERATIVE

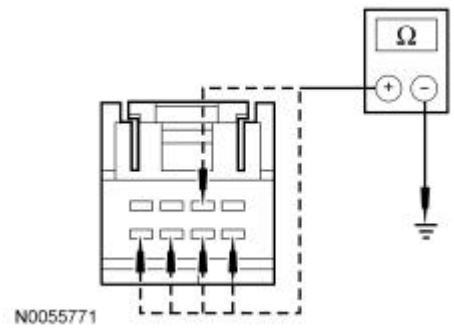
Test Step	Result / Action to Take
D1 RETRIEVE THE DTCs FROM DRIVER SEAT MODULE (DSM)	
• Use the recorded DSM DTCs from the continuous and on-demand self tests. • **Are any DTCs retrieved?**	**Yes** If DTC B1735, B1739, B1743 or B1747, CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, GO to D7 . If DTC B1632, B1636, B1774, B1779, B1640, B1644, B1783 or B1787, GO to D8 . If DTC B1633, B1637, B1775, B1780, B1641, B1645, B1784 or B1788, GO to D9 . If DTC B1634, B1638, B1776, B1781, B1642, B1646, B1785 or B1789, GO to D10 . If DTC B2316, B2312, B2324 or B2320, GO to D12 . If DTC B2318, B2314, B2326 or B2322, GO to D14 . If DTC B1669 or B1670 or if other DTCs are present diagnose them first. If no other DTCs are present, INSPECT the exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, INSTALL a new

	RH exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation. If DTC B1667 or B1668 or if other DTCs are present diagnose them first. If no other DTCs are present, INSPECT the exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, INSTALL a new LH exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation. **No** CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, GO to D2.
D2 CHECK CIRCUIT SBP12 (GN/RD) FOR VOLTAGE • Key in OFF position. • Disconnect: Exterior Mirror Control Switch C527. • Key in ON position. • Measure the voltage between ground and exterior mirror control switch C527-1, circuit SBP12 (GN/RD).  A0081901 • **Is the voltage greater than 10 volts?**	**Yes** GO to D3. **No** VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR circuit SBP12 (GN/RD) for an open. CLEAR the DTCs. TEST the system for normal operation.
D3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN • Key in OFF position. • Measure the resistance between ground and exterior mirror control switch C527-3, circuit GD133 (BK).  A0081902 • **Is the resistance less than 5 ohms?**	**Yes** CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, GO to D4. **No** REPAIR circuit GD133 (BK) for an open. CLEAR the DTCs. TEST the system for normal operation.

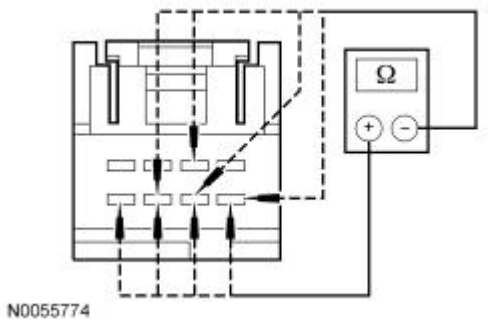
D4 CHECK CIRCUITS CPM18 (GN/BN), CPM14 (GY/BN), CPM19 (GY/OG), CPM15 (VT/OG) AND CPM23 (GY) FOR AN OPEN	

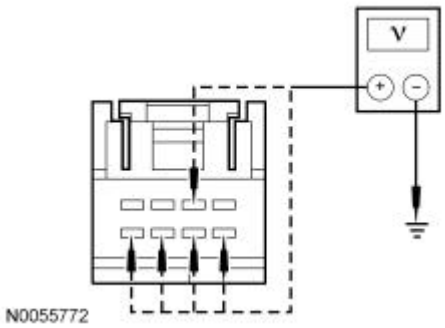
• Disconnect: Driver Seat Module (DSM) C341c and C341e.
• Measure the resistance between exterior mirror control switch:
  ▪ C527-2, circuit CPM18 (GN/BN) and DSM C341e-5, circuit CPM18 (GN/BN).
  ▪ C527-5, circuit CPM14 (GY/BN) and DSM C341e-15, circuit CPM14 (GY/BN).
  ▪ C527-6, circuit CPM23 (GY) and DSM C341e-6, circuit CPM23 (GY).
  ▪ C527-8, circuit CPM15 (VT/OG) and DSM C341e-18, circuit CPM15 (VT/OG).
  ▪ C527-7, circuit CPM19 (GY/OG) and DSM C341c-10, circuit CPM19 (GY/OG).
 
 	
• **Are the resistances less than 5 ohms?**
	Yes
	GO to D5 .
	
	No
	REPAIR the circuit(s) for an open. CLEAR the DTCs. TEST the system for normal operation.

D5 CHECK CIRCUITS CPM18 (GN/BN), CPM14 (GY/BN), CPM19 (GY/OG), CPM15 (VT/OG) AND CPM23 (GY) FOR A SHORT TO GROUND	

• Key in OFF position.
• Measure the resistance between ground and exterior mirror control switch:
  ▪ C527-2, circuit CPM18 (GN/BN).
  ▪ C527-5, circuit CPM14 (GY/BN).
  ▪ C527-6, circuit CPM23 (GY).
  ▪ C527-8, circuit CPM15 (VT/OG).
  ▪ C527-7, circuit CPM19 (GY/OG).
 
 	
• **Are the resistances greater than 10,000 ohms?**
	Yes
	GO to D6 .
	
	No
	REPAIR the circuit(s) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

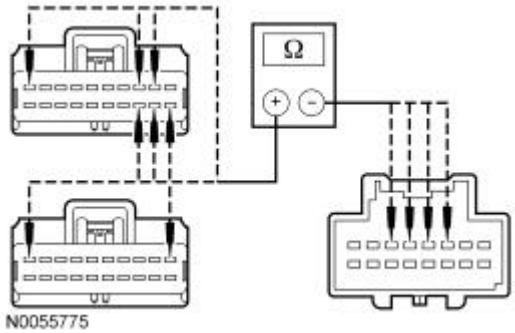
D6 CHECK CIRCUITS CPM18 (GN/BN), CPM14 (GY/BN), CPM19 (GY/OG), CPM15 (VT/OG) AND CPM23 (GY) FOR A SHORT TOGETHER	
• Measure the resistance between exterior mirror	**Yes**

control switch: ■ C527-2, circuit CPM18 (GN/BN) and C527-5, CPM14 (GY/BN). ■ C527-2, circuit CPM18 (GN/BN) and C527-6, CPM23 (GY). ■ C527-2, circuit CPM18 (GN/BN) and C527-7, CPM19 (GY/OG). ■ C527-2, circuit CPM18 (GN/BN) and C527-8, CPM15 (VT/OG). ■ C527-5, CPM14 (GY/BN) and C527-6, CPM23 (GY). ■ C527-5, CPM14 (GY/BN) and C527-7, CPM19 (GY/OG). ■ C527-5, CPM14 (GY/BN) and C527-8, CPM15 (VT/OG). ■ C527-6, CPM23 (GY) and C527-7, CPM19 (GY/OG). ■ C527-6, CPM23 (GY) and C527-8, CPM15 (VT/OG). ■ C527-7, CPM19 (GY/OG) and C527-8, CPM15 (VT/OG).  N0055774 • **Are the resistances greater than 10,000 ohms?**	CHECK the exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuits for a short together. CLEAR the DTCs. TEST the system for normal operation.
D7 CHECK CIRCUITS CPM18 (GN/BN), CPM14 (GY/BN), CPM19 (GY/OG), CPM15 (VT/OG) AND CPM23 (GY) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Exterior Mirror Control Switch C527. • Disconnect: Driver Seat Module (DSM) C341c and C341e. • Key in ON position. • Measure the voltage between ground and exterior mirror control switch: ■ C527-2, circuit CPM18 (GN/BN). ■ C527-5, circuit CPM14 (GY/BN). ■ C527-6, circuit CPM23 (GY). ■ C527-8, circuit CPM15 (VT/OG). ■ C527-7, circuit CPM19 (GY/OG).	**Yes** REPAIR the circuit(s) for a short to voltage. CLEAR the DTCs. TEST the system for normal operation. **No** CHECK the exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation.



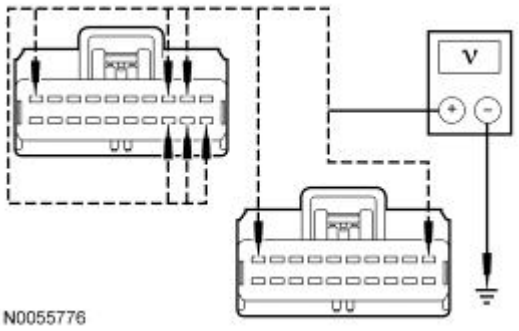
- **Is voltage indicated?**

D8 CHECK CIRCUITS CPM26 (WH), CPM29 (GN), CPM28 (BU/BN), CPM27 (GY/BU), CPM34 (WH/BN), CPM31 (YE/GY), CPM32 (WH/BU) AND CPM33 (WH/VT) FOR AN OPEN	

• Key in OFF position.
• Disconnect: Exterior Mirror (LH) C516 or (RH) C622.
• Disconnect: Driver Seat Module (DSM) C341d and C341e.
• Measure the resistance between DSM:
  ▪ (DTC B1779) C341d-1, circuit CPM26 (WH) and LH exterior mirror C516-4, circuit CPM26 (WH).
  ▪ (DTC B1774) C341e-3, circuit CPM29 (GN) and LH exterior mirror C516-3, circuit CPM29 (GN).
  ▪ (DTC B1636) C341e-10, circuit CPM28 (BU/BN) and LH exterior mirror C516-6, circuit CPM28 (BU/BN).
  ▪ (DTC B1632) C341e-13, circuit CPM27 (GY/BU) and LH exterior mirror C516-5, circuit CPM27 (GY/BU).
  ▪ (DTC B1783) C341d-10, circuit CPM34 (WH/BN) and RH exterior mirror C622-3, circuit CPM34 (WH/BN).
  ▪ (DTC B1787) C341e-2, circuit CPM31 (YE/GY) and RH exterior mirror C622-4, circuit CPM31 (YE/GY).
  ▪ (DTC B1640) C341e-12, circuit CPM32 (WH/BU) and RH exterior mirror C622-5, circuit CPM32 (WH/BU).
  ▪ (DTC B1644) C341e-11, circuit CPM33 (WH/VT) and RH exterior mirror C622-6, circuit CPM33 (WH/VT).
 
 	
• **Is the resistance less than 5 ohms?**
	Yes
	CHECK the exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation.
	
	No
	REPAIR the circuit(s) for an open. CLEAR the DTCs. TEST the system for normal operation.

D9 CHECK CIRCUITS CPM26 (WH), CPM29 (GN),	

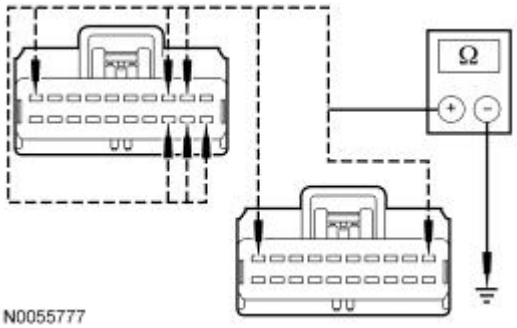
CPM28 (BU/BN), CPM27 (GY/BU), CPM34 (WH/BN), CPM31 (YE/GY), CPM32 (WH/BU) AND CPM33 (WH/VT) FOR A SHORT TO VOLTAGE	

• Key in OFF position.
• Disconnect: Exterior Mirror (LH) C516 or (RH) C622.
• Disconnect: Driver Seat Module (DSM) C341d and C341e.
• Key in ON position.
• Measure the voltage between ground and DSM:
  ▪ (DTC B1780) C341d-1, circuit CPM26 (WH).
  ▪ (DTC B1775) C341e-3, circuit CPM29 (GN).
  ▪ (DTC B1637) C341e-10, circuit CPM28 (BU/BN).
  ▪ (DTC B1633) C341e-13, circuit CPM27 (GY/BU).
  ▪ (DTC B1784) C341d-10, circuit CPM34 (WH/BN).
  ▪ (DTC B1788) C341e-2, circuit CPM31 (YE/GY).
  ▪ (DTC B1641) C341e-12, circuit CPM32 (WH/BU).
  ▪ (DTC B1645) C341e-11, circuit CPM33 (WH/VT).
 
 	
• **Is voltage indicated?**
	Yes
	REPAIR the circuit(s) for a short to voltage. CLEAR the DTCs. TEST the system for normal operation.
	
	No
	GO to D11 .

D10 CHECK CIRCUITS CPM26 (WH), CPM29 (GN), CPM28 (BU/BN), CPM27 (GY/BU), CPM34 (WH/BN), CPM31 (YE/GY), CPM32 (WH/BU) AND CPM33 (WH/VT) FOR A SHORT TO GROUND	

• Key in OFF position.
• Disconnect: Exterior Mirror (LH) C516 or (RH) C622.
• Disconnect: Driver Seat Module (DSM) C341d and C341e.
• Measure the resistance between ground and DSM:
  ▪ (DTC B1781) C341d-1, circuit CPM26 (WH).
  ▪ (DTC B1776) C341e-3, circuit CPM29 (GN).
  ▪ (DTC B1638) C341e-10, circuit CPM28 (BU/BN).
  ▪ (DTC B1634) C341e-13, circuit CPM27 (GY/BU).
  ▪ (DTC B1785) C341d-10, circuit CPM34 (WH/BN).
  ▪ (DTC B1789) C341e-2, circuit CPM31
	Yes
	GO to D11 .
	
	No
	REPAIR the circuit(s) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

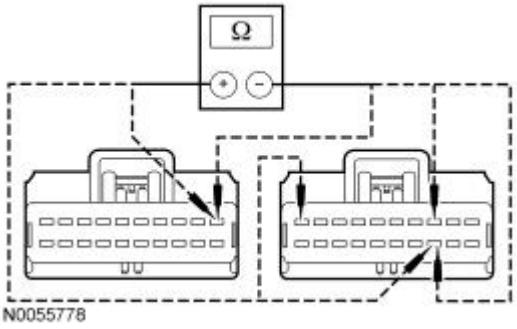
(YE/GY).
- (DTC B1642) C341e-12, circuit CPM32 (WH/BU).
- (DTC B1646) C341e-11, circuit CPM33 (WH/VT).



- **Are the resistances greater than 10,000 ohms?**

D11 CHECK CIRCUITS CPM26 (WH), CPM29 (GN), CPM28 (BU/BN), CPM27 (GY/BU), CPM34 (WH/BN), CPM31 (YE/GY), CPM32 (WH/BU) AND CPM33 (WH/VT) FOR A SHORT TOGETHER

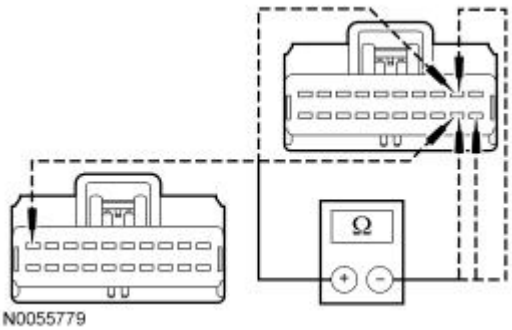
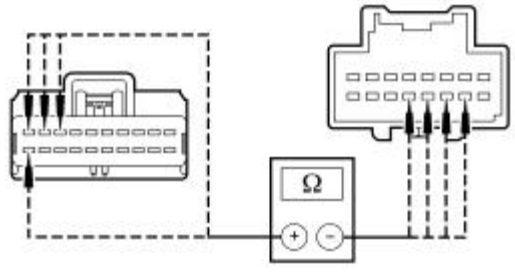
- **NOTE:** DTC B1780, B1781, B1775, B1776, B1637, B1638, B1633 or B1634 only.
- Measure the resistance between DSM:
  - C341e-3, circuit CPM29 (GN) and C341d-1, circuit CPM26 (WH).
  - C341e-3, circuit CPM29 (GN) and C341e-13, circuit CPM27 (GY/BU).
  - C341e-3, circuit CPM29 (GN) and C341e-10, circuit CPM28 (BU/BN).
  - C341d-1, circuit CPM26 (WH) and C341e-13, circuit CPM27 (GY/BU).
  - C341d-1, circuit CPM26 (WH) and C341e-10, circuit CPM28 (BU/BN).
  - C341e-13, circuit CPM27 (GY/BU) and C341e-10, circuit CPM28 (BU/BN).

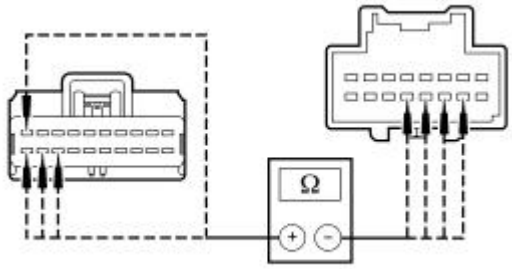
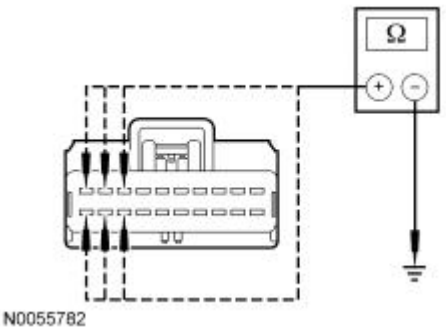


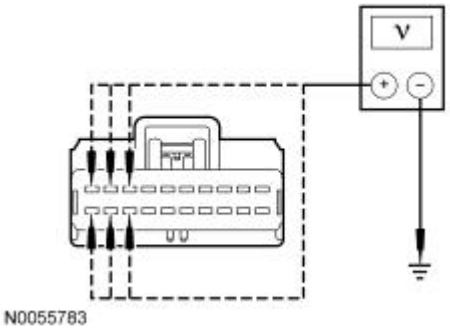
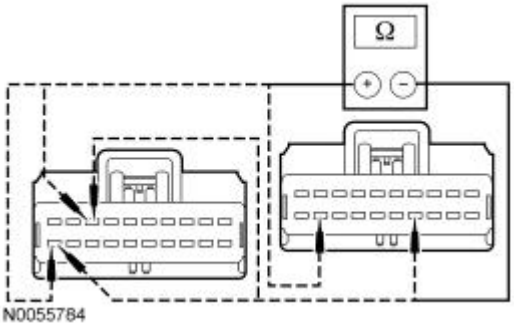
- **NOTE:** DTC B1784, B1785, B1788, B1789, B1641, B1642, B1645 or B1646 only.
- Measure the resistance between DSM:
  - C341d-10, circuit CPM34 (WH/BN) and C341e-2, circuit CPM31 (YE/GY).
  - C341d-10, circuit CPM34 (WH/BN) and C341e-12, circuit CPM32 (WH/BU).
  - C341d-10, circuit CPM34 (WH/BN) and C341e-11, circuit CPM33 (WH/VT).
  - C341e-2, circuit CPM31 (YE/GY) and C341e-12, circuit CPM32 (WH/BU).

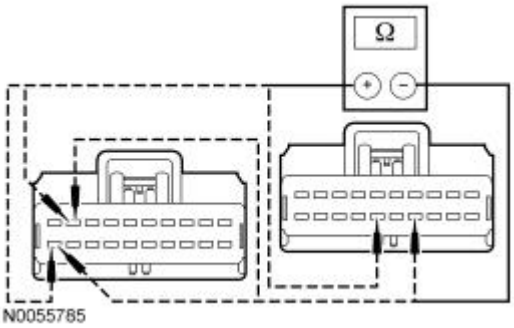
Yes
CHECK the exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation.

No
REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test.

■ C341e-2, circuit CPM31 (YE/GY) and C341e-11, circuit CPM33 (WH/VT). ■ C341e-12, circuit CPM32 (WH/BU), circuit CPM26 (WH) and C341e-11, circuit CPM33 (WH/VT).  N0055779 • **Are the resistances greater than 10,000 ohms?**	
D12 CHECK CIRCUITS VPM35 (YE/BU), LPP06 (YE/BU), VPM36 (BN/YE), RPP06 (GN), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR AN OPEN	
• Key in OFF position. • Disconnect: Exterior Mirror (LH) C516 or (RH) C622. • Disconnect: Driver Seat Module (DSM) C341d. • **NOTE:** DTC B2324 and B2320 only. • Measure the resistance between DSM: ■ (DTC B2324) C341d-9, circuit VPM35 (YE/BU) and LH exterior mirror C516-14, circuit VPM35 (YE/BU). ■ (DTC B2320) C341d-8, circuit VPM36 (BN/YE) and LH exterior mirror C516-13, circuit VPM36 (BN/YE). ■ (DTC B2324 and B2320) C341d-20, circuit LPP06 (YE/BU) and LH exterior mirror C516-12, circuit LPP06 (YE/BU). ■ (DTC B2324 and B2320) C341d-10, circuit RPP06 (GN) and LH exterior mirror C516-15, circuit RPP06 (GN).  N0055780 • **NOTE:** DTC B2316 and B2312 only. • Measure the resistance between DSM: ■ (DTC B2316) C341d-19, circuit VPM37 (BU/OG) and RH exterior mirror C622-14, circuit VPM37 (BU/OG). ■ (DTC B2312) C341d-18, circuit VPM39 (BN/GN) and RH exterior mirror C622-13, circuit VPM39 (BN/GN). ■ (DTC B2316 and B2312) C341d-20, circuit	**Yes** GO to D13 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. TEST the system for normal operation.

LPP06 (YE/BU) and RH exterior mirror C622-12, circuit LPP06 (YE/BU). ■ (DTC B2316 and B2312) C341d-10, circuit RPP06 (GN) and RH exterior mirror C622-15, circuit RPP06 (GN).  N0055781 • **Are the resistances less than 5 ohms?**	
D13 CHECK CIRCUITS VPM35 (YE/BU), LPP06 (YE/BU), VPM36 (BN/YE), RPP06 (GN), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TO GROUND	
• Measure the resistance between ground and driver deat module (DSM): ■ (DTC B2324) C341d-9, circuit VPM35 (YE/BU). ■ (DTC B2320) C341d-8, circuit VPM36 (BN/YE). ■ (DTC B2316) C341d-19, circuit VPM37 (BU/OG). ■ (DTC B2312) C341d-18, circuit VPM39 (BN/GN). ■ (DTC B2324, B2320, B2316 and B2312) C341d-20, circuit LPP06 (YE/BU). ■ (DTC B2324, B2320, B2316 and B2312) C341d-10, circuit RPP06 (GN).  N0055782 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D15 . **No** REPAIR the circuit(s) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.
D14 CHECK CIRCUITS VPM35 (YE/BU), LPP06 (YE/BU), VPM36 (BN/YE), RPP06 (GN), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Exterior Mirror (LH) C516 or (RH) C622. • Disconnect: Driver Seat Module (DSM) C341d. • Key in ON position. • Measure the voltage between ground and driver	**Yes** REPAIR the circuit(s) for a short to voltage. CLEAR the DTCs. TEST the system for normal operation. **No**

seat module (DSM): ■ (DTC B2326) C341d-9, circuit VPM35 (YE/BU). ■ (DTC B2322) C341d-8, circuit VPM36 (BN/YE). ■ (DTC B2318) C341d-19, circuit VPM37 (BU/OG). ■ (DTC B2314) C341d-18, circuit VPM39 (BN/GN). ■ (DTC B2326, B2322, B2318 and B2314) C341d-20, circuit LPP06 (YE/BU). ■ (DTC B2326, B2322, B2318 and B2314) C341d-10, circuit RPP06 (GN).  N0055783 • **Is voltage indicated?**	GO to D15 .
D15 CHECK CIRCUITS VPM35 (YE/BU), LPP06 (YE/BU), VPM36 (BN/YE), RPP06 (GN), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TOGETHER	
• Key in OFF position. • Disconnect: DSM C341d. • Key in ON position. • **NOTE:** DTC B2324, B2326, B2320 or B2322 only. • Measure the resistance between DSM: ■ C341e-19, circuit VPM36 (BN/YE) and C341c-8, circuit VPM35 (YE/BU). ■ C341e-19, circuit VPM36 (BN/YE) and C341c-20, circuit LPP06 (YE/BU). ■ C341e-19, circuit VPM36 (BN/YE) and C341e-14, circuit RPP06 (GN). ■ C341c-8, circuit VPM35 (YE/BU) and C341c-20, circuit LPP06 (YE/BU). ■ C341c-8, circuit VPM35 (YE/BU) and C341e-14, circuit RPP06 (GN). ■ C341c-20, circuit LPP06 (YE/BU) and C341e-14, circuit RPP06 (GN).  N0055784 • **NOTE:** DTC B2312, B2314, B2316 or B2318	**Yes** CHECK the exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, INSTALL a new mirror. REFER to Exterior Mirror in this section. Otherwise, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuits for a short together. CLEAR the DTCs. REPEAT the self-test.

only. • Measure the resistance between DSM: ▪ C341e-16, circuit VPM38 (BN/GN) and C341c-9, circuit VPM37 (BU/OG). ▪ C341e-16, circuit VPM38 (BN/GN) and C341c-20, circuit LPP06 (YE/BU). ▪ C341e-16, circuit VPM38 (BN/GN) and C341e-14, circuit RPP06 (GN). ▪ C341c-9, circuit VPM37 (BU/OG) and C341c-20, circuit LPP06 (YE/BU). ▪ C341c-9, circuit VPM37 (BU/OG) and C341e-14, circuit RPP06 (GN). ▪ C341c-20, circuit LPP06 (YE/BU) and C341e-14, circuit RPP06 (GN).  • **Are the resistances greater than 10,000 ohms?**	

Pinpoint Test E: The Power Folding Mirrors Do Not Operate

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

When the exterior mirror select switch is set to the center power folding mirror position and pressed rearward, the switch will ground the driver seat module (DSM) through circuit CPM22 (GY/BN). When the exterior mirrors are extended, and the driver seat module (DSM) receives ground on circuit CPM22 (GY/BN), the DSM will ground circuit (LH) CPM39 (GN/VT)/(RH) CPM40 (WH/OG) and send 12 volts to power folding mirror motors through circuit (LH) CPM04 (VT/BN)/(RH) CPM07 (BN), the mirrors will retract. When the exterior mirrors are retracted, and the DSM receives ground on circuit CPM22 (GY/BN), the DSM will ground circuit (LH) CPM39 (GN/VT)/(RH) CPM40 (WH/OG) and send 12 volts to both power folding mirrors through circuit (LH) CPM04 (VT/BN)/(RH) CPM07 (BN), the mirrors will extend.

Possible Causes

- An open in circuits CPM04 (VT/BN), CPM07 (BN), CPM22 (GY/BN), CPM39 (GN/VT) or CPM40 (WH/OG)
- A short to ground in circuits CPM04 (VT/BN), CPM07 (BN), CPM22 (GY/BN), CPM39 (GN/VT) or CPM40 (WH/OG)
- A short to voltage in circuits CPM04 (VT/BN), CPM07 (BN), CPM39 (GN/VT) or CPM40 (WH/OG)
- A short together in circuits CPM04 (VT/BN), CPM07 (BN), CPM39 (GN/VT) or CPM40 (WH/OG)
- Exterior mirror control switch
- Exterior mirror
- Driver seat module (DSM)

If the power folding mirrors are folded or unfolded continuously (6 to 10 cycles), the power lockout feature will disable the system for 2 minutes to prevent damage to the power fold motors. After 2

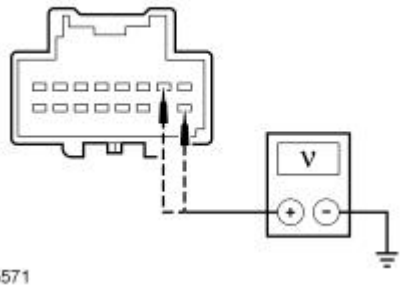
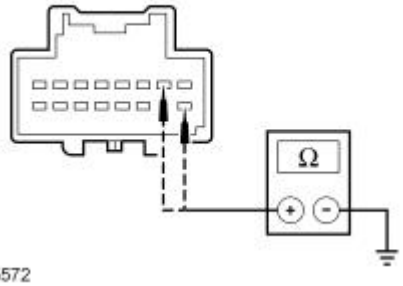
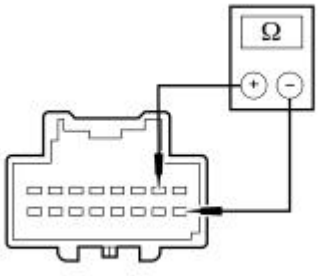
minutes have elapsed, normal operation will resume.

PINPOINT TEST E: THE POWER FOLDING MIRRORS DO NOT OPERATE

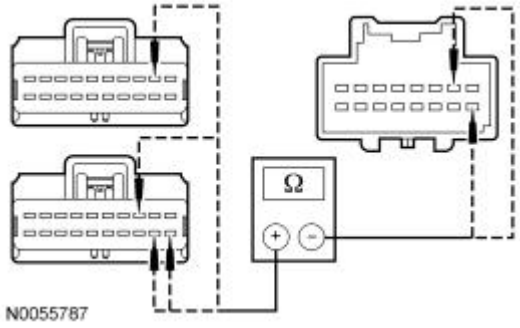
NOTE: Before running a self-test or retrieving codes, the power fold switch must be inactive for at least 30 seconds. Retrieving codes before 30 seconds will result in false codes.

Test Step	Result / Action to Take
E1 RETRIEVE THE DTCs FROM DRIVER SEAT MODULE (DSM)	
• Use the recorded DSM DTCs from the continuous and on-demand self tests. • **Are any DTCs retrieved?**	**Yes** If DTC B109A, B109D, B10A0 or B10A3, GO to E2 . If DTC B109B, B109E, B10A1 or B10A4, GO to E3 . If DTC B109C, B109F, B10A2 or B10A5, GO to E5 . If DTC B1102, CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, GO to E7 . **No** CARRY OUT the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. If the switch tests OK, GO to E9 .
E2 CHECK THE POWER FOLD EXTERIOR MIRROR CIRCUITS FOR A SHORT TO VOLTAGE	

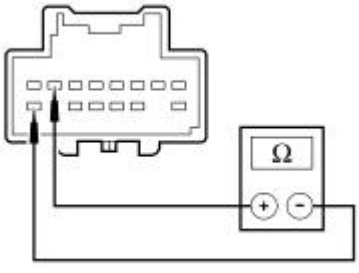
• Key in OFF position.
• Disconnect: Inoperative Power Folding Exterior Mirror (LH) C516 or (RH) C622.
• Disconnect: Driver Seat Module (DSM) C341c And C341d.
• Key in ON position.
• Measure the voltage between ground and inoperative power folding exterior mirror:
  ▪ (LH only), C516-16, circuit CPM39 (GN/VT).
  ▪ (LH only), C516-7, circuit CPM04 (VT/BN).
  ▪ (RH only), C622-16, circuit CPM40 (WH/OG).
  ▪ (RH only), C622-7, circuit CPM07 (BN).
	Yes
	REPAIR the circuit(s) for a short to voltage. CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test.
	
	No
	GO to E4 .

 N0035571 • **Is voltage present?**	
E3 CHECK THE POWER FOLD EXTERIOR MIRROR CIRCUITS FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: Inoperative Power Folding Exterior Mirror (LH) C516 or (RH) C622. • Disconnect: Driver Seat Module (DSM) C341c And C341d. • Measure the resistance between ground and inoperative power folding exterior mirror: ▪ (LH only), C516-16, circuit CPM39 (GN/VT). ▪ (LH only), C516-7, circuit CPM04 (VT/BN). ▪ (RH only), C622-16, circuit CPM40 (WH/OG). ▪ (RH only), C622-7, circuit CPM07 (BN).  N0035572 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit(s) for a short to ground. CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test.
E4 CHECK THE POWER FOLD EXTERIOR MIRROR CIRCUITS FOR A SHORT TOGETHER • Measure the resistance between inoperative power folding exterior mirror: ▪ (LH only), C516-16, circuit CPM39 (GN/VT) and C516-7, circuit CPM04 (VT/BN). ▪ (RH only), C622-16, circuit CPM40 (WH/OG) and C622-7, circuit CPM07 (BN).  N0055786 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to E10 . **No** REPAIR the circuits for a short together. CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test.

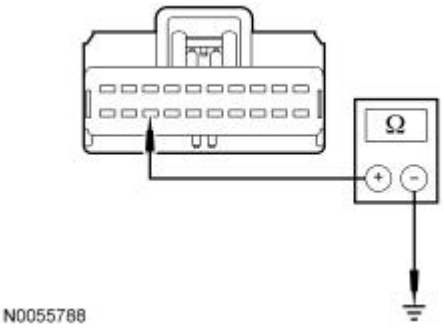
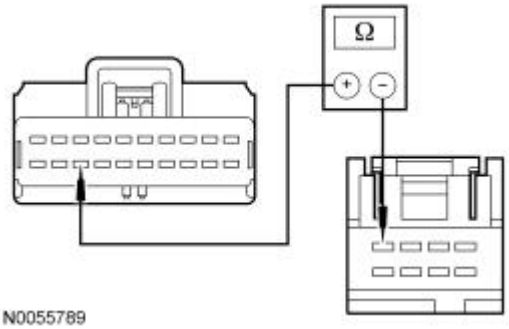
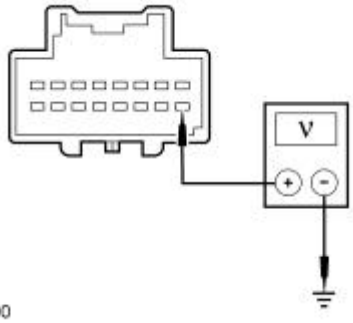
E5 CHECK THE POWER FOLD EXTERIOR MIRROR CIRCUITS FOR AN OPEN	

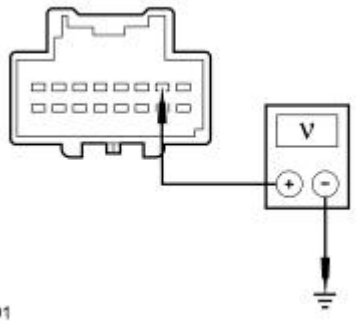
• Key in OFF position.
• Disconnect: Inoperative Power Folding Exterior Mirror (LH) C516 or (RH) C622.
• Disconnect: Driver Seat Module (DSM) C341c And C341d.
• Measure the resistance between inoperative power folding exterior mirror:
  ▪ (LH only), C516-16, circuit CPM39 (GN/VT) and DSM C341d-11, circuit CPM39 (GN/VT).
  ▪ (LH only), C516-7, circuit CPM04 (VT/BN) and DSM C341d-3, circuit CPM04 (VT/BN).
  ▪ (RH only), C622-16, circuit CPM40 (WH/OG) and DSM C341d-12, circuit CPM40 (WH/OG).
  ▪ (RH only), C622-7, circuit CPM07 (BN) and DSM C341c-2, circuit CPM07 (BN).
 
 	
N0055787
• **Are the resistances less than 5 ohms?**
	Yes
	GO to E6 .
	
	No
	REPAIR the circuit(s) for an open. CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test.

E6 CHECK THE POWER FOLD EXTERIOR MIRROR FOR A INTERNAL OPEN	

• **NOTE:** Make sure that the power fold mirrors are in the fully extended position. If the inoperative power fold mirror is not fully extended, extend the mirror manually (by hand).
• Measure the resistance between inoperative power fold exterior mirror:
  ▪ (LH only) C516-7, component side and C516-16, component side
  ▪ (RH only) C622-7, component side and C622-16, component side
 
 	
N0035574
• **Is the resistance less than 100 ohms?**
	Yes
	GO to E10 .
	
	No
	INSTALL a new power folding mirror. REFER to Exterior Mirror in this section. CLEAR the DTCs. TEST the system for normal operation.

E7 CHECK CIRCUIT CPM22 (GY/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Power Mirror Switch C527.	**Yes** GO to E8 .

• Disconnect: Driver Seat Module (DSM) C341c. • Measure the resistance between ground and DSM C341c-18, circuit CPM22 (GY/BN).  N0055788 • **Is the resistance greater than 10,000 ohms?**	**No** REPAIR circuit CPM22 (GY/BN) for a short to ground. CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test.
E8 CHECK CIRCUIT CPM22 (GY/BN) FOR AN OPEN	
• Measure the resistance between DSM C341c-18, circuit CPM22 (GY/BN) and exterior mirror control switch C527-4, circuit CPM22 (GY/BN).  N0055789 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit CPM22 (GY/BN) for an open. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test. TEST the system for normal operation.
E9 CHECK THE POWER FOLD EXTERIOR MIRROR FOR VOLTAGE	
• Key in OFF position. • Disconnect: Inoperative Power Folding Exterior Mirror (LH) C516 or (RH) C622. • While activating the exterior mirror control switch to the out position, measure the voltage between ground and inoperative power folding exterior mirror: ▪ (LH only), C516-16, circuit CPM39 (GN/VT). ▪ (RH only), C622-16, circuit CPM40 (WH/OG).  N0055790 • While activating the exterior mirror control switch to the in position, measure the voltage between ground	**Yes** INSTALL a new power folding mirror. REFER to Exterior Mirror in this section. TEST the system for normal operation. **No** GO to E10.

and inoperative power folding exterior mirror: ■ (LH only), C516-7, circuit CPM04 (VT/BN). ■ (RH only), C622-7, circuit CPM07 (BN).  N0055791 • **Are the voltages greater than 10 volts?**	
E10 CHECK THE DSM FOR CORRECT OPERATION	
• Disconnect all DSM connectors. • Check for: ■ corrosion. ■ pushed-out pins. • Connect all DSM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. SYNCHRONIZE the power folding mirrors. REFER to Exterior Mirror Motor Synchronization — Power Folding in this section. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. TEST the system for normal operation.

Pinpoint Test F: The Heated Mirror Does Not Defrost

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Refer to Wiring Diagrams Cell 56 , Heated Window for schematic and connector information.

Normal Operation

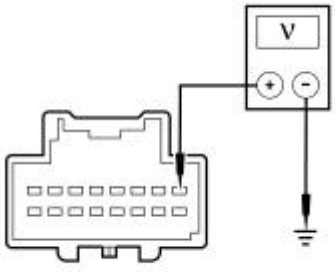
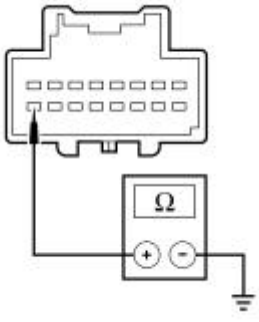
Under normal operation, when the rear window defrost is ON, the heated exterior mirrors receive power from the rear window defrost relay through circuit CBB23 (BN/YE) and ground through circuit (LH) GD143 (BK/VT) or (RH) GD138 (BK/WH).

Possible Causes

- Open in circuits D138 (BK/WH), GD143 (BK/VT) or CBB23 (BN/YE)
- Exterior mirror glass

PINPOINT TEST F: THE HEATED MIRROR DOES NOT DEFROST

Test Step	Result / Action to Take
F1 CHECK THE HEATED REAR WINDOW OPERATION	

• Key in ON position. • Depress the heated rear window switch to ON. • **Does the heated rear window defrost or warm up?**	**Yes** GO to F2 . **No** REFER to Section 501-11 to diagnose the heated rear window system.
F2 CHECK THE EXTERIOR MIRROR FOR POWER	
• Key in OFF position. • Disconnect: Inoperative Exterior Mirror (LH) C516 or (RH) C622. • Key in ON position. • Depress the heated rear window switch to ON. • Measure the voltage between ground and inoperative exterior mirror (LH) C516-8 /(RH) C622-8, circuit CBB23 (BN/YE).  N0055792 • **Is the voltage greater than 10 volts?**	**Yes** GO to F3 . **No** REPAIR circuit CBB23 (BN/YE) for an open. TEST the system for normal operation.
F3 CHECK THE EXTERIOR REAR VIEW MIRROR GROUND CIRCUIT FOR AN OPEN	
• Measure the resistance between ground and inoperative exterior mirror: ▪ (LH) C516-9, circuit GD143 (BK/VT). ▪ (RH) C622-9, circuit GD138 (BK/WH).  N0035643 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new exterior mirror glass. REFER to Exterior Mirror Glass in this section. TEST the system for normal operation. **No** REPAIR circuit GD138 (BK/WH) or GD143 (BK/VT) for an open. TEST the system for normal operation.

Pinpoint Test G: The Auto-Dimming Mirror Does Not Operate Correctly

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the auto-dimming-mirror receives power from circuit CBP31 (BU/OG) and ground from circuit GDD133 (BK). If the vehicle is placed in REVERSE, voltage is sent to circuit CLS10 (GN/BN) and the auto-dimming mirror will turn the dimming feature off. There are 2 photoelectric

sensors: one in the front of the interior rear view mirror and one mounted on the glass side of the mirror. If the sensors are blocked, the auto-dimming feature might not work correctly. Always verify both sensors are not physically blocked before attempting to diagnose auto-dimming mirror concerns.

Possible Causes

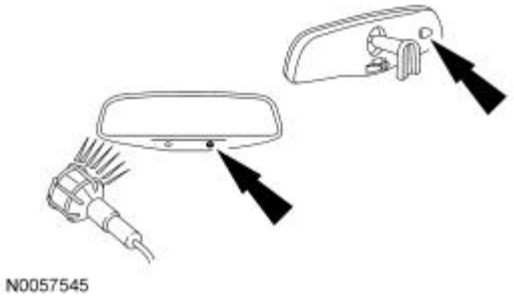
- Open in circuit CBP31 (BU/OG), GDD133 (BK) or CLS10 (GN/BN).
- Auto-dimming mirror

PINPOINT TEST G: THE AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

NOTE: If the transmission range (TR) sensor is malfunctioning and the backup lamps are on all the time or do not turn on, the auto-dimming interior mirror will not darken or return to normal view.

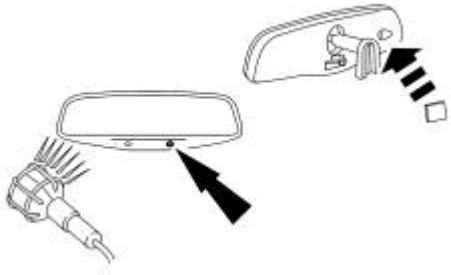
Test Step	Result / Action to Take
G1 CHECK OPERATION OF THE BACKUP LAMPS	
• Key in ON position. • Move the shift control selector through the entire range. • **Do the backup lamps illuminate only in REVERSE?**	**Yes** GO to G2. **No** REFER to Section 417-01.
G2 VERIFY THE FORWARD AND REARWARD FACING SENSORS ARE NOT BLOCKED	

• Visually verify the forward and rearward facing sensors are not blocked. Sources of blockage can include:
  ▪ Stickers, window decals or tags.
  ▪ Fold-down screens for TVs or DVD players.
  ▪ Non-OEM window tinting.
• **Were either of the sensors blocked?**
	Yes
	If possible, remove the blockage. TEST the system for normal operation. If it is not possible to remove the blockage, REVIEW the operation of the auto-dimming mirror with the customer.
	
	No
	GO to G3.

G3 CHECK OPERATION OF THE AUTO-DIMMING INTERIOR MIRROR — DAYLIGHT CONDITIONS	
• Key in ON position. • Use a bright lamp to illuminate the forward facing sensor and the rear facing sensor. The mirror should adjust to a high reflectance mode (mirror will be clear).  N0057545 • **Does the mirror adjust to the high reflectance (clear) mode?**	**Yes** GO to G4. **No** GO to G7.
G4 CHECK THE OPERATION OF THE AUTO-DIMMING MIRROR — NIGHTTIME CONDITIONS WITHOUT GLARE	
• Key in ON position.	**Yes**

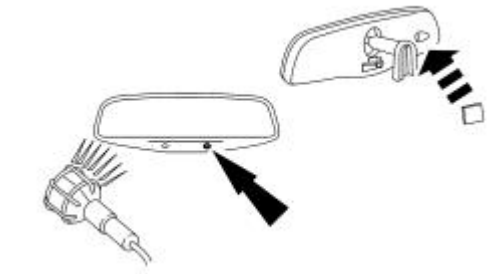
• **NOTE:** Covering the sensor with a finger or hand is not adequate.
• Simulate nighttime conditions without glare:
  ■ Cover the forward sensor with black electrical tape or other dark material.
  ■ Cover the rear facing sensor. The mirror should adjust to the high reflectance mode.
 	
N0057547
• **Did the mirror adjust to the high reflectance (clear) mode?**
	GO to G5 .
	
	No
	GO to G7 .

G5 CHECK THE OPERATION OF THE AUTO-DIMMING MIRROR — NIGHTTIME CONDITIONS WITH GLARE	

• Key in ON position.
• **NOTE:** Covering the sensor with a finger or hand is not adequate.
• Simulate nighttime conditions with glare:
  ■ Cover the forward sensor with black electrical tape or other dark material.
  ■ Illuminate the rear facing sensor. The mirror should darken to a lower reflectance mode.
 
N0057546
• **Did the mirror darken to a lower reflectance (darker) mode?**
	Yes
	GO to G6 .
	
	No
	GO to G7 .

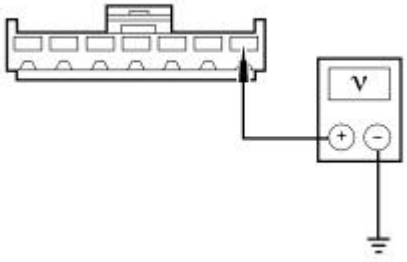
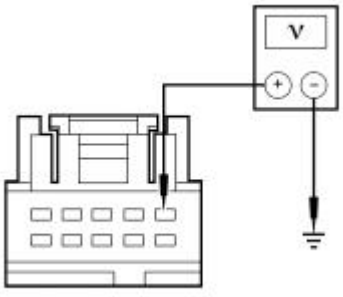
G6 CHECK THE OPERATION OF THE AUTO-DIMMING MIRROR — NIGHTTIME CONDITIONS WITH VEHICLE IN REVERSE	

• Key in ON position.
• **NOTE:** Covering the sensor with a finger or hand is not adequate.
• Simulate nighttime conditions with glare:
  ■ Cover the forward sensor with black electrical tape or other dark material.
  ■ Illuminate the rear facing sensor.
	Yes
	The system is operating normally at this time. REVIEW operation of the auto-dimming interior mirror feature with the customer.
	
	No
	GO to G7 .

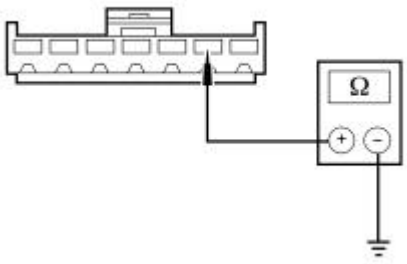


N0057546

- Select REVERSE.
- **Did the mirror adjust to a high reflectance (clear) mode?**

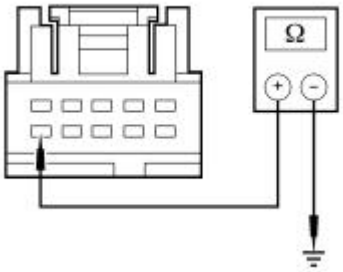
G7 CHECK CIRCUIT CBP31 (BU/OG) FOR VOLTAGE	
• Disconnect: Interior Mirror C911 (without navigation system)/C9012 (with navigation system). • **NOTE:** Not equipped with vehicle navigation system. • Measure the voltage between ground and auto-dimming interior mirror C911-1, circuit CBP31 (BU/OG).  A0073174 • **NOTE:** Equipped with vehicle navigation system. • Measure the voltage between ground and auto-dimming interior mirror C9012-1, circuit CBP31 (BU/OG).  N0055793 • **Is the voltage greater than 10 volts?**	**Yes** GO to G8 . **No** VERIFY smart junction box (SJB) fuse 31 (10A) is OK. If OK, REPAIR circuit CBP31 (BU/OG) for an open. TEST the system for normal operation.

G8 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Key in OFF position. • **NOTE:** Not equipped with vehicle navigation system. • Measure the resistance between ground and auto-dimming interior mirror C911-2, circuit GD133 (BK).	**Yes** GO to G9 . **No** REPAIR circuit GD133 (BK) for an open. TEST the system for normal operation.



A0073175

- **NOTE:** Equipped with vehicle navigation system.
- Measure the resistance between ground and auto-dimming interior mirror C9012-10, circuit GD133 (BK).

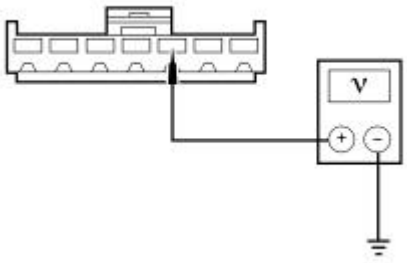


N0055794

- **Is the resistance less than 5 ohms?**

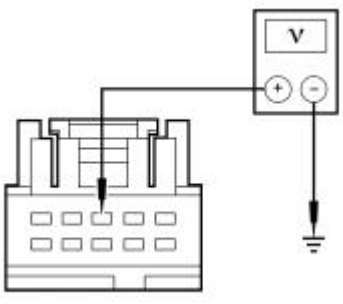
G9 CHECK CIRCUIT CLS10 (GN/BN) FOR VOLTAGE

- Key in ON position.
- Select REVERSE.
- **NOTE:** Not equipped with vehicle navigation system.
- Measure the voltage between ground and auto-dimming interior mirror C911-3, circuit CLS10 (GN/BN).



A0073178

- **NOTE:** Equipped with vehicle navigation system.
- Measure the voltage between ground and auto-dimming interior mirror C9012-3, circuit CLS10 (GN/BN).



N0055795

- **Is the voltage greater than 10 volts?**

Yes
INSTALL a new interior mirror. REFER to Interior Rear View Mirror in this section. TEST the system for normal operation.

No
REPAIR circuit CLS10 (GN/BN) for an open. TEST the system for normal operation.

Exterior Mirror Motor Synchronization — Power Folding

Printable View (78 KB)

NOTE: This procedure must be performed any time the power folding mirrors are manually folded in or out, or if the position of the mirror case has been moved without using the mirror control switch.

1. Set the mirror control switch to the CENTER position.

NOTE: It may be necessary to cycle the power folding mirrors in or out up to 4 times before they are synchronized.

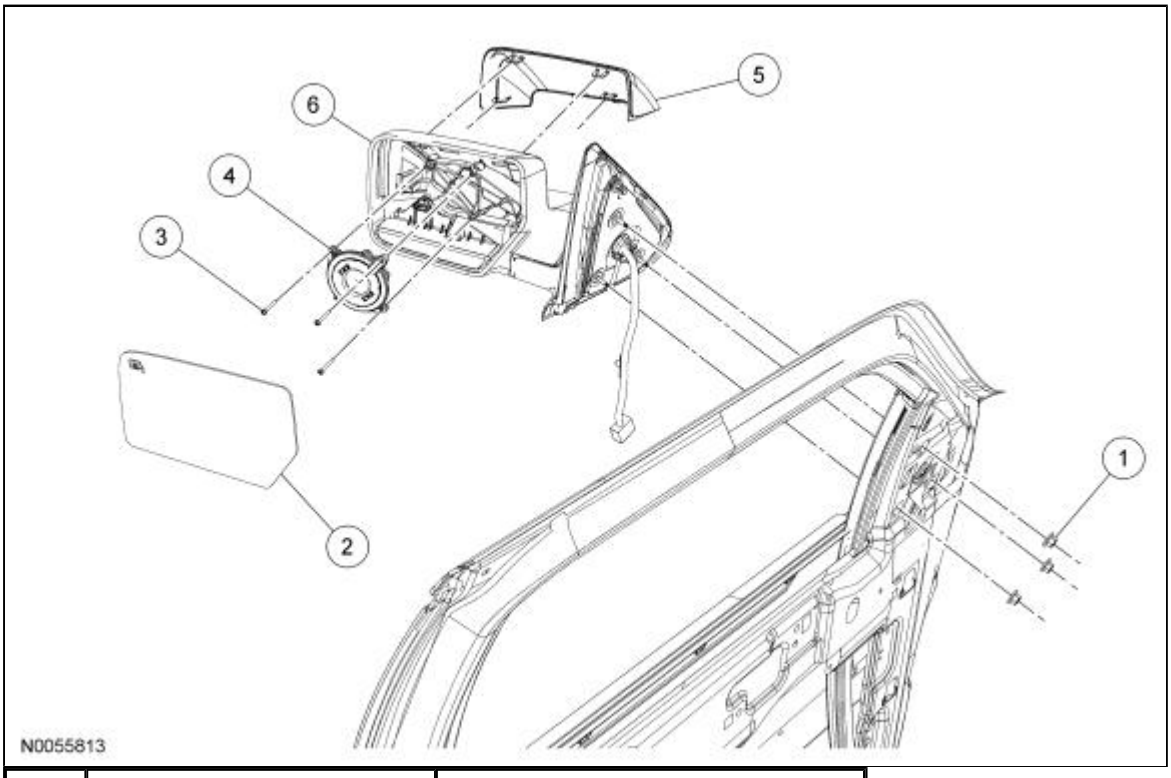
2. Use the mirror control switch (press rearward) to automatically cycle the power folding mirrors in and out 4 times.

3. When an audible popping sound is heard, the power folding mirror motors are synchronized.

Exterior Mirrors — Exploded View

Printable View (180 KB)

NOTE: LH side shown, RH side similar.



Item	Part Number	Description
1	N621906	Exterior mirror nut (3 required)
2	17K707	Exterior mirror glass
3	—	Exterior mirror motor screw
4	17D696	Exterior mirror motor
5	17D742 RH/ 17D743 LH	Exterior mirror cover
6	17682 RH/ 17683 LH	Exterior mirror

1. For additional information, refer to the procedures in this section.

Exterior Mirror

Printable View (79 KB)

Removal and Installation

NOTE: If equipped with power folding mirrors, they must be synchronized any time the mirrors have been folded or unfolded without using the mirror control switch. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

NOTE: Do not remove the exterior mirror asembly when repairing an individual part. Individual components can be installed without removing the exterior mirror.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Position aside the weather shield.
3. Disconnect the exterior mirror electrical connector.
4. Remove the exterior mirror.
   - Remove the nuts.
   - To install, tighten to 7 Nm (62 lb-in).
5. To install, reverse the removal procedure.
   - Install top nut first.
   - If equipped with power folding mirrors, they must be synchronized. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

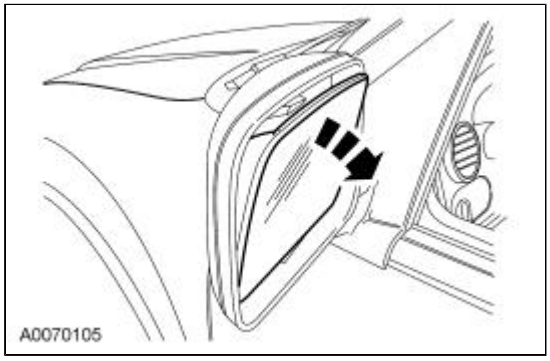
Exterior Mirror Glass

Printable View (165 KB)

Removal and Installation

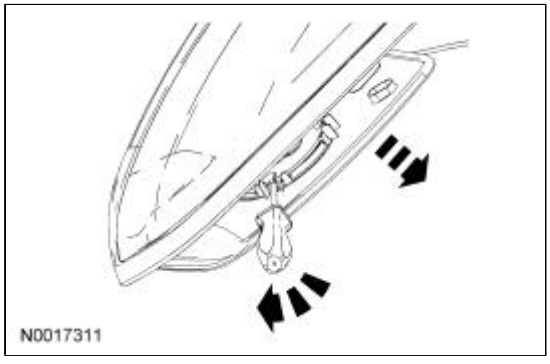
NOTE: If equipped with power folding mirrors, they must be synchronized any time the mirrors have been folded or unfolded without using the mirror control switch. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

1. Position the exterior mirror glass in a downward position to obtain a gap at the edge of the mirror.

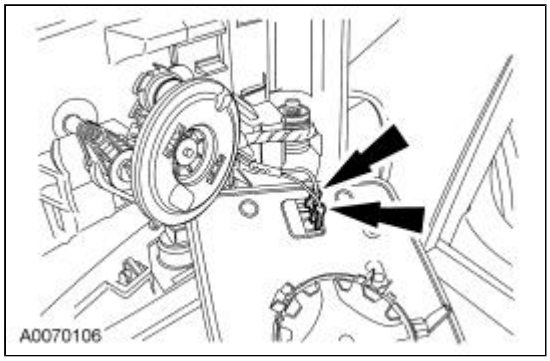


2. **WARNING: Place a shop towel between the exterior mirror glass and the hand to avoid personal injury in the instance of glass breakage.**

   Disengage the mirror glass.
   - Insert a flat-blade screwdriver between the mirror glass tabs and the mounting plate, and rotate to separate the locking tabs from the mounting plate.
   - Carefully pull the top edge of the glass away from the exterior mirror housing.



3. If equipped, disconnect the heated mirror electrical connectors and remove the glass.



4. To install, reverse the removal procedure.
    - Rotate the exterior mirror glass in all directions after the installation to make sure all clips are completely attached.
    - If equipped with power folding mirrors, they must be synchronized. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

Exterior Mirror Motor

Printable View (79 KB)

Removal and Installation

NOTE: If equipped with power folding mirrors, they must be synchronized any time the mirrors have been folded or unfolded without using the mirror control switch. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

1. Remove the mirror glass. For additional information, refer to Exterior Mirror Glass in this section.

2. Remove the 3 exterior mirror motor screws and exterior mirror motor.
   - Disconnect the electrical connectors.

3. To install, reverse the removal procedure.
   - If equipped with power folding mirrors, they must be synchronized. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

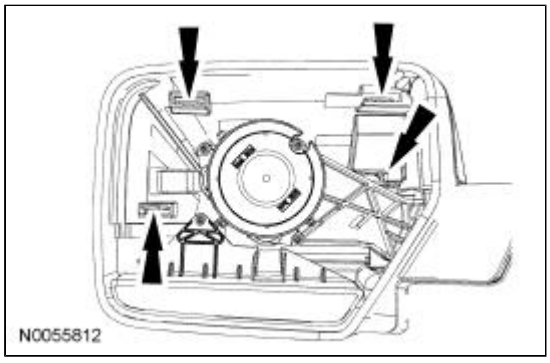
Exterior Mirror Cover

Printable View (112 KB)

Removal and Installation

NOTE: If equipped with power folding mirrors, they must be synchronized any time the mirrors have been folded or unfolded without using the mirror control switch. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

1. Remove the mirror glass. For additional information, refer to Exterior Mirror Glass in this section.
2. Release the 4 retaining tabs and remove the exterior mirror cover.

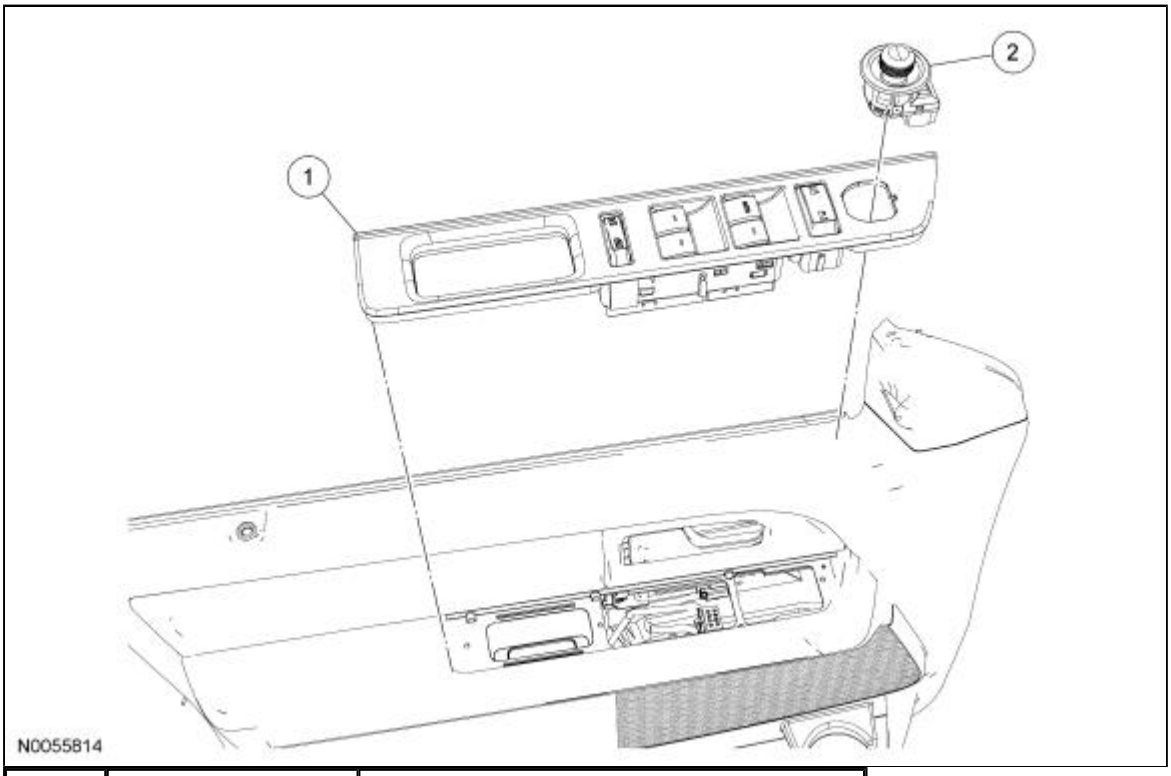


3. To install, reverse the removal procedure.
   - Rotate the exterior mirror glass in all directions after installation to make sure all clips are completely attached.
   - If equipped with power folding mirrors, they must be synchronized. For additional information, refer to Exterior Mirror Motor Synchronization — Power Folding in this section.

Exterior Mirror Control Switch

Printable View (167 KB)

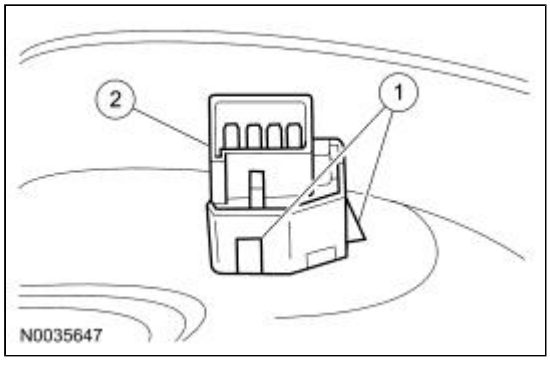
NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	14525	Switch bezel
2	17B676	Exterior mirror control switch

Removal and Installation

1. Remove the driver front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the exterior mirror control switch.
   1. Depress the locking tabs.
   2. Remove the exterior mirror control switch.



3. To install, reverse the removal procedure.

Interior Rear View Mirror

Printable View (117 KB)

Special Tool(s)

ST2833-A	Mirror Remover 501-D118
ST1793-A	Installer, Rear View Mirror 501-025 (T94P-17700-AH)

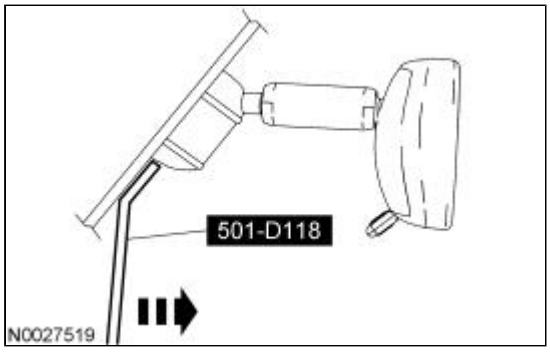
Removal

1. **CAUTION: Twisting the interior rear view mirror base from right to left may cause a stress fracture of the windshield.**

   Remove the wire cover (if equipped).

2. Remove the compass by pulling down on the compass rearmost edge (if equipped).

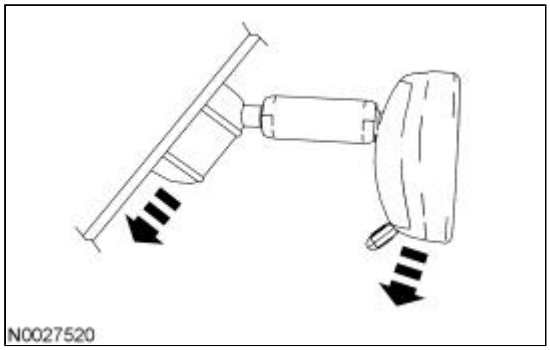
3. Insert the special tool between the mirror mount and windshield bracket from the bottom.



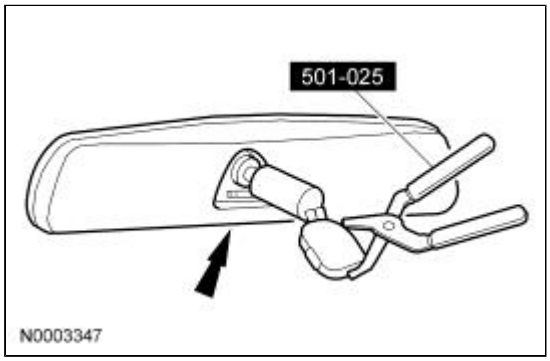
4. Release the mirror mount from windshield bracket by pulling the tool away from the windshield.

Installation

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the up position.



2. Using the special tool, press the mirror assembly downward along the windshield until the mount is seated on windshield bracket.



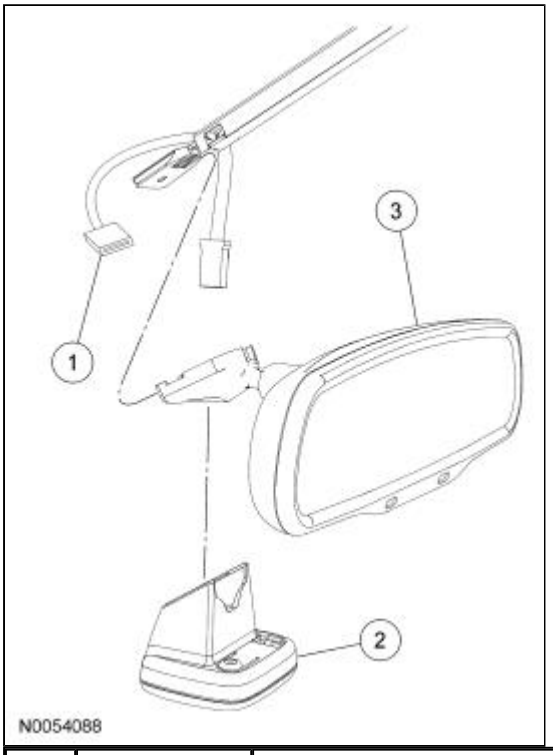
3. Install compass and wire cover (if equipped).

Auto-Dimming Interior Mirror

Printable View (132 KB)

Special Tool(s)

ST2833-A	Mirror Remover 501-D118



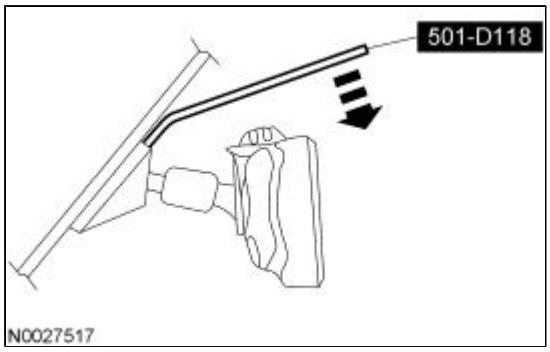
Item	Part Number	Description
1	—	Interior mirror electrical connector (part of 14A005)
2	19A548	Electroic compass sensor
3	17700	Interior mirror

Removal

1. Remove the wire cover.
2. Disconnect the electrical connector.
3. **NOTE:** The compass (if equipped) does not need to be removed prior to this step.

   NOTE: High level mirror shown, others similar.

Insert the special tool between the mirror mount and windshield bracket from the top.

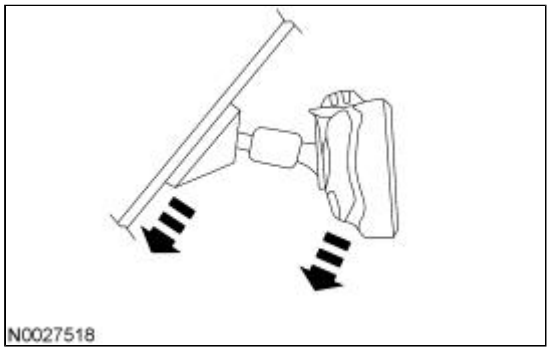


4. If equipped, separate the compass from the mirror assembly by disengaging the compass locking tabs.

5. Release the mirror mount from the windshield bracket by pulling the tool and mirror down and away from the windshield.

Installation

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the up position.



2. Quickly press the mirror assembly downward along the windshield until a click is felt. The click indicates the base is engaged to the windshield bracket.

3. If equipped, install the compass, electrical connector and wire cover. Check the compass zone and calibration. For additional information, refer to Section 413-08 .

Printable View (84 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Front Row			
Armrest bracket-to-seat track bolts	45	33	—
Armrest latch bolts	45	33	—
Armrest latch-to-seat track bolts	45	33	—
Armrest pivot bolt	35	26	—
Backrest frame-to-seat track bolts	45	33	—
Center seat safety belt bolt	55	41	—
Center seat safety belt buckle-to-floor bolt	40	30	—
Cushion frame-to-seat track bolts	25	18	—
Lumbar bolts	7	—	62
Safety belt buckle pretensioner nut	55	41	—
Seat-to-floor bolts, 40 percent [a]	—	—	—
Seat-to-floor bolts, 60 percent [a]	—	—	—
Seat track rail-to-seat track nuts (manual seat track)	30	22	—
Side air bag module nuts	10	—	89
Second Row — 20 Percent			
Backrest-to-cushion bolts	48	35	—
Pivot bolt	55	41	—
Riser-to-cushion frame bolts	30	22	—
Safety belt buckle nut	55	41	—
Safety belt retractor anchor bolt	55	41	—
Safety belt retractor bolt	40	30	—
Seat-to-floor bolts [a]	—	—	—
Swivel bolts	30	22	—
Second Row — 40 Percent E-Z Entry			
Backrest-to-cushion bolts	55	41	—
Safety belt buckle bolt	50	37	—
Seat-to-floor bolts	40	30	—
Striker plate bolts	40	30	—
Third Row			
Child safety seat tether anchor bolt	15	11	—
Inboard latch-to-backrest frame bolts, 40 percent	40	30	—
Inboard latch-to-backrest frame bolts, 60 percent	55	41	—
Inboard slide bracket-to-backrest frame nut	15	11	—
Inboard slide bracket-to-cushion frame nut	15	11	—

Inboard slide bracket-to-inboard latch nut	15	11	—
Outboard latch-to-cushion frame bolt, LH seat	35	26	—
Outboard latch-to-cushion frame bolt, RH seat	30	22	—
Outboard slide bracket-to-backrest frame nut	15	11	—
Outboard slide bracket-to-cushion frame nut	15	11	—
Outboard slide bracket-to-outboard latch nut	15	11	—
Power-fold seat motor bracket-to-latch bolt	30	22	—
Power-fold seat motor bracket-to-pivot bolt	30	22	—
Riser-to-cushion frame bolts	30	22	—
Safety belt anchor bolt	40	30	—
Safety belt buckle bolt	40	30	—
Safety belt retractor bolt	40	30	—
Seat-to-floor bolts	40	30	—

[a] Refer to procedure in this section.

Seats

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Front Seats

Forty Percent Seats

The front 40 percent seats can be equipped with the following systems:

- Two-way manual seat track
- Six-way power seat tracks
- Memory driver seat
- Manual lumbar
- Power lumbar
- Manual recline
- Power recline
- Adjustable head restraints
- Seat side air bags
- Driver and passenger seat safety belt buckle and pretensioners
- Heated/cooled climate controlled seats
    - With climate controlled seating, there is an air filter located in the fan motor housing under the seat. See the owner literature for additional service and scheduled maintenance interval information.

Sixty Percent Seats

The 60 percent passenger seat can be equipped with:

- Front passenger seat center armrest
- Manual recliner
- Two-way manual seat track
- Seat side air bag
- Adjustable head restraint

Driver Seat Module — Memory Seat

The power driver seat, power outside rear view mirrors, power adjustable pedals and adjustable steering column are controlled by the driver seat module (DSM) only when the vehicle is equipped with the programmable/recall memory option. The DSM is located on the driver seat track.

This system allows automatic positioning of the driver seat to 2 programmable positions.

The memory seat system consists of the following components:

- DSM
- Driver memory seat control switch
- Memory set switch
- Adjustable pedal switch
- Power mirror switch
- Adjustable steering column switch
- Memory seat track assembly (with seat position sensors integral to motors)
    - Horizontal motor (part of seat track)
    - Front height motor (part of seat track)
    - Rear height motor (part of seat track)
- Backrest power recliner motor (with integral position sensor) (part of backrest frame)
- LH memory power mirror
- RH memory power mirror
- Power adjustable memory pedals
- Power adjustable steering column
- Remote keyless entry transmitter

Two personalized seat positions may be programmed into the memory seat system. A memory seat position may be set by first positioning the driver seat using the driver power seat switch and depressing the memory set switch. Memory seat position 1 or 2 must be selected within 5 seconds to set a personalized seat position. If position 1 or 2 is not selected within 5 seconds, the operation is aborted. This operation also aborts if any input is received from the driver power seat switch, the power mirror switch, the adjustable pedal switch, the power adjustable steering column switch or if the memory set switch is depressed again during the 5-second limit. The personalized memory seat positions are recalled using the memory switch positions 1 and 2 or with the remote keyless entry transmitter.

A programmed seat position can only be recalled when the transmission selector is in PARK or NEUTRAL with the ignition switch in the RUN position. A position may be programmed at any time.

For information on the DSM, refer to Section 419-10 .

Easy Entry/Easy Exit

The driver power seat easy entry/easy exit feature can be enabled/disabled. Refer to the Owner's Literature.

Climate Controlled Seats

The climate control seat system is able to heat and cool the front seats. Each climate controlled seat is operated by push-buttons on the electronic automatic temperature control (EATC) module located on the instrument panel. Each front seat temperature is then monitored and controlled by the climate control seat module (CCSM) located on the passenger front seat track.

The front seat cushions are equipped with a plenum (duct) attached to the cushion frame suspension wires (serviced with the cushion frame). Air from the cushion thermo-electric device (TED) and blower assembly is routed through a plenum and into the manifold fitted within the cushion foam pad (serviced with the cushion foam pad). The front seat backrest TED and blower assembly operates similarly by routing air directly through the backrest manifold (serviced with the backrest foam pad).

The climate controlled seat system contains the following components:

- EATC module
- CCSM

- TED and blower assembly within each front seat cushion and backrest
- Air filter (attached to each TED and blower assembly)
- Cushion and backrest foam pads (includes manifolds)
- Cushion and backrest trim covers

Manual Lumbar

The manual front seat backrest lumbar is adjusted by a knob mounted on the side of the seat cushion side shield. The lumbar adjuster is mounted to the seat track assembly and drives a cable connected to the lumbar assembly attached to the backrest frame.

Power Lumbar

The driver seat has an electro-mechanical backrest lumbar assembly. The lumbar switch adjustment is on the side of the seat cushion side shield and is part of the seat control switch. The lumbar motor is mounted to the lumbar assembly and is serviced only with a new lumbar assembly.

Manual Recliner

The manual recliner can be adjusted by a handle mounted on the outboard side of the cushion side shield. Manual recliners are only serviceable by installing a new backrest frame assembly.

Power Recliner

The driver seat has an electro-mechanical backrest adjuster. The backrest adjustment switch is located on the side of the seat cushion side shield and is part of the seat control switch. The recliner motor is mounted to the backrest frame. Power recliners and motors are only serviceable by installing a new backrest frame assembly.

Seat Side Air Bags

The driver and passenger seat side air bags are attached to the seat backrest frame. For information, or if a seat side air bag deployment has occurred, refer to Section 501-20B .

Safety Belt Buckle Pretensioners

The driver and passenger front seats are equipped with safety belt buckle and pretensioner assemblies attached to the seat tracks. For information, or if a deployment has occurred, refer to Section 501-20B .

Seats — Second Row

The second row can have 40/20/40 or 40/center console/40 seats.

Forty Percent E-Z Entry Seats

The 40 percent E-Z entry seats are equipped with:

- fold-flat backrests.
- tip-forward seat base mechanisms for easy entry to third row seating.
- kneeling seat base mechanisms for added level cargo area.
- adjustable folding head restraints.
- manual recliners.

The 40 percent E-Z entry seat is serviced as an assembly. Only the trim coverings and head restraint can be serviced.

Twenty Percent Seat

The second row 20 percent center seat is equipped with:

- fold-flat backrest.
- 2-way manual seat track.
- adjustable head restraint.
- 3-point center safety belt.

Seats — Third Row

The third row seat:

- is 3-passenger seat.
- is a 60/40 split bench seat.
- folds down for more cargo area.
- has optional power fold-down seats.
- has a 3-point center safety belt integral to the 60 percent seat.

Third Row Power-Fold Seat

The third row power-fold seats are activated by the rear power-fold seat switches. The power-fold seats only operate with the vehicle in PARK, and the liftgate glass, liftgate door or any entry door is open, allowing the smart junction box (SJB) to enable power to the third row power-fold seat system.

The third row power-fold seat consists of the following components:

- SJB
- RH and LH third row power-fold seat relays
- RH and LH power-fold seat motors
- RH and LH rear third row seat switches
- RH and LH drive gear assemblies

The third row power-fold seat motors control drive gear assemblies to raise and lower the seat

backrests. The power-fold motors are serviceable separately.

Seats

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Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

Driver and Passenger Power Seats Without Memory

The 10-way seat control feature moves the seat in 10 possible directions: the seat can be moved forward or backward and the front and back of the cushion can be moved up and down independently. The backrest of the seat can be moved forward and backward, and the lumbar can be moved in and out. All 10 positions are controlled by one switch. The power seat feature operates independent of the ignition switch position.

The 6-way power seat feature moves the seat in 6 possible directions: the seat can be moved forward or backward and the front and back of the cushion can be moved up and down independently. The power seat feature operates independent of the ignition switch position.

The power seat motors are hardwired to the seat control switch. The circuits are normally at ground through the seat control switch. An individual circuit is switched to power when a specific adjustment position is selected.

Power Driver Seat With Memory

The memory driver seat feature allows the driver to program a personalized seat position that can be recalled using the memory switch or a remote keyless entry (RKE) transmitter (if associated). There are 2 memory settings possible. The outside rear view mirror positions, the power adjustable pedals (if equipped) position and power adjustable steering column tilt position are also stored and recalled with the power driver seat positions. For vehicles equipped with power telescopic steering columns, only the tilting feature is controlled by the memory system.

The driver power seat is controlled by the driver seat module (DSM), if equipped. The DSM is located underneath the driver seat cushion frame. Programmable module installation (PMI) must be carried out when installing a new DSM. Refer to Section 418-01 . The DSM does not require calibration to the driver

seat track.

The driver seat control switch provides voltage to the DSM when activated. The neutral position of each driver seat control switch position is a ground state through the seat control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate circuit from ground to power for operating the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove power from the motor upon termination of the seat control switch input or if the DSM does not see movement from the motor by monitoring the position sensor.

The DSM has the ability for soft stops both at the upper and lower limits on all axis of the driver seat and power adjustable steering column. When an axis reaches the hard stop and the switch is held for approximately one second it will then back up 180 msec and establish the soft stop for that axis in that direction. The DSM uses this 'back up' strategy to check sensor integrity any time movement has stopped prematurely due to a sensor failure or obstruction.

The DSM communicates diagnostic trouble code (DTC) and other information using the MS-CAN communication bus. It should be noted for diagnostics that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to Section 418-00 for additional information concerning MS-CAN bus communication.

This section only diagnoses concerns specific to the memory seat. To diagnose a memory power mirror concern, refer to Section 501-09 . To diagnose a power adjustable pedal concern, refer to Section 206-00 . To diagnose a power adjustable steering column concern, refer to Section 205-04 .

Programming Memory Seat Positions

- A power driver seat position can be stored at any time. The driver must move the seat to the desired position using the driver seat control switch. The driver must then depress the memory set switch. Within 5 seconds, the driver must select a memory position. Memory 1 is selected by depressing memory switch 1. Memory 2 is selected by depressing memory switch 2.
- If no memory switch input is received within the 5-second time limit, the operation is aborted. If one of the following inputs is received during the 5-second programming limit, the operation is aborted:
  - Power driver seat control switch
  - Memory set switch
  - Power adjustable pedal switch
  - Power adjustable steering column switch (power tilt switch only, telescopic switch does not apply, if equipped)

Recalling a Stored Memory Seat Position

NOTE: A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL gear and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the gearshift lever out of PARK or NEUTRAL.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

Once the driver has stored the driver seat position, the driver can recall the setting by depressing the corresponding memory switch or by using a programmed remote entry transmitter.

The driver can recall the desired driver seat position by depressing one of the memory recall switches. Depressing memory switch 1 will initiate a recall of the power driver seat position stored in Memory 1. Depressing memory switch 2 will initiate a recall of the power driver seat position stored in Memory 2.

A RKE transmitter can be used to recall previously set memory positions but must first be associated to that memory position. The transmitter associated with personality 1 is capable of recalling memory position 1 only. Similarly, the associated personality 2 transmitter can recall only memory position 2. Up to 8 RKE transmitters can be associated for memory position recall.

Memory recall occurs when the unlock switch is depressed on the RKE transmitter if it has been associated with a memory position. The second depression of the unlock switch, which unlocks passenger doors, does not initiate a memory recall.

A RKE transmitter can be associated with a memory seat position by pressing a RKE button within 5 seconds after pressing the memory set switch button (when setting a memory seat position). Refer to the Owner's Literature for additional information on using RKE transmitters.

A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.

Easy Entry/Exit Feature

The easy entry/exit feature moves the seat backwards about 2 inches when the ignition key is removed from the ignition switch. The DSM receives a key out command over the MS-CAN communication network and powers the driver seat rearward. This function will not operate if the seat is less than the travel distance to the end of the track or the function has been disabled. The DSM will also cancel this operation if a valid input command is received, such as the seat control switch or memory recall request.

The DSM will record the current seat position before powering the seat for an easy exit operation. This recorded position will be used to return the seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation. Easy entry operation will be cancelled if a valid input command is received by the DSM.

The easy entry/exit feature can be disabled and enabled by selecting easy entry on the message center display with the setup control button and pressing the reset control to select on or off from the display menu. Refer to driver controls in the Owner's Literature for additional instructions for using the message center.

Climate Controlled Seat System

NOTE: When installing a new climate control seat module (CCSM), it is necessary to carry out programmable module installation (PMI). Refer to Section 418-01 .

Both the driver and front passenger climate controlled seats are independently controlled electronically by the CCSM mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB 08 (VT) into CCSM C3265a pins E and F.

Both climate controlled seats operate independently. If a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

The 4 switches (identified with seat icons) on the electronic automatic temperature control (EATC) module activate each seat system setting and illuminate LEDs above each switch to indicate the

operating mode, 3 LEDs for HIGH, 2 LEDs for MED or 1 LED for LOW. The push-buttons with the blue seat icon operate the seat cooling mode and the push-buttons with the red seat icon operate the seat heating mode. The climate controlled seat system is not equipped with auto-mode.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

The TED uses a Peltier circuit of P-type and N-type semiconductors connected in series using copper electrical conductors. The semiconductors are sandwiched between 2 copper heat exchangers. When current is applied to the TED, one side releases energy as heat, while the opposite side absorbs energy and gets cold. By reversing the current flow, the hot and cold sides reverse.

NOTE: Avoid applying power directly to a TED for testing its operation. Doing so may cause damage to the TED or shorten its usable life.

The temperature differences between the individual heated and cooled settings is minimal. For example, it is difficult to distinguish between LOW COOL and MEDIUM COOL settings. Measuring seat temperature at different settings is possible by monitoring the CCSM PIDs using the scan tool.

The EATC module communicates climate controlled seat commands to the CCSM using the medium speed controller area network (MS-CAN) communication bus. The MS-CAN bus is connected to the data link connector (DLC) for diagnostic use. No direct connection exists between the CCSM and EATC for the climate controlled seat switches. The climate controlled seats can be commanded using the scan tool to verify both module communication on the MS-CAN bus and operation of the CCSM. This method may be useful for isolating a control switch concern. It should also be noted that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to Section 418-00 for additional information concerning CAN bus communication.

Heating Characteristics

NOTE: The presence of overtemperature faults (DTCs B2729, B2730, B272A and B272B) can be induced by incorrect operation of the climate controlled seat system after an initial HEAT setting has been attained. If a HEAT setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature, an overtemperature condition can result and the DTC(s) will be set.

- In HEAT mode, the TED circuits of a given seat are wired in parallel internally in the CCSM.
- The climate controlled seat system draws approximately 24 amperes, with both seats heating, until reaching the set point and then the system operates at a reduced amperage to maintain the climate setting.
- In HEAT mode, the TED can add up to 40°C-60°C (72°F-108°F) to the ambient air temperature entering the system.
- There are 4 manual settings based on the LEDs above each seat heat switch button on the EATC. The first setting is HIGH (3 LEDs), the second setting is MED (2 LEDs), the third is LOW (1 LED) then OFF (no LEDs).
- In the LOW setting, the climate controlled seat module is set to maintain TED temperature at approximately 46°C (115°F).
- In the HIGH setting, the climate controlled seat module is set to maintain TED temperature at 65° C (149°F).
- If the temperature at one of the TEDs rises above 110°C (230°F) in the HEAT mode or 65°C (149°F) in the COOL mode for more than 4 seconds, the CCSM will record an overtemperature DTC, remove power from the TEDs and go into blower only mode in an attempt to cool down the TEDs. If the TEDs temperature has not dropped to 105°C (221°F) in the HEAT mode or 60°C (140°F) in the COOL mode after 30 seconds, the CCSM will shut down and remain off until the

ignition is cycled. Also if the CCSM detects an overtemperature twice during the same ignition cycle, it will also shut down.
- When heating, the CCSM will vary the speed of the fans and the TED duty cycle in order to reach and maintain the temperature determined by the switch setting.

Climate Controlled Seat Heat State	Initial Temperature	Final Temperature
HIGH	90°C (194°F)	65°C (149°F)
MED	80°C (176°F)	60°C (140°F)
LOW	75°C (167°F)	46°C (115°F)

Cooling Characteristics

- In COOL mode, the TED circuits of a given seat are wired in series internally in the CCSM.
- The climate controlled seat system draws approximately 10 amps for the first 12 minutes and will operate at 2 amps thereafter.
- In COOL mode, the TED can remove up to 8°C (14°F) from the ambient air temperature entering the system.
- There are 4 manual settings based on the LEDs above each seat cool switch button on the EATC. The first setting is HIGH (3 LEDs), the second setting is MED (2 LEDs) and the third is LOW (1 LED) then OFF (no LEDs).
- If the temperature at one of the TEDs falls below 5°C (41°F), the climate controlled seat module will shut down the TEDs. If the temperature continues to drop below 2°C (36°F), the climate controlled seat module will shut down the blower motors.
- When cooling, the CCSM maintains constant speed of the fans and constant TED supply voltage (duty cycle) in open loop COOL mode.

Climate Controlled Seat Cool State	TED Voltage	TED Supply Duty Cycle
HIGH	Vbat	100%
MED	Vbat	75%
LOW	Vbat	50%

The climate controlled seat system is deactivated by one of the following actions:

- Selecting the EATC module setting to manual OFF
- Turning the vehicle OFF

Third Row Power-Fold Seat

CAUTION: To prevent possible damage to the third row seat or the safety belts, make sure that the safety belts are not fastened when moving the seat to the load floor position.

CAUTION: Make sure that no objects such as books, purses or briefcases are on the floor in front of the third row seats or on the seat cushion before lowering the backrest(s).

For the third row power-fold seat to operate, a shared voltage is supplied by the smart power distribution junction box (SPDJB) to both of the power-fold seat relays, enabling the seats to then be moved by

pressing one of the third row power-fold seat switches. The third row power-fold seat operates only when the vehicle is in PARK and the liftgate glass, liftgate door or any entry door must be open.

The third row power-fold seat motors transfer movement to a drive gear assembly to raise and lower the seat backrest. The power-fold seat motors rotate a short torque shaft which is connected to the drive gear assembly. The power-fold seat motor and bracket assembly is serviceable separately. Refer to Power-Fold Seat Motor in this section.

Inspection and Verification

1. Verify the customer concern by operating the power seat, memory seat or climate controlled seat functions.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Switch(es)
• Seat tracks obstructed or damaged
• Lumbar assembly damaged
• Recliner assembly damaged (backrest frame)
• Thermo-electric device (TED) assembly filter dirty (cushion or backrest)
	• Battery junction box (BJB) fuse(s):
	  ▪ 45 (30A) (driver power seat or memory seat)
	  ▪ 29 (30A) (passenger power seat)
	  ▪ 8 (40A) (climate controlled seats)
	  ▪ 4 (30A) (left third row power-fold seat)
	  ▪ 38 (30A) (right third row power-fold seat)
	• Smart power distribution junction box (SPDJB) fuse(s):
	  ▪ 2 (15A) (memory seat)
	  ▪ 12 (7.5) (memory seat)
	  ▪ 5 (10A) (third row power-fold seats relay enable)
	• Wiring harness
	• Loose or corroded connector(s)
	• Seat control switch
	• Lumbar control switch
	• Memory set switch
	• Power seat motor (seat track)
	• Power lumbar motor (lumbar assembly)
	• Thermo-electric device (TED) assembly (cushion or backrest)
	• Power recliner motor (backrest frame)
	• Third row power-fold seat relay(s)
	• Driver seat module (DSM)
	• Climate controlled seat module (CCSM)
	• Electronic automatic temperature control (EATC) module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is with the power seat (non-memory seat) or the power lumbar and the cause is not visually evident, verify the symptom and GO to Symptom Chart .

5. If the concern is with the memory seat or climate controlled seat and the cause is not visually evident, connect the scan tool to the data link connector (DLC).

6. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No power to the scan tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record on-demand and continuous memory diagnostic trouble codes (DTCs).

9. Clear the continuous DTCs and carry out the self-test diagnostics for the driver seat module (DSM) or climate controlled seat module (CCSM).

10. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart or Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Retrieved	Action
B109A	Driver Power Mirror Fold Inward Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B109B	Driver Power Mirror Fold Inward Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B109C	Driver Power Mirror Fold Inward Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B109D	Driver Power Mirror Fold Outward Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B109E	Driver Power Mirror Fold Outward Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B109F	Driver Power Mirror Fold Outward Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B10A0	Passenger Power Mirror Fold Inward Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .

B10A1	Passenger Power Mirror Fold Inward Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B10A02	Passenger Power Mirror Fold Inward Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B10A3	Passenger Power Mirror Fold Outward Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B10A4	Passenger Power Mirror Fold Outward Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B10A5	Passenger Power Mirror Fold Outward Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1102	Mirror Fold Switch Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1342	ECU is Faulted	On-Demand and Continuous	INSTALL a new DSM and CARRY OUT programmable module installation (PMI). REFER to Section 419-10 .
B1530	Memory Set Switch Circuit Short to Ground	On-Demand and Continuous	Go To Pinpoint Test M .
B1534	Memory 1 Switch Circuit Short to Ground	On-Demand and Continuous	Go To Pinpoint Test M .
B1538	Memory 2 Switch Circuit Short to Ground	On-Demand and Continuous	Go To Pinpoint Test M .
B1632	Mirror Driver Left Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1633	Mirror Driver Left Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1634	Mirror Driver Left Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1636	Mirror Driver Right Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1637	Mirror Driver Right Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1638	Mirror Driver Right Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1640	Mirror Passenger Left Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1641	Mirror Passenger Left Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .

B1642	Mirror Passenger Left Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1644	Mirror Passenger Right Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1645	Mirror Passenger Right Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1646	Mirror Passenger Right Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1663	Seat Driver Front Up/Down Motor Stalled	On-Demand	If the motor does not operate, Go To Pinpoint Test L . If motor operates, Go To Pinpoint Test M .
B1664	Seat Driver Rear Up/Down Motor Stalled	On-Demand	If the motor does not operate, Go To Pinpoint Test L . If motor operates, Go To Pinpoint Test M .
B1665	Seat Driver Forward/Backward Motor Stalled	On-Demand	If the motor does not operate, Go To Pinpoint Test L . If motor operates, Go To Pinpoint Test M .
B1666	Seat Driver Recline Motor Stalled	On-Demand	If the motor does not operate, Go To Pinpoint Test L . If motor operates, Go To Pinpoint Test M .
B1667	Mirror Driver Up/Down Motor Stalled	On-Demand	REFER to Section 501-09 .
B1668	Mirror Driver Right/Left Motor Stalled	On-Demand	REFER to Section 501-09 .
B1669	Mirror Passenger Up/Down Motor Stalled	On-Demand	REFER to Section 501-09 .
B1670	Mirror Passenger Right/Left Motor Stalled	On-Demand	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	On-Demand and Continuous	REFER to Section 414-00 .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1719	Seat Driver Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .

B1731	Seat Driver Rear Down Switch Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test L .
B1735	Mirror Driver Vertical Switch Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1739	Mirror Driver Horizontal Switch Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1743	Mirror Passenger Vertical Switch Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1747	Mirror Passenger Horizontal Switch Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1774	Mirror Driver Up Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1775	Mirror Driver Up Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1776	Mirror Driver Up Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1779	Mirror Driver Down Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1780	Mirror Driver Down Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1781	Mirror Driver Down Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1783	Mirror Passenger Up Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1784	Mirror Passenger Up Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1785	Mirror Passenger Up Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1787	Mirror Passenger Down Circuit Open	On-Demand and Continuous	REFER to Section 501-09 .
B1788	Mirror Passenger Down Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B1789	Mirror Passenger Down Circuit Short to Ground	On-Demand and Continuous	REFER to Section 501-09 .
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test M .

B1953	Seat Rear Up/Down Position Feedback Circuit Short to GND/Open Circuit	On-Demand and Continuous	Go To Pinpoint Test M .
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test M .
B1957	Seat Front Up/Down Position Feedback Circuit Short to GND/Open Circuit	On-Demand and Continuous	Go To Pinpoint Test M .
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test M .
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to GND/Open Circuit	On-Demand and Continuous	Go To Pinpoint Test M .
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go To Pinpoint Test M .
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to GND/Open Circuit	On-Demand and Continuous	Go To Pinpoint Test M .
B1987	Pedal Forward/Rearward Motor Stalled	On-Demand	REFER to Section 206-00 .
B1988	Pedal Position Forward Switch Circuit Short to Ground	On-Demand and Continuous	REFER to Section 206-00 .
B1989	Pedal Position Rearward Switch Circuit Short to Ground	On-Demand and Continuous	REFER to Section 206-00 .
B1990	Pedal Forward/Rearward Potentiometer Feedback Circuit Failure	On-Demand and Continuous	REFER to Section 206-00 .
B1991	Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Battery	On-Demand and Continuous	REFER to Section 206-00 .
B2084	Memory Set Indicator Short to GND	On-Demand and Continuous	**NOTE:** The memory set indicator application is not used for this vehicle and is disabled by default in a new module. The presence of this DTC indicates that programmable module installation (PMI) is required. DISCONNECT and CHECK DSM C341d for damaged or shorted pins. REPAIR as necessary. CARRY OUT programmable module installation (PMI) on the DSM. REFER to Section 418-01 . REPEAT the self-test. CLEAR the DTCs. If DTC B2084 is retrieved again, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 .

B208A	Memory Set Indicator Short to Vbat	On-Demand and Continuous	**NOTE:** The memory set indicator application is not used for this vehicle and is disabled by default in a new module. The presence of this DTC indicates that programmable module installation (PMI) is required. DISCONNECT and CHECK DSM C341d for damaged or shorted pins. REPAIR as necessary. CARRY OUT programmable module installation (PMI) on the DSM. REFER to Section 418-01 . REPEAT the self-test. CLEAR the DTCs. If DTC B208A is retrieved again, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 .
B2300	Seat Driver Memory Position Error	Continuous	Go To Pinpoint Test M .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	On-Demand and Continuous	REFER to Section 501-09 .
B2314	Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	On-Demand and Continuous	REFER to Section 501-09 .
B2318	Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	On-Demand and Continuous	REFER to Section 501-09 .
B2322	Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	On-Demand and Continuous	REFER to Section 501-09 .
B2326	Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	On-Demand and Continuous	REFER to Section 501-09 .
B2334	Tilt Steering Column Up/Down Position Feedback Circuit Short to Battery/Open Circuit	On-Demand and Continuous	REFER to Section 211-04 .
B2335	Tilt Steering Column Up/Down Position Feedback Circuit Short to GND	On-Demand and Continuous	REFER to Section 211-04 .
B2341	Tilt Steering Column Motor Stalled	On-Demand	REFER to Section 211-04 .
B2477	Module Configuration Failure	Continuous	**NOTE:** This DTC indicates programmable module installation (PMI) has not been done to a newly installed module. Presence of this DTC alone does not prevent basic seat operation from the seat

			control switch. CARRY OUT programmable module installation (PMI) on the DSM. REFER to Section 418-01 . REPEAT the self-test and VERIFY successful PMI. CLEAR the DTCs.
B2A1B	Hall Sensor Feed Circuit Short to Battery	On-Demand and Continuous	If present as an on-demand DTC: Depower the supplemental restraint system (SRS). Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . DISCONNECT the driver seat safety belt buckle pretensioner C3049. DISCONNECT the driver seat side air bag C3051. DISCONNECT DSM C341c. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C341c-12, circuit RPS13 (GN/OG), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
B2A1C	Hall Sensor Feed Circuit Short to Ground	On-Demand and Continuous	If present as an on-demand DTC: Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . DISCONNECT the driver seat safety belt buckle pretensioner C3049. DISCONNECT the driver seat side air bag C3051. DISCONNECT DSM C341c. CONNECT the battery ground cable. MEASURE the resistance between C341c-12, circuit RPS13 (GN/OG), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
B2A1D	Potentiometer Feed Circuit Short to Battery	On-Demand and Continuous	REFER to Diagnostic Trouble Code Chart in Section 419-10 .
B2A1E	Potentiometer Feed Circuit Short to Ground	On-Demand and Continuous	REFER to Diagnostic Trouble Code Chart in Section 419-10 .
B2A42	Tilt Steering Column Up Switch Circuit Short to Ground	On-Demand and Continuous	REFER to Section 211-04 .
B2A43	Tilt Steering Column Down Switch Circuit Short to Ground	On-Demand and Continuous	REFER to Section 211-04 .
U0140	Lost Communication With Body Control Module	Continuous	REPAIR all other DTCs first. REFER to Section 418-00 to diagnose the MS-CAN network concern.

	(GEM)		
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Continuous	REPAIR all other DTCs first. REFER to Section 418-00 to diagnose the MS-CAN network concern.
U2050	Application Not Present	Continuous	**NOTE:** This DTC is set only during a module re-flash that did not complete correctly. RE-FLASH the DSM using the latest version of software data available. REFER to Section 418-01 . REPEAT the self-test. If the DTC is retrieved again, CHECK the connection to the data link connector (DLC) and REPEAT module re-flash. REPEAT the self-test. CLEAR the DTCs.
U2471	Unexpected PRNDL State	On-Demand	**NOTE:** This DTC is set during a self-test if the PRNDL state is not PARK or NEUTRAL or is changed from either position while the self-test is in progress. VERIFY the transmission gear selector (PRNDL) is in PARK or NEUTRAL. REPEAT the self-test. CLEAR the DTCs. If the DTC is retrieved again, REFER to Section 307-01A or Section 307-01B to diagnose a transmission gear selector status concern.

Smart Power Distribution Junction Box (SPDJB) Diagnostic Trouble Code (DTC) Chart

NOTE: Only the third row power fold seating DTCs are listed. For all SPDJB DTCs, refer to Section 419-10 .

DTC	Description	Retrieved	Action
B2794	Third Row Power Fold Circuit Failure	On-Demand	Go To Pinpoint Test R .
B2A2D	Third Row Power Fold Circuit Short to Ground	Continuous	Go To Pinpoint Test R .

Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Retrieved	Action
B103B	Thermoelectric Driver Overcurrent Low	On-Demand and Continuous	Go To Pinpoint Test U .
B103C	Thermoelectric Driver Open Load	On-Demand and Continuous	Go To Pinpoint Test V .
B103D	Blower Driver Overtemperature	On-Demand and Continuous	Go To Pinpoint Test W .
B1111	Driver Thermoelectric Device Control Overtemperature	On-Demand and Continuous	Go To Pinpoint Test U .

	Fault		
B1113	Passenger Thermoelectric Device Control Overtemperature Fault	On-Demand and Continuous	Go To Pinpoint Test X .
B111B	Passenger Thermoelectric Driver Overcurrent Low	On-Demand and Continuous	Go To Pinpoint Test X .
B111C	Passenger Thermoelectric Driver Open Load	On-Demand and Continuous	Go To Pinpoint Test Y .
B111D	Passenger Blower Driver Overtemperature	On-Demand and Continuous	Go To Pinpoint Test Z .
B1342	ECU is Faulted	On-Demand and Continuous	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section.
B19A1	Passenger Seat Cushion Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT passenger seat safety belt buckle pretensioner C3050. DISCONNECT passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and passenger cushion TED C3040. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3265c-3, circuit RHS08 (VT/WH), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A2	Passenger Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT passenger seat safety belt buckle pretensioner C3050. DISCONNECT passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and passenger backrest TED C3039 (10-way power seat) or C3316 (6-way power seat). CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3265c-4, circuit CHS09 (GY), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A3	Driver Seat Cushion Blower Speed Short	On-Demand and	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT driver seat

	to Battery	Continuous	safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. DISCONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and driver cushion TED C3035. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3265c-11, circuit RHS03 (GY/OG), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A4	Driver Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. DISCONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and driver backrest TED C3034. CONNECT the battery ground cable. With the ignition switch ON, MEASURE the voltage between C3265c-12, circuit CHS04 (YE/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A5	Passenger Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT passenger seat safety belt buckle pretensioner C3050. DISCONNECT passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and passenger cushion TED C3040. CONNECT the battery ground cable. MEASURE the resistance between C3265c-3, circuit RHS08 (VT/WH), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A6	Passenger Seat Back Blower Speed	On-Demand and	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT passenger

	Short to Ground	Continuous	seat safety belt buckle pretensioner C3050. DISCONNECT passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and passenger backrest TED C3039 (10-way power seat) or C3316 (6-way power seat). CONNECT the battery ground cable. MEASURE the resistance between C3265c-4, circuit CHS09 (GY), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A7	Driver Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. DISCONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and driver cushion TED C3035. CONNECT the battery ground cable. MEASURE the resistance between C3265c-11, circuit RHS03 (GY/OG), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B19A8	Driver Seat Back Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . DISCONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. DISCONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. DISCONNECT CCSM C3265c and driver backrest TED C3034. CONNECT the battery ground cable. MEASURE the resistance between C3265c-12, circuit CHS04 (YE/GN), harness side and ground. REPAIR the short to ground as needed. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
B2477	Module Configuration Failure	On-Demand and	This DTC indicates programmable module installation (PMI) has not been done to a newly installed module.

		Continuous	CARRY OUT PMI. REFER to Section 418-01 . REPEAT the self-test. CLEAR the DTCs.
B2486	Climate Control Seat Module Voltage Out of Range	On-Demand and Continuous	REFER to Section 414-00 to diagnose the charging system concern.
B2729	Cushion Over-Temp Detected (Driver)	On-Demand and Continuous	Go To Pinpoint Test AA .
B272A	Passenger Cushion Over-Temp Detected	On-Demand and Continuous	Go To Pinpoint Test AB .
B272B	Passenger Back Over-Temp Detected	On-Demand and Continuous	Go To Pinpoint Test AC .
B272C	Driver Differential Temperature Fault	On-Demand and Continuous	Go To Pinpoint Test AD .
B272D	Passenger Differential Temperature Fault	On-Demand and Continuous	Go To Pinpoint Test AE .
B2730	Back Over-Temp Detected (Driver)	On-Demand and Continuous	Go To Pinpoint Test AF .
B6050	No Application Present	—	REFLASH with the latest operational software. REFER to Section 418-01 . REPEAT the self-test. CLEAR the DTCs. If the DTC does not clear, or is retrieved again, REFLASH with the latest operational software again. REPEAT the self-test. CLEAR the DTCs. If the DTC does not clear, or is again retrieved from the self-test, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver seat module (DSM)	• Fuse • Circuitry • DSM	• REFER to Section 418-00 .
• No communication with the climate control seat module (CCSM)	• Fuse • Circuitry • CCSM	• REFER to Section 418-00 .
• No communication with the module — unable to carry out on-demand self test with the DSM	• Fuse(s) • Circuitry • DSM	• REFER to Section 418-00 .
• The power seat is inoperative — driver, with power recliner	• Fuse • Circuitry • Seat control switch	• Go To Pinpoint Test A .
• The power seat is	• Fuse	• Go To Pinpoint Test B .

inoperative — driver, without power recliner	• Seat control switch • Circuitry	
• The power seat is inoperative — passenger, with power recliner	• Fuse • Circuitry • Seat control switch	• Go To Pinpoint Test C .
• The power seat is inoperative — passenger, without power recliner	• Fuse • Seat control switch • Circuitry	• Go To Pinpoint Test D .
• The power seat moves but is loose	• Fastening hardware • Seat track	• Go To Pinpoint Test E .
• The power seat moves but is noisy	• Seat track	• Go To Pinpoint Test F .
• The power seat does not make full travel	• Seat track obstructed • Seat track	• Go To Pinpoint Test G .
• The power seat does not move horizontally/vertically/recline — driver	• Seat track • Circuitry • Seat control switch • Power seat motor	• Go To Pinpoint Test H .
• The power seat does not move horizontally/vertically — driver	• Seat track • Circuitry • Seat control switch • Power seat motor	• Go To Pinpoint Test I .
• The power seat does not move horizontally/vertically/recline — passenger	• Seat track • Circuitry • Seat control switch • Power seat motor	• Go To Pinpoint Test J .
• The power seat does not move horizontally/vertically — passenger	• Circuitry • Seat track • Seat control switch • Power seat motor	• Go To Pinpoint Test K .
• The memory seat is inoperative/does not operate correctly — does not operate horizontally/vertically/recline	• Fuse • Circuitry • Seat control switch • Seat track • DSM • Power seat motor	• Go To Pinpoint Test L .
• The memory seat does not operate correctly — the seat moves in one second intervals	• Circuitry • Seat track • DSM	• REFER to the DTC Chart.
• The memory seat does not operate correctly — does not	• Circuitry • Memory set	• Go To Pinpoint Test M .

operate using the memory set switch	switch • Seat track • DSM	
• The memory seat does not operate correctly — does not operate using the remote transmitter	• Remote keyless entry (RKE) transmitter is not correctly associated to a memory position • Circuitry • Keyless entry transmitter • DSM • Vehicle security module (VSM)	• VERIFY the RKE transmitter is operating correctly and is associated to a memory position. REFER to Principles of Operation or the Owner's Literature for additional information on associating a RKE transmitter. For a RKE transmitter function concern, REFER to Section 501-14 . RUN the DSM self-test and REFER to the DTC Chart to diagnose any DTCs retrieved.
• Easy exit/easy entry is inoperative/not operating correctly	• Circuitry • Key in ignition switch • Instrument Cluster • DSM	• Go To Pinpoint Test N .
• The power lumbar is inoperative — driver	• Circuitry • Lumbar control switch • Power lumbar assembly • Power lumbar motor	• Go To Pinpoint Test O .
• The power lumbar is inoperative — passenger	• Circuitry • Lumbar control switch • Power lumbar assembly • Power lumbar motor	• Go To Pinpoint Test P .
• All climate controlled seats are inoperative	• Fuse • Circuitry • CCSM • EATC module	• VERIFY battery junction box (BJB) fuse 8 (40A) is OK. If OK, CARRY OUT the Data Links Diagnostics test using a scan tool and verify network communication of the EATC and CCSM. REFER to Section 418-00 to diagnose a module communication or network concern. If OK, CARRY OUT the CCSM on-demand self test and retrieve any DTCs. If any DTC is present, REFER to the Climate Controlled Seat Module (CCSM)

		Diagnostic Trouble Code (DTC) Chart. CHECK the climate control system for correct operation. REFER to Section 412-00 for diagnosis of the EATC or climate control system. If OK, INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section.
• A single climate controlled seat is inoperative/does not operate correctly	• Circuitry • MS-CAN network communication fault • EATC module • CCSM	• **NOTE:** If a fault occurs setting a DTC specific to only one climate controlled seat, the CCSM will disable only the affected seat outputs and allow the other seat to remain operational. CHECK for DTCs specific to the affected climate controlled seat and, if a DTC is present, REFER to the Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Chart. Go To Pinpoint Test Q .
• A single climate controlled seat does not operate correctly — exhibits poor airflow or performance	• Incorrectly installed thermo-electric device (TED), manifold or plenum • Airflow blockage • Disconnected air duct	• CARRY OUT the CCSM on-demand self test and retrieve any DTCs. If any DTC is present, REFER to the Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Chart. If no DTC is present, CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, plenum, air ducts and foam pad) and REPAIR as needed. If OK, CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold or plenum connections, filters and ducts) and REPAIR as needed.

		RETEST the system for normal operation.
• A second row E-Z entry seat does not operate correctly — seat stuck in E-Z entry position	• Incorrect shipping pin position	• CHECK the shipping pin at the seat pedestal pivot is in the released position. REFER to Seat — Second Row, 40 Percent for additional information.
• The power seat is inoperative — third row power-fold, left and right seats	• Fuse(s) • Circuitry • Smart power distrubution junction box (SPDJB)	• Go To Pinpoint Test R .
• The power seat is inoperative/does not operate correctly — third row power-fold, left seat	• Fuse(s) • Circuitry • Power-fold seat relay • Seat control switch(es) • Power-fold seat motor	• Go To Pinpoint Test S .
• The power seat is inoperative/does not operate correctly — third row power-fold, right seat	• Fuse(s) • Circuitry • Power-fold seat relay • Seat control switch(es) • Power-fold seat motor	• Go To Pinpoint Test T .

Pinpoint Tests

CAUTION: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage can result.

Refer to Inspection and Verification, the Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart, Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Chart, Smart Power Distribution Junction Box (SPDJB) Diagnostic Trouble Code (DTC) Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: The Power Seat is Inoperative — Driver, With Power Recliner

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB45 (GY/RD) and is supplied ground on circuit GD143 (BK/VT). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism

to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

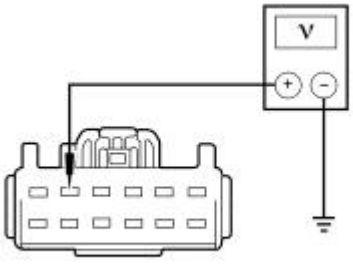
An inoperative driver power seat can be caused by:

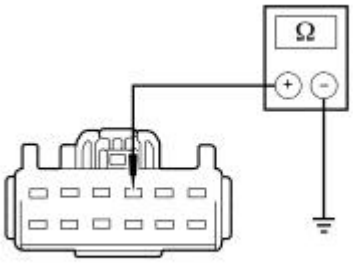
- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE — DRIVER, WITH POWER RECLINER

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
A1 CHECK CIRCUIT SBB45 (GY/RD) FOR VOLTAGE • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Control Switch C3016. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between driver seat control switch C3016-5, circuit SBB45 (GY/RD), harness side and ground.  N0010816 • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY battery junction box (BJB) fuse 45 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
A2 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN • Measure the resistance between driver seat control switch C3016-3, circuit GD143 (BK/VT), harness side and ground.	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery

 N0010815 • **Is the resistance less than 5 ohms?**	ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test B: The Power Seat is Inoperative — Driver, Without Power Recliner

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB45 (GY/RD) and is supplied ground on circuit GD143 (BK/VT). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

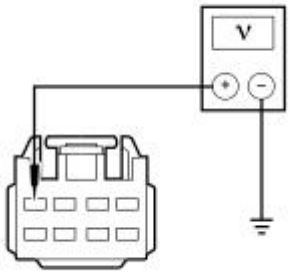
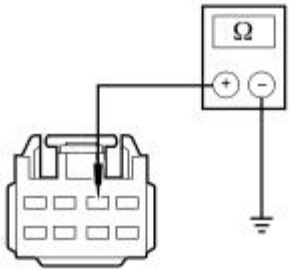
An inoperative driver power seat can be caused by:

- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.

PINPOINT TEST B: THE POWER SEAT IS INOPERATIVE — DRIVER, WITHOUT POWER RECLINER

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
B1 CHECK CIRCUIT SBB45 (GY/RD) FOR VOLTAGE • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Control Switch C352. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between driver seat control switch C352-4, circuit SBB45 (GY/RD), harness side and ground.  N0010817 • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** VERIFY battery junction box (BJB) fuse 45 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
B2 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN • Measure the resistance between driver seat control switch C352-2, circuit GD143 (BK/VT), harness side and ground.  N0010818 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051.

	REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test C: The Power Seat is Inoperative — Passenger, With Power Recliner

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB29 (GY/RD) and is supplied ground on circuit GD138 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

An inoperative passenger power seat can be caused by:

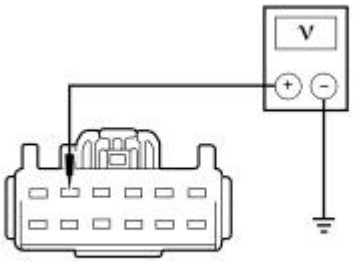
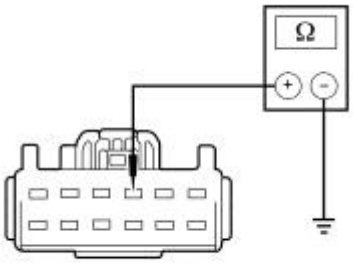
- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE — PASSENGER (WITH POWER RECLINER)

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
C1 CHECK CIRCUIT SBB29 (GY/RD) FOR VOLTAGE • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • Disconnect: Passenger Seat Control Switch C3026. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat control switch C3026-5, circuit SBB29 (GY/RD), harness side and ground.	**Yes** GO to C2 . **No** VERIFY battery junction box (BJB) fuse 29 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

 N0010819 • **Is the voltage greater than 10 volts?**	REPOWER the SRS. REFER to Section 501-20B .
C2 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C3026-3, circuit GD138 (BK/WH), harness side and ground.  N0010825 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test D: The Power Seat is Inoperative — Passenger, Without Power Recliner

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB29 (GY/RD) and is supplied ground on circuit GD138 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in

the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

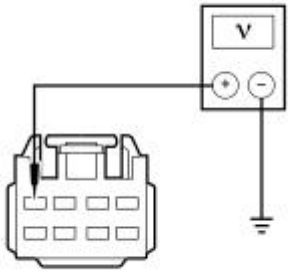
An inoperative passenger power seat can be caused by:

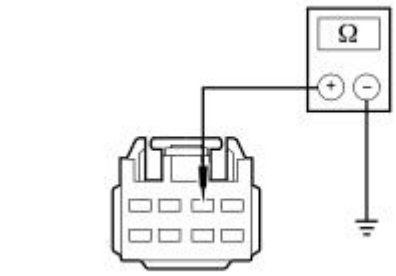
- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.

PINPOINT TEST D: THE POWER SEAT IS INOPERATIVE — PASSENGER, WITHOUT POWER RECLINER

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
D1 CHECK CIRCUIT SBB29 (GY/RD) FOR VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • Disconnect: Passenger Seat Control Switch C355. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat control switch C355-4, circuit SBB29 (GY/RD), harness side and ground.  N0010817 • **Is the voltage greater than 10 volts?**	**Yes** GO to D2 . **No** VERIFY battery junction box (BJB) fuse 29 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
D2 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C355-2, circuit GD138 (BK/WH), harness side and ground.	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for

 N0010818 • **Is the resistance less than 5 ohms?**	normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test E: The Power Seat Moves But is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

Possible Causes

A loose power seat can be caused by:

- loose fastening hardware.
- a faulty seat track component.

PINPOINT TEST E: THE POWER SEAT MOVES BUT IS LOOSE

Test Step	Result / Action to Take
E1 CHECK THE FASTENING HARDWARE	
• Key in OFF position. • Inspect for loose fastening hardware on the affected seat. • **Is the fastening hardware loose?**	**Yes** TIGHTEN all fastening hardware to specification. TEST the system for normal operation. **No** IDENTIFY the cause and REPAIR as necessary.

	TEST the system for normal operation.

Pinpoint Test F: The Power Seat Moves But is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

Possible Causes

A noisy power seat can be caused by:

- a misaligned seat track.
- a faulty seat track component.
- an object obstructing seat movement.

PINPOINT TEST F: THE POWER SEAT MOVES BUT IS NOISY

Test Step	Result / Action to Take
F1 CHECK THE TRACK ALIGNMENT	
• Check the alignment of the track to the floor and the track to the seat. • **Is the track out of alignment?**	**Yes** ALIGN the track to the seat and the floor. TEST the system for normal operation. **No** IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test G: The Power Seat Does Not Make Full Travel

Normal Operation

The power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down).

Possible Causes

A power seat that does not make full travel can be caused by:

- an obstruction.
- a faulty seat track component.

PINPOINT TEST G: THE POWER SEAT DOES NOT MAKE FULL TRAVEL

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
G1 CHECK FOR AN OBSTRUCTION IN THE SEAT TRACK	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Remove the affected seat. Refer to Seat — Front, 40 Percent in this section. • **Are there any obstructions in the track?**	**Yes** REMOVE the obstruction(s) and LUBRICATE the track(s). REPOWER the SRS. REFER to Section 501-20B . TEST the system for normal operation. **No** IDENTIFY the cause and REPAIR as necessary. REPOWER the SRS. REFER to Section 501-20B . TEST the system for normal operation.

Pinpoint Test H: The Power Seat Does Not Move Horizontally/Vertically/Recline — Driver

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB45 (GY/RD) and is supplied ground on circuit GD143 (BK/VT). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recliner motor is serviced with the seat backrest frame.

Possible Causes

A driver power seat that does not move horizontally and/or vertically can be caused by:

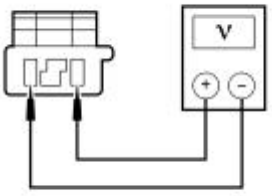
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty seat track motor (seat track).
- a faulty power recliner mechanism.

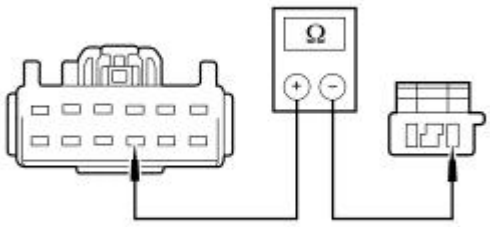
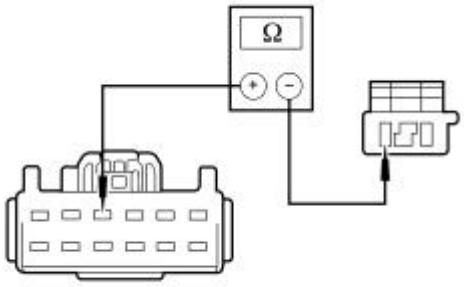
PINPOINT TEST H: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE — DRIVER

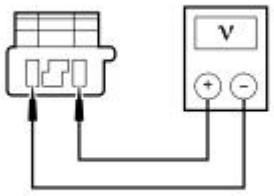
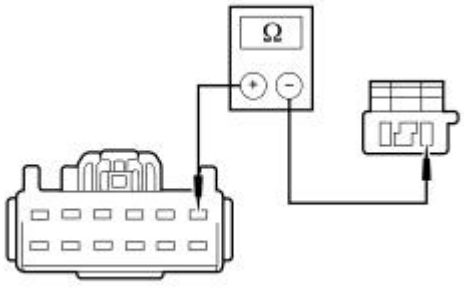
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

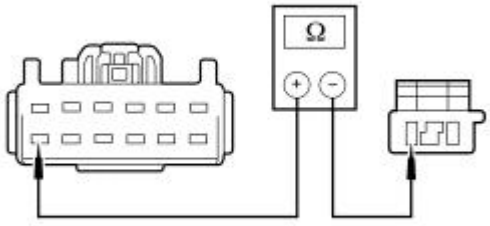
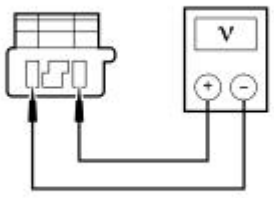
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

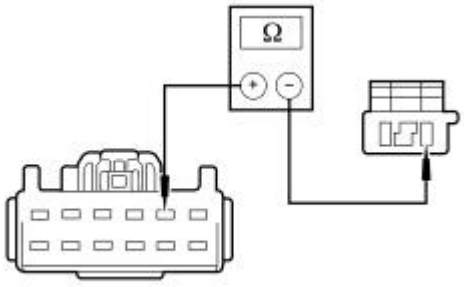
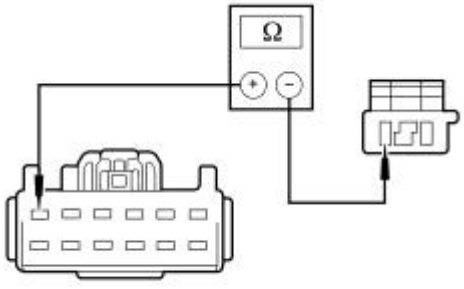
Test Step	Result / Action to Take

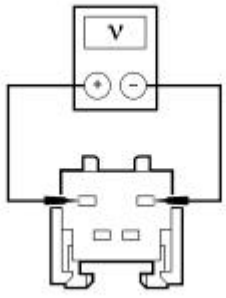
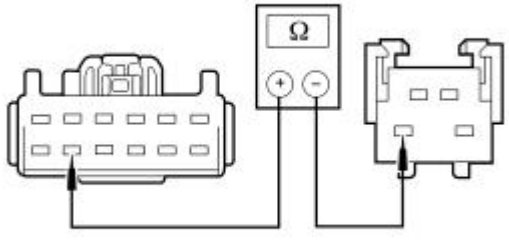
H1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION	
• Operate the driver power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to H2 . **No** GO to H3 .
H2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION	
• Recline the driver backrest forward and rearward. • **Will the seat backrest recline forward and rearward?**	**Yes** GO to H6 . **No** GO to H13 .
H3 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Motor C362. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side and C362-2, circuit CPS23 (GN/VT), harness side, while pushing the driver seat control switch forward and rearward.  N0052984 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to H4 .
H4 CHECK CIRCUIT CPS28 (GN) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between driver seat control switch C3016-9, circuit CPS28 (GN), harness side and driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side.	**Yes** GO to H5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle

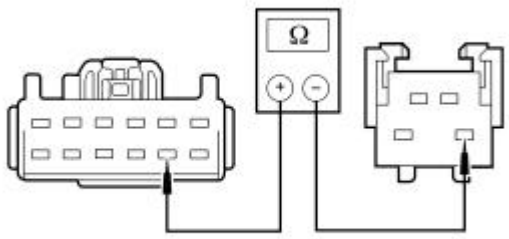
 N0055029 • **Is the resistance less than 5 ohms?**	pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H5 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN	
• Measure the resistance between driver seat control switch C3016-4, circuit CPS23 (GN/VT), harness side and driver seat horizontal motor C362-2, circuit CPS23 (GN/VT), harness side.  N0055030 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • **WARNING: Be sure that nobody is in the vehicle and**	**Yes** If only front height adjust operates, GO to H7 . If only rear height adjust operates, GO to H10 . **No** INSTALL a new driver

that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected. • Connect the battery ground cable. • Determine the seat height adjust failure. • **Does the seat front or rear height adjust up and down?**	seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H7 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR	
• Disconnect: Driver Seat Rear Height Motor C363. • Measure the voltage between driver seat rear height motor C363-1, circuit CPS27 (BU/BN), harness side and C363-2, circuit CPS26 (YE/BU), harness side, while depressing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than -10 volts when the rear height adjust is pressed down, greater than +10 volts when the rear height adjust is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to H8 .
H8 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between driver seat control switch C3016-1, circuit CPS27 (BU/BN), harness side and driver seat rear height motor C363-1, circuit CPS27 (BU/BN), harness side.  N0055031 • **Is the resistance less than 5 ohms?**	**Yes** GO to H9 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051.

	REPOWER the SRS. REFER to Section 501-20B .
H9 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN	
• Measure the resistance between driver seat control switch C3016-12, circuit CPS26 (YE/BU), harness side and driver seat rear height motor C363-2, circuit CPS26 (YE/BU), harness side.  N0055032 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H10 CHECK VOLTAGE TO DRIVER SEAT FRONT HEIGHT MOTOR	
• Disconnect: Driver Seat Front Height Motor C382. • Measure the voltage between driver seat rear height motor C382-1, circuit CPS25 (WH/VT), harness side and C382-2, circuit CPS24 (GY), while pushing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than -10 volts when the front height**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051.

adjust is pressed down, greater than +10 volts when the front height adjust is pressed up and 0 volt when the switch is in the rest position?	REPOWER the SRS. REFER to Section 501-20B . **No** GO to H11 .
H11 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN AND SHORT TO GROUND • Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between driver seat control switch C3016-2, circuit CPS25 (WH/VT), harness side and driver seat front height motor C382-1, circuit CPS25 (WH/VT), harness side.  N0055033 • **Is the resistance less than 5 ohms?**	**Yes** GO to H12 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H12 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN • Measure the resistance between driver seat control switch C3016-6, circuit CPS24 (GY) harness side, and driver seat front height motor C382-2, circuit CPS24 (GY), harness side.  N0055034 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat

	side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
H13 CHECK VOLTAGE TO THE DRIVER SEAT RECLINER MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Recliner Motor C3187. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between driver seat recliner motor C3187-1, circuit CPS08 (VT/OG), harness side and C3187-2, circuit CPS07 (GY/BN), while pushing the recline switch forward and rearward.  N0010826 • **Is the voltage greater than +10 volts when the switch is pushed forward, greater than -10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new driver seat recliner motor. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to H14 .
H14 CHECK CIRCUITS CPS29 (WH/BN) AND CPS07 (GY/BN) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between driver seat control switch C3016-11, circuit CPS29 (WH/BN), harness side and driver seat recliner motor C3187-2, circuit CPS07 (GY/BN), harness side.  N0055035 • **Is the resistance less than 5 ohms?**	**Yes** GO to H15 . **No** REPAIR the affected circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-

	20B .
H15 CHECK CIRCUITS CPS30 (VT/BN) AND CPS08 (VT/OG) FOR AN OPEN	
• Measure the resistance between driver seat control switch C3016-8, circuit CPS30 (VT/BN) harness side, and driver seat recliner motor C3187-1, circuit CPS08 (VT/OG), harness side.  N0055036 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test I: The Power Seat Does Not Move Horizontally/Vertically — Driver

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB45 (GY/RD) and is supplied ground on circuit GD143 (BK/VT). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

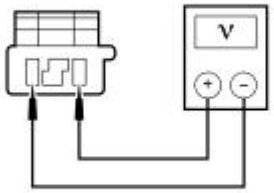
A driver power seat that does not move horizontally and/or vertically can be caused by:

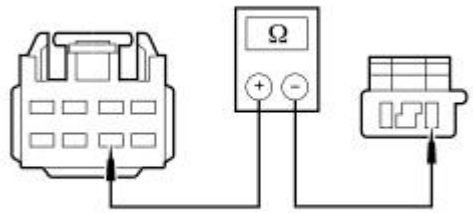
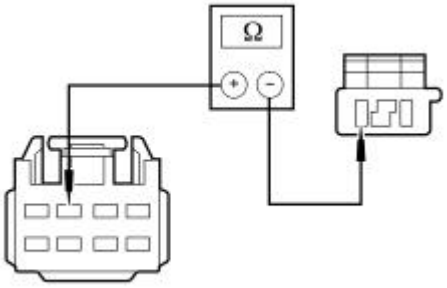
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty seat track motor (seat track).

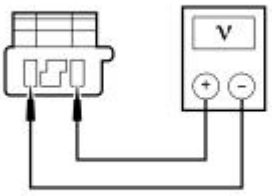
PINPOINT TEST I: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY — DRIVER

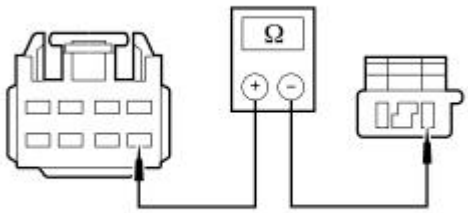
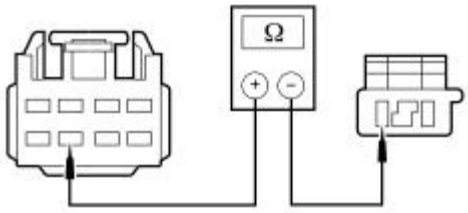
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

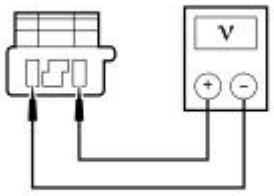
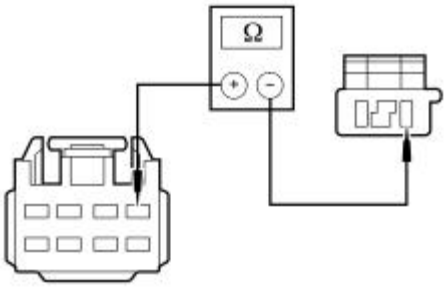
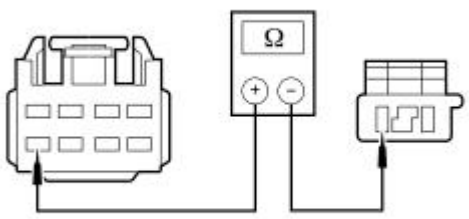
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
I1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION	
• Operate the driver power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to I5 . **No** GO to I2 .
I2 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Horizontal Motor C362. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side and C362-2, circuit CPS23 (GN/VT), harness side, while pushing the driver seat control switch forward and rearward.  N0052984 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to I3 .
I3 CHECK CIRCUIT CPS28 (GN) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C352.	**Yes**

• Measure the resistance between driver seat control switch C352-6, circuit CPS28 (GN), harness side and driver seat horizontal motor C362-1, circuit CPS28 (GN), harness side.  N0055037 • **Is the resistance less than 5 ohms ?**	GO to I4 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I4 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN	
• Measure the resistance between driver seat control switch C352-3, circuit CPS23 (GN/VT), harness side and driver seat horizontal motor C362-2, circuit CPS23 (GN/VT), harness side.  N0055038 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. If equipped, CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System	**Yes** If only front height adjust

(SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Determine the seat height adjust failure. • **Does the seat front or rear height adjust up and down?**	operates, GO to I6 . If only rear height adjust operates, GO to I9 . **No** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I6 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR	
• Disconnect: Driver Seat Rear Height Motor C363. • Measure the voltage between driver seat rear height motor C363-1, circuit CPS27 (BU/BN), harness side and C363-2, circuit CPS26 (YE/BU), harness side, while depressing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than -10 volts when the rear height adjust is pressed down, greater than +10 volts when the rear height adjust is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to I7 .
I7 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C352. • Measure the resistance between driver seat control switch C352-5, circuit CPS27 (BU/BN), harness side and driver seat rear height motor C363-1, circuit CPS27 (BU/BN), harness side.	**Yes** GO to I8 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT

 N0055040 • **Is the resistance less than 5 ohms ?**	driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I8 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN	
• Measure the resistance between driver seat control switch C352-7, circuit CPS26 (YE/BU), harness side and driver seat rear height motor C363-2, circuit CPS26 (YE/BU), harness side.  N0055041 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I9 CHECK THE VOLTAGE TO THE DRIVER SEAT FRONT HEIGHT MOTOR	
• Disconnect: Driver Seat Front Height Motor C382. • Measure the voltage between driver seat front height motor C382-1, circuit CPS25 (WH/VT), harness side and C382-2, circuit CPS24 (GY), while pushing the seat control switch rear height adjust up and down.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation.

 N0052984 • **Is the voltage greater than +10 volts when the front height adjust is pressed down, greater than -10 volts when the front height adjust is pressed up and 0 volt when the switch is in the rest position?**	DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to I10 .
I10 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN	
• Disconnect: Driver Seat Control Switch C352. • Measure the resistance between driver seat control switch C352-1, circuit CPS25 (WH/VT), harness side and driver seat front height motor C382-1, circuit CPS25 (WH/VT), harness side.  N0055042 • **Is the resistance less than 5 ohms?**	**Yes** GO to I11 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
I11 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN	
• Measure the resistance between driver seat control switch C352-8, circuit CPS24 (GY) harness side, and driver seat front height motor C382-2, circuit CPS24 (GY), harness side.  N0055043 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal

	operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test J: The Power Seat Does Not Move Horizontally/Vertically/Recline — Passenger

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB29 (GY/RD) and is supplied ground on circuit GD138 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced with the backrest frame.

Possible Causes

A passenger power seat that does not move horizontally and/or vertically can be caused by:

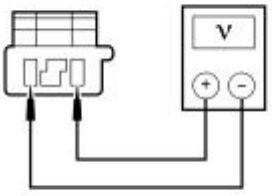
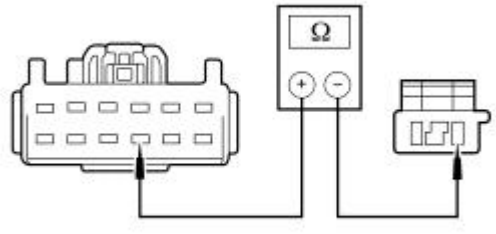
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty seat track motor (seat track).
- a faulty power recliner mechanism.

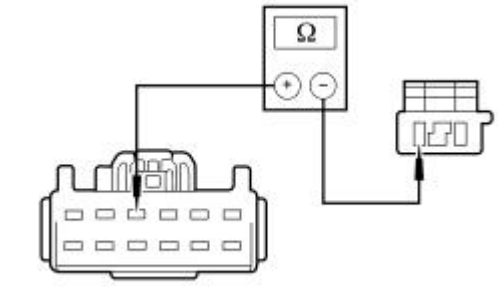
PINPOINT TEST J: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE — PASSENGER

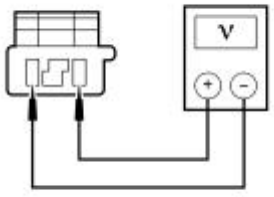
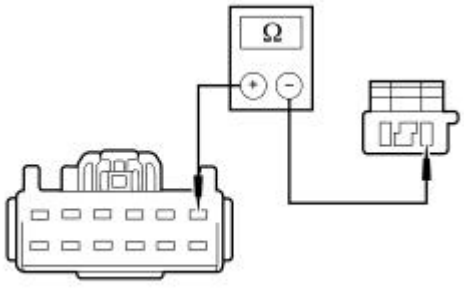
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

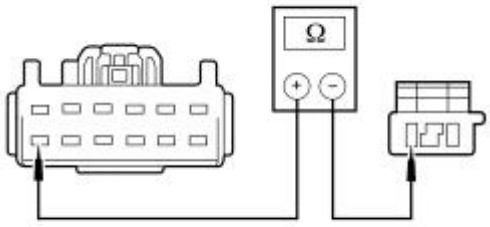
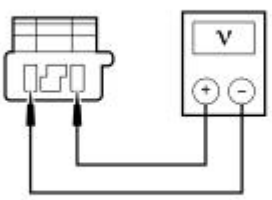
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

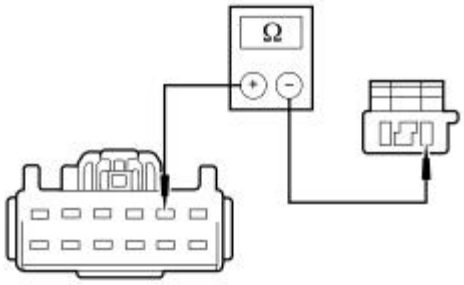
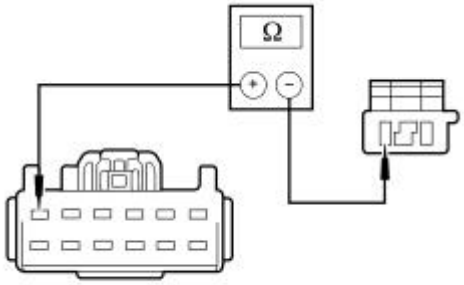
Test Step	Result / Action to Take
J1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION	
• Operate the passenger power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to J2 .

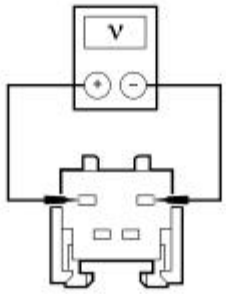
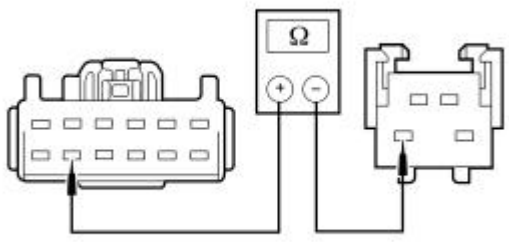
	No GO to J3 .
J2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION	
• Recline the passenger backrest forward and rearward. • **Will the seat backrest recline forward and rearward?**	**Yes** GO to J6 . **No** GO to J13 .
J3 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • Disconnect: Passenger Seat Horizontal Motor C332. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat motor C332-1, circuit CPS38 (GN/BU), harness side and C332-2, circuit CPS33 (WH), harness side, while pushing the passenger seat control switch forward and rearward.  N0052984 • **Is the voltage greater than +10 volts when the switch is pushed forward, greater than -10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to J4 .
J4 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN	
• Disconnect: Passenger Seat Control Switch C3026. • Measure the resistance between passenger seat control switch C3026-9, circuit CPS38 (GN/BU), harness side and passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side.  N0055029	**Yes** GO to J5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

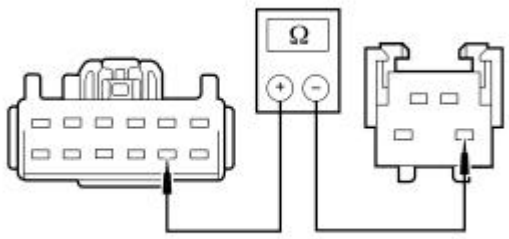
• **Is the resistance less than 5 ohms?**	REPOWER the SRS. REFER to Section 501-20B .
J5 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C3026-4, circuit CPS33 (WH), harness side and passenger seat horizontal motor C332-2, circuit CPS33 (WH), harness side.  N0055030 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
J6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Determine the seat height adjust failure. • **Does the seat front or rear height adjust up and down?**	**Yes** If only front height adjust operates, GO to J7 . If only rear height adjust operates, GO to J10 . **No** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation.

	DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
J7 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR • Disconnect: Passenger Seat Rear Height Motor C3075. • Measure the voltage between passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side and C3075-2, circuit CPS36 (YE/GY), harness side, while depressing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than -10 volts when the rear height adjust is pressed down, greater than +10 volts when the rear height adjust is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to J8 .
J8 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN • Disconnect: Passenger Seat Control Switch C3026. • Measure the resistance between passenger seat control switch C3026-12, circuit CPS37 (WH/BU), harness side and passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side.  N0055031 • **Is the resistance less than 5 ohms ?**	**Yes** GO to J9 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

J9 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C3026-1, circuit CPS36 (YE/GY), harness side and passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side.  N0055032 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
J10 CHECK VOLTAGE TO PASSENGER SEAT FRONT HEIGHT MOTOR	
• Disconnect: Passenger Seat Front Height Motor C3074. • Measure the voltage between passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side and C3074-2, circuit CPS34 (GY/BU), while pushing the seat control switch front height adjust up and down.  N0052984 • **Is the voltage greater than +10 volts when the front height adjust is pressed down, greater than -10 volts when the**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS.

front height adjust is pressed up and 0 volt when the switch is in the rest position?	REFER to Section 501-20B . **No** GO to J11 .
J11 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN • Disconnect: Passenger Seat Control Switch C3026. • Measure the resistance between passenger seat control switch C3026-6, circuit CPS35 (VT/GN), harness side and passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side.  N0055033 • **Is the resistance less than 5 ohms?**	**Yes** GO to J12 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
J12 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN • Measure the resistance between passenger seat control switch C3026-2, circuit CPS34 (GY/BU) harness side, and passenger seat front height motor C3074-2, circuit CPS34 (GY/BU), harness side.  N0055034 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050.

	CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
J13 CHECK VOLTAGE TO THE PASSENGER SEAT RECLINER MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • Disconnect: Passenger Seat Recliner Motor C3189. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat recliner motor C3189-1, circuit CPS08 (VT/OG), harness side and C3189-2, circuit CPS07 (GY/BN), while pushing the recline switch forward and rearward.  N0010826 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new passenger seat recliner motor. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to J14 .
J14 CHECK CIRCUITS CPS39 (GY/YE) AND CPS07 (GY/BN) FOR AN OPEN	
• Disconnect: Passenger Seat Control Switch C3026. • Measure the resistance between passenger seat control switch C3026-11, circuit CPS39 (GY/YE), harness side and passenger seat recliner motor C3189-2, circuit CPS07 (GY/BN), harness side.  N0055035 • **Is the resistance less than 5 ohms?**	**Yes** GO to J15 . **No** REPAIR the affected circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

	REPOWER the SRS. REFER to Section 501-20B .
J15 CHECK CIRCUITS CPS40 (VT/GY) AND CPS08 (VT/OG) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C3026-8, circuit CPS40 (VT/GY) harness side, and passenger seat recliner motor C3189-1, circuit CPS08 (VT/OG), harness side.  N0055036 • **Is the resistance less than 5 ohms ?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test K: The Power Seat Does Not Move Horizontally/Vertically — Passenger

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB29 (GY/RD) and is supplied ground on circuit GD138 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new motor needs to be installed, it is necessary to install an entire power seat track.

Possible Causes

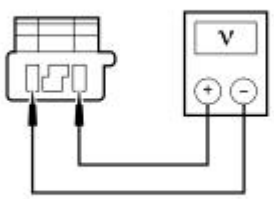
A passenger power seat that does not move horizontally and/or vertically can be caused by:

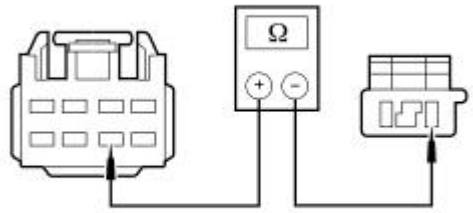
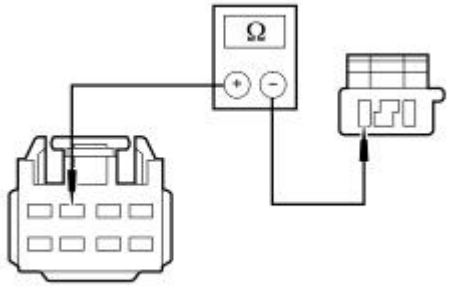
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty seat track motor (seat track).

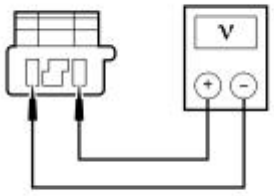
PINPOINT TEST K: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY — PASSENGER

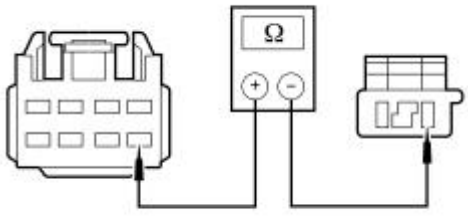
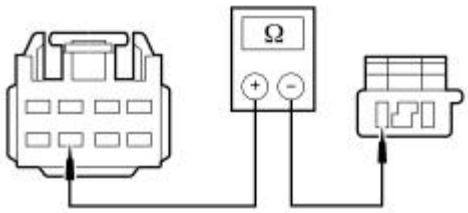
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

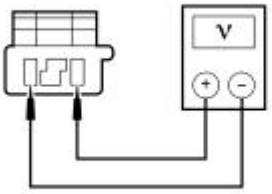
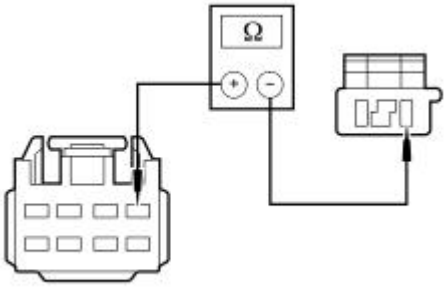
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

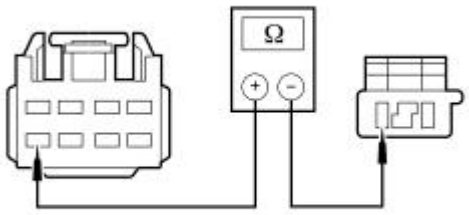
Test Step	Result / Action to Take
K1 CHECK HORIZONTAL DIRECTION MOTOR FOR CORRECT OPERATION	
• Operate the passenger power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to K5 . **No** GO to K2 .
K2 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • Disconnect: Passenger Seat Horizontal Motor C332. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side and C332-2, circuit CPS33 (WH), harness side, while pushing the passenger seat control switch forward and rearward.  N0052984 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to K3 .

pushed rearward and 0 volt when the switch is in a rest position?	
K3 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN	
• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between passenger seat control switch C355-6, circuit CPS38 (GN/BU), harness side and passenger seat horizontal motor C332-1, circuit CPS38 (GN/BU), harness side.  N0055037 • **Is the resistance less than 5 ohms ?**	**Yes** GO to K4 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
K4 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C355-3, circuit CPS33 (WH), harness side and passenger seat horizontal motor C332-2, circuit CPS33 (WH), harness side.  N0055038 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

	REPOWER the SRS. REFER to Section 501-20B .
K5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • Disconnect the passenger seat side air bag C3052. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Determine the seat height adjust failure. • **Does the seat front or rear height adjust up and down?**	**Yes** If only front height adjust operates, GO to K6 . If only rear height adjust operates, GO to K9 . **No** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
K6 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR	
• Disconnect: Passenger Seat Rear Height Motor C3075. • Measure the voltage between passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side and C3075-2, circuit CPS36 (YE/GY), harness side, while depressing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than -10 volts when the rear height adjust is pressed down, greater than +10 volts when the rear height adjust is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to K7 .
K7 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN	

• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between passenger seat control switch C355-5, circuit CPS36 (YE/GY), harness side and passenger seat rear height motor C3075-2, circuit CPS36 (YE/GY), harness side.  N0055040 • **Is the resistance less than 5 ohms ?**	**Yes** GO to K8 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
K8 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C355-7, circuit CPS37 (WH/BU), harness side and passenger seat rear height motor C3075-1, circuit CPS37 (WH/BU), harness side.  N0055041 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

K9 CHECK VOLTAGE TO THE PASSENGER SEAT FRONT HEIGHT MOTOR	
• Disconnect: Passenger Seat Front Height Motor C3074. • Measure the voltage between passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side and C3074-2, circuit CPS34 (GY/BU), while pushing the seat control switch rear height adjust up and down.  N0052984 • **Is the voltage greater than +10 volts when the front height adjust is pressed down, greater than -10 volts when the front height adjust is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track — Power in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to K10 .
K10 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN	
• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between passenger seat control switch C355-8, circuit CPS35 (VT/GN), harness side and passenger seat front height motor C3074-1, circuit CPS35 (VT/GN), harness side.  N0055042 • **Is the resistance less than 5 ohms?**	**Yes** GO to K11 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
K11 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C355-1, circuit CPS34 (GY/BU) harness side, and passenger seat front height motor C3074-2, circuit CPS34 (GY/BU), harness side.	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner

 N0055043 • **Is the resistance less than 5 ohms?**	C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test L: The Memory Seat is Inoperative/Does Not Operate Correctly — Does Not Operate Horizontally/Vertically/Recline

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to DSM on circuit SBP02 (YE/RD) and SBB45 (GY/RD). Ground is supplied to the DSM on circuits GD133 (BK) and GD143 (BK/VT).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a shared signal feed circuit to each position sensor. Each position sensor sends a signal pulse back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory set switch or a remote entry transmitter. Refer to Principles of Operation in this section or the Owner's Literature for additional information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate in one or more directions when using the seat control switch. If the memory seat moves in all directions using the seat control switch, Go To Pinpoint Test M .

Possible Causes

An inoperative memory seat can be caused by:

- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.
- missing status information (CAN communication bus messages):
  - ignition switch status.
  - gear selector position.
- a faulty power seat track.
- a faulty power recliner motor.
- a faulty DSM.

PINPOINT TEST L: THE MEMORY SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — DOES NOT OPERATE HORIZONTALLY/VERTICALLY/RECLINE

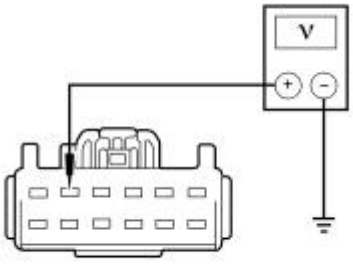
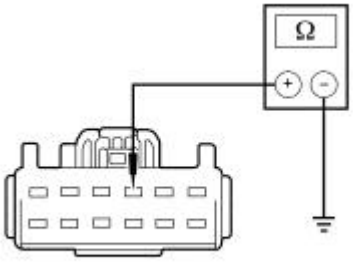
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

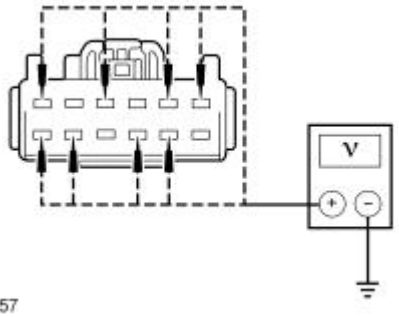
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

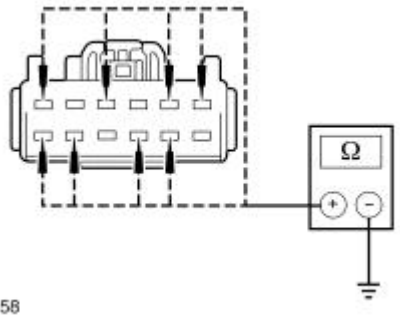
NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

Test Step	Result / Action to Take
L1 CHECK IGNITION SWITCH STATUS, TRANSMISSION GEAR SELECTOR STATUS AND RETRIEVE THE DSM DTCs	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/Transmission Control Module (TCM) PID: Transmission Range (PRNDL). • Operate the transmission gear selector in all positions while monitoring the PID. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/Smart Power Distribution Junction Box (SPDJB) PIDs: Ignition Switch Status. • Cycle the ignition switch in all positions while monitoring the PID. • Verify the PID values agree with the ignition switch and transmission gear selector in all positions before proceeding with memory seat diagnosis. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Driver Seat Module (DSM) Self Test/Retrieve DTCs. • **Are any DSM DTCs retrieved?**	**Yes** If DTCs B1663, B1664, B1665 and B1666 are all retrieved, GO to L10 . If DTC B1663, GO to L20 . If DTC B1664, GO to L23 . If DTC B1665, GO to L26 . If DTC B1666, GO to L29 . If DTC B1703, GO to L3 . If DTC B1707, GO to L3 . If DTC B1711, GO to L3 . If DTC B1715, GO to L3 .

	If DTC B1719, GO to L3. If DTC B1723, GO to L3. If DTC B1727, GO to L3. If DTC B1731, GO to L3. If DTC B1342, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs. For any other DSM DTCs, REFER to the Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. **No** To diagnose an ignition switch status concern, REFER to Section 211-05. To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B. Otherwise, GO to L2.
L2 MONITOR THE DSM PIDs AND CHECK FOR CORRECT MEMORY SEAT SWITCH INPUTS • Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM PIDs: Driver Seat/Pedal/Tilt Steering Column Input Switch Status. • Operate the seat control switch in all positions while monitoring the DSM driver seat switch input status PIDs. • **Do the PID values agree with the switch positions?**	**Yes** GO to L9. **No** VERIFY smart power distribution junction box (SPDJB) fuse 12 (7.5A) is OK. If the fuse fails while operating the seat control switch, DISCONNECT the seat control switch C3016 and GO to L7. If the fuse is OK, GO to L3.
L3 CHECK THE SEAT CONTROL SWITCH • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B. • Disconnect the driver seat safety belt buckle pretensioner C3049.	**Yes** GO to L4. **No** INSTALL a new seat control switch. REFER to

• Disconnect the driver seat side air bag C3051. • Disconnect: Seat Control Switch C3016. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Check the seat control switch. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Is the seat control switch OK?**	Seat Control Switch — Front in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L4 CHECK CIRCUIT SBP12 (GN/RD) FOR VOLTAGE TO THE SEAT CONTROL SWITCH	
• Measure the voltage between seat control switch C3016-5, circuit SBP12 (GN/RD), harness side and ground.  N0010816 • **Is the voltage greater than 10 volts?**	**Yes** GO to L5 . **No** VERIFY smart power distribution junction box (SPDJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L5 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between seat control switch C3016-3, circuit GD133 (BK), harness side and ground.  N0010815 • **Is the resistance less than 5 ohms?**	**Yes** GO to L6 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS.

	REFER to Section 501-20B .
L6 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO POWER • Disconnect: DSM C341c and C341d. • Key in ON position. • Measure the voltage between the following seat control switch C3016 pins, harness side and ground. **Connector** / **Circuit** C3016-9 — CPS28 (GN) C3016-4 — CPS23 (GN/VT) C3016-2 — CPS25 (WH/VT) C3016-6 — CPS24 (GY) C3016-12 — CPS26 (YE/BU) C3016-1 — CPS27 (BU/BN) C3016-11 — CPS29 (WH/BN) C3016-8 — CPS30 (VT/BN)  N0013557 • **Is voltage indicated?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L7 .
L7 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO GROUND • Key in OFF position. • Measure the resistance between the following seat control switch C3016 pins, harness side and ground. **Connector** / **Circuit** C3016-9 — CPS28 (GN) C3016-4 — CPS23 (GN/VT) C3016-2 — CPS25 (WH/VT) C3016-6 — CPS24 (GY) C3016-12 — CPS26 (YE/BU) C3016-1 — CPS27 (BU/BN) C3016-11 — CPS29 (WH/BN) C3016-8 — CPS30 (VT/BN)	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L8 .



- **Are the resistances greater than 10,000 ohms?**

L8 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR AN OPEN

- Measure the resistance between the following seat control switch C3016 pins, harness side and DSM C341c/C341d pins, harness side.

Seat Control Switch Connector	Circuit	DSM Connector
C3016-9	CPS28 (GN)	C341c-3
C3016-4	CPS23 (GN/VT)	C341c-4
C3016-2	CPS25 (WH/VT)	C341c-14
C3016-6	CPS24 (GY)	C341c-13
C3016-12	CPS26 (YE/BU)	C341c-15
C3016-1	CPS27 (BU/BN)	C341c-16
C3016-11	CPS29 (WH/BN)	C341c-19
C3016-8	CPS30 (VT/BN)	C341d-4

- **Are the resistances less than 5 ohms?**

Yes
INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 .
REPEAT the self-test.
CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

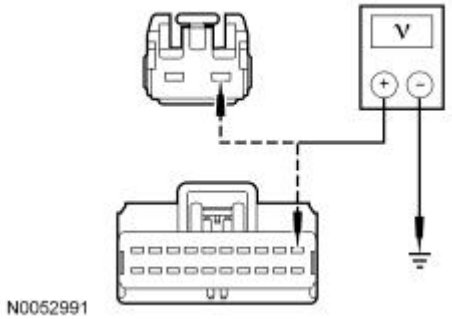
REPOWER the SRS. REFER to Section 501-20B .

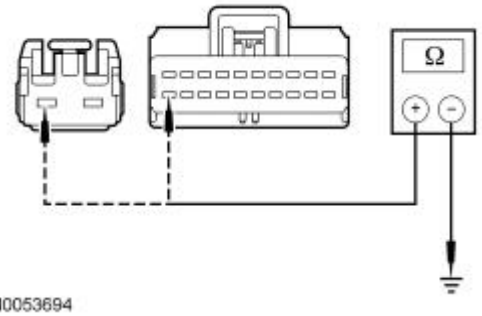
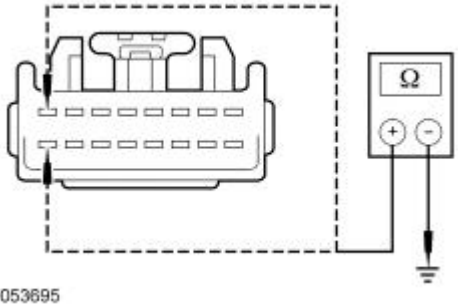
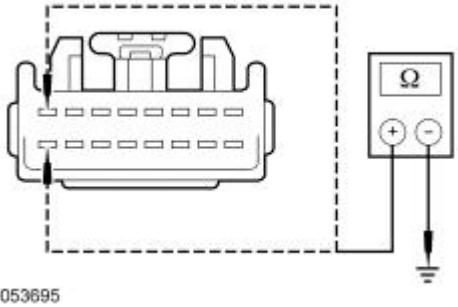
L9 CHECK THE DSM FOR CORRECT OUTPUTS USING A SCAN TOOL AND DSM ACTIVE COMMANDS

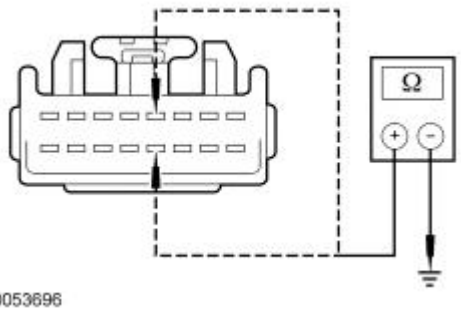
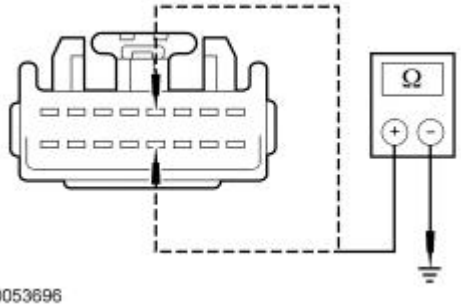
- Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM: Driver's Seat Output Control.
- Toggle the following DSM active commands ON and OFF while monitoring the seat movement:
  - Front Motor Up
  - Front Motor Down
  - Rear Motor Up

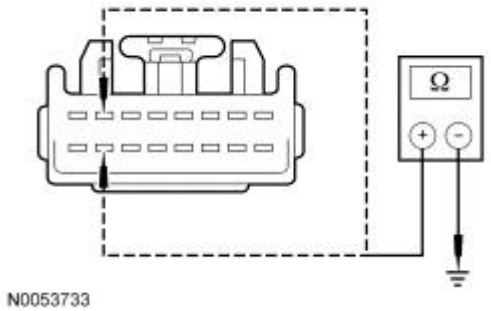
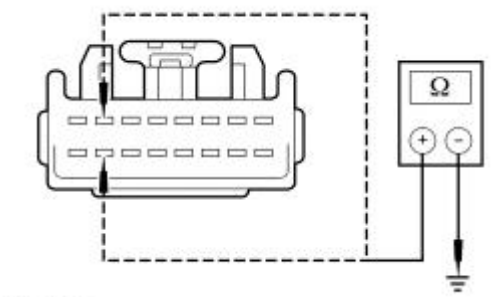
Yes
INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 .
REPEAT the self-test.
CLEAR the DTCs.

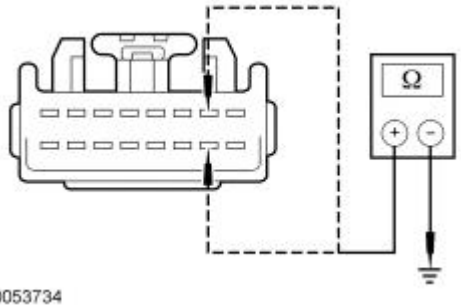
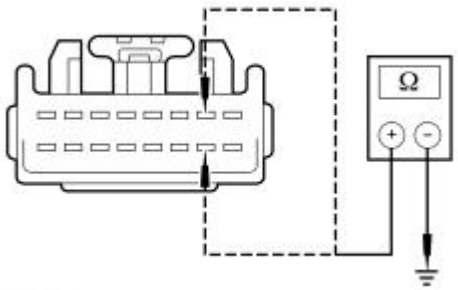
DISCONNECT the battery

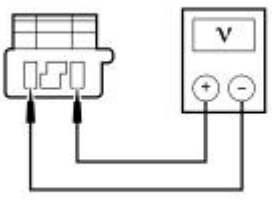
■ Rear Motor Down ■ Horizontal Motor Forward ■ Horizontal Motor Backward ■ Recline Motor Forward ■ Recline Motor Backward • **Does the driver seat operate correctly using the active commands?**	ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** If no seat movement, GO to L10 . If no front vertical seat movement, GO to L20 . If no rear vertical seat movement, GO to L23 . If no horizontal seat movement, GO to L26 . If no recline seat movement, GO to L29 .
L10 CHECK DSM CIRCUIT SBB45 (GY/RD) FOR VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: DSM C341a. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between DSM C341a-1, circuit SBB45 (GY/RD), harness side and ground; and between DSM C341c-1, circuit SBP02 (YE/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to L11 . **No** VERIFY battery junction box (BJB) fuse 45 (30A) or smart power distribution junction box (SPDJB) fuse 2 (15A) is OK. If OK, REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L11 CHECK CIRCUITS GD133 (BK) AND GD143 (BK/VT) FOR AN OPEN	
• Disconnect: DSM C341e. • Measure the resistance between DSM C341a-2, circuit GD143 (BK/VT), harness side and ground; and between DSM C341e-	**Yes** GO to L12 .

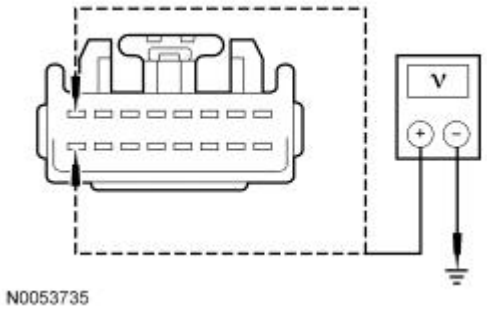
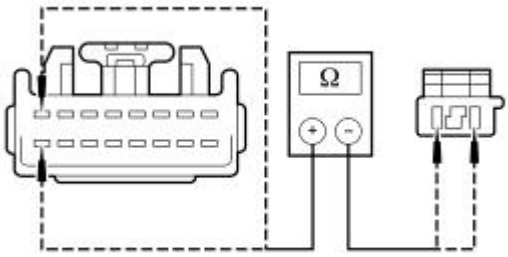
20, circuit GD133 (BK), harness side and ground.  N0053694 • **Is the resistance less than 5 ohms?**	**No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L12 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND	
• Disconnect: DSM C341b. • Measure the resistance between DSM C341b-8, circuit CPS03 (VT/GY), harness side and ground; and between DSM C341b-16, circuit CPS02 (GY/YE), harness side and ground.  N0053695 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to L14 . **No** GO to L13 .
L13 CHECK POWER SEAT FRONT HEIGHT MOTOR CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND	
• Disconnect: Power Seat Front Height Motor C382. • Measure the resistance between DSM C341b-8, circuit CPS03 (VT/GY), harness side and ground; and between DSM C341b-16, circuit CPS02 (GY/YE), harness side and ground.  N0053695 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-

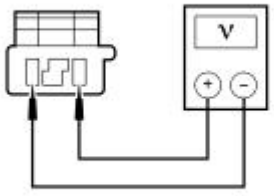
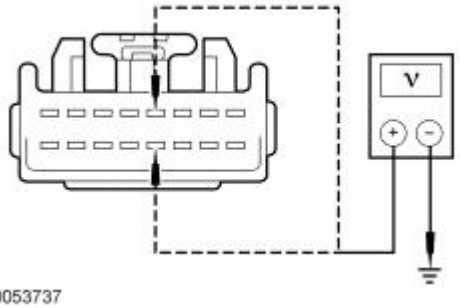
	test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L14 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND • Measure the resistance between DSM C341b-4, circuit CPS05 (BU/WH), harness side and ground; and between DSM C341b-12, circuit CPS04 (YE/OG), harness side and ground.  N0053696 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to L16 . **No** GO to L15 .
L15 CHECK THE POWER SEAT REAR HEIGHT MOTOR CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND • Disconnect: Power Seat Rear Height Motor C363. • Measure the resistance between DSM C341b-4, circuit CPS05 (BU/WH), harness side and ground; and between DSM C341b-12, circuit CPS04 (YE/OG), harness side and ground.  N0053696 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery

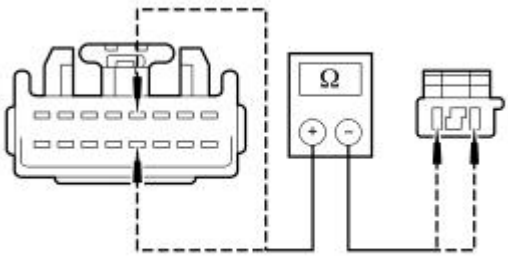
	ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L16 CHECK CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND • Measure the resistance between DSM C341b-15, circuit CPS06 (GN/WH), harness side and ground; and between DSM C341b-7, circuit CPS01 (GN/BU), harness side and ground.  N0053733 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to L18 . **No** GO to L17 .
L17 CHECK THE POWER SEAT HORIZONTAL MOTOR CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND • Disconnect: Power Seat Horizontal Motor C362. • Measure the resistance between DSM C341b-15, circuit CPS06 (GN/WH), harness side and ground; and between DSM C341b-7, circuit CPS01 (GN/BU), harness side and ground.  N0053733 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

	CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L18 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND • Measure the resistance between DSM C341b-2, circuit CPS07 (GY/BN), harness side and ground; and between DSM C341b-10, circuit CPS08 (VT/OG), harness side and ground.  N0053734 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L19 .
L19 CHECK THE DRIVER POWER SEAT RECLINER MOTOR CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND • Disconnect: Driver Power Seat Recliner Motor C3187. • Measure the resistance between DSM 341b-2, circuit CPS07 (GY/BN), harness side and ground; and between DSM C341b-10, circuit CPS08 (VT/OG), harness side and ground.  N0053734 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat recliner motor. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT

	driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L20 CHECK THE POWER SEAT FRONT HEIGHT MOTOR FOR CORRECT OPERATION	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Power Seat Front Height Motor C382. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM: Driver Seat Output Control. • Measure the voltage between power seat front height motor C382-1, circuit CPS03 (VT/GY) and C382-2, circuit CPS02 (GY/YE), harness side while using the scan tool to operate DSM active commands front motor up and front motor down, ON and OFF.  N0052984 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L21 .
L21 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO POWER	
• Key in OFF position. • Disconnect: DSM C341b. • Key in ON position. • Measure the voltage between DSM C341b-8, circuit CPS03 (VT/GY), harness side and ground; and between DSM C341b-16, circuit CPS02 (GY/YE), harness side and ground.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051.

 N0053735 • **Is voltage indicated?**	REPOWER the SRS. REFER to Section 501-20B . **No** GO to L22 .
L22 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between DSM C341b-8, circuit CPS03 (VT/GY), harness side and power seat motor C382-1, circuit CPS03 (VT/GY), harness side; and between DSM C341b-16, circuit CPS02 (GY/YE), harness side and power seat motor C382-2, circuit CPS02 (GY/YE), harness side.  N0053736 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
L23 CHECK THE REAR HEIGHT MOTOR FOR CORRECT OPERATION	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs.

• Disconnect: Power Seat Rear Height Motor C363. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM: Driver Seat Output Control. • Measure the voltage between power seat rear height motor C363-1, circuit CPS05 (BU/WH), harness side and C363-2, circuit CPS04 (YE/OG), harness side while using the scan tool to operate DSM active commands rear motor up and rear motor down, ON and OFF.  N0052984 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L24 .
L24 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO POWER	
• Key in OFF position. • Disconnect: DSM C341b. • Key in ON position. • Measure the voltage between DSM C341b-4, circuit CPS05 (BU/WH), harness side and ground; and between DSM C341b-12, circuit CPS04 (YE/OG), harness side and ground.  N0053737 • **Is voltage indicated?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L25 .
L25 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between DSM C341b-4, circuit CPS05 (BU/WH), harness side and power seat motor C363-1, circuit CPS05 (BU/WH), harness side; and between DSM C341b-12, circuit CPS04 (YE/OG), harness side and rear height power seat motor C363-2, circuit CPS04 (YE/OG), harness side.	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle



N0053738

- **Are the resistances less than 5 ohms?**

pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

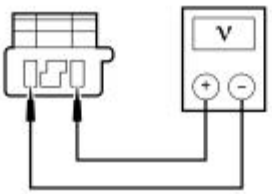
DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

L26 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
- Disconnect the driver seat safety belt buckle pretensioner C3049.
- Disconnect the driver seat side air bag C3051.
- Disconnect: Power Seat Horizontal Motor C362.
- **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**
- Connect the battery ground cable.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM: Driver Seat Output Control.
- Measure the voltage between power seat motor C362-2, circuit CPS01 (GN/BU) and C362-1, circuit CPS06 (GN/WH), harness side while using the scan tool to operate DSM active commands horizontal motor forward and horizontal motor backward, ON and OFF.



N0052984

- **Is voltage present when the motor is commanded ON and**

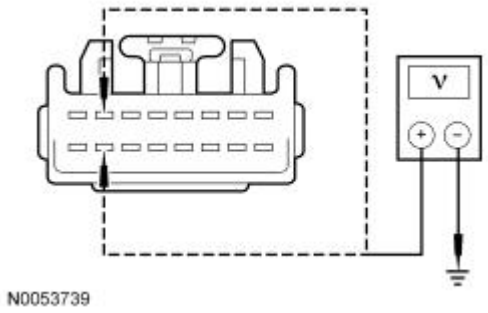
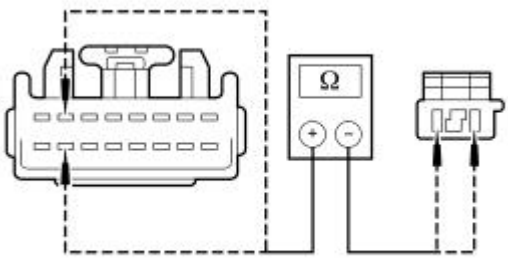
Yes
INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs.

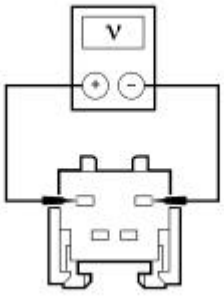
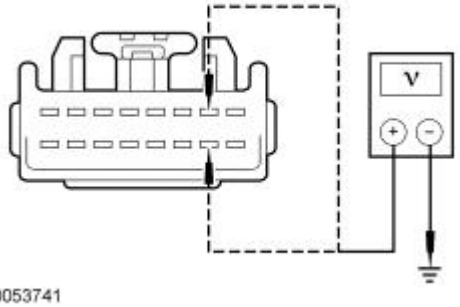
DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

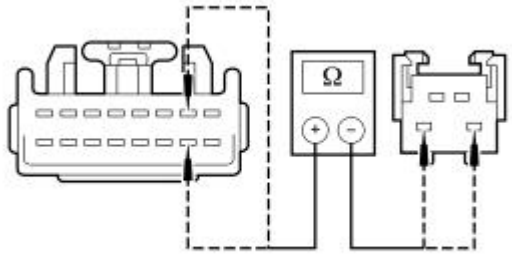
CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
GO to L27 .

no voltage present when commanded OFF?	
L27 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR A SHORT TO POWER	
• Key in OFF position. • Disconnect: DSM C341b. • Key in ON position. • Measure the voltage between DSM C341b-15, circuit CPS06 (GN/WH), harness side and ground; and between DSM C341b-7, circuit CPS01 (GN/BU), harness side and ground.  N0053739 • **Is voltage indicated?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L28 .
L28 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between DSM C341b-15, circuit CPS06 (GN/WH), harness side and power seat motor C362-1, circuit CPS06 (GN/WH), harness side; and between DSM C341b-7, circuit CPS01 (GN/BU), harness side and horizontal power seat motor C362-2, circuit CPS01 (GN/BU), harness side.  N0053740 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-

	20B .
L29 CHECK THE DRIVER SEAT POWER RECLINER MOTOR FOR CORRECT OPERATION	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Driver Seat Power Recliner Motor C3187. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM: Driver Seat Output Control. • Measure the voltage between driver seat power recliner motor C3187-2, circuit CPS07 (GY/BN) and C3187-1, circuit CPS08 (VT/OG), harness side while using the scan tool to operate the DSM active commands recline motor forward and recline motor backward, ON and OFF.  N0010826 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	**Yes** INSTALL a new driver seat recliner motor. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L30 .
L30 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO POWER	
• Key in OFF position. • Disconnect: DSM C341b. • Key in ON position. • Measure the voltage between DSM C341b-2, circuit CPS07 (GY/BN), harness side and ground; and between DSM C341b-10, circuit CPS08 (VT/OG), harness side and ground.  N0053741 • **Is voltage indicated?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to L31 .
L31 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR	

AN OPEN	
• Key in OFF position. • Measure the resistance between DSM C341b-2, circuit CPS07 (GY/BN), harness side and power seat recliner motor C3187-2, circuit CPS07 (GY/BN), harness side; and between DSM C341b-10, circuit CPS08 (VT/OG), harness side and power seat recliner motor C3187-1, circuit CPS08 (VT/OG), harness side.  N0053742 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test M: The Memory Seat Does Not Operate Correctly — Does Not Operate Using the Memory Set Switch

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBP12 (GN/RD) and is supplied ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to DSM on circuit SBP02 (YE/RD) and SBB45 (GY/RD). Ground is supplied to the DSM on circuits GD133 (BK) and GD143 (BK/VT).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a shared signal feed circuit to each position sensor. Each position sensor sends a signal pulse back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory set switch or a remote entry transmitter. Refer to Principles of Operation in this section or the Owner's Literature for additional information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate correctly using the memory set switch. If the memory seat does not move in all directions using the seat control switch, Go To Pinpoint Test L .

Possible Causes

A memory seat that does not operate correctly can be caused by:

- wiring, terminals or connectors.
- a faulty memory set switch.
- missing status information (CAN communication bus messages):
  - ignition switch status.
  - gear selector position.
- a faulty remote entry transmitter.
- a faulty memory power seat track.
- a faulty recliner mechanism.
- a faulty DSM.

PINPOINT TEST M: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY — DOES NOT OPERATE USING THE MEMORY SET SWITCH

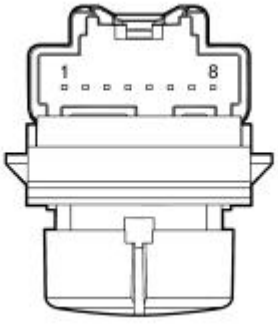
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

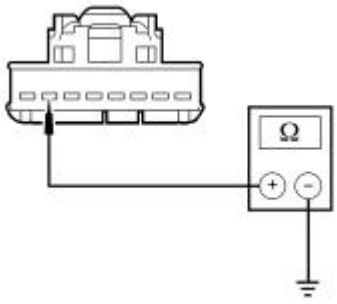
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

Test Step	Result / Action to Take
M1 CHECK IGNITION SWITCH STATUS, TRANSMISSION GEAR SELECTOR STATUS AND RETRIEVE THE DSM DTCs	
• Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/Transmission Control Module (TCM) PID: PRND Position. • Operate the transmission gear selector in all positions while monitoring the PID. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/Smart Power Distribution Junction Box (SPDJB) PID: Ignition Switch Status. • Cycle the ignition switch in all positions while monitoring the PID. • Verify the PID values agree with the ignition switch and transmission gear selector in all positions before proceeding with memory seat diagnosis. • Key in ON position. • Using the switches, operate the memory seat, memory mirrors,	**Yes** If DTC B2084 and B208A, GO to M5 . If DTCs B1952, B1956, B1960 and B1964 are all retrieved, GO to M8 . If DTCs B1953, B1957, B1961 and B1965 are all retrieved, GO to M8 . If DTC B1530, GO to M3 . If DTC B1534, GO to

adjustable memory pedals (if equipped) and adjustable memory steering column (if equipped) in all directions through the full range of travel. ● Place the memory seat, memory mirrors, adjustable memory pedals (if equipped) and adjustable memory steering column (if equipped) in central travel positions. ● Enter the following diagnostic mode on the diagnostic tool: Driver Seat Module (DSM) Self Test/Retrieve DTCs. ● **Are any DSM DTCs retrieved?**	M3 . If DTC B1538, GO to M3 . If DTC B1663, GO to M9 . If DTC B1664, GO to M12 . If DTC B1665, GO to M15 . If DTC B1666, GO to M18 . If DTC B1952, GO to M12 . If DTC B1953, GO to M12 . If DTC B1956, GO to M9 . If DTC B1957, GO to M9 . If DTC B1960, GO to M18 . If DTC B1961, GO to M18 . If DTC B1964, GO to M15 . If DTC B1965, GO to M15 . If DTC B2300, GO to M8 . If DTC B1342, INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. For any other DSM DTCs, REFER to the Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. **No** To diagnose an ignition switch status concern, REFER to Section 211-05 .

	To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B . Otherwise, GO to M2 .
M2 MONITOR THE DSM PIDs AND CHECK THE DSM FOR CORRECT MEMORY SET SWITCH INPUTS	
• Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM PID: Memory Set/Recall Input Switch Status. • Monitor the DSM memory set switch, memory set/recall 1 switch and memory set/recall 2 switch PID while activating the memory set switch, recall 1 and recall 2 buttons. • **Do the PID values agree with the switch button positions?**	**Yes** GO to M8 . **No** GO to M3 .
M3 CHECK THE MEMORY SET SWITCH	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Memory Set Switch C3246. • Using the following table to check the memory set switch, measure the resistance between the memory set switch pins, component side, while pressing the indicated switch buttons and compare the results to the table. **Switch Button / Pins / Ohms** Memory Switch 1 / 2 and 7 / Less than 5 Memory Switch 2 / 2 and 3 / Less than 5 Memory Set Switch / 2 and 4 / Less than 5  N0054920 • **Is the resistance less than 5 ohms with the switch buttons depressed and greater than 10,000 ohms with the switch buttons released?**	**Yes** GO to M4 . **No** INSTALL a new memory set switch. REFER to Memory Set Switch . REPOWER the SRS. REFER to Section 501-20B . REPEAT the self-test. CLEAR the DTCs.
M4 CHECK GROUND CIRCUIT GD133 (BK) TO THE MEMORY SET SWITCH	
• Key in ON position. • Measure the resistance between memory set switch C3246-2, circuit GD133 (BK), harness side and ground.	**Yes** GO to M5 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.



N0040379

- **Is the resistance less than 5 ohms?**

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

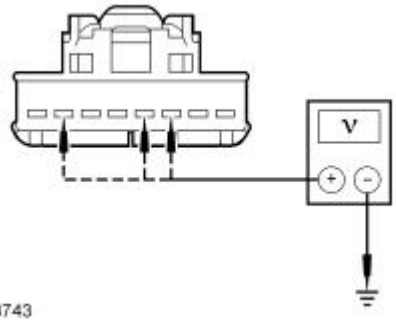
CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

M5 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO POWER

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
- Disconnect the driver seat safety belt buckle pretensioner C3049.
- Disconnect the driver seat side air bag C3051.
- Disconnect: DSM C341c and C341d.
- **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**
- Connect the battery ground cable.
- Key in ON position.
- Measure the voltage between the following memory set switch C3246 pins, harness side and ground:

Connector - Pin	Circuit
C3246-4	CPS14 (GY/VT)
C3246-7	CPS15 (VT/WH)
C3246-3	CPS16 (YE)



N0053743

- **Is voltage indicated?**

Yes
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
GO to M6 .

M6 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR A SHORT TO GROUND

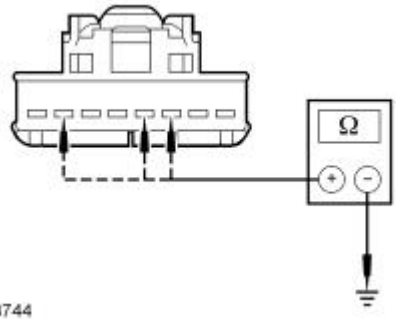
- Key in OFF position.
- Measure the resistance between the following memory set switch C3246 pins, harness side and ground:

Connector - Pin	Circuit

Yes
GO to M7 .

No
REPAIR the affected circuit. REPEAT the self-

C3246-4	CPS14 (GY/VT)
C3246-7	CPS15 (VT/WH)
C3246-3	CPS16 (YE)



- **Are the resistances greater than 10,000 ohms?**

test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

M7 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH) AND CPS16 (YE) FOR AN OPEN

- Measure the resistance between the following memory set switch C3246 pins and DSM C341c/C341d pins:

Memory Set Switch	Circuit	DSM
C3246-3	CPS16 (YE)	C341c-11
C3246-4	CPS14 (GY/VT)	C341d-19
C3246-7	CPS15 (VT/WH)	C341d-9

- **Are the resistances less than 5 ohms?**

Yes
INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

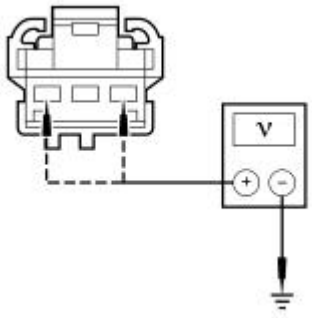
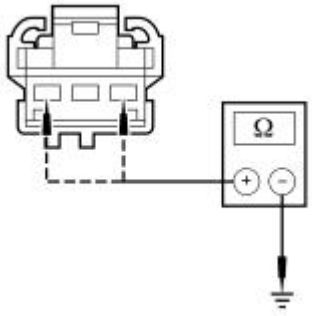
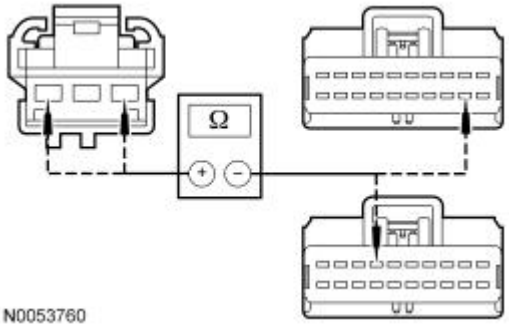
CONNECT driver seat side air bag module C3051.

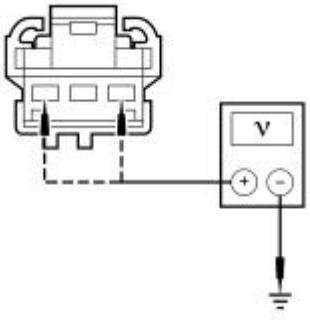
REPOWER the SRS. REFER to Section 501-20B .

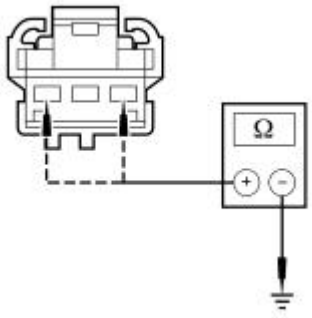
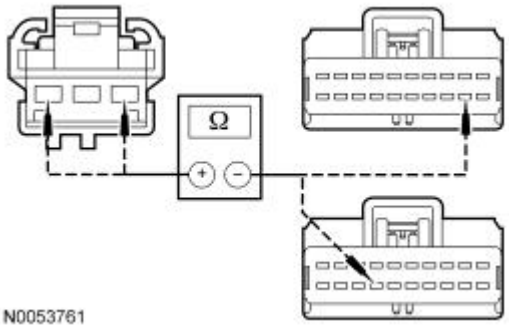
M8 MONITOR THE DSM PIDs

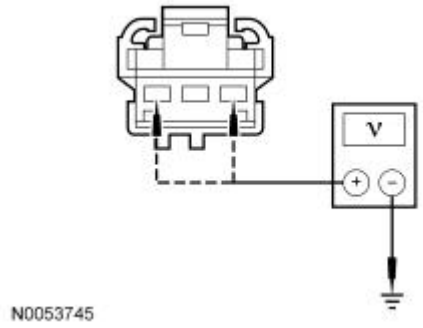
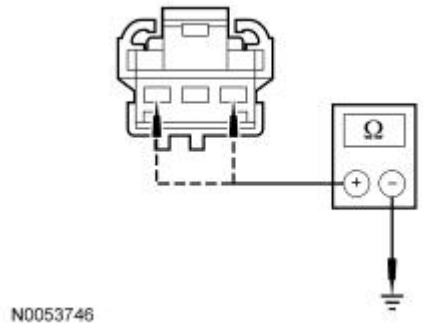
• Enter the following diagnostic mode on the diagnostic tool: Datalogger/DSM PIDs:.
  ▪ Driver Seat/Mirror/Pedal Sensor Output Status
  ▪ Steering Column Tilt Position (if equipped)
• Monitor the memory seat, memory mirrors, adjustable memory pedals (if equipped) and adjustable memory steering column (if equipped) sensor PIDs.
• Using the switches, operate the memory seat, memory mirrors, adjustable memory pedals (if equipped) and adjustable memory steering column (if equipped) in all directions through the full range of travel while monitoring the PIDs.
• **Does each PID indicate the sensor is operational throughout each associated motor's full range of travel?**
	Yes
	INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.
	
	No
	If front up/down position sensor PID value indicates not present, GO to M9 .
	
	If rear up/down position sensor PID value indicates not present, GO to M12 .
	
	If forward/rearward position sensor PID value indicates not present, GO to M15 .
	
	If recline position sensor PID value indicates not present, GO to M18 .
	
	For a memory mirror sensor concern, REFER to Section 501-09 .
	
	For a memory adjustable pedal sensor concern, REFER to Section 206-00 .
	
	For an adjustable memory column sensor concern, REFER to Section 211-04 .

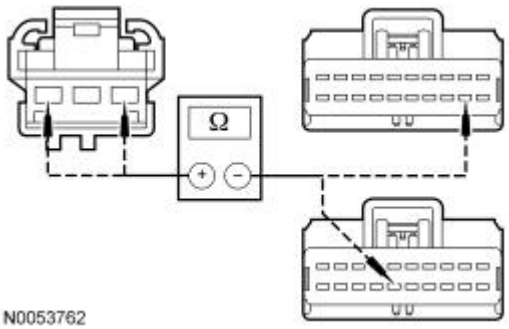
M9 CHECK SENSOR CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO POWER	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: DSM C341c and C341d. • Disconnect: Memory Seat Front Height Position Sensor C383. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between memory seat front height position sensor C383-1, circuit VPS10 (BU/GN), harness side and ground; and between memory seat front height position sensor 383-3, circuit RPS13 (GN/OG), harness side and ground.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No**

 N0053745 • **Is voltage indicated?**	GO to M10 .
M10 CHECK SENSOR CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND • Key in OFF position. • Measure the resistance between memory seat front height position sensor C383-1, circuit VPS10 (BU/GN), harness side and ground; and between memory seat front height position sensor 383-3, circuit RPS13 (GN/OG), harness side and ground.  N0053746 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to M11 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M11 CHECK SENSOR CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR AN OPEN • Measure the resistance between memory seat front height position sensor C383-1, circuit VPS10 (BU/GN), harness side and DSM C341d-7, circuit VPS10 (BU/GN), harness side; and between memory seat front height position sensor 383-3, circuit RPS13 (GN/OG), harness side and DSM C341c-12, circuit RPS13 (GN/OG), harness side.  N0053760 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected

	circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M12 CHECK SENSOR CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO POWER	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: DSM C341c and C341d. • Disconnect: Memory Seat Rear Height Position Sensor C373. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between memory seat rear height position sensor C373-1, circuit VPS11 (GN/BN), harness side and ground; and between memory seat rear height position sensor C373-3, circuit RPS13 (GN/OG), harness side and ground.  N0053745 • **Is voltage indicated?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to M13 .
M13 CHECK SENSOR CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between memory seat rear height position sensor C373-1, circuit VPS11 (GN/BN), harness side and ground; and between memory seat rear height position sensor C373-3, circuit RPS13 (GN/OG), harness side and ground.	**Yes** GO to M14 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety

 N0053746 • **Are the resistances greater than 10,000 ohms?**	belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M14 CHECK SENSOR CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) AND FOR AN OPEN	
• Measure the resistance between memory seat rear height position sensor C373-1, circuit VPS11 (GN/BN), harness side and DSM C341d-17, circuit VPS11 (GN/BN), harness side; and between memory seat rear height position sensor C373-3, circuit RPS13 (GN/OG), harness side and DSM C341c-12, circuit RPS13 (GN/OG), harness side.  N0053761 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M15 CHECK SENSOR CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) AND FOR A SHORT TO POWER	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

portion of Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: DSM C341c and C341d. • Disconnect: Memory Seat Horizontal Position Sensor C372. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between memory seat horizontal position sensor C373-1, circuit VPS09 (BN/BU), harness side and ground; and between memory seat horizontal position sensor C373-3, circuit RPS13 (GN/OG), harness side and ground.  N0053745 • **Is voltage indicated?**	DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to M16 .
M16 CHECK SENSOR CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between memory seat horizontal position sensor C373-1, circuit VPS09 (BN/BU), harness side and ground; and between memory seat horizontal position sensor C373-3, circuit RPS13 (GN/OG), harness side and ground.  N0053746 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to M17 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M17 CHECK SENSOR CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR AN OPEN	
• Measure the resistance between memory seat horizontal position sensor C373-1, circuit VPS09 (BN/BU), harness side and DSM C341d-16, circuit VPS09 (BN/BU), harness side; and between memory seat horizontal position sensor C373-3, circuit RPS13 (GN/OG), harness side and DSM C341c-12, circuit RPS13 (GN/OG), harness side.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track — Power in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the



- **Are the resistances less than 5 ohms?**

battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

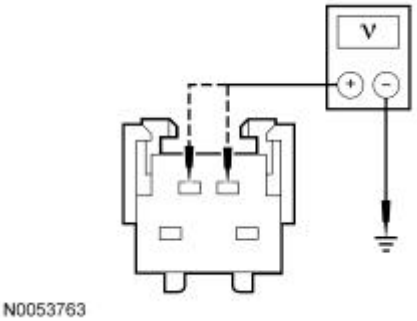
DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

M18 CHECK SENSOR CIRCUITS VPS12 (GY/OG) AND RPS13 (GN/OG) FOR A SHORT TO POWER

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
- Disconnect the driver seat safety belt buckle pretensioner C3049.
- Disconnect the driver seat side air bag C3051.
- Disconnect: DSM C341c and C341d.
- Disconnect: Driver Seat Recliner Motor C3187.
- **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**
- Connect the battery ground cable.
- Key in ON position.
- Measure the voltage between driver seat recliner motor C3187-3, circuit VPS12 (GY/OG), harness side and ground; and between driver seat recliner motor C3187-4, circuit RPS13 (GN/OG), harness side and ground.



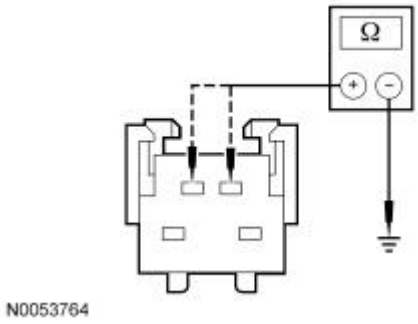
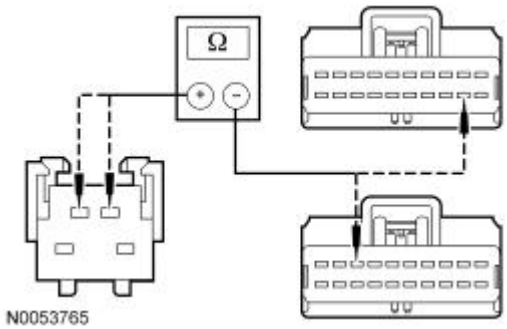
Yes
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049.

CONNECT driver seat side air bag module C3051.

REPOWER the SRS. REFER to Section 501-20B .

No
GO to M19 .

• **Is voltage indicated?**	
M19 CHECK SENSOR CIRCUITS VPS12 (GY/OG) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between driver seat recliner motor C3187-3, circuit VPS12 (GY/OG), harness side and ground; and between driver seat recliner motor C3187-4, circuit RPS13 (GN/OG), harness side and ground.  N0053764 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to M20 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
M20 CHECK SENSOR CIRCUITS VPS12 (GY/OG) AND RPS13 (GN/OG) FOR AN OPEN	
• Measure the resistance between driver seat recliner motor C3187-3, circuit VPS12 (GY/OG), harness side and DSM C341d-8, circuit VPS12 (GY/OG), harness side; and between driver seat recliner motor C3187-4, circuit RPS13 (GN/OG), harness side and DSM C341c-12, circuit RPS13 (GN/OG), harness side.  N0053765 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat recliner motor. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051.

	REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test N: Easy Exit/Easy Entry is Inoperative/Does Not Operate Correctly

Normal Operation

The DSM receives a key out command over the MS-CAN communication network and powers the driver seat rearward about 51 mm (2 in).

Possible Causes

An inoperative/not operating correctly easy entry/exit seat feature can be caused by:

- the easy entry/exit feature is not enabled.
- missing status information (CAN communication bus messages) to the driver seat module (DSM):
  - ignition switch status.
  - gear selector position.
- wiring, terminals or connectors.
- a faulty key-in-ignition warning switch.
- a faulty driver seat module (DSM).

PINPOINT TEST N: EASY EXIT/EASY ENTRY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: The transmission gear selector must be in park for the easy entry/exit feature to function.

Test Step	Result / Action to Take
N1 CHECK THE DRIVER POWER SEAT OPERATION	
• Key in ON position. • Check the message center to verify the easy entry/exit feature is enabled. • Using the seat control switch, operate the driver power seat fully forward and rearward. • Position the seat at least 2 inches from its rear stopping point. • Connect the diagnostic tool. • Enter the following diagnostic mode on the diagnostic tool: Driver Seat Module (DSM) Self Test/Retrieve DTCs. • **Are any DSM DTCs retrieved?**	**Yes** REFER to the Driver Seat Module (DSM) Diagnostic Trouble Code (DTC) Chart. **No** If disabled, ENABLE the easy entry/exit feature with the message center. REFER to the Owner's Literature — Driver Controls for easy entry/exit feature enable/disable instructions. TEST the system for normal operation. If OK, INSTRUCT the customer on correct system operation. If easy entry/exit is enabled and the seat does not move horizontally from the seat control switch, Go To Pinpoint Test L . Otherwise, GO to N2 .
N2 CHECK THE DRIVER SEAT MODULE (DSM) FOR CORRECT INPUTS	

• Enter the following diagnostic mode on the diagnostic tool: Datalogger/Transmission Control Module (TCM): Transmission Range (PRNDL) PID. • Monitor the PID while operating the transmission gear selector in all positions. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/Smart Power Distribution Junction Box (SPDJB): Ignition Switch Position PIDs. • Monitor the PIDs with the key in the ignition switch and with the key removed. • **Do the PID values agree with the ignition switch and transmission gear selector positions?**	**Yes** INSTALL a new DSM and CARRY OUT PMI. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. **No** To diagnose the key-in-ignition warning switch fault, REFER to Section 413-09 . To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B .

Pinpoint Test O: The Power Lumbar is Inoperative — Driver

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The seat control switch is powered by battery voltage on circuit SBB45 (GY/RD) or SBP12 (GN/RD) (memory seat) and is supplied ground on circuit GD143 (BK/VT) or GD133 (BK) (memory seat). When the lumbar knob on the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the switch in the opposite direction, voltage polarity to the power lumbar motor is reversed, moving the lumbar assembly in the opposite direction.

Possible Causes

An inoperative power lumbar can be caused by:

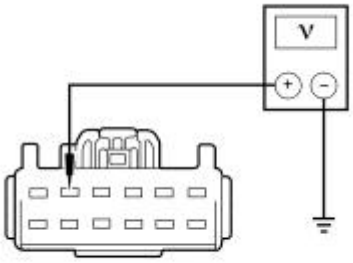
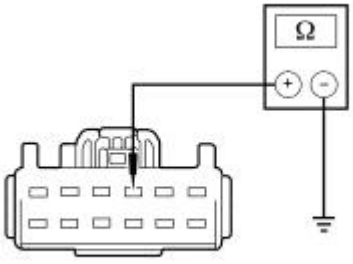
- wiring, terminals or connectors.
- a faulty lumbar control switch.
- a faulty power lumbar motor assembly.

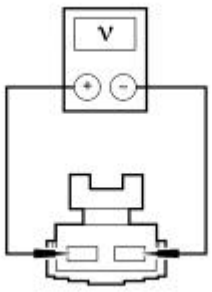
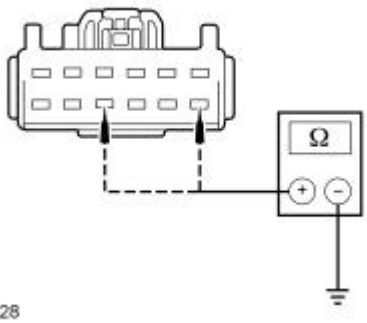
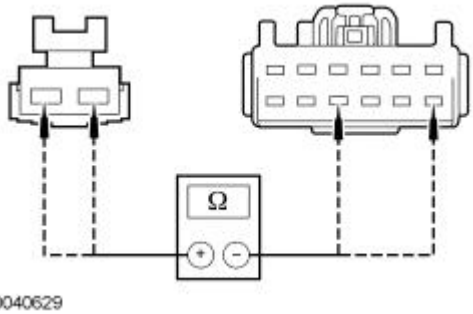
PINPOINT TEST O: THE POWER LUMBAR IS INOPERATIVE — DRIVER

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
O1 CHECK CIRCUIT SBB45 (GY/RD) OR SBP12 (GN/RD) (MEMORY SEAT) FOR AN OPEN	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of	**Yes** GO to O2 . **No**

Section 501-20B . • Disconnect the driver seat safety belt buckle pretensioner C3049. • Disconnect the driver seat side air bag C3051. • Disconnect: Seat Control Switch C3016. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between seat control switch C3016-5, circuit SBB45 (GY/RD) (SBP12 [GN/RD] for memory seat), harness side and ground.  N0010816 • **Is the voltage greater than 10 volts?**	VERIFY battery junction box (BJB) fuse 45 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
O2 CHECK CIRCUIT GD143 (BK/VT) OR GD133 (BK) (MEMORY SEAT) FOR AN OPEN • Measure the resistance between seat control switch C3016-3, circuit GD143 (BK/VT) (GD133 [BK] for memory seat), harness side and ground.  N0010815 • **Is the resistance less than 5 ohms?**	**Yes** GO to O3 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
O3 CHECK THE LUMBAR MOTOR • Connect: Seat Control Switch C3016. • Disconnect: Power Lumbar Motor C3215. • For power seat, measure the voltage between power lumbar motor C3215-B, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-A, circuit CPS19 (GY/VT), harness side.	**Yes** INSTALL a new power lumbar assembly. REFER to Lumbar Assembly in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle

 N0040627 • Operate the seat control switch in both directions. • **Is the voltage greater than 10 volts in both directions?**	pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No** GO to O4 .
O4 CHECK CIRCUIT CPS19 (GY/VT) AND CIRCUIT CPS18 (BN/GN) FOR A SHORT TO GROUND	
• Disconnect: Seat Control Switch C3016. • Measure the resistance between seat control switch C3016-7, circuit CPS18 (BN/GN), harness side and ground; and between seat control switch C3016-10, circuit CPS19 (GY/VT), harness side and ground.  N0040628 • **Are the resistances greater than 10,000 ohms.**	**Yes** GO to O5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .
O5 CHECK CIRCUITS CPS19 (GY/VT) AND CPS18 (BN/GN) FOR AN OPEN	
• Measure the resistance between seat control switch C3016-7, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-B, circuit CPS18 (BN/GN), harness side; and between seat control switch C3016-10, circuit CPS19 (GY/VT), harness side and power lumbar motor C3215-A, circuit CPS19 (GY/VT), harness side.  N0040629 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new seat control switch. REFER to Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B . **No**

	REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3049. CONNECT driver seat side air bag module C3051. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test P: The Power Lumbar is Inoperative — Passenger

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB29 (GY/RD) and is supplied ground on circuit GD138 (BK/WH). When the lumbar knob on the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the switch in the opposite direction, voltage polarity to the power lumbar motor is reversed, moving the lumbar assembly in the opposite direction.

Possible Causes

An inoperative power lumbar can be caused by:

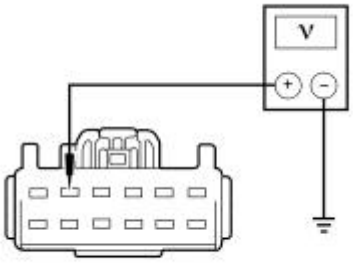
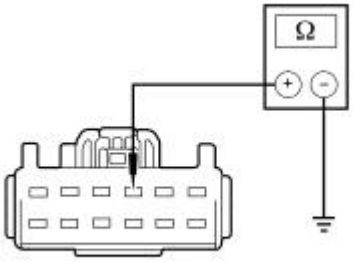
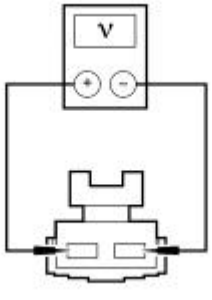
- wiring, terminals or connectors.
- a faulty lumbar control switch.
- a faulty power lumbar motor assembly.

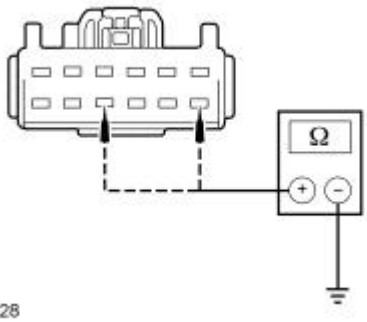
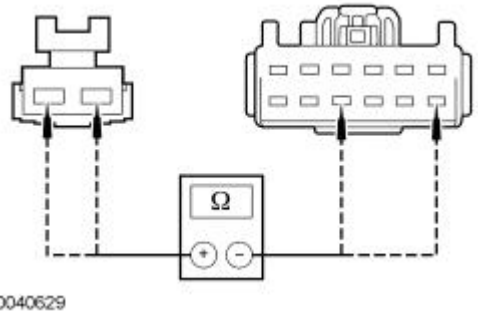
PINPOINT TEST P: THE POWER LUMBAR IS INOPERATIVE — PASSENGER

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
P1 CHECK CIRCUIT SBB29 (GY/RD) FOR AN OPEN	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect the passenger seat safety belt buckle pretensioner C3050. • If equipped, disconnect the passenger seat side air bag C3052.	**Yes** GO to P2 . **No** VERIFY battery junction box (BJB) fuse 29 (30A) is OK. If OK,

• Disconnect: Passenger Seat Control Switch C3026. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between passenger seat control switch C3026-5, circuit SBB29 (GY/RD), harness side and ground.  N0010816 • **Is the voltage greater than 10 volts?**	REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
P2 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C3026-3, circuit GD138 (BK/WH), harness side and ground.  N0010815 • **Is the resistance less than 5 ohms?**	**Yes** GO to P3 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
P3 CHECK THE LUMBAR MOTOR	
• Connect: Passenger Seat Control Switch C3026. • Disconnect: Power Lumbar Motor C3216. • For power seat, measure the voltage between power lumbar motor C3216-B, circuit CPS18 (BN/GN), harness side and power lumbar motor C3216-A, circuit CPS19 (GY/VT), harness side.  N0040627 • Operate the seat control switch in both directions.	**Yes** INSTALL a new power lumbar assembly. REFER to Lumbar Assembly in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

• **Is the voltage greater than 10 volts in both directions?**	REPOWER the SRS. REFER to Section 501-20B . **No** GO to P4 .
P4 CHECK CIRCUIT CPS20 (VT) AND CIRCUIT CPS21 (WH/OG) FOR A SHORT TO GROUND	
• Disconnect: Passenger Seat Control Switch C3026. • Measure the resistance between seat control switch C3026-7, circuit CPS20 (VT), harness side and ground; and between seat control switch C3026-10, circuit CPS21 (WH/OG), harness side and ground.  N0040628 • **Are the resistances greater than 10,000 ohms.**	**Yes** GO to P5 . **No** REPAIR the affected circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
P5 CHECK CIRCUITS CPS18 (BN/GN), CPS19 (GY/VT), CPS20 (VT) AND CPS21 (WH/OG) FOR AN OPEN	
• Measure the resistance between seat control switch C3026-7, circuit CPS20 (VT), harness side and power lumbar motor C3216-B, circuit CPS18 (BN/GN), harness side; and between seat control switch C3026-10, circuit CPS21 (WH/OG), harness side and power lumbar motor C3216-A, circuit CPS19 (GY/VT), harness side.  N0040629 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new seat control switch. Seat Control Switch — Front . TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. TEST the system for normal operation.

	DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test Q: A Single Climate Controlled Seat is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a SPDJB device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A single climate controlled seat that does not operate can be caused by:

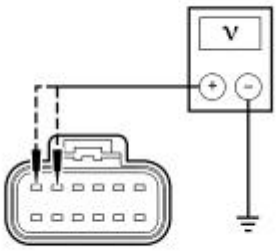
- wiring, terminals or connectors.
- an MS-CAN fault.
- a faulted electronic automatic temperature control (EATC) module.
- a faulted CCSM.

PINPOINT TEST Q: A SINGLE CLIMATE CONTROLLED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Q1 CHECK CLIMATE CONTROLLED SEAT OPERATION	
• Check the operation of both climate controlled seats and verify the symptom. • **Does the other climate controlled seat operate?**	**Yes** GO to Q2 . **No** GO to Symptom Chart .
Q2 CHECK FOR CCSM AND EATC DTCS	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • Enter the following diagnostic mode on the diagnostic tool: Electronic Automatic Temperature Control (EATC) Self Test/Retrieve DTCs. • **Were any DTCs retrieved during the on-demand self test?**	**Yes** For CCSM DTCs, GO to the Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Table. For EATC DTCs, REFER to Section 412-00 to diagnose the EATC module fault. **No** GO to Q3 .
Q3 CHECK OPERATION OF THE CCSM USING THE SCAN TOOL	
• Enter the following diagnostic mode on the diagnostic tool: Datalogger/CCSM Active Command: Thermal Electric Device (TED) Heat Mode (driver seat) or Passenger Thermal Electric Device (TED) Heat Mode (passenger seat). • Enter the following diagnostic mode on the diagnostic tool: Datalogger/CCSM PID: Driver DATC State Encoded Seat Mode or Passenger DATC State Encoded Seat Mode. • **NOTE:** The CCSM active commands thermal electric device (TED) heat mode (driver seat) and passenger thermal electric device (TED) heat mode (passenger seat) are limited to 15 seconds in the ON state, then turn OFF. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational and also demonstrates the CCSM is able to receive and process inbound command messages from the communication bus. This indicates the EATC module may not be sending the commands correctly. • Monitor the CCSM PID for the affected seat while using the scan tool to command the seat on. • **Does the affected seat operate using the active command?**	**Yes** GO to Q5 . **No** GO to Q4 .
Q4 CHECK FOR VOLTAGE TO THE CCSM	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265a. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the voltage between CCSM C3265a-F, circuit SBB08 (VT/RD), harness side and CCSM C3265a-E, circuit	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

SBB08 (VT/RD), harness side and ground.  N0042997 • **Is the voltage greater than 10 volts?**	REPOWER the SRS. REFER to Section 501-20B . **No** VERIFY battery junction box (BJB) fuse 8 (40A) is OK. If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
Q5 MONITOR THE CCSM PID	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Enter the following diagnostic mode on the diagnostic tool: Datalogger/CCSM PID: Driver DATC State Encoded Seat Mode (driver seat) or Passenger DATC State Encoded Seat Mode (passenger seat). • **NOTE:** Operation of the climate controlled seats repeatedly ON and OFF or repeatedly switching between HEAT and COOL modes may cause a CCSM DTC(s) to set, disabling one or both seat system and may require the DTC(s) to be cleared before seat operation may continue. It is recommended to allow time between modes for seat temperatures to adjust back toward ambient temperatures before continuing. • Monitor the CCSM PID for the driver (or passenger) seat while operating the affected climate controlled seat by selecting HIGH HEAT, MEDIUM HEAT, LOW HEAT and OFF on the EATC module. Then select HIGH COOL, MEDIUM COOL and LOW COOL. • **Do all the PID values match climate controlled seat settings selected on the EATC module?**	**Yes** If the fault is intermittent, CHECK for causes of the intermittent fault. INSPECT the connectors, terminals and wiring. ATTEMPT to recreate the fault by flexing the wire harness and operating the system. CHECK the electrical connectors for corrosion or pushed-out pins. REPAIR any intermittent concerns found. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new EATC module. REFER to Section 412-01 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050.

	CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test R: The Power Seat is Inoperative — Third Row Power-Fold, Left and Right Seats

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

Voltage is supplied to the power-fold seat relay coils controlled from the smart power distribution junction box (SPDJB) through circuit CPS48 (BU) enabling the system. Ground is supplied to the power-fold seat relay coils and both left and right seat control switches on circuit GD151 (BK/GN). The power fold seat relays will be provided voltage on the coil side from the SPDJB for 10 minutes when the transmission selector is in PARK and the liftgate, or liftgate glass, is open. The voltage will be disabled 10 minutes after turning the vehicle off. If the voltage is disabled after 10 minutes, it can be re-enabled by opening any door or pressing the unlock key on the key fob.

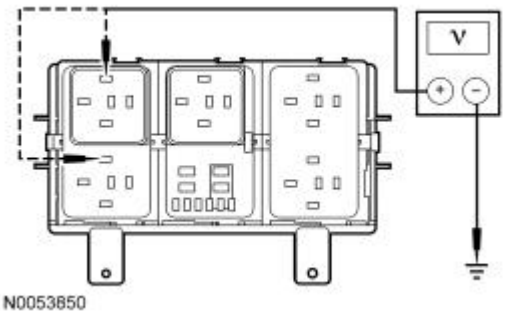
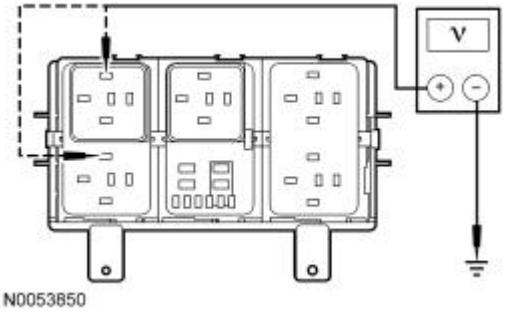
Possible Causes

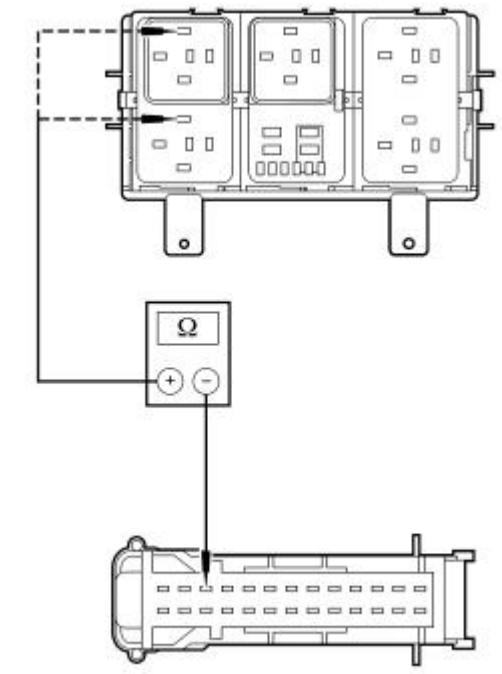
An inoperative third row power-fold seat can be caused by:

- open fuse.
- auxiliary relay box third row power-fold seat relay(s).
- wiring, terminals or connectors.
- a faulty SPDJB.

PINPOINT TEST R: THE POWER SEAT IS INOPERATIVE — THIRD ROW POWER-FOLD, LEFT AND RIGHT SEATS

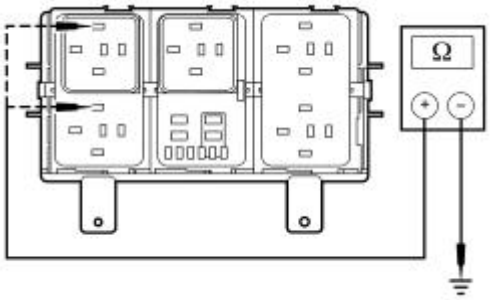
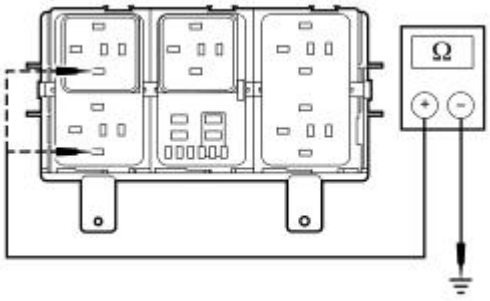
Test Step	Result / Action to Take
R1 CHECK FOR SMART POWER DISTRIBUTION JUNCTION BOX (SPDJB) DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Smart Power Distrubution Junction Box (SPDJB) Self Test/Retrieve DTCs. • **Are any SPDJB DTCs retrieved?**	**Yes** If DTC B2A2D, key OFF and VERIFY smart junction box fuse 5 (10A) is OK. DISCONNECT SPDJB C2280d and GO to R6 . If DTC B2794, key OFF. DISCONNECT auxiliary relay box left and right third row power-fold seat relays and GO to R3 . For all other SPDJB DTCs, REFER to Diagnostic Trouble Code (DTC) Chart in Section 419-10 . **No** GO to R2 .

R2 CHECK FOR VOLTAGE TO THE RELAYS	
• Key in OFF position. • Disconnect: Left Third Row Power-Fold Seat Relay. • Disconnect: Right Third Row Power-Fold Seat Relay. • Key in ON position. • Measure the voltage between auxiliary relay box left and right third row power-fold seat relay terminals 85, circuit CPS48 (BU), harness side and ground.  N0053850 • **Is the voltage greater than 10 volts?**	**Yes** GO to R3 . **No** Key OFF. DISCONNECT SPDJB C2280d. GO to R5 .
R3 CHECK FOR FAULTY RELAYS	
• Carry-out the component test on the auxiliary relay box left and right third row power-fold seat relays. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Did both relays pass the component test?**	**Yes** GO to R4 . **No** INSTALL a new relay(s). REPEAT the self-test. CLEAR the DTCs.
R4 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Smart Power Distribution Junction Box (SPDJB) C2280d. • Key in ON position. • Measure the voltage between auxiliary relay box left and right third row power-fold seat relay terminals 85, circuit CPS48 (BU), harness side and ground.  N0053850 • **Is voltage present?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. **No** GO to R5 .
R5 CHECK CIRCUIT CPS48 (BU) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between auxiliary relay box left and right third row power-fold seat relay terminals 85, circuit CPS48 (BU), harness side and SPDJB C2280d-24, circuit CPS48 (BU), harness side.	**Yes** GO to R6 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.



N0053851

- **Is the resistance less than 5 ohms?**

R6 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO GROUND	
• Measure the resistance between auxiliary relay box left and right power-fold seat relay terminals 85, circuit CPS48 (BU), harness side and ground.  N0053852 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to R7 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.
R7 CHECK GROUND CIRCUIT GD151 (BK/GN) FOR OPEN	
• Measure the resistance between auxiliary relay box left and right third row power-fold seat relay terminals 86, circuit GD151 (BK/GN), harness side and ground.  N0053853 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new SPDJB. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

Pinpoint Test S: The Power Seat is Inoperative/Does Not Operate Correctly — Third Row Power-Fold, Left Seat

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information.

Normal Operation

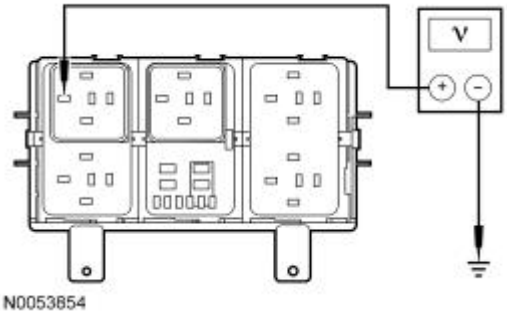
Battery voltage is supplied from the battery junction box (BJB) to the switch side of left third row power-fold seat relay through circuit SBB04 (GN/RD) and is hot at all times. When the smart power distribution junction box (SPDJB) energizes the left power-fold seat relay circuit CPS48 (BU), battery voltage is switched through the relay to the left power-fold seat control switch on circuit SBB31 (WH/RD). Ground is supplied to the left power-fold seat control switch through circuit GD151 (BK/GN). When the left third row power-fold seat control switch is pressed, battery voltage and ground is supplied to the left power-fold seat motor. Pressing the switch in the opposite direction, reverses the polarity to the left power-fold seat motor, which moves the third row seat backrest in the opposite direction.

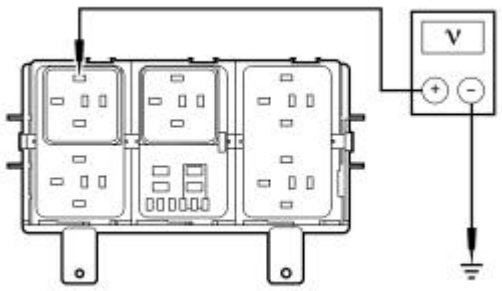
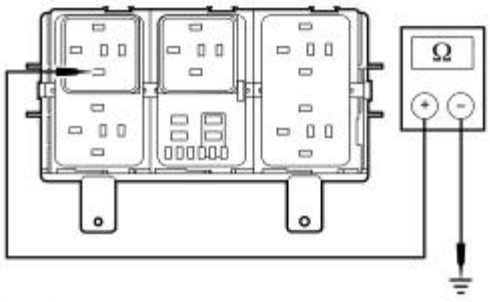
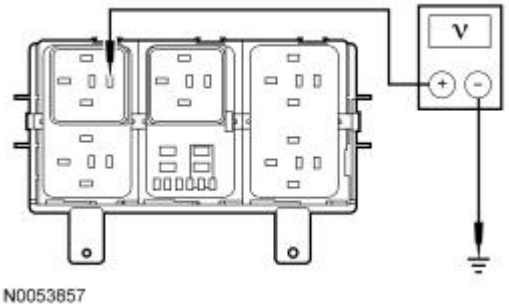
Possible Causes

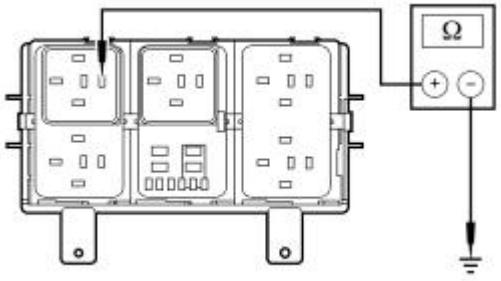
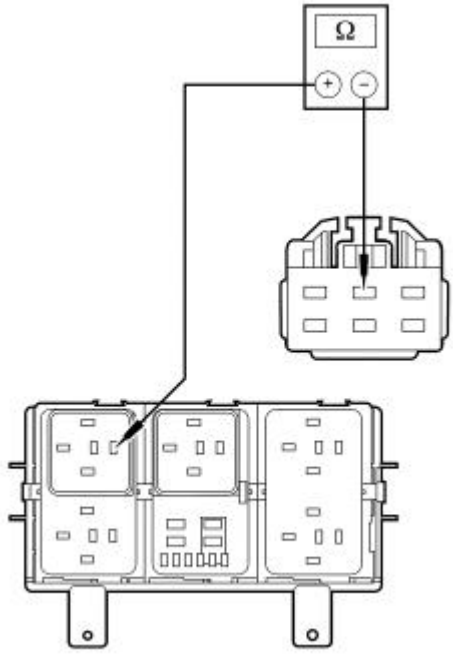
An inoperative third row power-fold seat can be caused by:

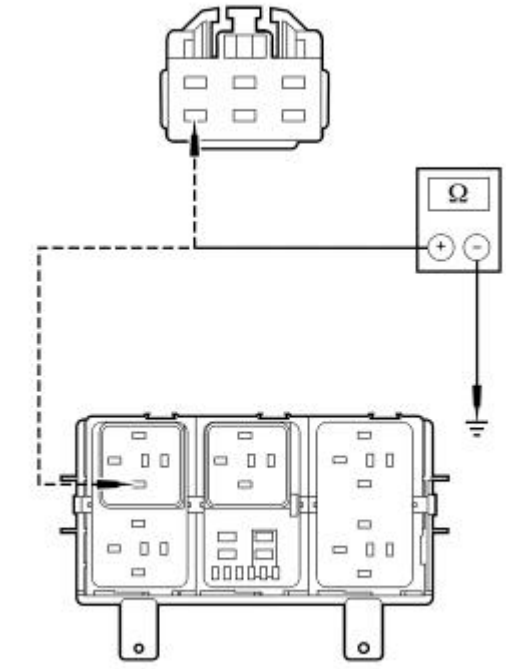
- fuse(s).
- wiring, terminals or connectors.
- a faulty left third row power-fold seat control switch.
- a faulty left third row power-fold seat relay.
- a faulty left third row power-fold seat motor.

PINPOINT TEST S: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — THIRD ROW POWER-FOLD, LEFT SEAT

Test Step	Result / Action to Take
S1 CHECK CIRCUIT SBB04 (GN/RD) FOR AN OPEN	
• Disconnect: Left Third Row Power-Fold Seat Relay. • Key in ON position. • Measure the voltage between auxiliary relay box left third row power-fold seat relay terminal 30, circuit SBB04 (GN/RD), harness side and ground.  N0053854 • **Is the voltage greater than 10 volts?**	**Yes** GO to S2 . **No** VERIFY battery junction box (BJB) fuse 4 (30A) is OK. If OK, REPAIR the circuit. If the fuse is open, INSTALL a new fuse and RE-TEST the circuit for greater than 10 volts. If the fuse opens again or voltage is not present, REPAIR the circuit. TEST the system for normal operation. Otherwise, GO to S6 .
S2 CHECK CIRCUIT CPS48 (BU) FOR VOLTAGE	
• Measure the voltage between left third row seat relay terminal 85, circuit CPS48 (BU), harness side and ground.	**Yes** GO to S3 . **No**

 N0053855 • **Is the voltage greater than 10 volts?**	CHECK operation of the right side power-fold seat. If the right side power-fold seat is operational, REPAIR the circuit. TEST the system for normal operation. Otherwise, Go To Pinpoint Test R .
S3 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between auxiliary relay box left third row power-fold seat relay terminal 86, circuit GD151 (BK/GN), harness side and ground.  N0053856 • **Is the resistance less than 5 ohms?**	**Yes** GO to S4 . **No** REPAIR the circuit. TEST the system for normal operation.
S4 CHECK LEFT THIRD ROW SEAT RELAY	
• Carry out the component test on the left third row power-fold seat relay. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Did the relay pass the component test?**	**Yes** GO to S5 . **No** INSTALL a new left third row power-fold seat relay. TEST the system for normal operation.
S5 CHECK CIRCUIT SBB31 (WH/RD) FOR A SHORT TO VOLTAGE	
• Disconnect: Left Rear Third Row Seat Control Switch C4179. • Key in ON position. • Measure the voltage between auxiliary relay box left rear third row power-fold seat relay terminal 87, circuit SBB31 (WH/RD), harness side and ground.  N0053857 • **Is voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to S6 .
S6 CHECK CIRCUIT SBB31 (WH/RD) FOR A SHORT TO GROUND	

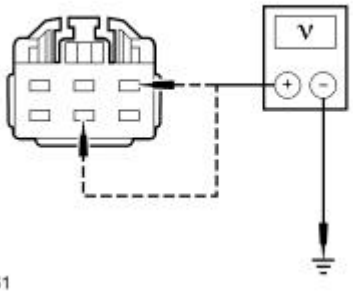
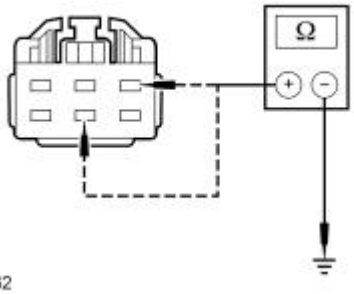
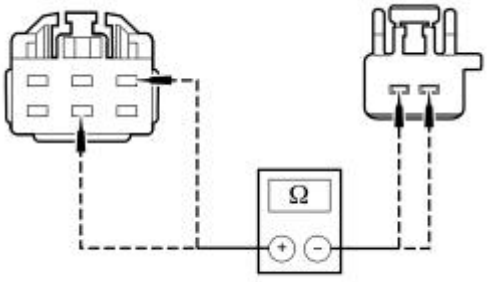
• Key in OFF position. • Measure the resistance between auxiliary relay box left third row power-fold seat relay terminal 87, circuit SBB31 (WH/RD), harness side and ground.  N0053858 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S7 . **No** REPAIR the circuit. TEST the system for normal operation.
S7 CHECK CIRCUIT SBB31 (WH/RD) FOR AN OPEN	
• Measure the resistance between auxiliary relay box left third row power-fold seat relay terminal 87, circuit SBB31 (WH/RD), harness side and left third row seat control switch C4179-2, circuit SBB31 (WH/RD), harness side.  N0053859 • **Is the resistance less than 5 ohms?**	**Yes** GO to S8 . **No** REPAIR the circuit. TEST the system for normal operation.
S8 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between left third row power-fold seat relay terminal 86, circuit GD151 (BK/GN), harness side and ground; and between left third row power-fold seat control switch C4179-6, circuit GD151 (BK/GN), harness side and ground.	**Yes** GO to S9 . **No** REPAIR the circuit. TEST the system for normal operation.



N0053860

- **Is the resistance less than 5 ohms?**

S9 CHECK LEFT THIRD ROW POWER-FOLD SEAT CONTROL SWITCH	
• Using the following table to check the left power-fold seat switch, measure the resistance between the switch pins, component side, while pressing the switch buttons in the indicated position and compare the results to the table. **Switch Position / Pins / Ohms** Up / 2 and 5 / Less than 5 Down / 2 and 5 / Greater than 10,000 Down / 2 and 1 / Less than 5 Up / 2 and 1 / Greater than 10,000 Up and at Rest / 1 and 6 / Less than 5 Down / 1 and 6 / Greater than 10,000 Down and at Rest / 5 and 6 / Less than 5 Up / 5 and 6 / Greater than 10,000 • **Is the switch OK?**	**Yes** GO to S10 . **No** INSTALL a switch. REFER to Seat Control Switch — Third Row . TEST the system for normal operation.
S10 CHECK CIRCUIT CPS50 (BU/BN) AND CPS49 (BN/GN) FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between left third row power-fold seat control switch C4179-5, circuit CPS50 (BU/BN) and ground; and between C4179-1, circuit CPS49 (BN/GN) harness side and ground.	**Yes** REPAIR the circuit(s). TEST the system for normal operation. **No** GO to S11 .

 N0053861 • **Is voltage present?**	
S11 CHECK CIRCUIT CPS50 (BU/BN) AND CPS49 (BN/GN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between left third row power-fold seat control switch C4179-5, circuit CPS50 (BU/BN) and ground; and between left third row power-fold seat control switch C4179-1, circuit CPS49 (BN/GN) harness side and ground.  N0053862 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S12 . **No** REPAIR the circuit(s). TEST the system for normal operation.
S12 CHECK CIRCUITS CPS49 (BN/GN) AND CPS50 (BU/BN) FOR AN OPEN	
• Disconnect: Left Third Row Seat Motor C4181. • Measure the resistance between left third row power-fold seat control switch C4179-5, circuit CPS50 (BU/BN), harness side and left third row power-fold seat motor C4181-2, circuit CPS50 (BU/BN) or circuit CPS52 (YE/GN) (Expedition EL), harness side; and between left third row power-fold seat control switch, C4179-1, circuit CPS49 (BN/GN), harness side and left third row power-fold seat motor C4181-1, circuit CPS49 (BN/GN) or circuit CPS51 (VT/GN) (Expedition EL), harness side.  N0053863 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new left third row power-fold seat motor. REFER to Power-Fold Seat Motor . TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

Pinpoint Test T: The Power Seat is Inoperative/Does Not Operate Correctly — Third Row Power-Fold, Right Seat

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information.

Normal Operation

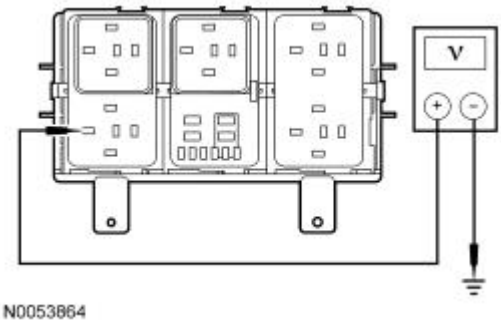
Battery voltage is supplied from the battery junction box (BJB) to the switch side of right third row power-fold seat relay through circuit SBB38 (BN/RD) and is hot at all times. When the smart power distribution junction box (SPDJB) energizes the right power-fold seat relay, battery voltage is switched through the relay to the right power-fold seat control switch on circuit SBB32 (VT/RD). Ground is supplied to the right power-fold seat control switch through circuit GD151 (BK/GN). When the right third row power-fold seat control switch is pressed, battery voltage and ground is supplied to the right power-fold seat motor. Pressing the switch in the opposite direction, reverses the polarity to the right power-fold seat motor, which moves the third row seat backrest in the opposite direction.

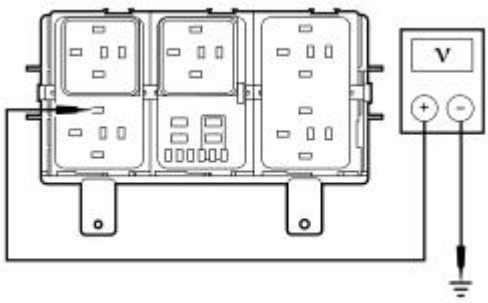
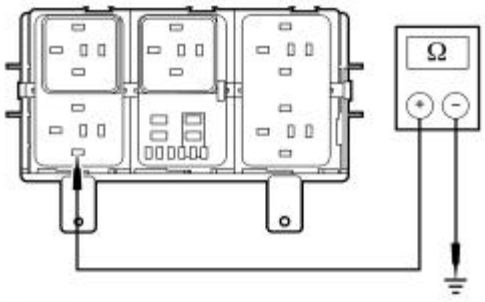
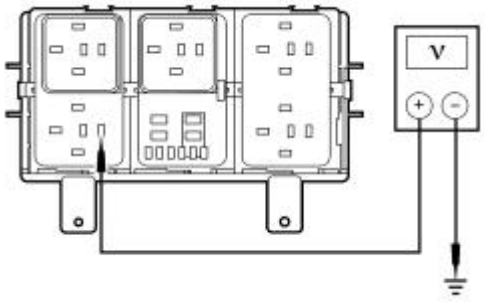
Possible Causes

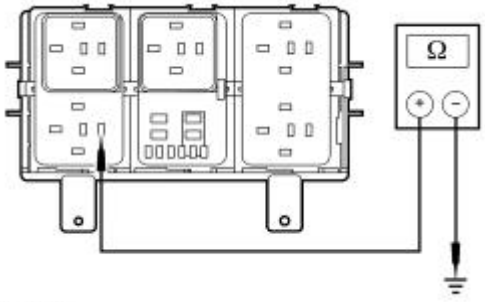
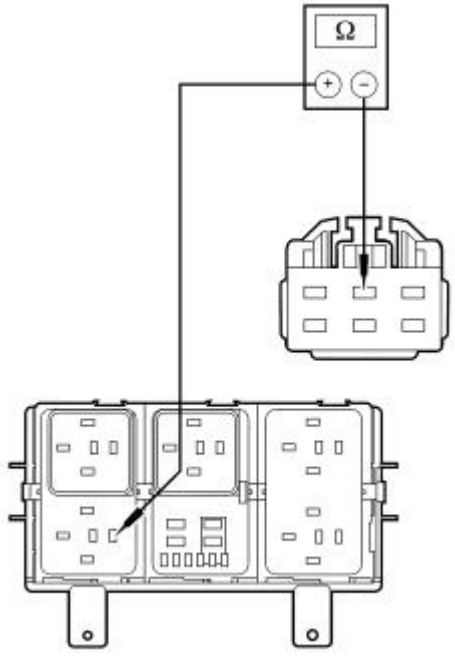
An inoperative third row power-fold seat can be caused by:

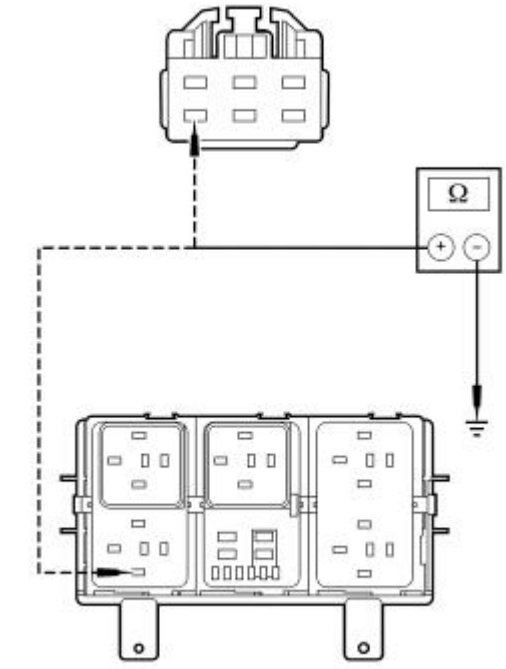
- fuse(s).
- wiring, terminals or connectors.
- a faulty right third row power-fold seat control switch.
- a faulty right third row power-fold seat relay.
- a faulty right third row power-fold seat motor.
- a faulty SPDJB.

PINPOINT TEST T: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — THIRD ROW POWER-FOLD, RIGHT SEAT

Test Step	Result / Action to Take
T1 CHECK CIRCUIT SBB38 (BN/RD) FOR AN OPEN	
• Key in ON position. • Measure the voltage between auxiliary relay box right third row power-fold seat relay terminal 30, circuit SBB38 (BN/RD), harness side and ground.  N0053864 • **Is the voltage greater than 10 volts?**	**Yes** GO to T2 . **No** VERIFY battery junction box (BJB) fuse 38 (30A) is OK. If OK, REPAIR the circuit. If the fuse is open, INSTALL a new fuse and RE-TEST the circuit for greater than 10 volts. If the fuse opens again or voltage is not present, REPAIR the circuit. TEST the system for normal operation. Otherwise, GO to T6 .
T2 CHECK CIRCUIT CPS48 (BU) FOR VOLTAGE	
• Measure the voltage between auxiliary relay box right third row power-fold seat relay terminal 85, circuit CPS48 (BU), harness side and ground.	**Yes** GO to T3 . **No** CHECK operation of the left side power-fold seat. If the left side power-fold

 N0053865 • **Is the voltage greater than 10 volts?**	seat is operational, REPAIR the circuit. TEST the system for normal operation. Otherwise, Go To Pinpoint Test S .
T3 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between auxiliary relay box right third row power-fold seat relay terminal 86, circuit GD151 (BK/GN), harness side and ground.  N0053866 • **Is the resistance less than 5 ohms?**	**Yes** GO to T4 . **No** REPAIR the circuit. TEST the system for normal operation.
T4 CHECK RIGHT THIRD ROW POWER-FOLD SEAT RELAY	
• Carry out component test on the right third row power-fold seat relay. Refer to Wiring Diagrams Cell 149 , Component Testing for schematic and connector information. • **Did the relay pass the component test?**	**Yes** GO to T5 . **No** INSTALL a new right third row power-fold seat relay. TEST the system for normal operation.
T5 CHECK CIRCUIT SBB32 (VT/RD) FOR A SHORT TO POWER	
• Disconnect: Right Third Row Power-Fold Seat Control Switch C4180. • Key in ON position. • Measure the voltage between auxiliary relay box right third row power-fold seat relay terminal 87, circuit SBB32 (VT/RD), harness side and ground.  N0053867 • **Is voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to T6 .

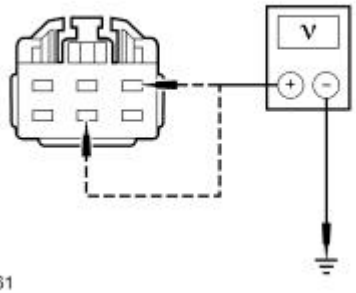
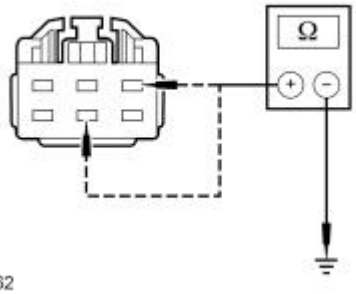
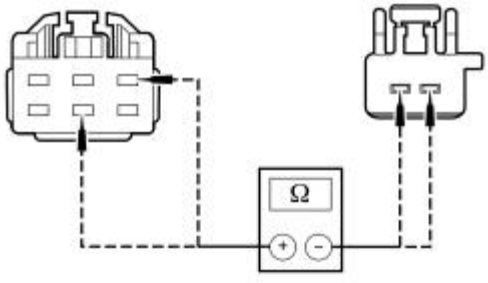
T6 CHECK CIRCUIT SBB32 (VT/RD) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between auxiliary relay box right third row power-fold seat relay terminal 87, circuit SBB32 (VT/RD), harness side and ground.  N0053868 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to T7 . **No** REPAIR the circuit. TEST the system for normal operation.
T7 CHECK CIRCUIT SBB32 (VT/RD) FOR AN OPEN	
• Measure the resistance between auxiliary relay box right third row power-fold seat relay terminal 87, circuit SBB32 (VT/RD), harness side and right third row power-fold seat control switch C4180-2, circuit SBB32 (VT/RD), harness side.  N0053869 • **Is the resistance less than 5 ohms?**	**Yes** GO to T8 . **No** REPAIR the circuit. TEST the system for normal operation.
T8 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between auxiliary relay box right third row power-fold seat relay terminal 86, circuit GD151 (BK/GN), harness side and ground; and between right third row power-fold seat control switch C4180-6, circuit GD151 (BK/GN), harness side and ground.	**Yes** GO to T9 . **No** REPAIR the circuit. TEST the system for normal operation.



N0053891

- **Is the resistance less than 5 ohms?**

T9 CHECK RIGHT THIRD ROW POWER-FOLD SEAT CONTROL SWITCH	
• Using the following table to check the right power-fold seat switch, measure the resistance between the switch pins, component side, while pressing the switch buttons in the indicated position and compare the results to the table. **Switch Position / Pins / Ohms** Up / 2 and 5 / Less than 5 Down / 2 and 5 / Greater than 10,000 Down / 2 and 1 / Less than 5 Up / 2 and 1 / Greater than 10,000 Up and at Rest / 1 and 6 / Less than 5 Down / 1 and 6 / Greater than 10,000 Down and at Rest / 5 and 6 / Less than 5 Up / 5 and 6 / Greater than 10,000 • **Is the switch OK?**	**Yes** GO to T10 . **No** INSTALL a new switch. REFER to Seat Control Switch — Third Row . TEST the system for normal operation.
T10 CHECK CIRCUIT CPS51 (VT/GY) AND CPS52 (YE/GN) FOR A SHORT TO POWER	
• Key in ON position. • Measure the voltage between right third row power-fold seat control switch C4180-5, circuit CPS51 (VT/GY) and C4180-1, circuit CPS52 (YE/GN) harness side and ground.	**Yes** REPAIR the circuit(s). TEST the system for normal operation. **No** GO to T11 .

 N0053861 • **Is voltage present?**	
T11 CHECK CIRCUIT CPS51 (VT/GY) AND CPS52 (YE/GN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between right third row power-fold seat control switch C4180-5, circuit CPS51 (VT/GY) and C4180-1, circuit CPS52 (YE/GN) harness side and ground.  N0053862 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to T12 . **No** REPAIR the affected circuit. TEST the system for normal operation.
T12 CHECK CIRCUIT CPS51 (VT/GY) AND CPS52 (YE/GN) FOR AN OPEN	
• Disconnect: Right Third Row Power-Fold Seat Motor C4182. • Measure the resistance between right third row power-fold seat control switch C4180-5, circuit CPS51 (VT/GY), harness side and right third row power-fold seat motor C4182-1, circuit CPS51 (VT/GY) harness side; and between right third row power-fold seat control switch, C4180-1, circuit CPS52 (YE/GN), harness side and right third row power-fold seat motor C4182-2, circuit CPS52 (YE/GN), harness side.  N0053863 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new right third row power-fold seat motor. REFER to Power-Fold Seat Motor . TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

Pinpoint Test U: DTC B103B/B1111 — Thermoelectric Driver Overcurrent Low/Driver Thermoelectric Device Control Overtemperature Fault

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A TED driver overcurrent low or device control overtemperature fault can be caused by:

- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST U: DTC B103B/B1111 — THERMOELECTRIC DRIVER OVERCURRENT LOW/DRIVER THERMOELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
U1 CHECK THE TED CIRCUITS FOR SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265a. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between the following CCSM C3265a pins, harness side and ground.	**Yes** GO to U2 . **No** If the resistances of C3265a-G, circuit CHS02 (YE/BU) and/or C3265a-H, circuit RHS02 (BU/OG) to ground were **not** greater than 10,000 ohms to ground, GO to U6 . If resistances of C3265a-J, circuit CHS01 (GY/VT) and/or C3265a-K, circuit RHS01 (WH/VT) to ground were **not** greater

Connector-Pin	Circuit
C3265a-G	CHS02 (YE/BU)
C3265a-H	RHS02 (BU/OG)
C3265a-J	CHS01 (GY/VT)
C3265a-K	RHS01 (WH/VT)

- **Are the resistances greater than 10,000 ohms?**

than 10,000 ohms to ground, GO to U7 .

U2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following CCSM C3265a pins, harness side and ground.

Connector-Pin	Circuit
C3265a-G	CHS02 (YE/BU)
C3265a-H	RHS02 (BU/OG)
C3265a-J	CHS01 (GY/VT)
C3265a-K	RHS01 (WH/VT)

- **Are the voltages less than one volt?**

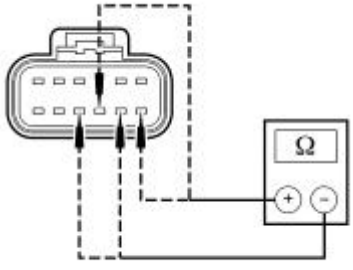
No
GO to U3 .

No
If the voltages measured at C3265a-G and/or C3265a-H were **not** less than one volt, GO to U8 .

If voltages measured at C3265a-J and/or C3265a-K were **not** less than one volt, GO to U9 .

U3 CHECK THE TED RESISTANCE

- Key in OFF position.
- **CAUTION: Make sure the TEDs are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.**
- Measure the resistance between CCSM C3265a-G, circuit CHS02 (YE/BU), harness side and CCSM C3265a-H, circuit RHS02 (BU/OG), harness side; and between CCSM C3265a-J, circuit CHS01 (GY/VT), harness side and C3265a-K, circuit RHS01 (WH/VT), harness die and ground.



N0042873

- **Are the resistances between 0.9 and 10 ohms?**

Yes
INSTALL a new CCSM. REFER to Climate Controlled Seat Module . REPEAT the self-test. CLEAR the DTCs.

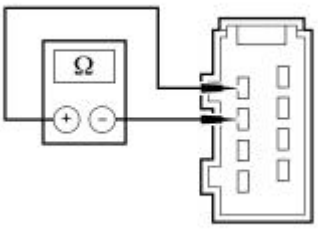
DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

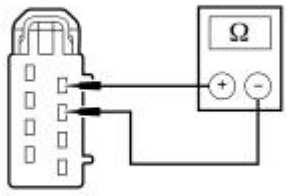
CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
If the resistance between CCSM C3265a-G and C3265a-H was **not** between 0.9 and 10 ohms, GO to U5 .

If the resistance between CCSM C3265a-J and C3265a-K was **not**

	between 0.9 and 10 ohms, GO to U4 .
U4 CHECK THE RESISTANCE OF THE BACKREST TED	
• Disconnect: Backrest TED C3034. • Measure the resistance between backrest TED C3034 pin 1 and pin 3, component side.  N0053766 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
U5 CHECK THE RESISTANCE OF THE CUSHION TED	
• Disconnect: Cushion TED C3035. • Measure the resistance between cushion TED C3035 pin 1 and pin 3, component side.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner



N0042874

- **Is the resistance between 0.9 and 10 ohms?**

C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

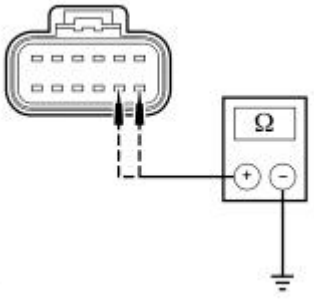
DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

U6 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Cushion TED C3035.
- Measure the resistance between CCSM C3265a-G, circuit CHS02 (YE/BU), harness side and ground and between C3265a-H, circuit RHS02 (BU/OG), harness side and ground.



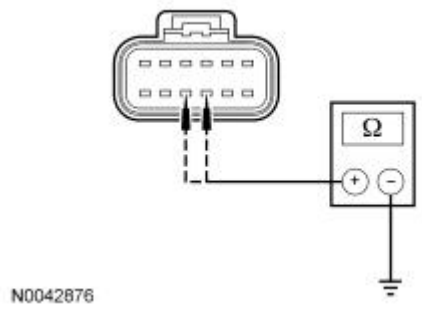
N0042875

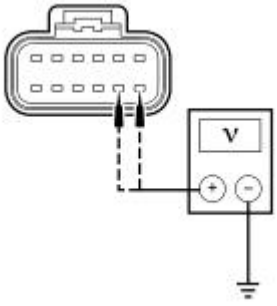
- **Are the resistances greater than 10,000 ohms?**

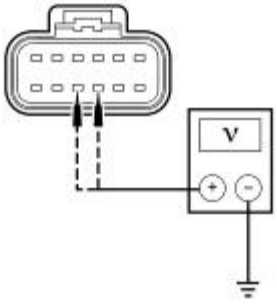
Yes
INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

	REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
U7 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO GROUND	
• Disconnect: Backrest TED C3034. • Measure the resistance between CCSM C3265a-J, circuit CHS01 (GY/VT), harness side and ground and between C3265a-K, circuit RHS01 (WH/VT), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT

	driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
U8 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Cushion TED C3035. • Key in ON position. • Measure the voltage between CCSM C3265a-G, circuit CHS02 (YE/BU), harness side and ground and between C3265a-H, circuit RHS02 (BU/OG), harness side and ground.  N0042877 • **Are the voltages less than one volt?**	**Yes** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

	REPOWER the SRS. REFER to Section 501-20B .
U9 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Backrest TED C3034. • Key in ON position. • Measure the voltage between CCSM C3265a-J, circuit CHS01 (GY/VT), harness side and ground and between C3265a-K, circuit RHS01 (WH/VT), harness side and ground.  N0042878 • **Are the voltages less than one volt?**	**Yes** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test V: DTC B103C — Thermoelectric Driver Open Load

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A TED driver open load fault can be caused by:

- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST V: DTC B103C — THERMOELECTRIC DRIVER OPEN LOAD

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
V1 CHECK THE TED CIRCUITS FOR AN OPEN	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265a. • Disconnect: Cushion TED C3035. • Disconnect: Backrest TED C3034. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance of the following circuits.	**Yes** GO to V2 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

CCSM Connector-Pin	Circuit	TED Connector-Pin
C3265a-G	CHS02 (YE/BU)	C3035-1
C3265a-H	RHS02 (BU/OG)	C3035-3
C3265a-J	CHS01 (GY/VT)	C3034-1
C3265a-K	RHS01 (WH/VT)	C3034-3

- **Are the resistances less than 5 ohms?**

REPOWER the SRS. REFER to Section 501-20B .

V2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following CCSM C3265a pins, harness side and ground.

Connector-Pin	Circuit
C3265a-G	CHS02 (YE/BU)
C3265a-H	RHS02 (BU/OG)
C3265a-J	CHS01 (GY/VT)
C3265a-K	RHS01 (WH/VT)

- **Is voltage present on any circuit?**

Yes
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

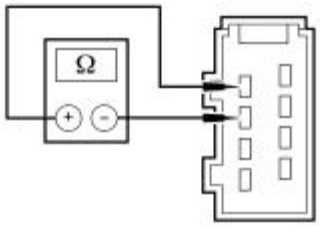
CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
GO to V3 .

V3 CHECK RESISTANCE OF THE TEDs

- Key in OFF position.
- Measure the resistance between backrest TED C3034 pin 1 and pin 3, component side and between cushion TED C3034 pin 1 and pin 3, component side.



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- **Are the resistances between 0.9 and 10 ohms?**

Yes
INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

	No If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test W: DTC B103D — Blower Driver Overtemperature

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

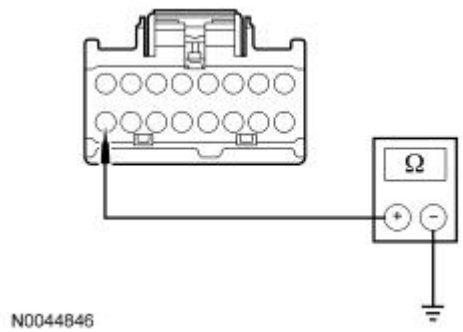
A blower overtemperature fault can be caused by:

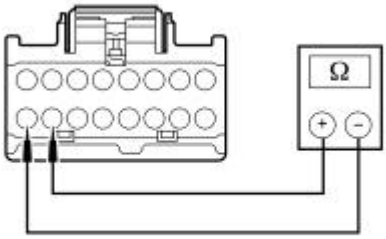
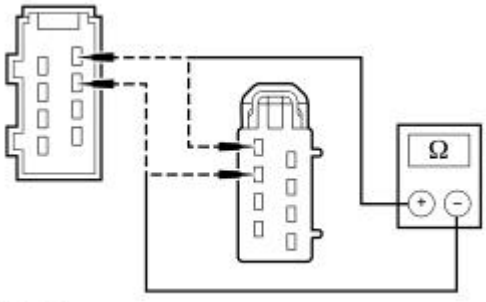
- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST W: DTC B103D — BLOWER DRIVER OVERTEMPERATURE

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
W1 CHECK THE BLOWER CIRCUIT FOR AN OPEN	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Cushion TED C3035. • Disconnect: Backrest TED C3034. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to W2 . **No** REPAIR the affected circuit. REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
W2 CHECK THE BLOWER CIRCUITS FOR A SHORT	
• Measure the resistance between CCSM C3265c-15, circuit CHS03 (GN/BN), harness side and C3265c-16, circuit CHS13 (VT/BN), harness side.	**Yes** GO to W3 . **No** REPAIR the affected circuits. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery

 N0044847 • **Is the resistance greater than 10,000 ohms?**	ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
W3 CHECK THE BLOWER RESISTANCE • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3035 pin 2 and pin 4, component side and between backrest TED C3034 pin 2 and pin 4, component side.  N0054027 • **Are the resistances between 6,000 ohms and 9,000 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. **No** If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test X: DTC B1113/B111B — Passenger Thermoelectric Device Control Overtemperature Fault/Passenger Thermoelectric Driver Overcurrent Low

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A TED device control overtemperature or overcurrent low fault can be caused by:

- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST X: DTC B1113/B111B — PASSENGER THERMOELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT/PASSENGER THERMOELECTRIC DRIVER OVERCURRENT LOW

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
X1 CHECK THE TED CIRCUITS FOR SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265a. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**	**Yes** GO to X2 . **No** If the resistances of C3265a-A and/or C3265a-B to ground were **not** greater than 10,000 ohms to ground, GO to X6 . If resistances of C3265a-C

- Connect the battery ground cable.
- Measure the resistance between the following CCSM C3265a pins, harness side and ground.

Connector-Pin	Circuit
C3265a-A	CHS07 (GY/BU)
C3265a-B	RHS07 (BU)
C3265a-C	CHS06 (BU/BN)
C3265a-D	RHS06 (WH)

- **Are the resistances greater than 10,000 ohms?**

and/or C3265a-D to ground were **not** greater than 10,000 ohms to ground, GO to X7 .

X2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following CCSM C3265a pins, harness side and ground.

Connector-Pin	Circuit
C3265a-A	CHS07 (GY/BU)
C3265a-B	RHS07 (BU)
C3265a-C	CHS06 (BU/BN)
C3265a-D	RHS06 (WH)

- **Are the voltages less than one volt?**

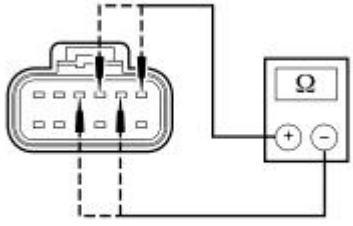
No
GO to X3 .

No
If the voltages measured at C3265a-A and/or C3265a-B were **not** less than one volt, GO to X8 .

If voltages measured at C3265a-C and/or C3265a-D were **not** less than one volt, GO to X9 .

X3 CHECK THE TED RESISTANCE

- Key in OFF position.
- **CAUTION: Make sure the TEDs are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.**
- Measure the resistance between CCSM C3265a-A, circuit CHS07 (GY/BU), harness side and CCSM C3265a-B, circuit RHS07 (BU), harness side; and between CCSM C3265a-C, circuit CHS06 (BU/BN), harness side and C3265a-D, circuit RHS06 (WH), harness side and ground.



N0042882

- **Are the resistances between 0.9 and 10 ohms?**

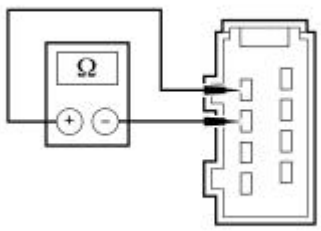
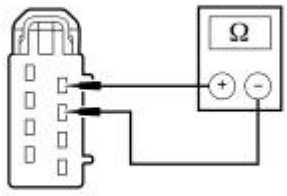
Yes
INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.

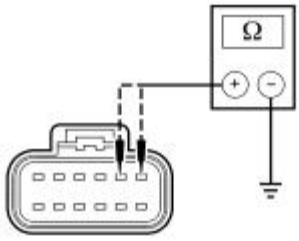
DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

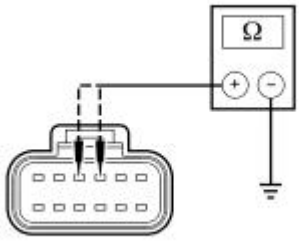
REPOWER the SRS. REFER to Section 501-20B .

No
If the resistance between CCSM C3265a-A and C3265a-B was **not** between 0.9 and 10 ohms, GO to X5 .

If the resistance between CCSM C3265a-C and

	C3265a-D was **not** between 0.9 and 10 ohms, GO to X4 .
X4 CHECK THE RESISTANCE OF THE BACKREST TED	
• Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 1 and pin 3, component side.  N0053766 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
X5 CHECK THE RESISTANCE OF THE CUSHION TED	
• Disconnect: Cushion TED C3040. • Measure the resistance between cushion TED C3040 pin 1 and pin 3, component side.  N0042874 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat

	Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
X6 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO GROUND • Disconnect: Cushion TED C3040. • Measure the resistance between CCSM C3265a-A, circuit CHS07 (GY/BU), harness side and ground and between C3265a-B, circuit RHS07 (BU), harness side and ground.  N0042883 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
X7 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO GROUND • Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • Measure the resistance between CCSM C3265a-C, circuit CHS06 (BU/BN), harness side and ground and between C3265a-D, circuit RHS06 (WH), harness side and ground.	**Yes** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section.



N0042884

- **Are the resistances greater than 10,000 ohms?**

REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

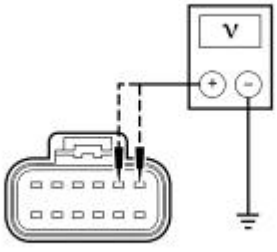
No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

X8 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Cushion TED C3040.
- Key in ON position.
- Measure the voltage between CCSM C3265a-A, circuit CHS07 (GY/BU), harness side and ground and between C3265a-B, circuit RHS07 (BU), harness side and ground.



N0042885

- **Are the voltages less than one volt?**

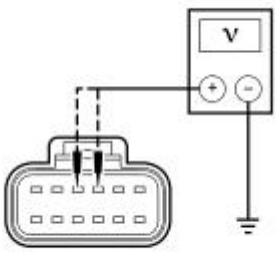
Yes
INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner

	C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
X9 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • Key in ON position. • Measure the voltage between CCSM C3265a-C, circuit CHS06 (BU/BN), harness side and ground and between C3265a-D, circuit RHS06 (WH), harness side and ground.  N0042886 • **Are the voltages less than one volt?**	**Yes** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test Y: DTC B111C — Passenger Thermoelectric Driver Open Load

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a

fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A TED driver open load fault can be caused by:

- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST Y: DTC B111C — PASSENGER THERMOELECTRIC DRIVER OPEN LOAD

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>Y1 CHECK THE TED CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>

Key in OFF position.
Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
Disconnect passenger seat safety belt buckle pretensioner C3050.
Disconnect passenger seat side air bag C3052.
Disconnect: CCSM C3265a.
Disconnect: Cushion TED C3040.
Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat).
 WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.
Connect the battery ground cable.
Measure the resistance of the following circuits.

<table>
<tr><th>CCSM Connector-Pin</th><th>Circuit</th><th>TED Connector-Pin</th></tr>
<tr><td>C3265a-A</td><td>CHS07 (GY/BU)</td><td>C3040-1</td></tr>
<tr><td>C3265a-B</td><td>RHS07 (BU)</td><td>C3040-3</td></tr>
<tr><td>C3265a-C</td><td>CHS06 (BU/BN) and CHS01</td><td>C3039-1 (10-Way Power Seat) or</td></tr>
</table>
</td><td>Yes
GO to Y2 .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .</td></tr>
</table>

	(GY/VT) (10-Way Power Seat)	C3316-1 (6-Way Power Seat)
C3265a-D	RHS06 (WH) and RHS01 (WH/VT) (10-Way Power Seat)	C3039-3 (10-Way Power Seat) or C3316-3 (6-Way Power Seat)

- **Are the resistances less than 5 ohms?**

Y2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following CCSM C3265a pins, harness side and ground.

Connector-Pin	Circuit
C3265a-A	CHS07 (GY/BU)
C3265a-B	RHS07 (BU)
C3265a-C	CHS06 (BU/BN)
C3265a-D	RHS06 (WH)

- **Is voltage present on any circuit?**

Yes
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

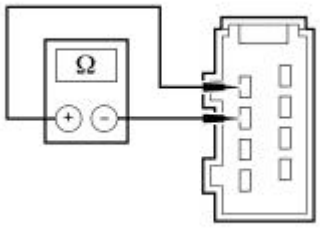
DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
GO to Y3 .

Y3 CHECK RESISTANCE OF THE TEDs

- Key in OFF position.
- Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 1 and pin 3, component side and between cushion TED C3040 pin 1 and pin 3, component side.



N0053766

- **Are the resistances between 0.9 and 10 ohms?**

Yes
INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to Seat

	Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test Z: DTC B111D — Passenger Blower Driver Overtemperature

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

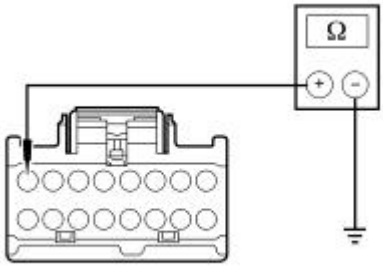
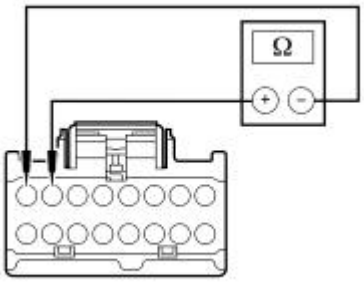
A blower overtemperature fault can be caused by:

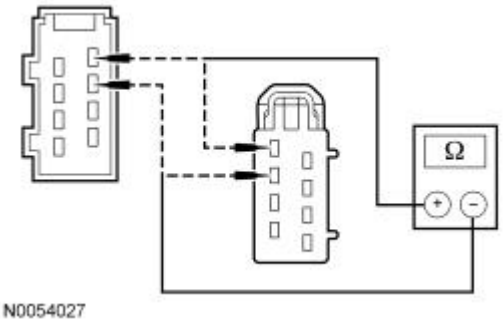
- wiring, terminals or connectors.
- a faulted TED assembly.
- a faulted CCSM.

PINPOINT TEST Z: DTC B111D — PASSENGER BLOWER DRIVER OVERTEMPERATURE

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Z1 CHECK THE BLOWER CIRCUIT FOR AN OPEN • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Cushion TED C3040. • Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground.  N0044848 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Z2 . **No** REPAIR the affected circuit. REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
Z2 CHECK THE BLOWER CIRCUITS FOR A SHORT • Measure the resistance between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and C3265c-8, circuit CHS14 (GN), harness side.  N0044849 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Z3 . **No** REPAIR the affected circuits. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
Z3 CHECK THE BLOWER RESISTANCE • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3040 pin 2	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the

and pin 4, component side and between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 2 and pin 4, component side.  N0054027 • **Are the resistances between 6,000 ohms and 9,000 ohms?**	self-test. CLEAR the DTCs. **No** If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AA: DTC B2729 — Driver Cushion Over-Temp Detected

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

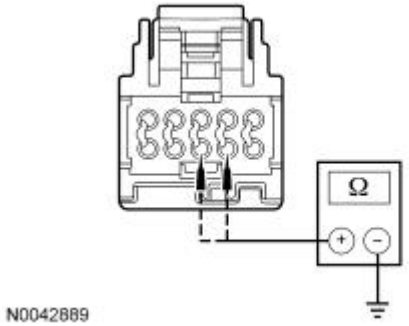
A driver seat cushion over-temp fault can be caused by:

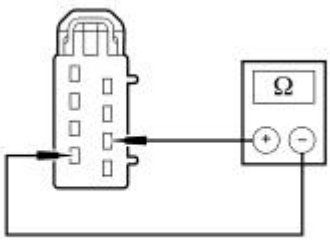
- wiring, terminals or connectors.
- restricted cushion TED filter.
- crushed or restricted cushion foam pad.
- crushed or restricted climate controlled seat manifold.
- a faulted cushion TED assembly.
- a faulted CCSM.

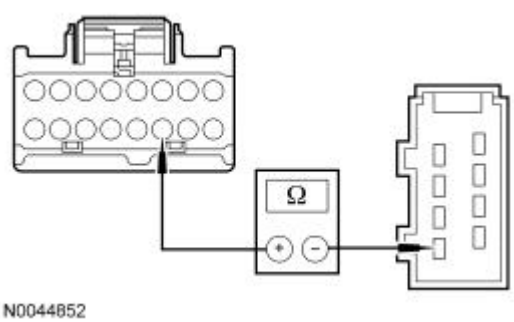
PINPOINT TEST AA: DTC B2729 — DRIVER CUSHION OVER-TEMP DETECTED

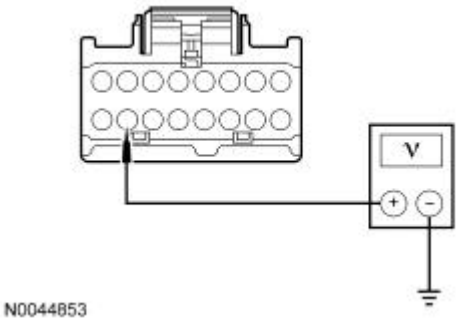
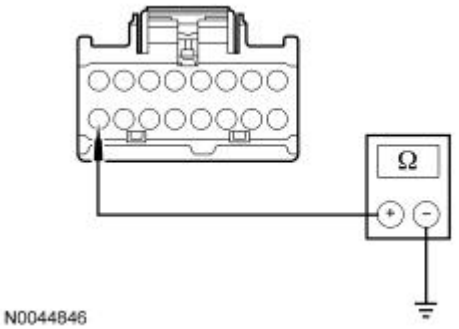
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

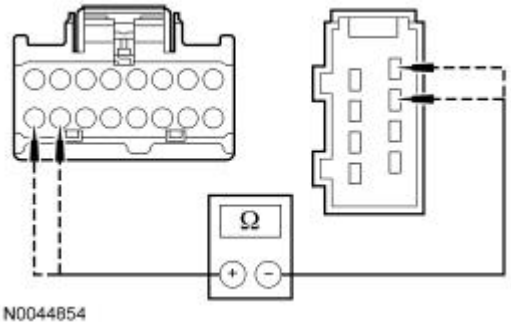
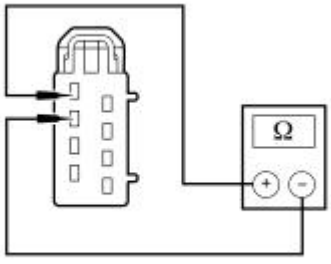
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

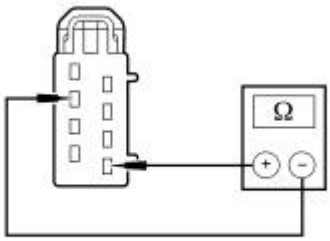
Test Step	Result / Action to Take
AA1 CHECK THE CCSM FOR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • **Was DTC B2729 retrieved during the on-demand self test?**	**Yes** GO to AA2 . **No** GO to AA4 .
AA2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • Disconnect: Cushion TED C3035. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265b-7, circuit VHS26 (VT), harness side and ground and between CCSM C3265b-8, circuit RHS05 (YE/VT), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to AA3 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

AA3 CHECK THE TED THERMISTOR	
• Measure the resistance between cushion TED C3035 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) / 2782-1663 ohms 10-20°C (50-68°F) / 1837-1140 ohms 20-30°C (68-86°F) / 1260-806 ohms 30-40°C (86-104°F) / 893-570 ohms 40-50°C (104-122°F) / 630-428 ohms  N0042890 • **Is the resistance within the limits indicated?**	**Yes** REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA4 CONFIRM THE FAULT	
• Verify with the customer that the concern is the seat shuts OFF in HEAT mode. • **NOTE:** A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • Attempt to recreate the fault. Start the vehicle and set the driver seat to HIGH HEAT for at least 15 minutes. • **Is the customer concern with the seat shutting OFF in HEAT mode or was the fault recreated?**	**Yes** GO to AA5 . **No** Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.

AA5 CHECK OPERATION OF THE SEAT	
• Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Compare the airflow from the driver seat cushion and compare it to the airflow from the passenger seat cushion. • **Is the airflow exhausting from the driver seat cushion comparable to the airflow exhausting from the passenger seat cushion?**	**Yes** GO to AA14 . **No** GO to AA6 .
AA6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER	
• Key in OFF position. • Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter. • **Is the blower obstructed or the filter restricted?**	**Yes** REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs. **No** GO to AA7 .
AA7 CHECK THE CUSHION FAN OPERATION	
• Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Inspect the cushion blower for operation. • **Does the cushion blower operate?**	**Yes** GO to AA14 . **No** GO to AA8 .
AA8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Cushion TED C3035. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265c-11, circuit CHS03 (GN/BN), harness side and cushion TED C3035-7, circuit CHS03 (GN/BN), harness side.  N0044852 • **Is the resistance less than 5 ohms?**	**Yes** GO to AA9 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA9 CHECK THE BLOWER CIRCUIT CHS03 (GN/BN) FOR A	

SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between CCSM C3265c-15, circuit CHS03 (GN/BN), harness side and ground.  N0044853 • **Is voltage greater than 1 volt?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AA10 .
AA10 CHECK THE BLOWER CIRCUIT CHS13 (VT/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground.  N0044846 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AA11 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA11 CHECK THE BLOWER CIRCUITS CHS13 (VT/BN) AND CHS03 (GN/BN) FOR AN OPEN	
• Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and cushion TED C3035-2, circuit CHS13 (VT/BN), harness side; and between CCSM C3265c-15, circuit CHS03 (GN/BN), harness side and cushion TED C3035-4, circuit CHS03 (GN/BN), harness side.	**Yes** GO to AA12 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

 N0044854 • **Are the resistances less than 5 ohms?**	DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA12 CHECK THE BLOWER RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3035 pin 2 and pin 4, component side.  N0042881 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AA13 . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA13 CHECK THE BLOWER SPEED CONTROL RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3035 pin 7 and pin 4, component side.	**Yes** GO to AA14 . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety

 N0042893 • **Is the resistance between 290K ohms and 420K ohms?**	belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AA14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION	

• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat cushion trim cover. Refer to Seat Cushion Cover — Front, 40 Percent in this section.
• Inspect the seat cushion for the following:
  ▪ Is the TED correctly installed?
  ▪ Is the seat cushion foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	CONNECT the battery ground cable.
	
	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.
	
	CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.
	
	REPOWER the SRS. REFER to Section 501-20B .
	
	No
	CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

	CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AB: DTC B272A — Passenger Cushion Over-Temp Detected

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A passenger seat cushion over-temp fault can be caused by:

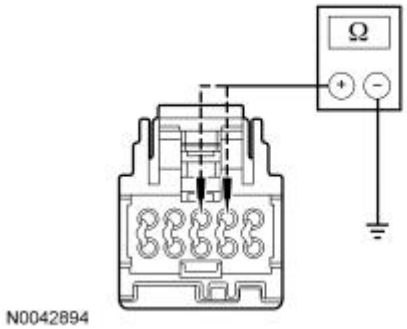
- wiring, terminals or connectors.
- restricted cushion TED filter.
- crushed or restricted cushion foam pad.
- crushed or restricted climate controlled seat manifold.
- a faulted cushion TED assembly.
- a faulted CCSM.

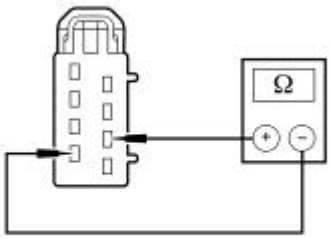
PINPOINT TEST AB: DTC B272A — PASSENGER CUSHION OVER-TEMP DETECTED

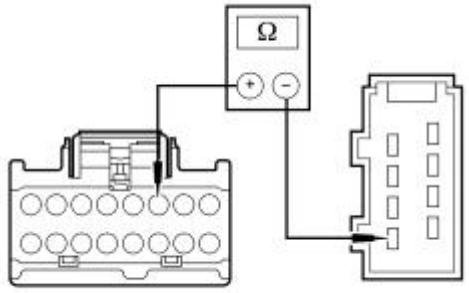
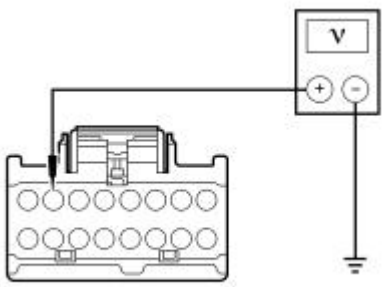
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

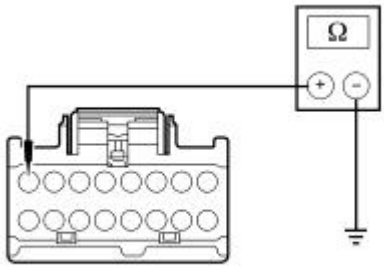
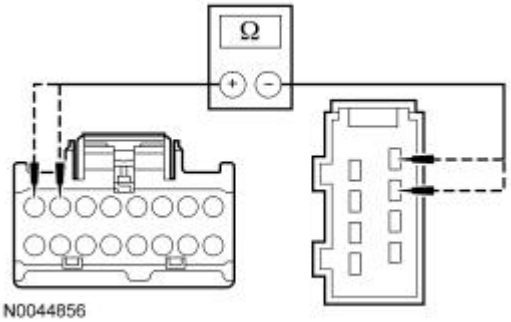
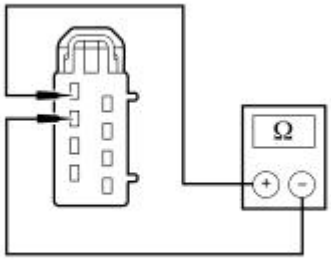
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

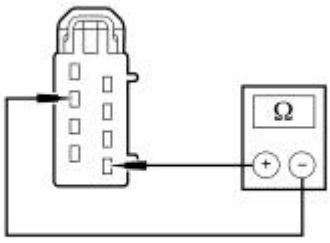
Test Step	Result / Action to Take

AB1 CHECK THE CCSM FOR ON-DEMAND DTCS	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • **Was DTC B272A retrieved during the on-demand self test?**	**Yes** GO to AB2 . **No** GO to AB4 .
AB2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • Disconnect: Cushion TED C3040. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265b-2, circuit VHS27 (WH/OG), harness side and ground and between CCSM C3265b-3, circuit RHS10 (BU/OG), harness side and ground.  N0042894 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to AB3 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB3 CHECK THE TED THERMISTOR	
• Measure the resistance between cushion TED C3040 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) / 2782-1663 ohms 10-20°C (50-68°F) / 1837-1140 ohms 20-30°C (68-86°F) / 1260-806 ohms 30-40°C (86-104°F) / 893-570 ohms 40-50°C (104-122°F) / 630-428 ohms	**Yes** REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat

 N0042890 • **Is the resistance within the limits indicated?**	Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB4 CONFIRM THE FAULT	
• Verify with the customer that the concern is the seat shuts OFF in HEAT mode. • **NOTE:** A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • Attempt to recreate the fault. Start the vehicle and set the passenger seat to HIGH HEAT for at least 15 minutes. • **Is the customer concern with the seat shutting OFF in HEAT mode or was the fault recreated?**	**Yes** GO to AB5 . **No** Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.
AB5 CHECK OPERATION OF THE SEAT	
• Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Compare the airflow from the passenger seat cushion and compare it to the airflow from the driver seat cushion. • **Is the airflow exhausting from the passenger seat cushion comparable to the airflow exhausting from the driver seat cushion?**	**Yes** GO to AB14 . **No** GO to AB6 .
AB6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER	
• Key in OFF position. • Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter. • **Is the blower obstructed or the filter restricted?**	**Yes** REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs. **No** GO to AB7 .
AB7 CHECK THE CUSHION FAN OPERATION	
• Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Inspect the cushion blower for operation. • **Does the cushion blower operate?**	**Yes** GO to AB14 . **No** GO to AB8 .
AB8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN	
• Key in OFF position.	**Yes**

• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Cushion TED C3040. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265c-3, circuit RHS08 (VT/WH), harness side and cushion TED C3040-7, circuit RHS08 (VT/WH), harness side.  N0044844 • **Is the resistance less than 5 ohms?**	GO to AB9 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB9 CHECK THE BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and ground.  N0044855 • **Is voltage greater than 1 volt?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AB10 .
AB10 CHECK THE BLOWER CIRCUIT CHS14 (GN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground.	**Yes** GO to AB11 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT

 N0044848 • **Is the resistance greater than 10,000 ohms?**	passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB11 CHECK THE BLOWER CIRCUITS CHS14 (GN) AND CHS08 (BN/YE) FOR AN OPEN	
• Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and cushion TED C3040-2, circuit CHS14 (GN), harness side; and between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and cushion TED C3040-4, circuit CHS08 (BN/YE), harness side.  N0044856 • **Are the resistances less than 5 ohms?**	**Yes** GO to AB12 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB12 CHECK THE BLOWER RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3040 pin 2 and pin 4, component side.  N0042881 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AB13 . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB13 CHECK THE BLOWER SPEED CONTROL RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect**	**Yes** GO to AB14 . **No** INSTALL a new cushion

identification of components that are not faulty. • Measure the resistance between cushion TED C3040 pin 7 and pin 4, component side.  N0042893 • **Is the resistance between 290K ohms and 420K ohms?**	TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AB14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION	

• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat cushion trim cover. Refer to Seat Cushion Cover — Front, 40 Percent in this section.
• Inspect the seat cushion for the following:
  ▪ Is the TED correctly installed?
  ▪ Is the seat cushion foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	CONNECT the battery ground cable.
	
	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.
	
	REPOWER the SRS. REFER to Section 501-20B .
	
	No
	CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.
	
	REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AC: DTC B272B — Passenger Back Over-Temp Detected

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A driver seat backrest over-temp fault can be caused by:

- wiring, terminals or connectors.
- restricted backrest TED filter.
- crushed or restricted backrest foam pad.
- crushed or restricted climate controlled seat manifold.
- a faulted backrest TED assembly.
- a faulted CCSM.

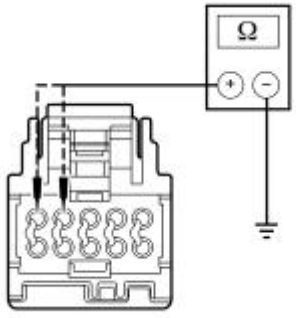
PINPOINT TEST AC: DTC B272B — PASSENGER BACK OVER-TEMP DETECTED

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
AC1 CHECK THE CCSM FOR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • **Was DTC B2730 retrieved during the on-demand self test?**	**Yes** GO to AC2 . **No** GO to AC4 .
AC2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System	**Yes** GO to AC3 .

(SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
- Disconnect passenger seat safety belt buckle pretensioner C3050.
- Disconnect passenger seat side air bag C3052.
- Disconnect: CCSM C3265b.
- Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat).
- **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**
- Connect the battery ground cable.
- Measure the resistance between CCSM C3265b-4, circuit VHS36 (YE/BU), harness side and ground and between CCSM C3265b-5, circuit RHS20 (GN/BU), harness side and ground.



N0042899

- **Are the resistances greater than 10,000 ohms?**

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

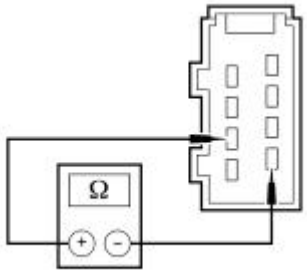
CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

AC3 CHECK THE TED THERMISTOR

- Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2782-1663 ohms
10-20°C (50-68°F)	1837-1140 ohms
20-30°C (68-86°F)	1260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms



N0053767

- **Is the resistance within the limits indicated?**

Yes
REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

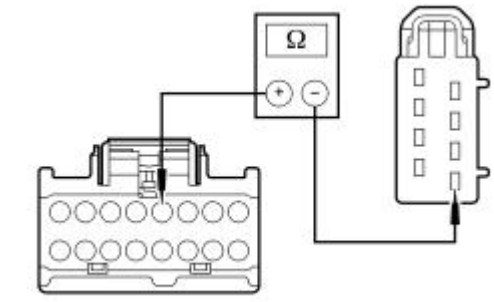
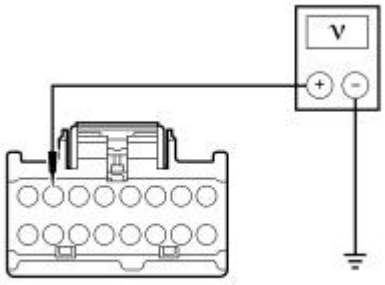
CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

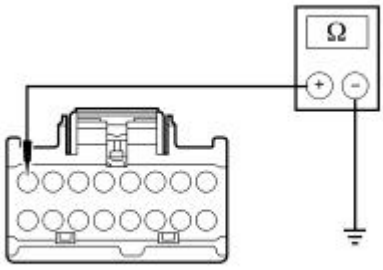
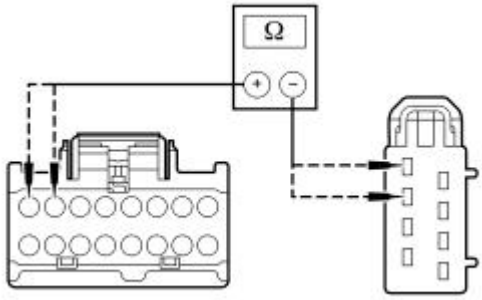
REPOWER the SRS. REFER to Section 501-20B .

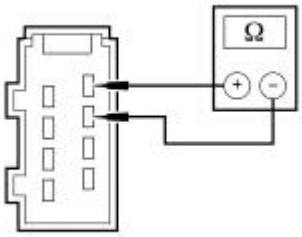
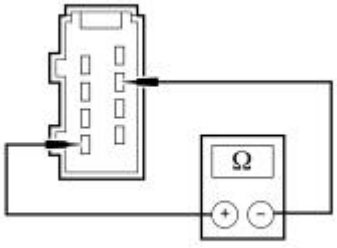
No
INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT

	driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC4 CONFIRM THE FAULT • Verify with the customer that the concern is the seat shuts OFF in HEAT mode. • **NOTE:** A crushed seat backrest foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • Attempt to recreate the fault. Start the vehicle and set the front passenger seat to HIGH HEAT for at least 15 minutes. • **Is the customer concern with the seat shutting OFF in HEAT mode or was the fault recreated?**	**Yes** GO to AC5 . **No** Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.
AC5 CHECK OPERATION OF THE SEAT • Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Compare the airflow from the front passenger seat backrest and compare it to the airflow from the driver seat backrest. • **Is the airflow exhausting from the front passenger seat backrest comparable to the airflow exhausting from the driver seat backrest?**	**Yes** GO to AC14 . **No** GO to AC6 .
AC6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER • Key in OFF position. • Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter. • **Is the blower obstructed or the filter restricted?**	**Yes** REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs. **No** GO to AC7 .
AC7 CHECK THE BACKREST FAN OPERATION • Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Inspect the backrest blower for operation. • **Does the backrest blower operate?**	**Yes** GO to AC14 . **No** GO to AC8 .
AC8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General	**Yes** GO to AC9 .

Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • For 10-way power seat, measure the resistance between CCSM C3265c-4, circuit CHS09 (GY), harness side and backrest TED C3039-7, circuit CHS04 (YE/GY), harness side.  N0053808 • For 6-way power seat, measure the resistance between CCSM C3265c-4, circuit CHS09 (GY), harness side and backrest TED C3316-7, circuit CHS09 (GY), harness side. • **Is the resistance less than 5 ohms?**	**No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC9 CHECK THE BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and ground.  N0044855 • **Is voltage greater than 1 volt?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AC10 .
AC10 CHECK THE BLOWER CIRCUIT CHS14 (GN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground.	**Yes** GO to AC11 .

 N0044848 • **Is the resistance greater than 10,000 ohms?**	**No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC11 CHECK THE BLOWER CIRCUITS CHS14 (GN) AND CHS08 (BN/YE) FOR AN OPEN	
• For 10-way power seat, measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and backrest TED C3039-2, circuit CHS13 (VT/BN), harness side; and between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and backrest TED C3039-4, circuit CHS03 (GN/BN), harness side.  N0053809 • For 6-way power seat, measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and backrest TED C3316-2, circuit CHS14 (GN), harness side; and between CCSM C3265c-7, circuit CHS08 (BN/YE), harness side and backrest TED C3316-4, circuit CHS08 (BN/YE), harness side. • **Are the resistances less than 5 ohms?**	**Yes** GO to AC12 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC12 CHECK THE BLOWER RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 2 and pin 4, component side.	**Yes** GO to AC13 . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery

 N0053768 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC13 CHECK THE BLOWER SPEED CONTROL RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 7 and pin 4, component side.  N0054028 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** GO to AC14 . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AC14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST	

• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat backrest trim cover. Refer to Seat Backrest Cover — Front, 40 Percent in this section.
• Inspect the seat backrest for the following:
  ▪ Is the TED correctly installed?
  ▪ Is the seat backrest foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	CONNECT the battery ground cable.
	
	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT driver seat safety belt

	buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AD: DTC B272C — Driver Differential Temperature Fault

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver

and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on an affected seat are reporting very different temperatures to the CCSM. This may result from an airflow restriction or a circuit fault of either TED area. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not the area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

Possible Causes

A driver differential temperature fault can be caused by:

- wiring, terminals or connectors.
- restricted cushion or backrest TED filter.
- crushed or restricted cushion or backrest foam pad.
- crushed or restricted cushion or backrest climate controlled seat manifold.
- a faulted cushion or backrest TED assembly.
- a faulted CCSM.

PINPOINT TEST AD: DTC B272C — DRIVER DIFFERENTIAL TEMPERATURE FAULT

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

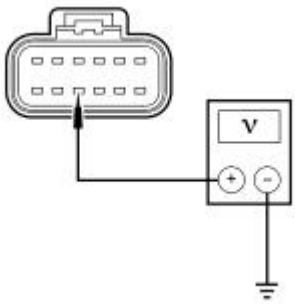
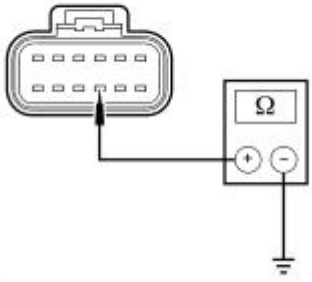
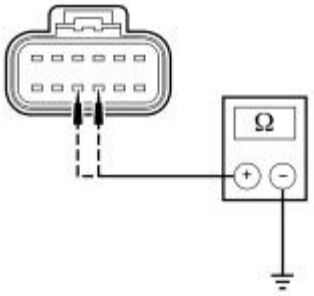
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

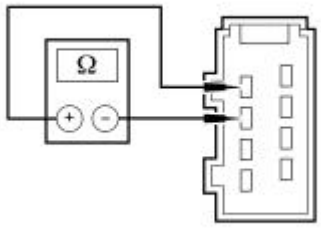
Test Step	Result / Action to Take
AD1 CHECK THE CCSM FOR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • **Was DTC B2729 or B2730 retrieved during the on-demand self test or as a continuous DTC?**	**Yes** For DTC B2729, Go To Pinpoint Test AA . For DTC B2730, Go To Pinpoint Test AF . **No** GO to AD2 .
AD2 MONITOR THE CCSM TED TEMPERATURE PIDs	
• Enter the following diagnostic mode on the diagnostic tool: Datalogger/CCSM PIDs:. ▪ Passenger Cushion Thermal Electric Device (TED) Temperature ▪ Passenger Back Thermal Electric Device (TED) Temperature ▪ Cushion Thermal Electric Device (TED) Temperature ▪ Back Thermal Electric Device (TED) Temperature • **CAUTION: Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs.** • Monitor the TED temperature PIDs with the climate controlled seats OFF. Compare the PID values of the driver seat to those	**Yes** GO to AD3 . **No** If the driver seat cushion PID value varies 10°C (18° F) or more from ambient temperature, GO to AD15 . If the driver seat backrest PID value varies 10°C (18° F) or more from ambient

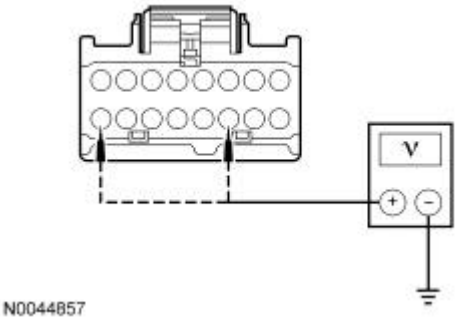
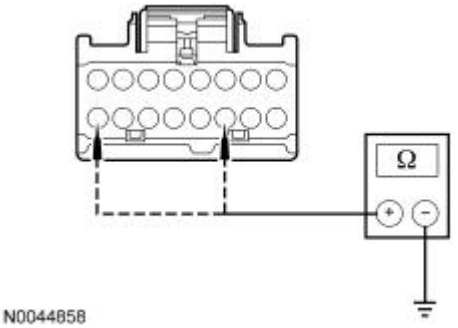
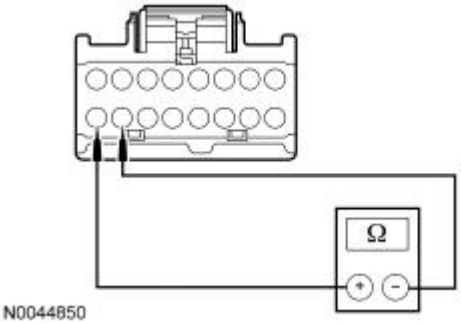
of the front passenger seat, this can help identify if there is a concern with the driver seat cushion or backrest PID value readings. • **Are both driver seat TED temperature PID values within 10°C (18°F) of the ambient temperature?**	temperature, GO to AD30 .
AD3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST	
• Key in OFF position. • Key in ON position. • **NOTE:** A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • After cycling the ignition switch and with the engine running, set the driver seat to HIGH HEAT (3 LEDs illuminated on EATC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. • **Do the driver seat cushion or backrest PID values vary more than 10°C (18°F)?**	**Yes** If the driver seat cushion PID value is 10°C (18°F) hotter than the backrest PID value, GO to AD4 . If the driver seat backrest PID value is 10°C (18°F) hotter than the cushion PID value, GO to AD19 . **No** Fault is currently not present. INSPECT for crushed seat cushion or backrest foam pad or climate controlled seat cushion or backrest manifold. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.
AD4 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION	

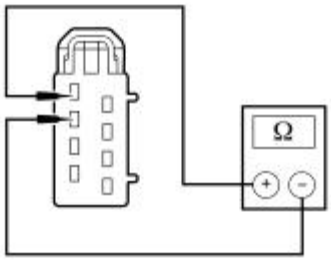
• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat cushion trim cover. Refer to Seat Cushion Cover — Front, 40 Percent in this section.
• Inspect the seat cushion for the following:
  ▪ Is the cushion blower obstructed?
  ▪ Is the blower filter restricted or plugged?
  ▪ Is the TED correctly installed?
  ▪ Is the seat cushion foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	GO to AD5 .
	
	No
	CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.
	
	REPOWER the SRS. REFER to Section 501-20B .

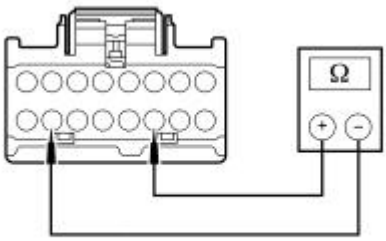
AD5 CHECK BACKREST TED CIRCUIT RHS01 (WH/VT) FOR SHORT TO VOLTAGE	
• Disconnect: CCSM C3265a. • **NOTE:** Do not connect the safety belt buckle pretensioner or seat side air bag electrical connectors at this time. • Position the driver seat in the vehicle and connect the seat-to-floor connectors. • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265a-K, circuit RHS01 (WH/VT), harness side and ground.	**Yes** GO to AD6 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery

 N0044951 • **Is the voltage less than 0.5 volt?**	ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD6 CHECK BACKREST TED CIRCUIT CHS01 (GY/VT) FOR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265a-J, circuit CHS01 (GY/VT), harness side and ground.  N0042910 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AD7 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD7 CHECK RESISTANCE OF THE BACKREST TED AND WIRING	
• Measure the resistance between CCSM C3265a-J, circuit CHS01 (GY/VT), harness side and CCSM C3265a-K, circuit RHS01 (WH/VT), harness side.  N0042876 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** GO to AD9 . **No** GO to AD8 .
AD8 CHECK RESISTANCE OF THE BACKREST TED	
	Yes

• Disconnect: Backrest TED C3034. • Measure the resistance between backrest TED C3034 pin 1 and pin 3, component side.  N0053766 • **Is the resistance between 0.9 and 10 ohms?**	REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD9 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: CCSM C3265c. • Key in ON position. • Measure the voltage between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground and between CCSM C3265c-11, circuit CHS03 (GN/BN), harness side and ground.	**Yes** GO to AD10 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety

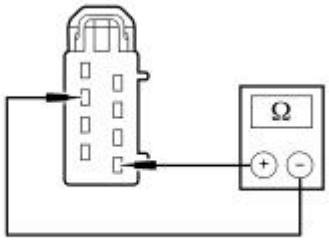
 N0044857 • **Are the voltages less than one volt?**	belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD10 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND • Key in OFF position. • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground and between CCSM C3265c-11, circuit CHS03 (GN/BN), harness side and ground.  N0044858 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to AD11 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD11 CHECK THE BLOWER AND WIRING • **CAUTION: The ohmmeter must be connected with the positive lead to CCSM C3265c-16, circuit CHS13 (VT/BN) and the negative lead to CCSM C3265c-15, circuit CHS03 (GN/BN) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and CCSM C3265c-15, circuit CHS03 (GN/BN), harness side.  N0044850	**Yes** GO to AD13 . **No** GO to AD12 .

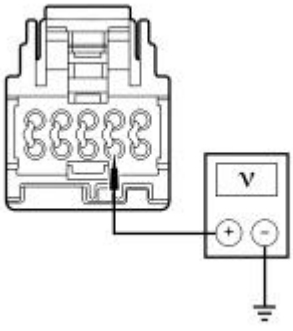
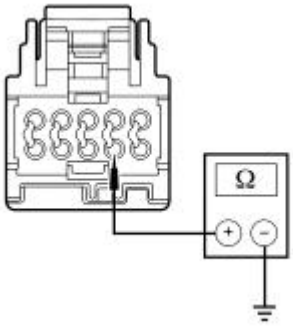
• **Is the resistance between 6,000 ohms and 9,000 ohms?**	
AD12 CHECK THE BLOWER	
• Disconnect: Cushion TED C3035. • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3035 pin 2 and pin 4, component side.  N0042881 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD13 CHECK BLOWER SPEED CONTROL AND CIRCUIT	
• **CAUTION: The ohmmeter must be connected with the positive lead to C3265c-11, circuit CHS03 (GN/BN), harness side and the negative lead to C3265c-15, circuit CHS03 (GN/BN), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-11, circuit CHS03 (GN/BN) harness side and CCSM C3265c-15, circuit CHS03 (GN/BN), harness side.	**Yes** GO to AD15 . **No** GO to AD14 .

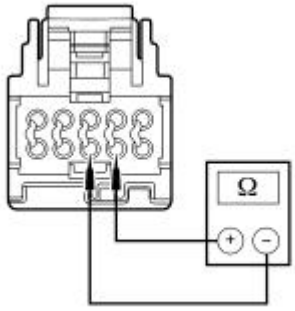
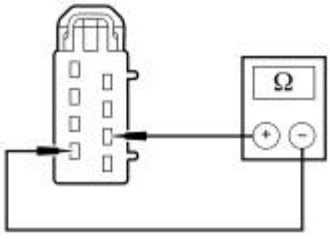


N0044859

- **Is the resistance between 290K ohms and 420K ohms?**

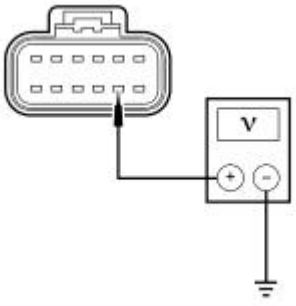
AD14 CHECK THE BLOWER SPEED CONTROL	
• Disconnect: Cushion TED C3035. • **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3035 pin 7 and pin 4, component side.  N0054029 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD15 CHECK THERMISTOR CIRCUIT FOR A SHORT TO	

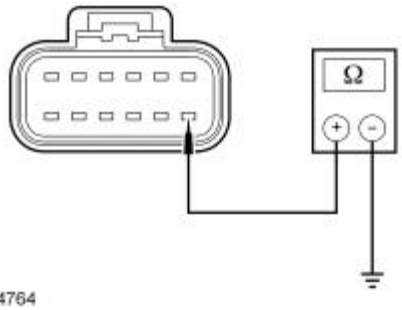
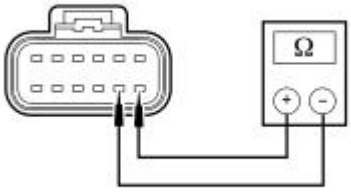
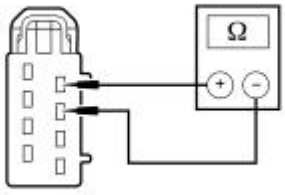
VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265b-7, circuit VHS26 (VT), harness side and ground.  N0042906 • **Is the voltage less than 0.5 volt?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AD16 .
AD16 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265b-7, circuit VHS26 (VT), harness side and ground.  N0042907 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AD17 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD17 CHECK THE THERMISTOR AND WIRING	
• Measure the resistance between CCSM C3265b-7, circuit VHS26 (VT), harness side and CCSM C3265b-8, circuit RHS05 (YE/VT), harness side. Note the ambient temperature	**Yes** INSTALL a new CCSM and CARRY OUT

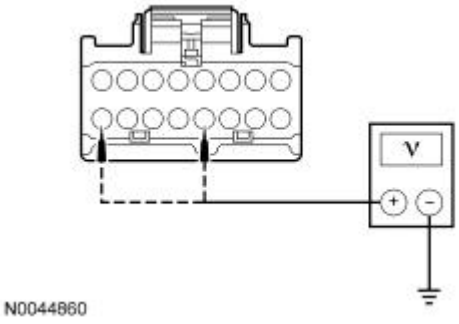
and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) — 2782-1663 ohms 10-20°C (50-68°F) — 1837-1140 ohms 20-30°C (68-86°F) — 1260-806 ohms 30-40°C (86-104°F) — 893-570 ohms 40-50°C (104-122°F) — 630-428 ohms  N0042908 • **Is the resistance within the limits indicated?**	programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AD18 .
AD18 CHECK THE THERMISTOR	
• Disconnect: Cushion TED C3035. • Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) — 2782-1663 ohms 10-20°C (50-68°F) — 1837-1140 ohms 20-30°C (68-86°F) — 1260-806 ohms 30-40°C (86-104°F) — 893-570 ohms 40-50°C (104-122°F) — 630-428 ohms  N0042890 • **Is the resistance within the limits indicated?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049

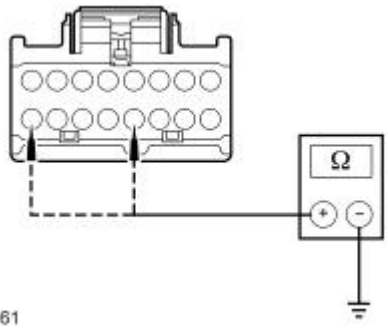
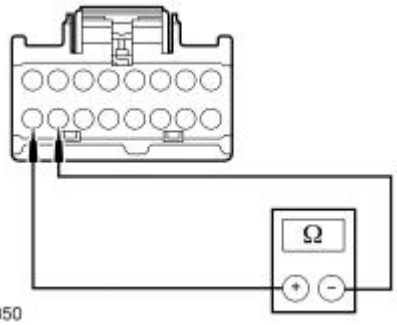
	and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD19 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST	

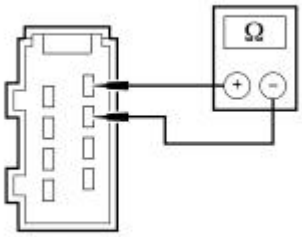
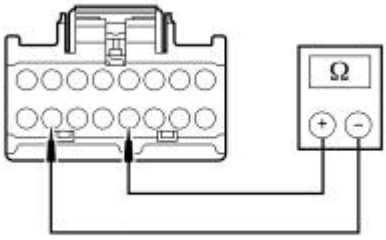
• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat backrest trim cover. Refer to Seat Backrest Cover — Front, 40 Percent in this section.
• Inspect the seat backrest for the following:
  ▪ Is the backrest blower obstructed?
  ▪ Is the blower filter restricted or plugged?
  ▪ Is the TED correctly installed?
  ▪ Is the seat backrest foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	GO to AD20 .
	
	No
	CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.
	
	REPOWER the SRS. REFER to Section 501-20B .

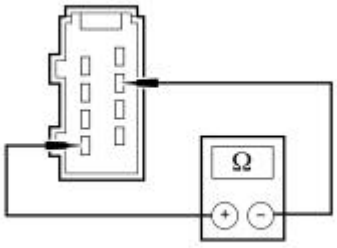
AD20 CHECK THE CUSHION TED CIRCUIT RHS02 (BU/OG) FOR SHORT TO VOLTAGE	
• Disconnect: CCSM C3265a. • **NOTE:** Do not connect the safety belt buckle pretensioner or seat side air bag electrical connectors at this time. • Position the driver seat in the vehicle and connect the seat-to-floor connectors. • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265a-H, circuit RHS02 (BU/OG), harness side and ground.  N0044952 • **Is the voltage less than 0.5 volt?**	**Yes** GO to AD21 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD21 CHECK THE CUSHION TED CIRCUIT CHS02 (YE/BU) FOR SHORT TO GROUND	
• Key in OFF position.	**Yes**

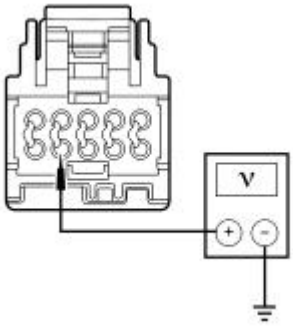
• Measure the resistance between CCSM C3265a-G, circuit CHS02 (YE/BU), harness side and ground.  N0044764 • **Is the resistance greater than 10,000 ohms?**	GO to AD22 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD22 CHECK RESISTANCE OF THE CUSHION TED AND WIRING	
• Measure the resistance between CCSM C3265a-G circuit CHS02 (YE/BU), harness side and CCSM C3265a-H, circuit RHS02 (BU/OG), harness side.  N0042194 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** GO to AD24 . **No** GO to AD23 .
AD23 CHECK RESISTANCE OF THE CUSHION TED	
• Disconnect: Cushion TED C3035. • Measure the resistance between cushion TED C3035 pin 1 and pin 3, component side.  N0042874 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-

	20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD24 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: CCSM C3265c. • Key in ON position. • Measure the voltage between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground and between CCSM C3265c-12, circuit CHS04 (YE/GN), harness side and ground.  N0044860 • **Are the voltages less than one volt?**	**Yes** GO to AD25 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD25 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground and between CCSM C3265c-12, circuit CHS04 (YE/GN), harness side and ground.	**Yes** GO to AD26 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

 N0044861 • **Are the resistances greater than 10,000 ohms?**	DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD26 CHECK THE BLOWER AND WIRING	
• **CAUTION: The ohmmeter must be connected with the positive lead to CCSM C3265c-16, circuit CHS13 (VT/BN) and the negative lead to CCSM C3265c-15, circuit CHS03 (GN/BN) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and CCSM C3265c-15, circuit CHS03 (GN/BN), harness side.  N0044850 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AD28 . **No** GO to AD27 .
AD27 CHECK THE BLOWER	
• Disconnect: Backrest TED C3034. • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3034 pin 2 and pin 4, component side.	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS.

 N0053768 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD28 CHECK BLOWER SPEED CONTROL AND CIRCUIT	
• **CAUTION: The ohmmeter must be connected with the positive lead to C3265c-12, circuit CHS04 (YE/GN), harness side and the negative lead to C3265c-15, circuit CHS03 (GN/BN), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-12, circuit CHS04 (YE/GN) harness side and CCSM C3265c-15, circuit CHS03 (GN/BN), harness side.  N0044862 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** GO to AD30 . **No** GO to AD29 .
AD29 CHECK THE BLOWER SPEED CONTROL	
• Disconnect: Backrest TED C3034. • **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3034 pin 7 and pin 4, component side.	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt

 N0054028 • **Is the resistance between 290K ohms and 420K ohms?**	buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AD30 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265b-9, circuit VHS35 (VT/OG), harness side and ground.	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

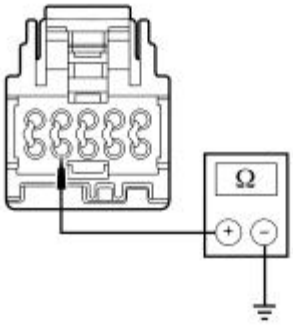


- **Is the voltage less than 0.5 volt?**

No
GO to AD31 .

AD31 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between CCSM C3265b-9, circuit VHS35 (VT/OG), harness side and ground.



- **Is the resistance greater than 10,000 volts?**

Yes
GO to AD32 .

No
REPAIR the circuit.
REPEAT the self-test.
CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS.
REFER to Section 501-20B .

AD32 CHECK THE THERMISTOR AND WIRING

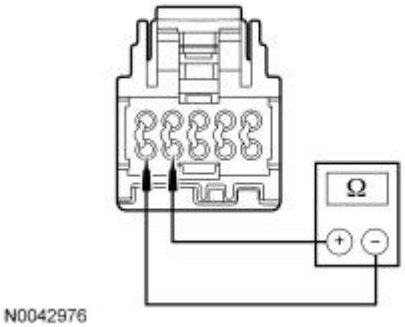
- Measure the resistance between CCSM C3265b-9, circuit VHS35 (VT/OG), harness side and CCSM C3265b-10, circuit RHS15 (GY/BN), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2782-1663 ohms
10-20°C (50-68°F)	1837-1140 ohms
20-30°C (68-86°F)	1260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

Yes
INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section.
REPEAT the self-test.
CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.



- **Is the resistance within the limits indicated?**

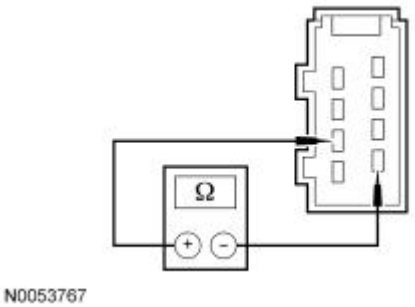
REPOWER the SRS. REFER to Section 501-20B .

No
GO to AD33 .

AD33 CHECK THE THERMISTOR

- Disconnect: Backrest TED C3034.
- Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2782-1663 ohms
10-20°C (50-68°F)	1837-1140 ohms
20-30°C (68-86°F)	1260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms



- **Is the resistance within the limits indicated?**

Yes
REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

No
INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050.

CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AE: DTC B272D — Passenger Differential Temperature Fault

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on an affected seat are reporting very different temperatures to the CCSM. This may result from an airflow restriction or a circuit fault of either TED area. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not the area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

Possible Causes

A driver differential temperature fault can be caused by:

- wiring, terminals or connectors.
- restricted cushion or backrest TED filter.
- crushed or restricted cushion or backrest foam pad.
- crushed or restricted cushion or backrest climate controlled seat manifold.
- a faulted cushion or backrest TED assembly.
- a faulted CCSM.

PINPOINT TEST AE: DTC B272D — PASSENGER DIFFERENTIAL TEMPERATURE FAULT

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

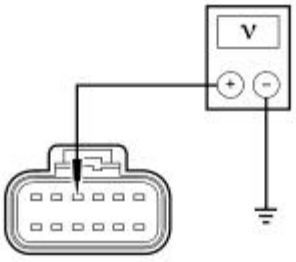
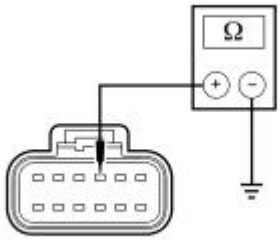
Test Step	Result / Action to Take
AE1 CHECK THE CCSM FOR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs.	**Yes** For DTC B272A, Go To Pinpoint Test AB . For

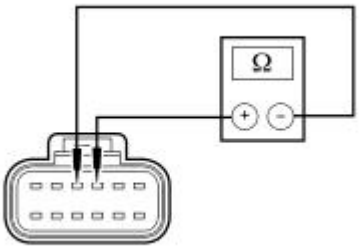
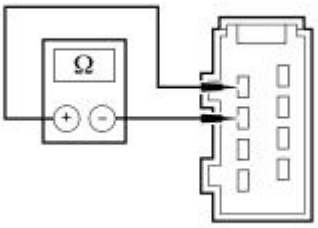
• **Was DTC B272A or B272B retrieved during the on-demand self test or as a continuous DTC?**	DTC B272B, Go To Pinpoint Test AC . **No** GO to AE2 .
AE2 MONITOR THE CCSM TED TEMPERATURE PIDs	

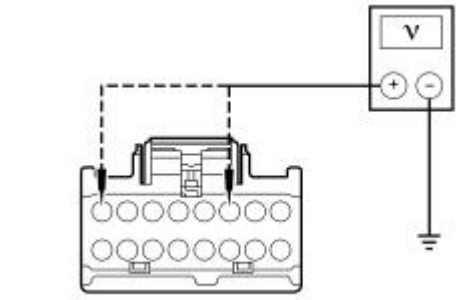
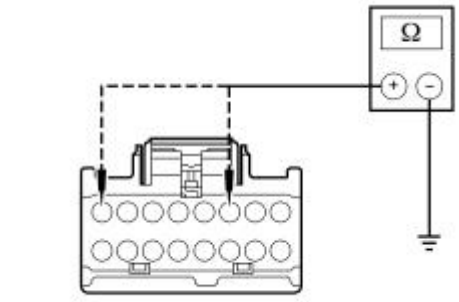
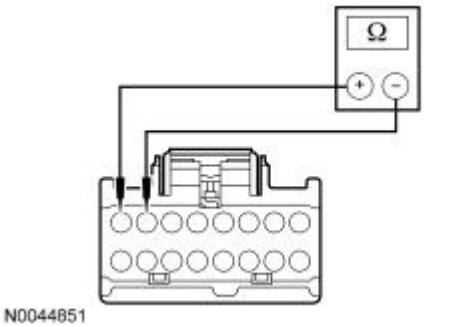
• Enter the following diagnostic mode on the diagnostic tool: Datalogger/CCSM PIDs:.
  ▪ Passenger Cushion Thermal Electric Device (TED) Temperature
  ▪ Passenger Back Thermal Electric Device (TED) Temperature
  ▪ Cushion Thermal Electric Device (TED) Temperature
  ▪ Back Thermal Electric Device (TED) Temperature
• **CAUTION: Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs.**
• Monitor the TED temperature PIDs with the climate controlled seats OFF. Compare the PID values of the front passenger seat to those of the driver seat, this can help identify if there is a concern with the front passenger seat cushion or backrest PID value readings.
• **Are both front passenger seat TED temperature PID values within 10°C (18°F) of the ambient temperature?**
	Yes
	GO to AE3 .
	
	No
	If the front passenger seat cushion PID value varies 10°C (18°F) or more from ambient temperature, GO to AE15 .
	
	If the front passenger seat backrest PID value varies 10°C (18°F) or more from ambient temperature, GO to AE30 .

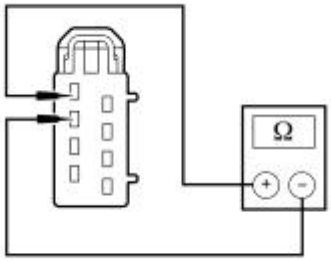
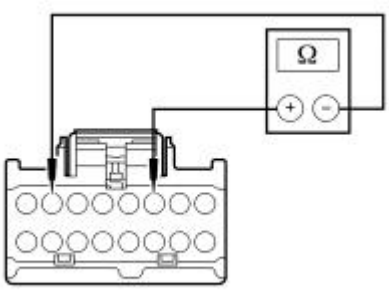
AE3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST	
• Key in OFF position. • Key in ON position. • **NOTE:** A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • After cycling the ignition switch and with the engine running, set the driver seat to HIGH HEAT (3 LEDs illuminated on EATC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. • **Do the front passenger seat cushion or backrest PID values vary more than 10°C (18°F)?**	**Yes** If the front passenger seat cushion PID value is 10°C (18°F) hotter than the backrest PID value, GO to AE4 . If the front passenger seat backrest PID value is 10°C (18°F) hotter than the cushion PID value, GO to AE19 . **No** Fault is currently not present. INSPECT for crushed seat cushion or backrest foam pad or climate controlled seat cushion or backrest manifold. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.
AE4 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052.	**Yes** GO to AE5 . **No** CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate

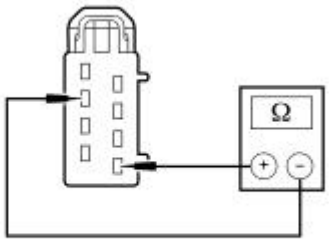
• **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**
• Connect the battery ground cable.
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat cushion trim cover. Refer to Seat Cushion Cover — Front, 40 Percent in this section.
• Inspect the seat cushion for the following:
  ■ Is the cushion blower obstructed?
  ■ Is the blower filter restricted or plugged?
  ■ Is the TED correctly installed?
  ■ Is the seat cushion foam pad crushed or restricted?
  ■ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.
	
	DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052.
	
	REPOWER the SRS. REFER to Section 501-20B .

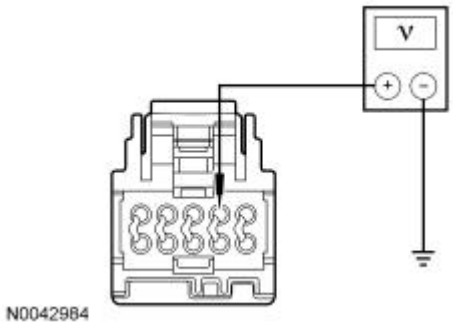
AE5 CHECK THE BACKREST TED CIRCUIT RHS06 (WH) FOR SHORT TO VOLTAGE	
• Disconnect: CCSM C3265a. • Position the front passenger seat in the vehicle and connect the seat-to-floor connectors. • Key in ON position. • Measure the voltage between CCSM C3265a-D, circuit RHS06 (WH), harness side and ground.  N0044950 • **Is the voltage less than 0.5 volt?**	**Yes** GO to AE6 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE6 CHECK THE BACKREST TED CIRCUIT CHS06 (BU/BN) FOR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265a-C, circuit CHS06 (BU/BN), harness side and ground.  N0042988 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AE7 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE7 CHECK RESISTANCE OF THE BACKREST TED AND	

WIRING	
• Measure the resistance between CCSM C3265a-C, circuit CHS06 (BU/BN), harness side and CCSM C3265a-D, circuit RHS06 (WH), harness side.  N0042989 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** GO to AE9 . **No** GO to AE8 .
AE8 CHECK RESISTANCE OF THE BACKREST TED	
• Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 1 and pin 3, component side.  N0053766 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE9 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: CCSM C3265c. • Key in ON position. • Measure the voltage between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground and between CCSM C3265c-3, circuit RHS08 (VT/WH), harness side and ground.	**Yes** GO to AE10 . **No** REPAIR the circuit.

 N0044863 • **Are the voltages less than one volt?**	REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE10 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground and between CCSM C3265c-3, circuit RHS08 (VT/WH), harness side and ground.  N0044864 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to AE11 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE11 CHECK THE BLOWER AND WIRING	
• **CAUTION: The ohmmeter must be connected with the positive lead to CCSM C3265c-8, circuit CHS14 (GN) and the negative lead to CCSM C3265c-7, circuit CHS08 (BN/YE) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and CCSM C3265c-7, circuit CHS08 (BN/YE), harness side.  N0044851 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AE13 . **No** GO to AE12 .
AE12 CHECK THE BLOWER	
• Disconnect: Cushion TED C3040.	**Yes**

• **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3040 pin 2 and pin 4, component side.  N0042881 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE13 CHECK BLOWER SPEED CONTROL AND CIRCUIT	
• **CAUTION: The ohmmeter must be connected with the positive lead to C3265c-3, circuit RHS08 (VT/WH), harness side and the negative lead to C3265c-7, circuit CHS08 (BN/YE), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-3, circuit RHS08 (VT/WH) harness side and CCSM C3265c-7, circuit CHS08 (BN/YE), harness side.  N0047113 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** GO to AE15 . **No** GO to AE14 .
AE14 CHECK THE BLOWER SPEED CONTROL	

• Disconnect: Cushion TED C3040. • **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between cushion TED C3040 pin 7 and pin 4, component side.  N0054029 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE15 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265b-2, circuit VHS27 (WH/OG), harness side and ground.	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AE16 .

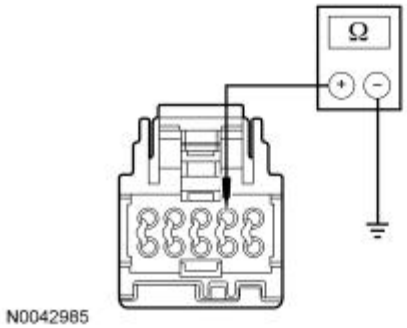


N0042984

- **Is the voltage less than 0.5 volt?**

AE16 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between CCSM C3265b-2, circuit VHS27 (WH/OG), harness side and ground.



N0042985

- **Is the resistance greater than 10,000 volts?**

Yes
GO to AE17 .

No
REPAIR the circuit.
REPEAT the self-test.
CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

AE17 CHECK THE THERMISTOR AND WIRING

- Measure the resistance between CCSM C3265b-2, circuit VHS27 (WH/OG), harness side and CCSM C3265b-3, circuit RHS10 (BU/OG), harness side. Note the ambient temperature and refer to the following table.

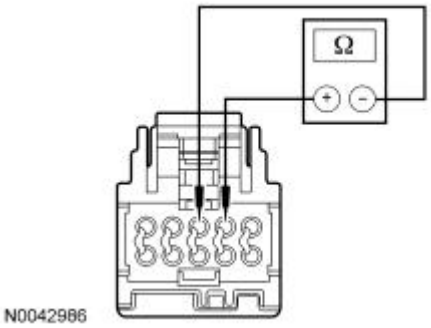
Temperature	Resistance
0-10°C (32-50°F)	2782-1663 ohms
10-20°C (50-68°F)	1837-1140 ohms
20-30°C (68-86°F)	1260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

Yes
INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section.
REPEAT the self-test.
CLEAR the DTCs.

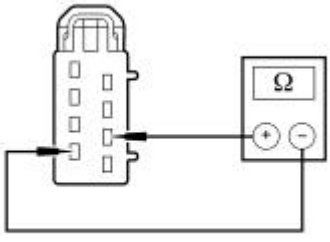
DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052.

REPOWER the SRS. REFER to Section 501-20B .

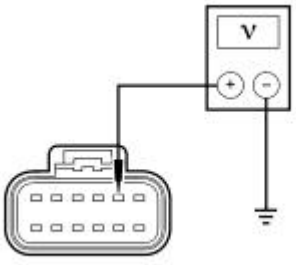
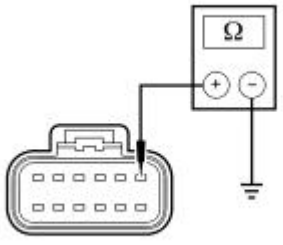
No
GO to AE18 .

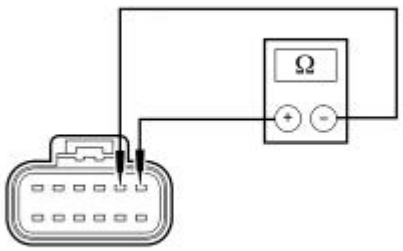
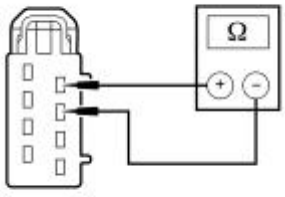


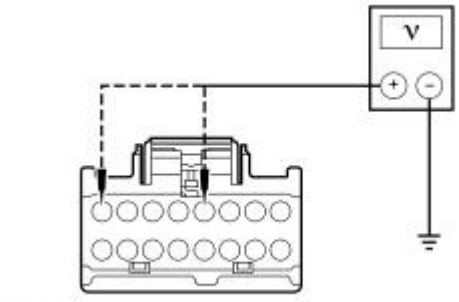
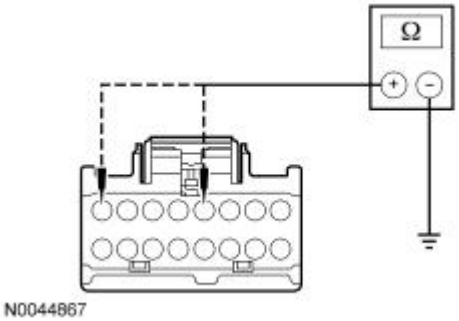
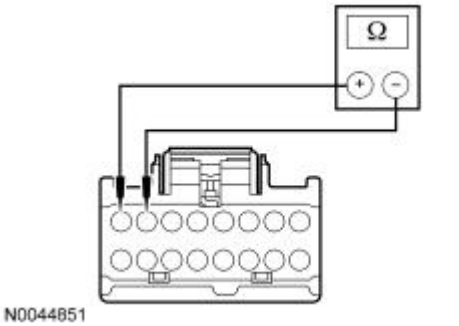
- **Is the resistance within the limits indicated?**

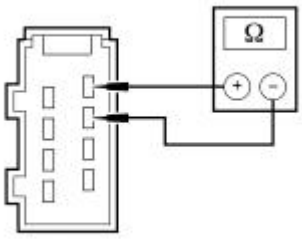
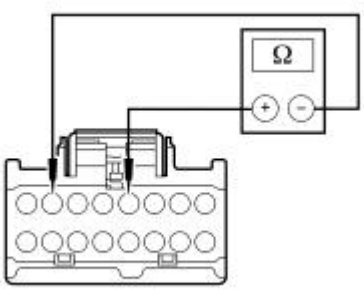
AE18 CHECK THE THERMISTOR	
• Disconnect: Cushion TED C3040. • Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) / 2782-1663 ohms 10-20°C (50-68°F) / 1837-1140 ohms 20-30°C (68-86°F) / 1260-806 ohms 30-40°C (86-104°F) / 893-570 ohms 40-50°C (104-122°F) / 630-428 ohms  N0042890 • **Is the resistance within the limits indicated?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE19 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Remove the seat. Refer to Seat — Front, 40 Percent in this section. • Remove the seat backrest trim cover. Refer to Seat Backrest Cover — Front, 40 Percent in this section.	**Yes** GO to AE20 . **No** CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold.

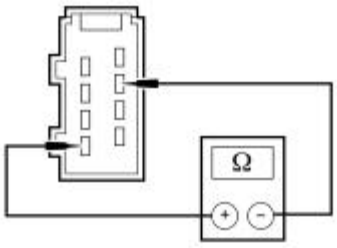
• Inspect the seat backrest for the following:
  ▪ Is the backrest blower obstructed?
  ▪ Is the blower filter restricted or plugged?
  ▪ Is the TED correctly installed?
  ▪ Is the seat backrest foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.
	
	REPOWER the SRS. REFER to Section 501-20B .

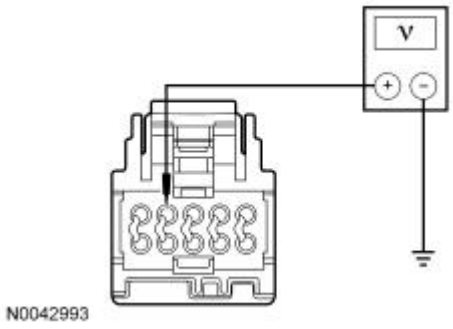
AE20 CHECK CUSHION TED CIRCUIT RHS07 (BU) FOR SHORT TO VOLTAGE	
• Disconnect: CCSM C3265a. • **NOTE:** Do not connect the safety belt buckle pretensioner or seat side air bag electrical connectors at this time. • Position the front passenger seat in the vehicle and connect the seat-to-floor connectors. • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265a-B, circuit RHS07 (BU), harness side and ground.  N0044870 • **Is the voltage less than 0.5 volt?**	**Yes** GO to AE21 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE21 CHECK THE CUSHION TED CIRCUIT CHS07 (GY/BU) FOR SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265a-A, circuit CHS07 (GY/BU), harness side and ground.  N0042978 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AE22 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE22 CHECK RESISTANCE OF THE CUSHION TED AND WIRING	
• Measure the resistance between CCSM C3265a-A circuit CHS07 (GY/BU), harness side and CCSM C3265a-B, circuit RHS07 (BU), harness side.	**Yes** GO to AE24 . **No**

 N0042979 • **Is the resistance between 0.9 and 10 ohms?**	GO to AE23 .
AE23 CHECK RESISTANCE OF THE CUSHION TED	
• Disconnect: Cushion TED C3040. • Measure the resistance between cushion TED C3040 pin 1 and pin 3, component side.  N0042874 • **Is the resistance between 0.9 and 10 ohms?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new cushion TED. REFER to Seat Cushion Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE24 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: CCSM C3265c. • Key in ON position. • Measure the voltage between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground and between CCSM C3265c-4, circuit CHS09 (GY), harness side and ground.	**Yes** GO to AE25 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT

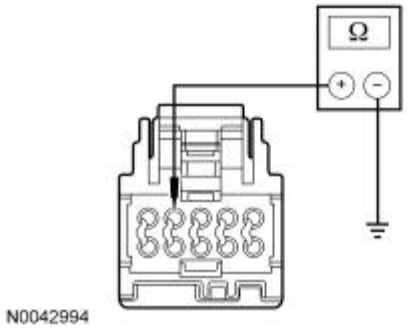
 N0044866 • **Are the voltages less than one volt?**	passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE25 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and ground and between CCSM C3265c-4, circuit CHS09 (GY), harness side and ground.  N0044867 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to AE26 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. If equipped, CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE26 CHECK THE BLOWER AND WIRING	
• **CAUTION: The ohmmeter must be connected with the positive lead to CCSM C3265c-8, circuit CHS14 (GN) and the negative lead to CCSM C3265c-7, circuit CHS08 (BN/YE) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-8, circuit CHS14 (GN), harness side and CCSM C3265c-7, circuit CHS08 (BN/YE), harness side.  N0044851 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AE28 . **No** GO to AE27 .
AE27 CHECK THE BLOWER	
• Disconnect: Backrest TED C3039 (10-Way Power Seat) or	**Yes**

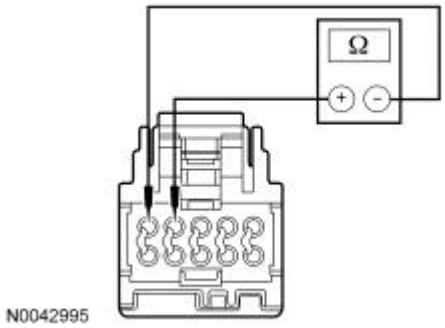
C3316 (6-Way Power Seat). • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 2 and pin 4, component side.  N0053768 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE28 CHECK BLOWER SPEED CONTROL AND CIRCUIT	
• **CAUTION: The ohmmeter must be connected with the positive lead to C3265c-4, circuit CHS09 (GY), harness side and the negative lead to C3265c-7, circuit CHS08 (BN/YE), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between CCSM C3265c-4, circuit CHS09 (GY) harness side and CCSM C3265c-7, circuit CHS08 (BN/YE), harness side.  N0044868 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** GO to AE30 . **No** GO to AE29 .
AE29 CHECK THE BLOWER SPEED CONTROL	

• Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3039 (10-way power seat) or C3316 (6-way power seat) pin 7 and pin 4, component side.  N0054028 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE30 CHECK THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect passenger seat safety belt buckle pretensioner C3050. • Disconnect passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Key in ON position. • Measure the voltage between CCSM C3265b-4, circuit VHS36 (YE/BU), harness side and ground.	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AE31 .



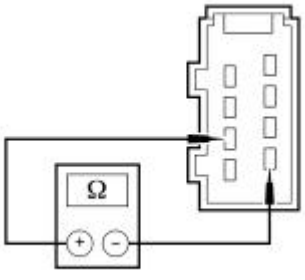
- **Is the voltage less than 0.5 volt?**

AE31 CHECK THERMISTOR CIRCUIT FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265b-4, circuit VHS36 (YE/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AE32 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AE32 CHECK THE THERMISTOR AND WIRING	
• Measure the resistance between CCSM C3265b-4, circuit VHS36 (YE/BU), harness side and CCSM C3265b-5, circuit RHS20 (GN/BU), harness side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) / 2782-1663 ohms 10-20°C (50-68°F) / 1837-1140 ohms 20-30°C (68-86°F) / 1260-806 ohms 30-40°C (86-104°F) / 893-570 ohms 40-50°C (104-122°F) / 630-428 ohms	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AE33 .



N0042995

- **Is the resistance within the limits indicated?**

AE33 CHECK THE THERMISTOR	
• Disconnect: Backrest TED C3039 (10-Way Power Seat) or C3316 (6-Way Power Seat). • Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature / Resistance** 0-10°C (32-50°F) — 2782-1663 ohms 10-20°C (50-68°F) — 1837-1140 ohms 20-30°C (68-86°F) — 1260-806 ohms 30-40°C (86-104°F) — 893-570 ohms 40-50°C (104-122°F) — 630-428 ohms  N0053767 • **Is the resistance within the limits indicated?**	**Yes** REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT passenger seat safety belt buckle pretensioner C3050. CONNECT passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .

Pinpoint Test AF: DTC B2730 — Back Over-Temp Detected (Driver)

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the climate controlled seat module (CCSM) mounted to the bottom of the passenger seat cushion.

The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the CCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives power from battery junction box (BJB) fuse 8 (40A) feeding battery voltage on circuit SBB08 (VT/RD) into CCSM C3265a pins E and F. If power is disconnected from either pin E or F of CCSM C3265a with the power connection remaining on the other circuit, both seats will remain operational because the power feed circuits are connected internally in the CCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the CCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependant on the EATC seat switch settings.

Possible Causes

A driver seat backrest over-temp fault can be caused by:

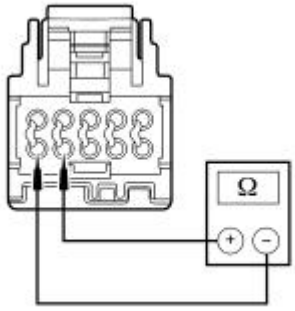
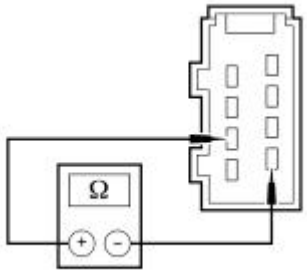
- wiring, terminals or connectors.
- restricted backrest TED filter.
- crushed or restricted backrest foam pad.
- crushed or restricted climate controlled seat manifold.
- a faulted backrest TED assembly.
- a faulted CCSM.

PINPOINT TEST AF: DTC B2730 — BACK OVER-TEMP DETECTED (DRIVER)

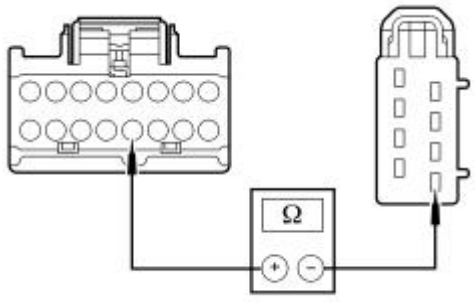
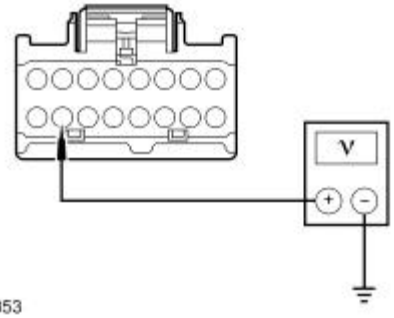
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

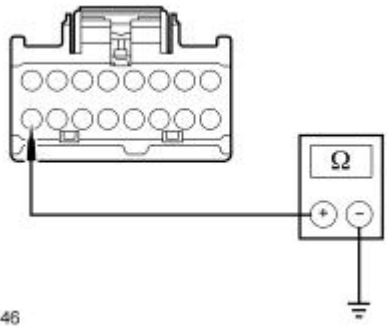
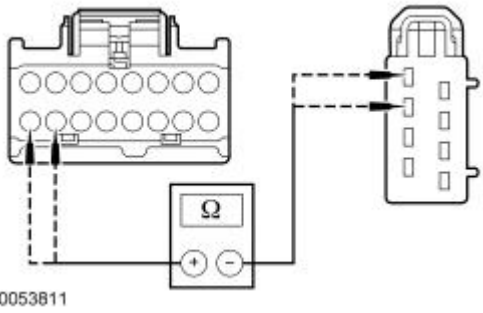
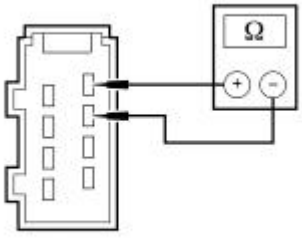
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

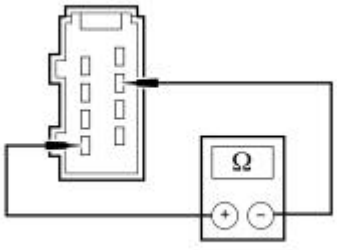
Test Step	Result / Action to Take
AF1 CHECK THE CCSM FOR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Climate Controlled Seat Module (CCSM) Self Test/Retrieve DTCs. • **Was DTC B2730 retrieved during the on-demand self test?**	**Yes** GO to AF2 . **No** GO to AF4 .
AF2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND	
• Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • Disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265b. • Disconnect: Backrest TED C3034.	**Yes** GO to AF3 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt

• **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265b-9, circuit VHS35 (VT/OG), harness side and ground and between CCSM C3265b-10, circuit RHS15 (GY/BN), harness side and ground.  N0042976 • **Are the resistances greater than 10,000 ohms?**	buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF3 CHECK THE TED THERMISTOR	
• Measure the resistance between backrest TED C3034 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table. **Temperature** / **Resistance** 0-10°C (32-50°F) / 2782-1663 ohms 10-20°C (50-68°F) / 1837-1140 ohms 20-30°C (68-86°F) / 1260-806 ohms 30-40°C (86-104°F) / 893-570 ohms 40-50°C (104-122°F) / 630-428 ohms  N0053767 • **Is the resistance within the limits indicated?**	**Yes** REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and

	passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF4 CONFIRM THE FAULT • Verify with the customer that the concern is the seat shuts OFF in HEAT mode. • **NOTE:** A crushed seat backrest foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault. • Attempt to recreate the fault. Start the vehicle and set the driver seat to HIGH HEAT for at least 15 minutes. • **Is the customer concern with the seat shutting OFF in HEAT mode or was the fault recreated?**	**Yes** GO to AF5 . **No** Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.
AF5 CHECK OPERATION OF THE SEAT • Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Compare the airflow from the driver seat backrest and compare it to the airflow from the passenger seat backrest. • **Is the airflow exhausting from the driver seat backrest comparable to the airflow exhausting from the passenger seat backrest?**	**Yes** GO to AF14 . **No** GO to AF6 .
AF6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER • Key in OFF position. • Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter. • **Is the blower obstructed or the filter restricted?**	**Yes** REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs. **No** GO to AF7 .
AF7 CHECK THE BACKREST FAN OPERATION • Key in ON position. • With the engine running, set both front seats to HIGH COOL (3 LEDs illuminated on EATC module). • Inspect the backrest blower for operation. • **Does the backrest blower operate?**	**Yes** GO to AF14 . **No** GO to AF8 .
AF8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN • Key in OFF position. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. • If equipped, disconnect driver seat side air bag C3051 and passenger seat side air bag C3052. • Disconnect: CCSM C3265c. • Disconnect: Backrest TED C3034.	**Yes** GO to AF9 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt

• **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Connect the battery ground cable. • Measure the resistance between CCSM C3265c-12, circuit CHS04 (YE/GN), harness side and backrest TED C3034-7, circuit CHS04 (YE/GN), harness side.  N0053810 • **Is the resistance less than 5 ohms?**	buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF9 CHECK THE BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO VOLTAGE	
• Key in ON position. • Measure the voltage between CCSM C3265c-15, circuit CHS03 (GN/BN), harness side and ground.  N0044853 • **Is voltage greater than 1 volt?**	**Yes** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B . **No** GO to AF10 .
AF10 CHECK THE BLOWER CIRCUIT CHS13 (VT/BN) FOR A SHORT TO GROUND	
• Key in OFF position. • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and ground.	**Yes** GO to AF11 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety

 N0044846 • **Is the resistance greater than 10,000 ohms?**	belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF11 CHECK THE BLOWER CIRCUITS CHS13 (VT/BN) AND CHS03 (GN/BN) FOR AN OPEN • Measure the resistance between CCSM C3265c-16, circuit CHS13 (VT/BN), harness side and backrest TED C3034-2, circuit CHS13 (VT/BN), harness side; and between CCSM C3265c-15, circuit CHS03 (GN/BN), harness side and backrest TED C3034-4, circuit CHS03 (GN/BN), harness side.  N0053811 • **Are the resistances less than 5 ohms?**	**Yes** GO to AF12 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF12 CHECK THE BLOWER RESISTANCE • **CAUTION: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3034 pin 2 and pin 4, component side.  N0053768 • **Is the resistance between 6,000 ohms and 9,000 ohms?**	**Yes** GO to AF13 . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag

	module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF13 CHECK THE BLOWER SPEED CONTROL RESISTANCE	
• **CAUTION: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.** • Measure the resistance between backrest TED C3034 pin 7 and pin 4, component side.  N0054028 • **Is the resistance between 290K ohms and 420K ohms?**	**Yes** GO to AF14 . **No** INSTALL a new backrest TED. REFER to Seat Backrest Thermo-Electric Device in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat safety belt buckle pretensioner C3049 and passenger seat safety belt buckle pretensioner C3050. CONNECT driver seat side air bag module C3051 and passenger seat side air bag module C3052. REPOWER the SRS. REFER to Section 501-20B .
AF14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST	

• Key in OFF position.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Remove the seat. Refer to Seat — Front, 40 Percent in this section.
• Remove the seat backrest trim cover. Refer to Seat Backrest Cover — Front, 40 Percent in this section.
• Inspect the seat backrest for the following:
  ▪ Is the TED correctly installed?
  ▪ Is the seat backrest foam pad crushed or restricted?
  ▪ Is the climate controlled seat manifold crushed or restricted?
• **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**
	Yes
	CONNECT the battery ground cable.
	
	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module in this section. REPEAT the self-test. CLEAR the DTCs.
	
	REPOWER the SRS. REFER to Section 501-20B .
	
	No
	CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. CONNECT the battery ground cable. REPEAT the self-test. CLEAR the DTCs.

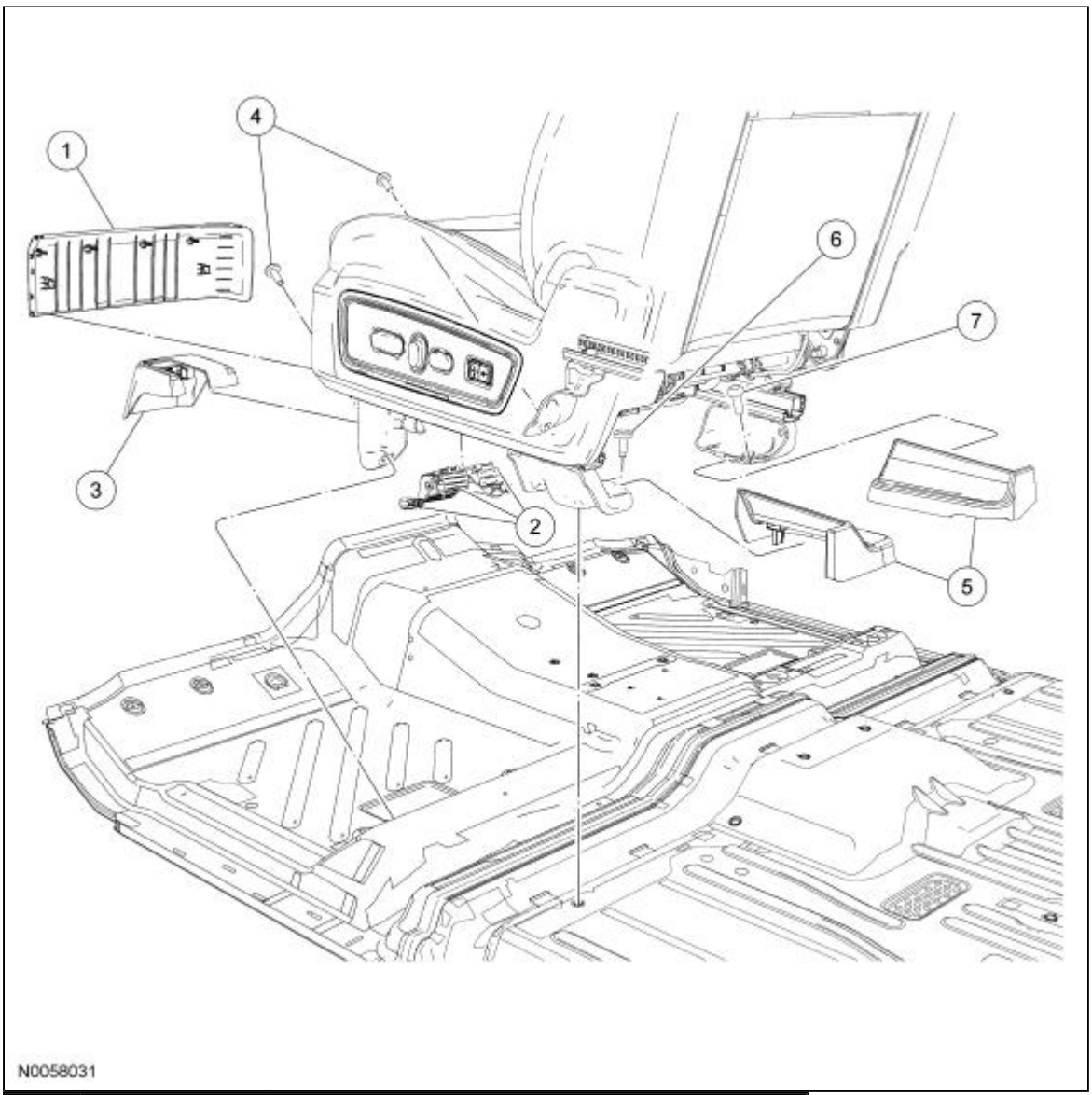
	REPOWER the SRS. REFER to Section 501-20B .

Seat — Front, 40 Percent

Printable View (292 KB)

NOTE: Driver seat shown, passenger seat similar.

NOTE: For torque specifications and torque sequence, refer to the procedure steps.



Item	Part Number	Description
1	62184	Front seat cushion panel shield
2	—	Electrical connectors (part of 14A699)
3	618D49	Seat-to-floor front bolt cover
4	W708564	Seat-to-floor front bolts (2 required)
5	618D49	Seat-to-floor rear bolt covers (2 required)
6	W708564	Seat-to-floor rear outboard bolt
7	W710482	Seat-to-floor rear inboard bolt

Removal

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the seat to access all seat-to-floor fasteners.

2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

3. Remove the 2 seat-to-floor rear bolt covers.

4. Remove the 2 seat-to-floor rear bolts.

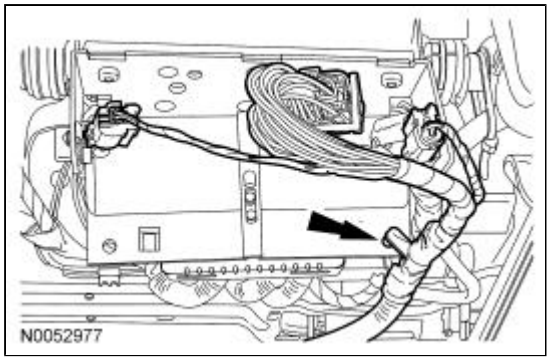
5. **CAUTION: Do not pull from the inboard side of the front seat cushion panel shield to avoid damaging it.**

   Remove the front seat cushion panel shield.
   - Release the upper retaining clips working from the outboard side and then release the lower retaining clips.

6. Remove the seat-to-floor front bolt cover.

7. Remove the 2 seat-to-floor front bolts.

8. Detach the pin-type retainer and vehicle wiring harness from the seat.



9. Disconnect the seat harness electrical connectors.

- Disconnect the safety belt buckle pretensioner electrical connector.
  - Slide the release button and separate the connector.
- Disconnect the side air bag electrical connector.
  - Slide the release button and separate the connector.
- Disconnect the seat harness electrical connector.
  - Release the locking tab and rotate the assurance lever fully to disengage the seat harness electrical connector.
  - Slightly tip the connector away and disconnect.
  - For memory seat, repeat the step and disconnect the other connector.

10. Remove the seat from the vehicle.

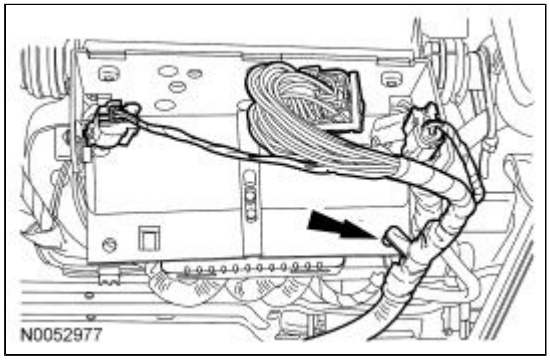
Installation

NOTE: The seat-to-floor bolts must be tightened in the sequence described in this procedure.

1. Position the seat in the vehicle.

2. Connect the electrical connectors.
   - Connect the seat harness electrical connector.
     - Make sure the electrical connector assurance lever is in the fully released position.
     - Tip the body harness connector into the seat connector and partially insert.
     - Rotate the assurance lever while pushing the connectors together until the handle is locked.
     - For memory seat, repeat the step and connect the other connector.
   - Connect the safety belt buckle pretensioner electrical connector.
     - Make sure the release is locked.
   - Connect the side air bag electrical connector.
     - Make sure the release is locked.

3. Install the wiring harness pin-type retainer.



4. Install the seat-to-floor front inboard bolt.
   - Tighten to 40 Nm (30 lb-ft).

5. Install the seat-to-floor front outboard bolt and bolt cover.
   - Tighten to 40 Nm (30 lb-ft).

6. Install the seat-to-floor rear inboard bolt.
   - Tighten to 40 Nm (30 lb-ft).

7. Install the seat-to-floor rear outboard bolt.
   - Tighten to 40 Nm (30 lb-ft).

8. Install the 2 seat-to-floor rear bolt covers.

9. Install the front seat cushion panel shield.

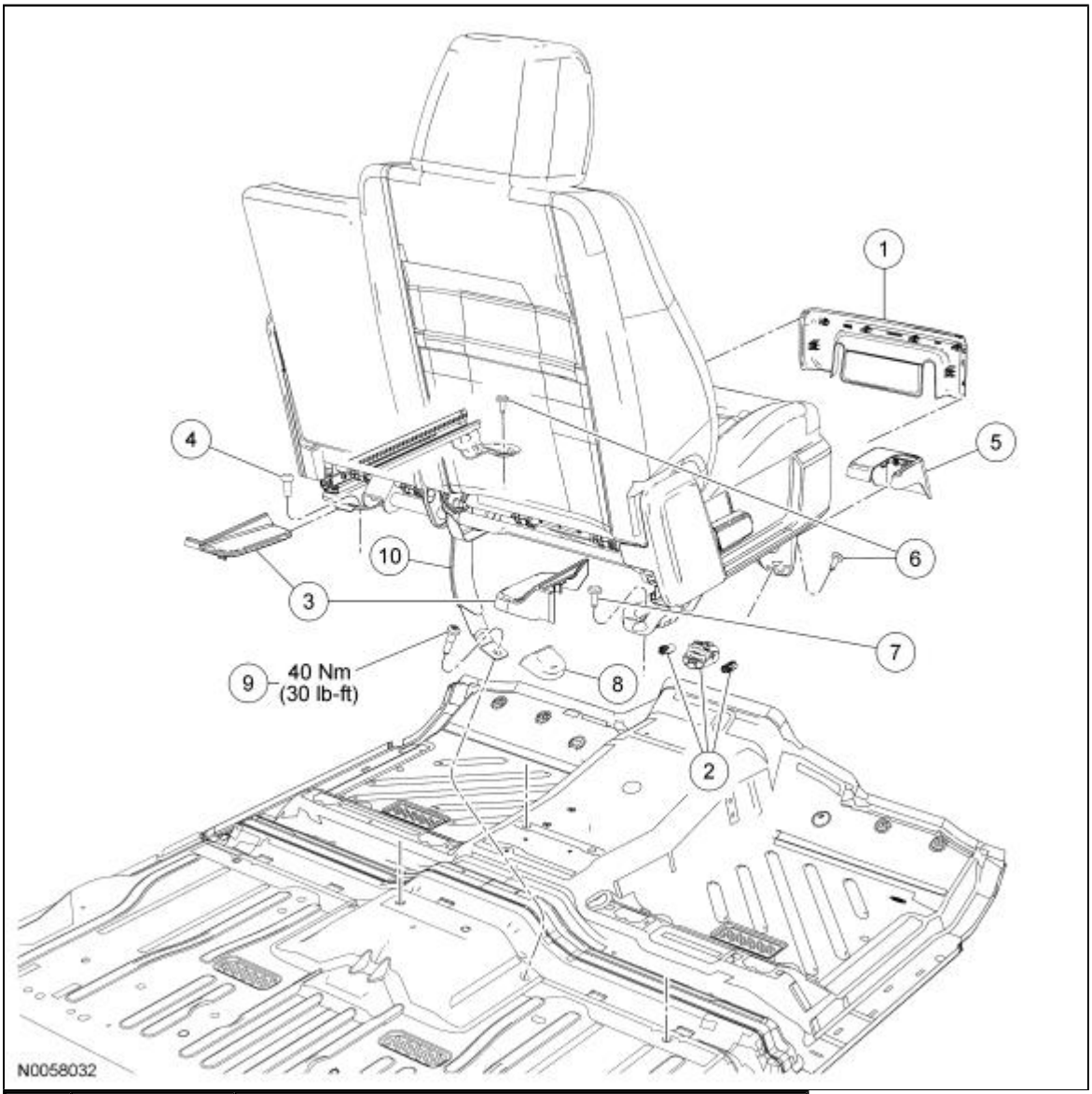
10. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

11. Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat — Front, 60 Percent

Printable View (291 KB)

NOTE: For torque specifications and torque sequence, refer to the procedure steps.



Item	Part Number	Description
1	62184	Front seat cushion panel shield
2	—	Electrical connectors (part of 14A699)
3	618D48	Seat-to-floor rear bolt covers (2 required)
4	W710482	Seat-to-floor rear inboard bolt
5	618D48	Seat-to-floor front bolt cover
6	W708564	Seat-to-floor front bolts (2 required)
7	W708564	Seat-to-floor rear outboard bolt
8	—	Center seat safety belt buckle bolt cover

9	—	Center seat safety belt buckle bolt (part of 611B60)
10	611B60	Center seat safety belt buckle

Removal

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

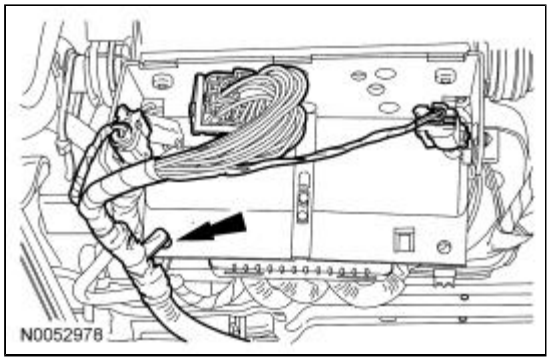
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the seat to access all seat-to-floor fasteners.
2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
3. Remove the front seat cushion panel shield.
4. Remove the seat-to-floor front bolt cover.
5. Remove the 2 seat-to-floor front bolts.
6. Detach the pin-type retainer and vehicle wiring harness from the seat.



7. Disconnect the seat harness electrical connectors.
   - Disconnect the safety belt buckle pretensioner electrical connector.
     - Slide the release button and separate the connector.
   - Disconnect the side air bag electrical connector.
     - Slide the release button and separate the connector.
   - Disconnect the seat harness electrical connector.

        - Release the locking tab and rotate the assurance lever fully to disengage the seat harness electrical connector.
        - Slightly tip the connector away and disconnect.

8. Remove the 2 seat-to-floor rear bolt covers.

9. Remove the 2 seat-to-floor rear bolts.

10. Remove the center seat safety belt buckle bolt cover and bolt.

11. Remove the seat from the vehicle.

Installation

NOTE: The seat-to-floor bolts must be tightened in the sequence described in this procedure.

1. Position the seat in the vehicle.

2. Install the inboard seat-to-floor rear bolt and bolt cover.
    - Tighten to 40 Nm (30 lb-ft).

3. Install the outboard seat-to-floor front bolt and bolt cover.
    - Tighten to 40 Nm (30 lb-ft).

4. Install the inboard seat-to-floor front bolt.
    - Tighten to 40 Nm (30 lb-ft).

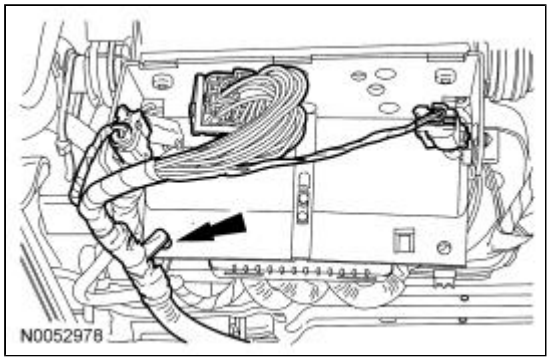
5. Install the outboard seat-to-floor rear bolt and bolt cover.
    - Tighten to 40 Nm (30 lb-ft).

6. Position the center seat safety belt buckle and install the bolt.
    - Make sure the safety belt webbing is not twisted prior to installation.
    - Tighten to 40 Nm (30 lb-ft).

7. Install the center seat safety belt buckle bolt cover.

8. Connect the electrical connectors.
    - Connect the seat harness electrical connector.
        - Make sure the electrical connector assurance lever is in the fully released position.
        - Tip the body harness connector into the seat connector and partially insert.
        - Rotate the assurance lever while pushing the connectors together until the handle is locked.
    - Connect the safety belt buckle pretensioner electrical connector.
        - Make sure the release is locked.
    - Connect the side air bag electrical connector.
        - Make sure the release is locked.

9. Install the wiring harness pin-type retainer.



10. Install the front seat cushion panel shield.

11. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

12. Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat — Exploded View, Front

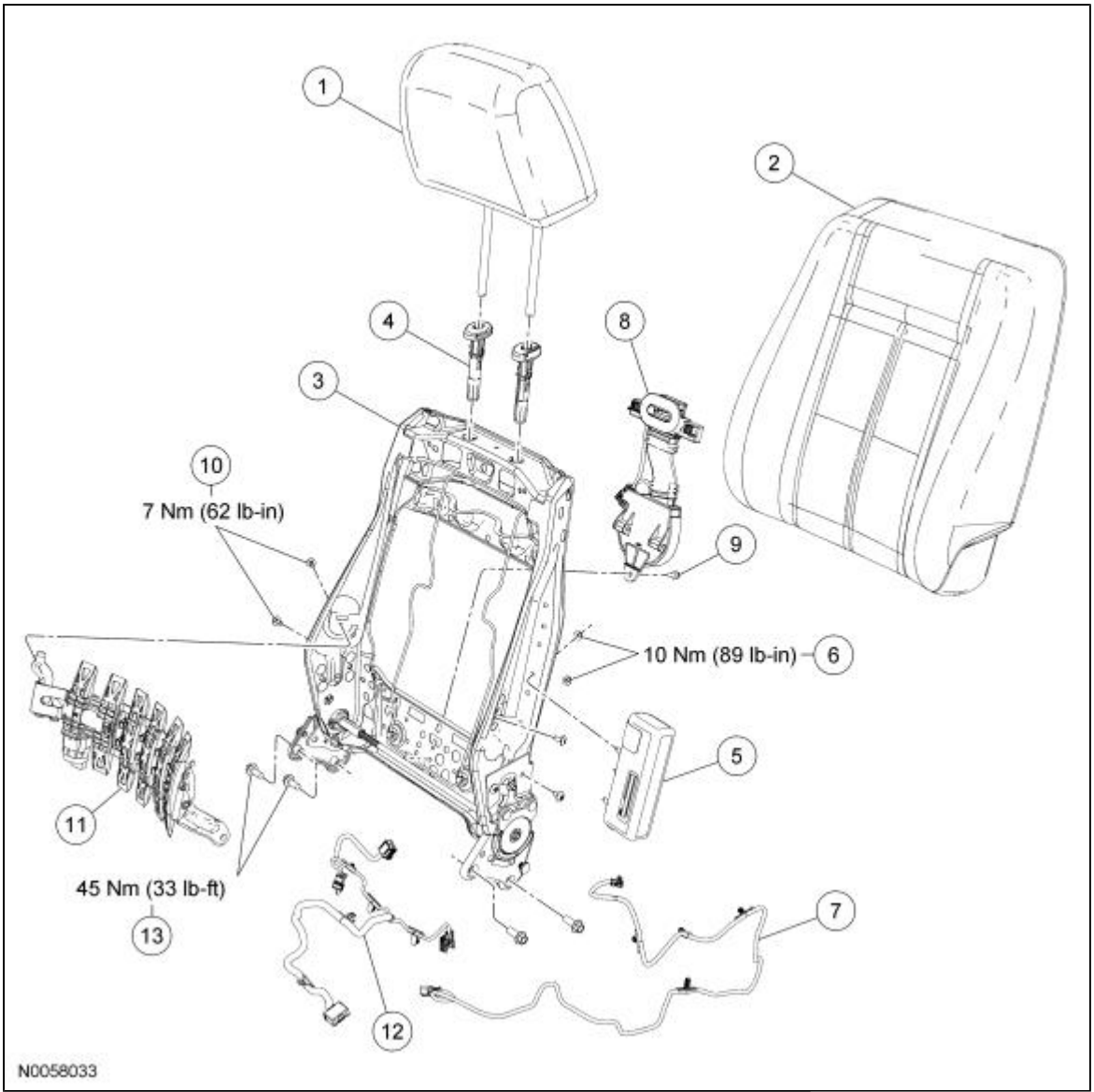
Printable View (525 KB)

Seat Backrest — Front, 40 Percent

NOTE: Driver backrest shown, passenger similar.

NOTE: 40 Percent seat backrest shown, 60 percent seat backrest similar.

NOTE: Backrest with power recline shown, backrest with manual recline similar.

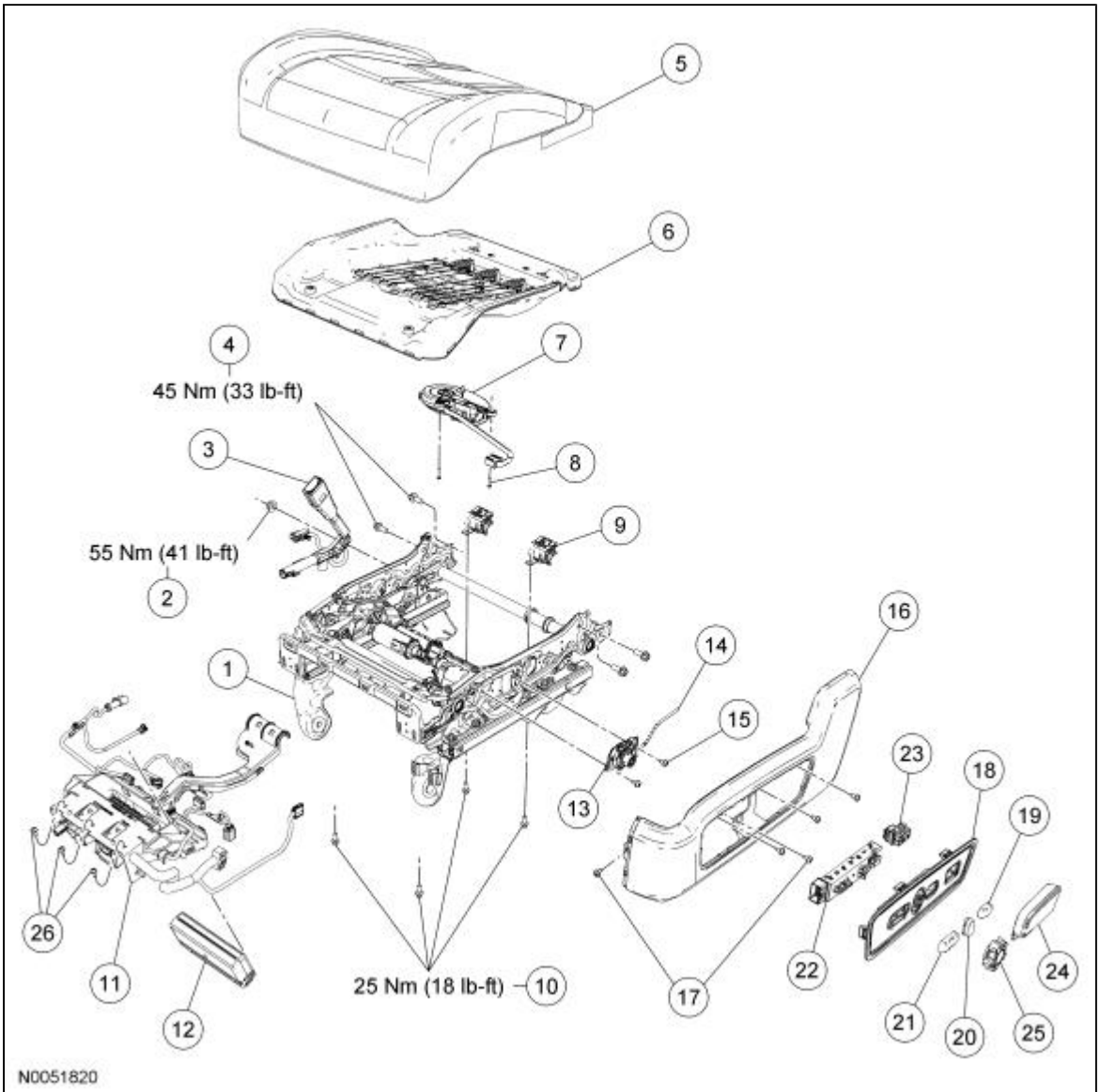


Item	Part Number	Description
1	611A08	Head restraint
2	64416/64810	Backrest trim cover/foam pad
3	61019	Backrest frame assembly

4	610A16	Head restraint guide (2 required)
5	611D10	Side air bag module
6	N620480	Nuts, side air bag module (if equipped)
7	14K155	Wiring harness, side air bag
8	14C712	Backrest thermo-electric device (TED)
9	N803946	Scrivet (if equipped)
10	—	Screws, lumbar (4 required)
11	65500	Lumbar assembly
12	14A699	Wiring harness (if equipped)
13	—	Backrest-to-cushion bolts (4 required) (part of hardware kit 000A25)

Seat Cushion — Front, 40 Percent

NOTE: Driver memory seat shown, driver and passenger power seat similar.

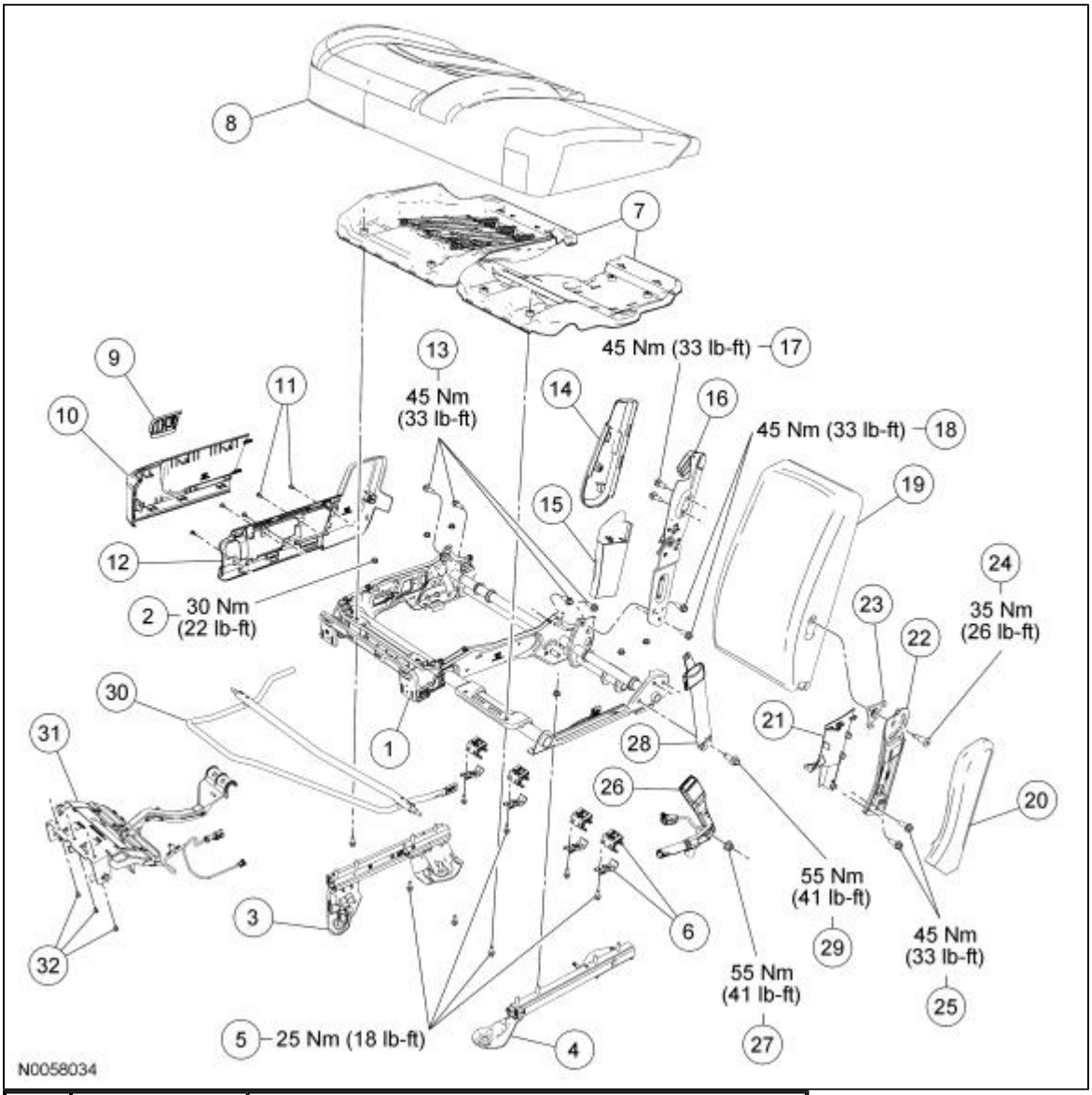


Item	Part Number	Description

1	61704	Seat track assembly
2	W520114	Nut, safety belt buckle pretensioner
3	61203	Safety belt buckle pretensioner
4	—	Bolts, backrest-to-cushion (4 required) (part of hardware kit 000A25)
5	62900/632A22	Cushion trim cover/foam pad
6	63100	Seat cushion frame
7	18D508	Cushion thermo-electric device (TED) (if equipped)
8	—	Screws, TED (2 required) (if equipped)
9	617D44/63518	Cushion frame rear clip and strap (2 sets required)
10	—	Cushion frame-to-seat track bolts (4 required) (part of hardware kit 000A25)
11	14A699	Wiring harness and bracket assembly
12	14C708	Driver seat module (if equipped)
13	65501	Manual lumbar actuator (if equipped)
14	—	Manual lumbar cable (if equipped) (part of 65501)
15	—	Screw, manual lumbar actuator (2 required) (if equipped) (part of hardware kit 000A25)
16	62187	Cushion side shield
17	—	Screws, cushion side shield (5 required)
18	14A707	Side shield cover
19	14711	Knob, power lumbar switch (if equipped)
20	14711	Knob, power recliner switch (if equipped)
21	14711	Knob, seat control switch
22	14A701	Seat control switch
23	14776	Memory set switch (if equipped)
24	61737	Recliner handle (if equipped)
25	62622	Manual lumbar knob (if equipped)
26	—	Screw, wiring harness bracket (3 required) (part of hardware kit 000A25)

Seat Cushion — Front, 60 Percent

NOTE: Sixty percent manual seat track shown, 40 percent manual seat track similar.



Item	Part Number	Description
1	61705	Seat track
2	—	Nut, seat track rail-to-seat track (6 required) (part of hardware kit 000A25)
3	—	Outboard seat track rail (part of 61705)
4	—	Inboard seat track rail (part of 61705)
5	—	Cushion frame-to-seat track bolts (8 required) (part of hardware kit 000A25)
6	617D44	Cushion frame rear clip and strap (4 sets required)
7	63100	Cushion frames
8	62900/632A22	Cushion trim cover/foam pad
9	61737	Manual recliner lever handle
10	14A706	Side shield cover
11	—	Screws, cushion side shield (5 required) (part of hardware kit 000A25)
12	62186	Cushion side shield

13	—	Bolts, backrest-to-cushion (4 required)
14	672A32	Armrest latch upper cover
15	672A32	Armrest latch lower cover
16	645A04	Armrest latch
17	—	Armrest latch-to-armrest bolts (2 required)
18	—	Armrest latch-to-seat track bolts (2 required)
19	65478	Armrest
20	—	Armrest bracket outer cover
21	672A28	Armrest bracket inner cover
22	63076	Armrest bracket
23	654A76	Armrest spacer
24	W707769	Armrest pivot bolt and washer
25	N804266	Armrest bracket-to-seat track bolts (2 required)
26	61202	Safety belt buckle pretensioner
27	W520014	Nut, safety belt buckle and pretensioner
28	611B60	Center seat safety belt
29	—	Bolt, center seat safety belt (part of 611B60)
30	603A86	Seat track adjust handle
31	14A699	Wiring harness and bracket assembly
32	—	Screws, wiring harness and bracket (3 required) (part of hardware kit 000A25)

1. For additional information, refer to the procedures in this section.

Seat Backrest — Front, 40 Percent

Printable View (240 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module and nuts must be installed. The seat back frame should be replaced if necessary.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat shown, passenger seat similar.

All seats

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent .

2. If equipped, release the tab and remove the manual recliner lever handle.

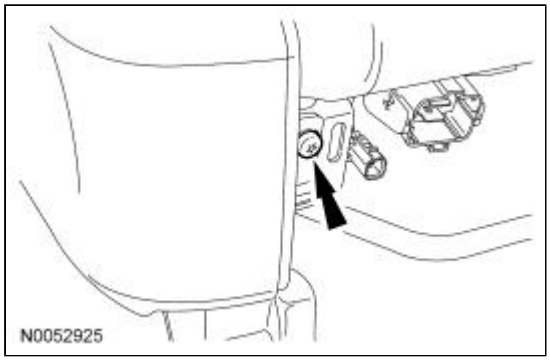
3. If equipped, remove the manual lumbar control knob.
    - Adjust the manual lumbar to the fully relaxed position.
    - Pull outward and remove the manual lumbar knob.

4. Detach and remove the cushion side shield cover.
    - If equipped, disconnect the seat control switch.
    - If equipped, disconnect the memory set switch electrical connector.

Power seat with manual recliner

5. Remove the seat control switch knob.

6. Remove the cushion side shield cover forward screw.



7. **CAUTION: Do not damage the manual recliner lever when removing the cushion side shield cover.**

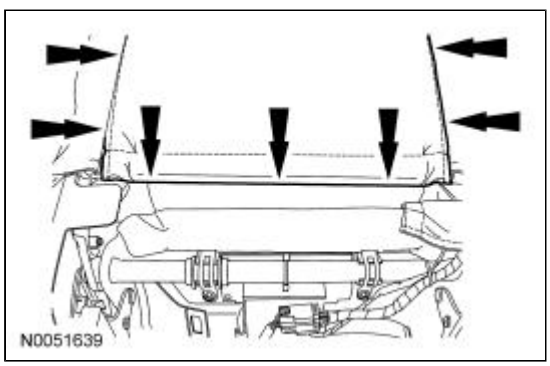
    Remove the cushion side shield cover.
    - Partially remove the cover to gain access to the seat control switch.
    - Release the retainers and detach the seat control switch from the side shield cover.
    - Remove the cushion side shield cover.

All seats

8. **NOTE:** For power seats, note the wiring harness routing for installation.

    Remove the 5 screws and cushion side shield.
    - Detach the pin-type retainer.
    - If equipped, route out the wiring harness.

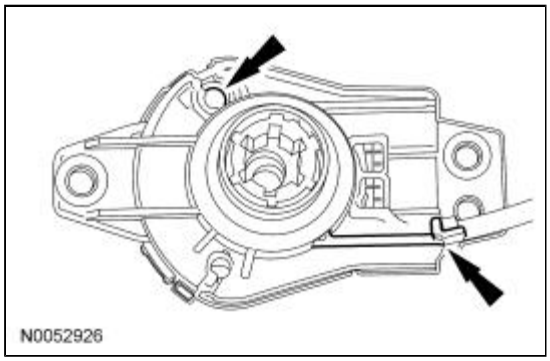
9. Release the backrest lower J-strip and unzip the 2 side zippers.



Seats with manual lumbar

10. **NOTE:** The lumbar support assembly must be fully relaxed.

    Remove the manual lumbar actuator.
    - Remove the 2 screws.
    - Remove the manual lumbar actuator.
    - Detach the lumbar cable.



11. **NOTE:** Note manual lumbar cable routing for installation.

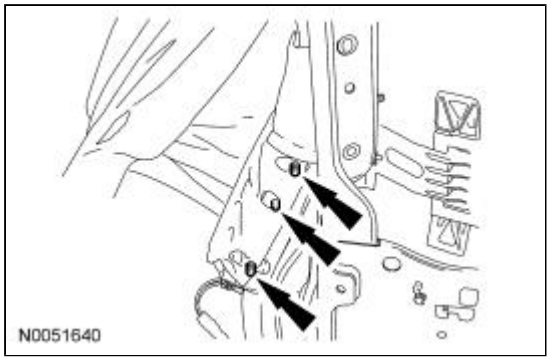
    Route the manual lumbar cable from the backrest.

12. **NOTE:** Note the position of the side air bag module locator pin to the seat backrest frame for installation.

    Remove the 2 side air bag module nuts.
    - To install, tighten to 10 Nm (89 lb-in).

13. **NOTE:** Note the position of the side air bag module locator pin and mounting studs in the seat backrest trim cover deployment chute for installation.

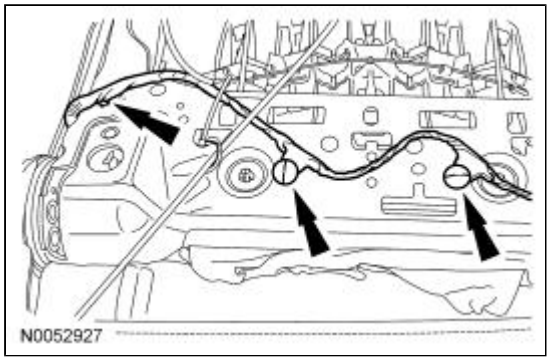
    Position the seat backrest foam aside and remove the side air bag module from the backrest frame. Then slide the side air bag module out of the seat backrest trim cover deployment chute.



14. Disconnect the electrical connector and remove the side air bag module.

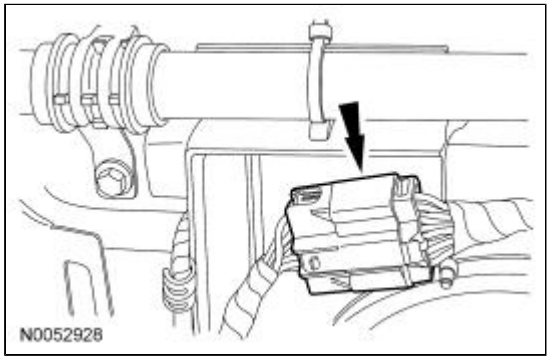
15. **NOTE:** Note wiring harness routing for installation.

    Detach the 3 pin-type retainers and route out the side air bag wiring harness.



Power and climate controlled seats

16. Disconnect the backrest wiring harness electrical connector.



17. **NOTE:** Note wiring harness routing for installation.

    Route the backrest wiring harness from the cushion.

All seats

18. Release the cushion trim cover rear hook and loop strip from the inboard side.

19. Remove the 4 backrest frame-to-seat track bolts and backrest.
    - To install, tighten to 45 Nm (33 lb-ft).

20. **WARNING: Check the side air bag module deployment chute for damage. The side air bag module deployment chute must not be repaired. If there is any damage to the deployment chute, a new seat back trim cover and deployment chute must be installed as a unit. Failure to do so may result in personal injury, in the event of an air bag deployment.**

    WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

    WARNING: If the side air bag module cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

    To install, reverse the removal procedure.

21. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40

Percent in this section.

Seat Backrest — Front, 60 Percent

Printable View (124 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module and nuts must be installed. The seat back frame should be replaced if necessary.

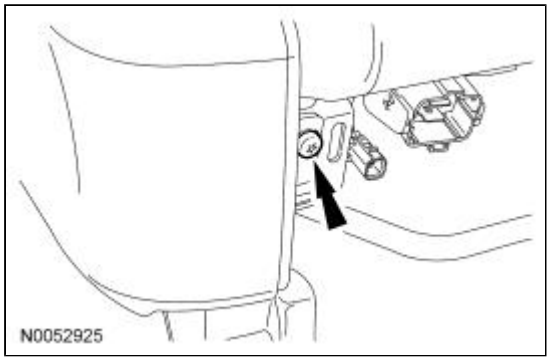
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the front 60 percent seat and depower the supplemental restraint system (SRS). For additional information, refer Seat — Front, 60 Percent .

2. Release tab and remove the manual recliner lever handle.

3. Remove the cushion side shield cover.
   - Remove the forward screw.
   - Detach the retainer clips and remove the cover.



4. Remove the 5 screws and cushion side shield.

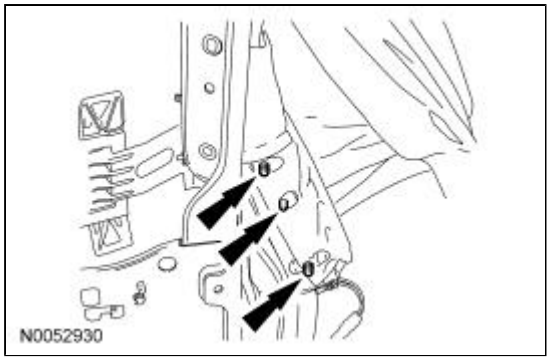
5. Release the backrest lower J-strip and unzip the 2 side zippers.

6. **NOTE:** Note the position of the side air bag module locator pin to the seat backrest frame for installation.

   Remove the 2 side air bag module nuts.
   - To install, tighten to 10 Nm (89 lb-in).

7. **NOTE:** Note the position of the side air bag module locator pin and mounting studs in the seat backrest trim cover deployment chute for installation.

   Position the seat backrest foam aside and remove the side air bag module from the backrest frame. Then slide the side air bag module out of the seat backrest trim cover deployment chute.



8. Disconnect the electrical connector and remove the side air bag module.

9. **NOTE:** Note wiring harness routing for installation.

   Route the backrest wiring harness from the cushion.
   - Detach the clip and 3 pin-type retainers.

10. Remove the 4 backrest frame-to-seat track bolts and backrest.
    - To install, tighten to 45 Nm (33 lb-ft).

11. **WARNING: Check the side air bag module deployment chute for damage. The side air bag module deployment chute must not be repaired. If there is any damage to the deployment chute, a new seat back trim cover and deployment chute must be installed as a unit. Failure to do so may result in personal injury, in the event of an air bag deployment.**

    WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove

them. Failure to do so may result in personal injury, in the event of an air bag deployment.

WARNING: If the side air bag module cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

To assemble, reverse the disassembly procedure.

12. Install the 60 percent seat and repower the SRS. For additional information, refer to Seat — Front, 60 Percent in this section.

Seat Backrest Cover — Front, 40 Percent

Printable View (141 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module and nuts must be installed. The seat back frame should be replaced if necessary.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

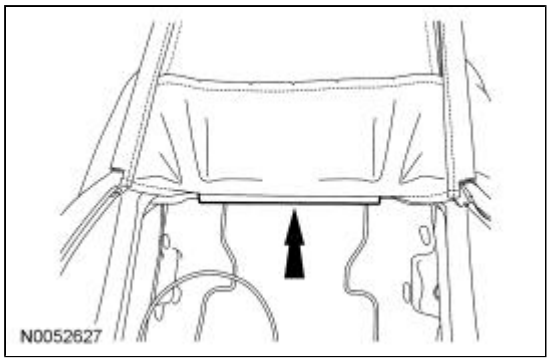
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the seat and depower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

2. Remove the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

3. Remove the head restraint.
   - Push in the RH guide button to release and remove the head restraint.

4. Raise the rear trim cover flap and release the inner J-clip.

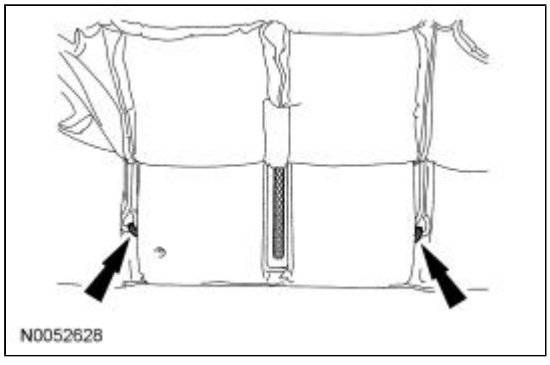


5. **NOTE:** The head restraint guides are not interchangeable. Note location for installation.

   Remove the headrest guides.
   - Reach into the backrest and pinch the headrest guide ends together to release from the backrest frame.
   - Pull the backrest trim cover away from the spring clips while pulling out the headrest guides.

6. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

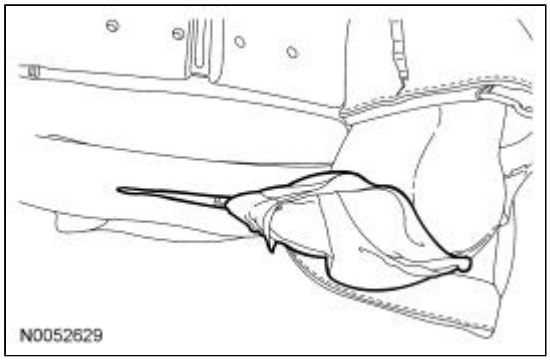
   Partially invert the backrest trim cover and remove the lower hog rings from the support wires.



7. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   NOTE: Note the side air bag module deployment chute routing for installation.

   Continue to invert the trim cover and remove the upper hog rings.
   - Route the side air bag module deployment chute through the slot in the foam pad.



8. Remove the backrest trim cover.

9. **WARNING: Check the side air bag module deployment chute for damage. The side air bag module deployment chute must not be repaired. If there is any damage to the deployment chute, a new seat back trim cover and deployment chute must be installed as a unit. Failure to do so may result in personal injury, in the event of an air bag deployment.**

   WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   WARNING: If the side air bag module cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

   To assemble, reverse the disassembly procedure.

10. Install the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

11. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Seat Backrest Cover — Front, 60 Percent

Printable View (141 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module and nuts must be installed. The seat back frame should be replaced if necessary.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

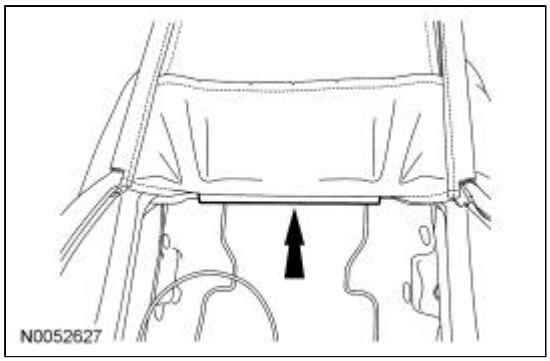
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the seat and depower the SRS. For additional information, refer to Seat — Front, 60 Percent in this section.

2. Remove the backrest assembly. For additional information, refer to Seat Backrest — Front, 60 Percent in this section.

3. Remove the head restraint.
   - Push in the RH guide button to release and remove the head restraint.

4. Raise the rear trim cover flap and release the inner J-clip.

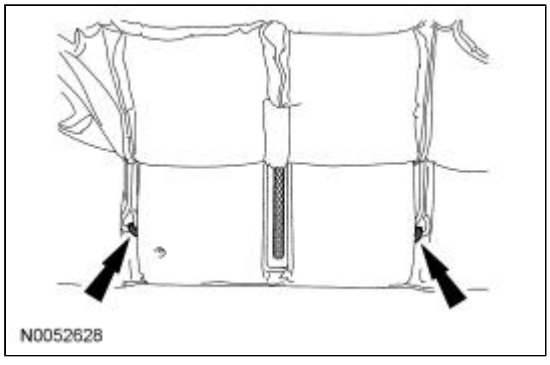


5. **NOTE:** The head restraint guides are not interchangeable. Note location for installation.

   Remove the headrest guides.
   - Reach a hand into the backrest and pinch the headrest guide ends together to release from the backrest frame.
   - Pull the backrest trim cover away from the spring clips while pulling out the headrest guides.

6. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

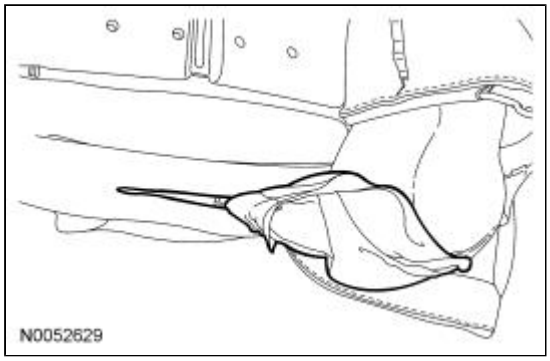
   Partially invert the backrest trim cover and remove the lower hog rings from the support wires.



7. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   NOTE: Note the side air bag module deployment chute routing for installation.

   Continue to invert the trim cover and remove the upper hog rings.
   - Route the side air bag module deployment chute through the slot in the foam pad.



8. Remove the trim cover.

9. **WARNING: Check the side air bag module deployment chute for damage. The side air bag module deployment chute must not be repaired. If there is any damage to the deployment chute, a new seat back trim cover and deployment chute must be installed as a unit. Failure to do so may result in personal injury, in the event of an air bag deployment.**

   WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   WARNING: If the side air bag module cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

   To assemble, reverse the disassembly procedure.

10. Install the backrest assembly. For additional information, refer to Seat Backrest — Front, 60 Percent in this section.

11. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 60 Percent in this section.

Seat Cushion Cover — Front, 40 Percent

Printable View (154 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

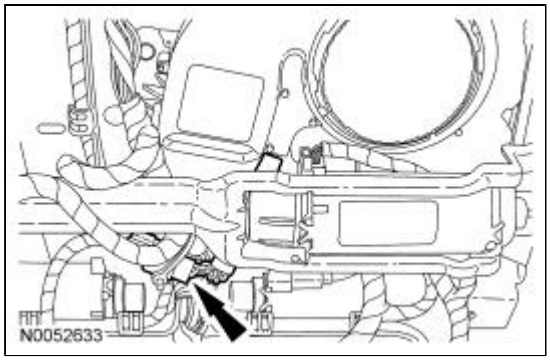
1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent .

2. Release the cushion trim cover front and rear J-clips and hook-and-loop strip.

3. **NOTE:** Note wiring harness routing for installation.

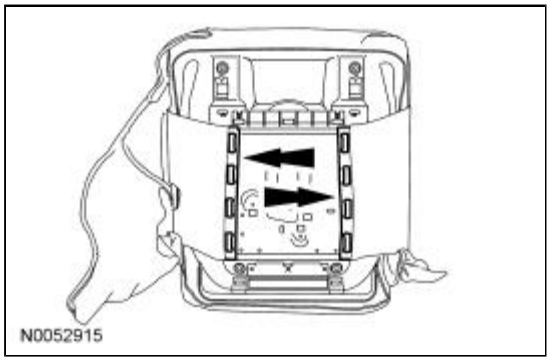
   NOTE: Use care when removing the thermo-electric device (TED). The U-nuts can slip into the cushion frame.

   If equipped, remove the climate controlled seat thermo-electric device (TED).
   - Disconnect the electrical connector.
   - Detach the pin-type retainer and wiring harness.
   - Remove the 2 screws.
   - Route the wiring harness and remove the TED.



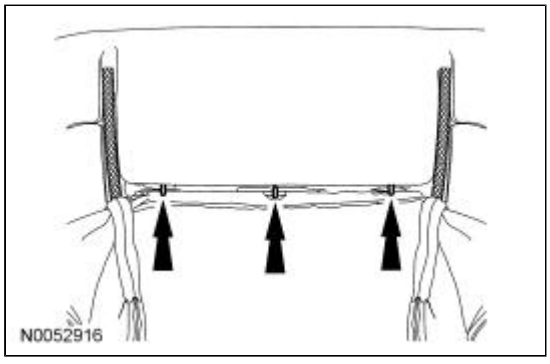
4. Remove the cushion frame from the seat track.
   - Remove the 4 cushion frame-to-seat track bolts.
     - To install, tighten to 25 Nm (18 lb-ft).
   - Release the 2 cushion frame rear clips and straps from the seat track and remove the cushion frame.

5. Release the 2 cushion trim cover retainer clips and remove the trim cover and foam pad from the cushion frame.



6. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Remove the cushion trim cover.
   - Partially invert the cushion trim cover to the row of hog rings and separate the hook-and-loop strips.
   - Remove the hog rings and separate the trim cover and foam pad.



7. To install, reverse the removal procedure.

8. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Seat Cushion Cover — Front, 60 Percent

Printable View (125 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

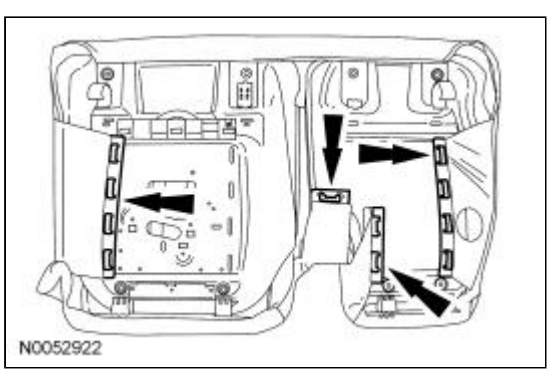
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the 60 percent seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 60 Percent in this section.

2. Release the cushion trim cover front and rear J-clips and hook-and-loop strips.

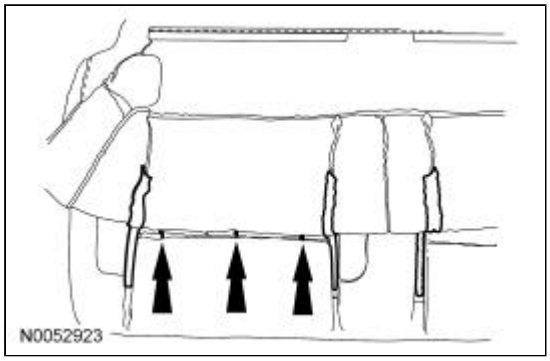
3. Remove the 2 cushion frames from the seat track.
   - Remove the 8 cushion frame-to-seat track bolts.
     - To install, tighten to 25 Nm (18 lb-ft).
   - Release the 4 cushion frame rear clips and straps from the seat track and remove both cushion frames.

4. Release the 4 cushion trim cover retainer clips and remove the trim cover and foam pad from the cushion frames.



5. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Remove the cushion trim cover.
   - Partially invert the cushion trim cover and separate the hook-and-loop strips.
   - Remove the hog rings and separate the trim cover and foam pad.



6. To install, reverse the removal procedure.

7. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 60 Percent in this section.

Seat Track — Manual

Printable View (101 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

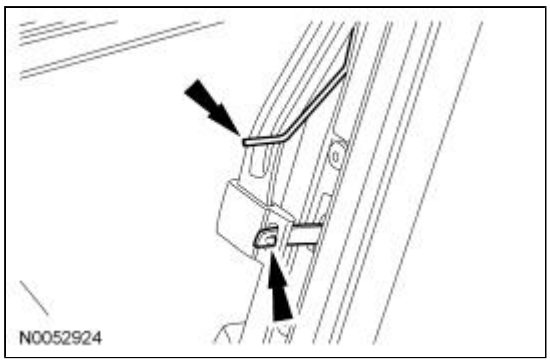
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent or Seat — Front, 60 Percent in this section.

2. Remove the inboard and outboard seat track rails.
   - Remove the 6 seat track rail-to-seat track nuts from the inboard and outboard seat track rails.
     - To install, tighten to 30 Nm (22 lb-ft).
   - Remove the inboard and outboard seat track rails.
   - Release and separate the seat track adjust handle from the seat track rails.
     - **NOTE:** Note the spring position for installation.

       Disconnect the spring.
     - Slightly bend the tab and detach the seat adjust handle from the inboard seat track rail.



3. To install, reverse the removal procedure.

4. Install the seat. For additional information, refer to Seat — Front, 40 Percent or Seat — Front, 60 Percent in this section.

5. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS)

Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Track — Power

Printable View (263 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

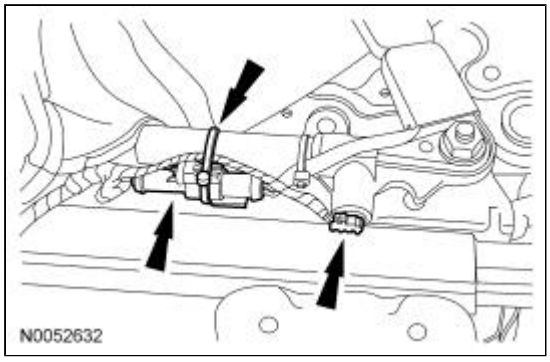
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent in this section.

2. Remove the seat backrest. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

3. Remove the safety belt buckle pretensioner.
   - Remove the tie strap.
   - Disconnect the 2 electrical connectors.
   - Remove the nut and safety belt buckle pretensioner.
     - To install, tighten to 55 Nm (41 lb-ft).



4. Release the cushion trim cover front and rear J-clips and rear hook-and-loop strip.

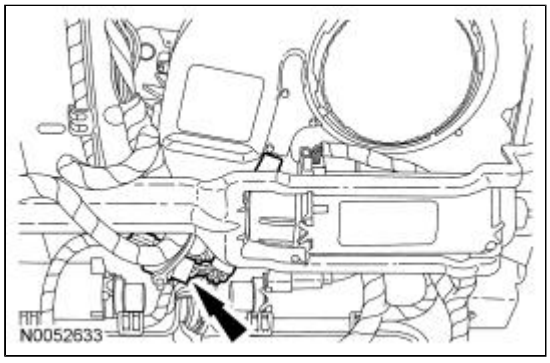
Climate controlled seats

5. **NOTE:** Use care when removing the thermo-electric device (TED). The U-nuts can slip into the cushion frame.

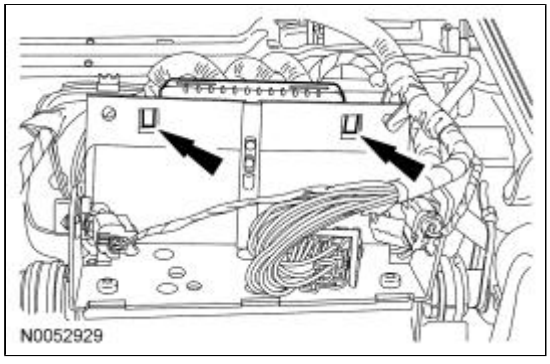
NOTE: Note wiring harness routing for installation.

Remove the climate controlled seat thermo-electric device (TED).

- Disconnect the electrical connector.
- Detach the pin-type retainer and wiring harness.
- Remove the 2 screws.
- Route the wiring harness and remove the TED.



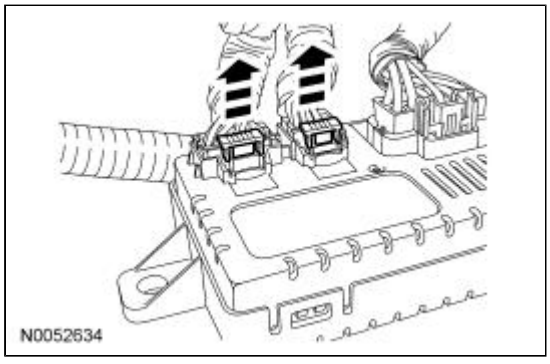
6. Release the 2 tabs and slide out the climate controlled seat module (CCSM).



7. **NOTE:** When installing a new climate control seat module (CCSM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to Section 418-01 .

   If passenger seat, remove the CCSM.

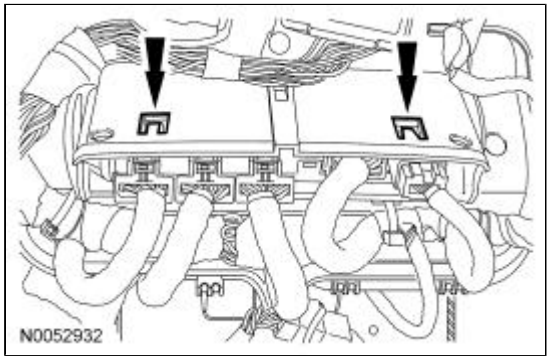
   - Cut and remove the wiring harness tie strap.
   - Release the 2 locking wedges.
   - Disconnect the 3 electrical connectors.



Driver memory seat

8. Remove the driver seat module (DSM).
   - Disconnect the 5 electrical connectors.

- Release the 2 tabs and slide out the DSM.



All seats

9. Remove the cushion frame, foam pad and trim cover assembly from the seat track.
   - Remove the 4 cushion frame-to-seat track bolts.
     - To install, tighten to 25 Nm (18 lb-ft).
   - Release the 2 cushion frame rear clips and straps from the seat track and remove the cushion frame.

10. Disconnect the seat track motor electrical connector.
    - For 6-way power seat, disconnect the 3 motor electrical connectors.
    - For memory seat, disconnect the 6 motor electrical connectors.

11. **NOTE:** Note wiring harness routing for installation.

    Remove the wiring harness.
    - Remove the 3 wiring harness bracket screws.
    - Remove the tie strap and release the rear wiring harness bracket clip from the seat track.
    - Separate the electrical connectors and wiring harness from the seat track.
    - Route and remove the wiring harness and bracket.

12. To install, reverse the removal procedure.

13. Install the seat backrest. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

14. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Lumbar Assembly

Printable View (81 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent in this section.

2. Remove the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

3. Raise the backrest trim cover rear flap and release the foam pad flap from the backrest frame hooks.

4. Position aside the backrest trim cover and foam pad to gain access to the lumbar assembly bolts.

5. Remove the 4 bolts and lumbar assembly.
   - To install, tighten to 7 Nm (62 lb-in).
   - If equipped, disconnect the electrical connector from the lumbar assembly.
   - If equipped, route out the manual lumbar cable.

Manual lumbar actuator removal

6. **NOTE:** Note manual lumbar cable routing for installation.

   Remove the 2 screws and manual lumbar actuator.

All seats

7. To install, reverse the removal procedure.

8. Install the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

9. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Seat Backrest Thermo-Electric Device

Printable View (103 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

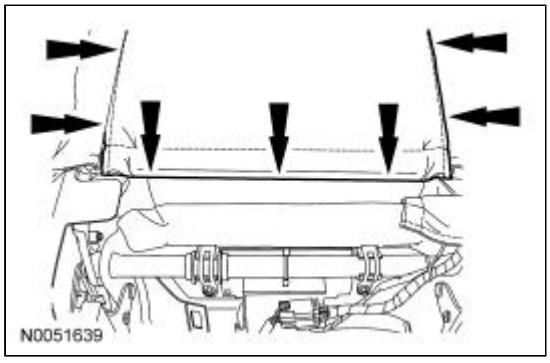
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the affected seat backrest fully forward.

2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

3. Release the seat backrest cover lower rear J-clip, then unzip the 2 side zippers.



4. Remove the climate controlled seat thermo-electric device (TED).
   - Disconnect the TED electrical connector.
   - Remove the scrivet.
   - Detach the 2 retainer clips from the backrest frame support wires.

5. To install, reverse the removal procedure.

6. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Cushion Thermo-Electric Device

Printable View (117 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

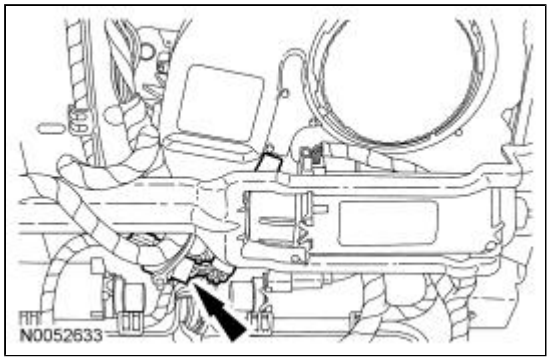
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent in this section.

2. **NOTE:** Use care when removing the thermo-electric device (TED). The U-nuts can slip into the cushion frame.

   NOTE: Note wiring harness routing for installation.

   Remove the climate controlled seat thermo-electric device (TED).
   - Disconnect the electrical connector.
   - Detach the pin-type retainer and wiring harness.
   - Remove the 2 screws.
   - Route the wiring harness and remove the TED.



3. To install, reverse the removal procedure.

4. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Climate Controlled Seat Module

Printable View (155 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

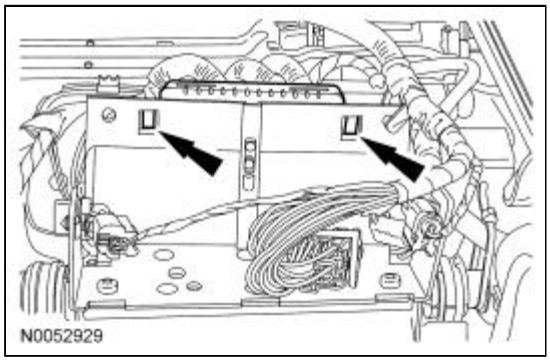
1. When installing a new climate control seat module (CCSM), carry out the appropriate steps in the programmable module installation (PMI) procedure. For additional information, refer to Section 418-01 .

2. Position the front passenger seat fully upward and depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

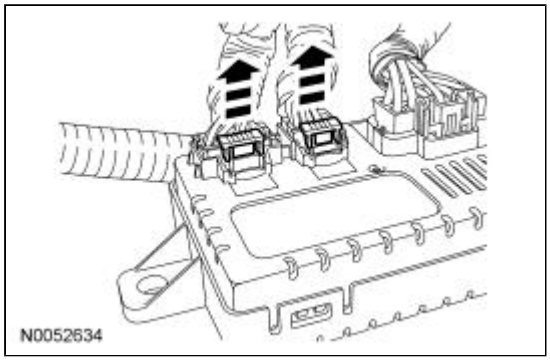
3. **CAUTION: Do not pull from the inboard side of the front seat cushion panel shield to avoid damaging it.**

   Remove the front seat cushion panel shield.
   - Release the upper retaining clips working from the outboard side and then release the lower retaining clips.

4. Release the 2 tabs and slide out the CCSM.



5. Remove the CCSM.
   - Cut and remove the wiring harness tie strap.
   - Release the 2 locking wedges.
   - Disconnect the 3 electrical connectors.



6. To install, reverse the removal procedure.

7. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

8. If a new CCSM has been installed, carry out the appropriate steps in the PMI procedure. For additional information, refer to Section 418-01 .

Seat Control Switch — Front

Printable View (98 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat shown, passenger similar.

All seats

1. Position the seat forward and upward to aid in seat control switch removal.

2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

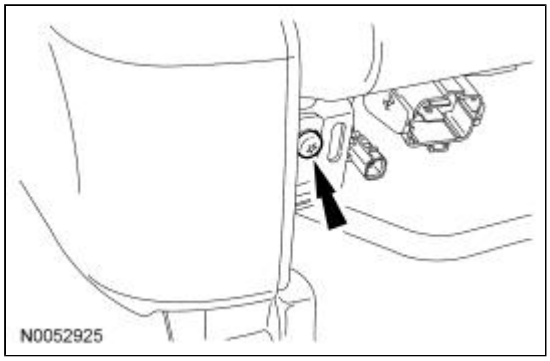
3. Pull and remove the seat control switch button(s).
   - If equipped, remove the power recliner switch button.

Power seat with manual recliner

4. **CAUTION: Do not pull from the inboard side of the front seat cushion panel shield to avoid damaging it.**

   Remove the front seat cushion panel shield.
   - Release the upper retaining clips working from the outboard side and then release the lower retaining clips.

5. Remove the cushion side shield cover forward screw.



6. **CAUTION: Do not damage the manual recliner lever when removing the cushion side shield cover.**

   Remove the cushion side shield cover.
   - Partially remove the cover to gain access to the seat control switch.
   - Release the retainers and detach the seat control switch from the side shield cover.
   - Remove the cushion side shield cover.

All seats

7. Detach and remove the cushion side shield cover.
   - Disconnect the seat control switch.
   - If equipped, disconnect the memory set switch electrical connector.

8. Release the clips and remove the seat control switch.

9. To install, reverse the removal procedure.

10. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Memory Set Switch

Printable View (80 KB)

Removal and Installation

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat shown, passenger similar.

1. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

2. Detach and position aside the driver seat cushion side shield cover.

3. Release the clips and remove the memory set switch.
   - Disconnect the seat control switch.

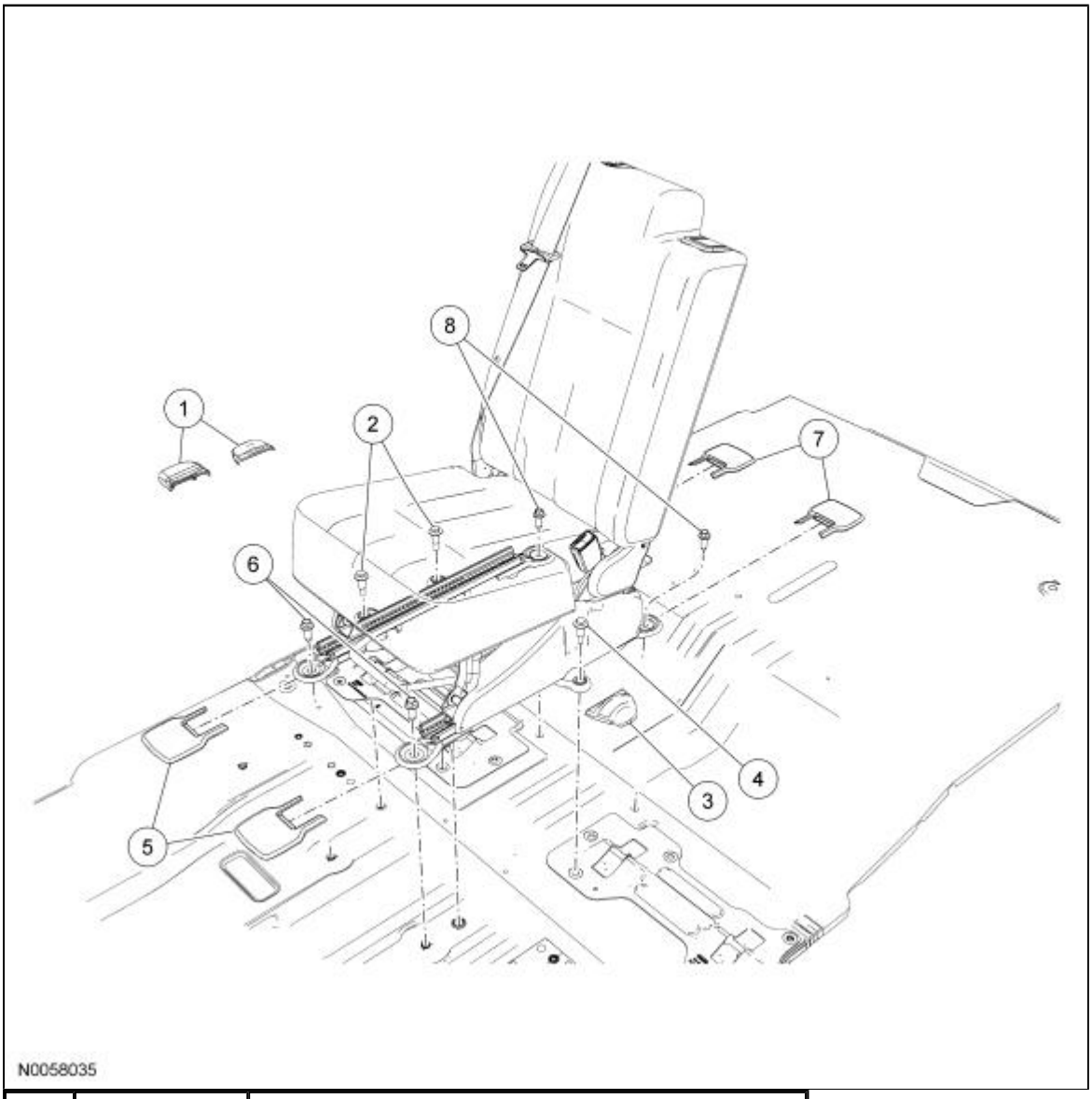
4. To install, reverse the removal procedure.

5. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat — Second Row, 20 Percent

Printable View (180 KB)

NOTE: For torque specifications and torque sequence, refer to the procedure steps.



Item	Part Number	Description
1	666C00	Right side seat-to-floor bolt covers (2 required)
2	W708367	Right side seat-to-floor bolts (2 required)
3	666C00	Left side seat-to-floor bolt cover
4	W708367	Left side seat-to-floor bolt
5	666C00	Seat-to-floor front bolt covers (2 required)
6	W505284	Seat-to-floor front bolts (2 required)
7	666C00	Seat-to-floor rear bolt covers (2 required)
8	W505284	Seat-to-floor rear bolts (LH/RH)

Removal and Installation

CAUTION: The seat-to-floor bolts must be installed in the sequence described.

1. Fold both 40 percent seats to the E-Z entry position.

2. **CAUTION: Use a screwdriver to pry beneath the attaching metal clips.**

   Remove the 2 right side seat-to-floor bolt covers.

3. Remove the 2 right side seat-to-floor bolts.
   - To install, tighten to 40 Nm (30 lb-ft).

4. **CAUTION: Use a screwdriver to pry beneath the attaching metal clips.**

   Remove the left side seat-to-floor bolt cover.

5. Remove the left side seat-to-floor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

6. Position the 40 percent seats upright.

7. **CAUTION: Use a screwdriver to pry beneath the attaching metal clips.**

   Remove the 2 seat-to-floor front bolt covers.

8. **CAUTION: Use a screwdriver to pry beneath the attaching metal clips.**

   Remove the 2 seat-to-floor rear bolt covers.

9. Remove the 2 seat-to-floor front bolts.
   - To install, tighten to 40 Nm (30 lb-ft).

10. Fold both 40 percent seats to the E-Z entry position.

11. Remove the LH seat-to-floor rear bolt and then the RH seat-to-floor rear bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

12. Remove the 20 percent seat from the vehicle.
    - For installation, align the locator pins to the holes in the floor.

13. **CAUTION: The seat-to-floor bolts must be installed in the sequence described.**

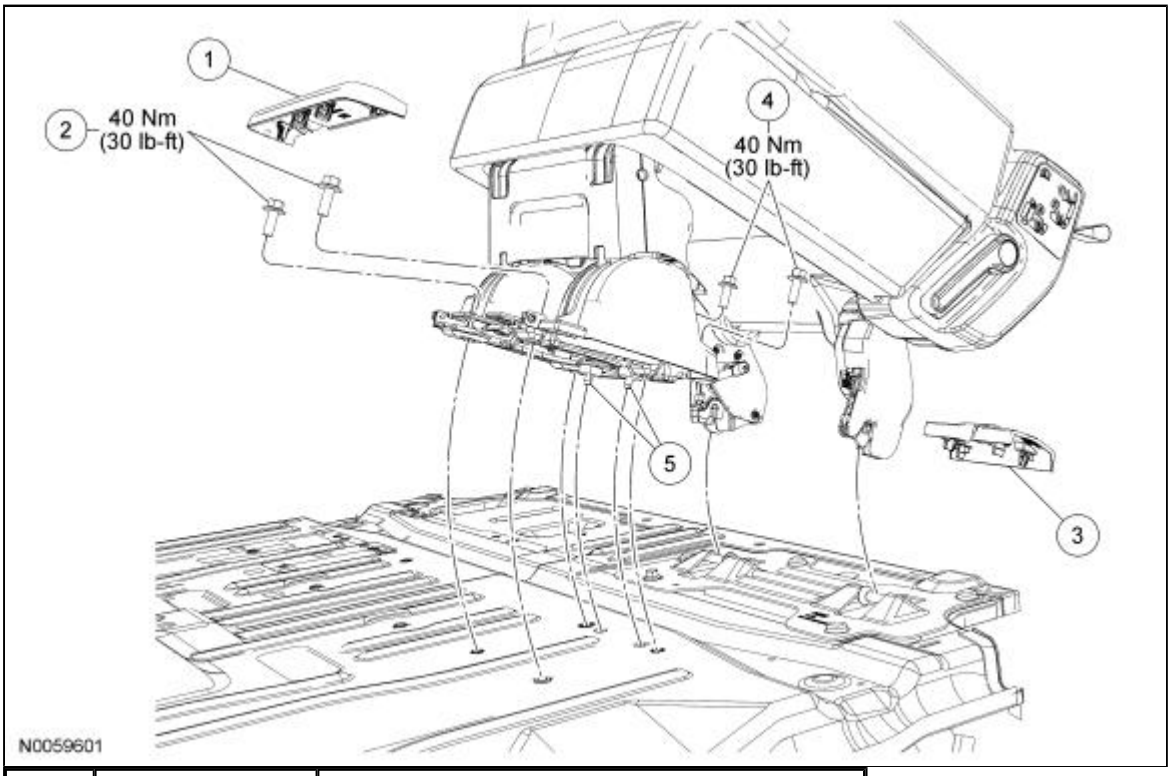
    To install, reverse the removal procedure.
    - Install the fasteners as follows:
      - Install the RH seat-to-floor rear bolt.
      - Install the LH seat-to-floor rear bolt.
      - Install the 2 seat-to-floor front bolts.
      - Install the 3 right and left side seat-to-floor bolts (note, shoulder bolts do not tighten to seat brackets).
    - Make sure the safety belts and buckles are accessible to the occupants after installation.

- Make sure the safety belt retractor operates without excessive effort or binding.

Seat — Second Row, 40 Percent

Printable View (234 KB)

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	638B30A	Seat-to-floor bolt front cover
2	W708175	Seat-to-floor front bolts (2 required)
3	638B30B	Seat-to-floor bolt rear cover
4	W708175	Seat-to-floor rear bolts (2 required)
5	—	Locator pins

Removal

All seats

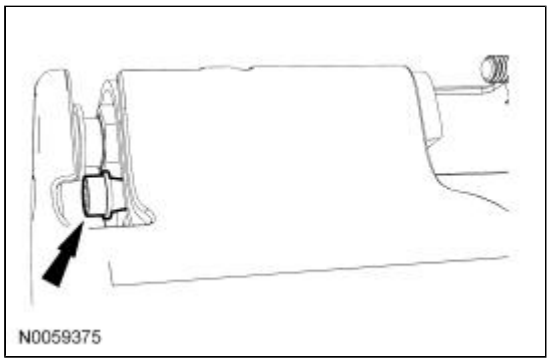
1. Place the seat in the E-Z entry position.
2. Remove the cover and 2 seat-to-floor rear bolts.
3. **NOTE:** Do not place the seat in the kneeled position (cargo mode).

   Latch the seat to the floor and lower the backrest.
4. **CAUTION: The seat base must be in the locked position, using the shipping pin, prior to seat removal, otherwise damage to the seat linkage components can occur.**

NOTE: Shown with the cushion removed for clarity.

Lock the shipping pin.

- Using an appropriate tool, slide the shipping pin outward to engage and lock the seat base.
  - Align the seat base and shipping pin, as needed.

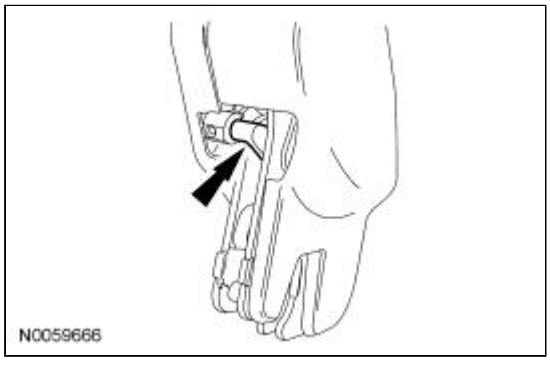


5. Remove the cover and 2 seat-to-floor front bolts.

6. Pull the recliner handle and release the latch feet.

Seat with inoperative latch, stuck to floor

7. Using an appropriate tool, manually release the latches from the striker plate.
   - Push inward on the outboard latch release lever.



All seats

8. Lift to disengage the 2 locator pins and remove the seat.

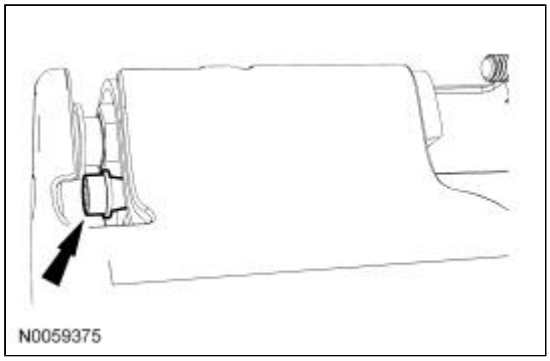
Installation

1. Position the seat in the vehicle.
   - Align the 2 locator pins to the floor holes.
   - Press downward and lock the latch feet to the floor.

2. Install the 2 seat-to-floor front bolts.
   - Tighten to 40 Nm (30 lb-ft).

3. Install the seat-to-floor bolt front cover.

4. Using an appropriate tool, push the shipping pin fully inward to unlock the seat from the E-Z entry position.



5. Release the seat to the E-Z entry position.

6. Install the 2 seat-to-floor rear bolts.
    - Tighten to 40 Nm (30 lb-ft).

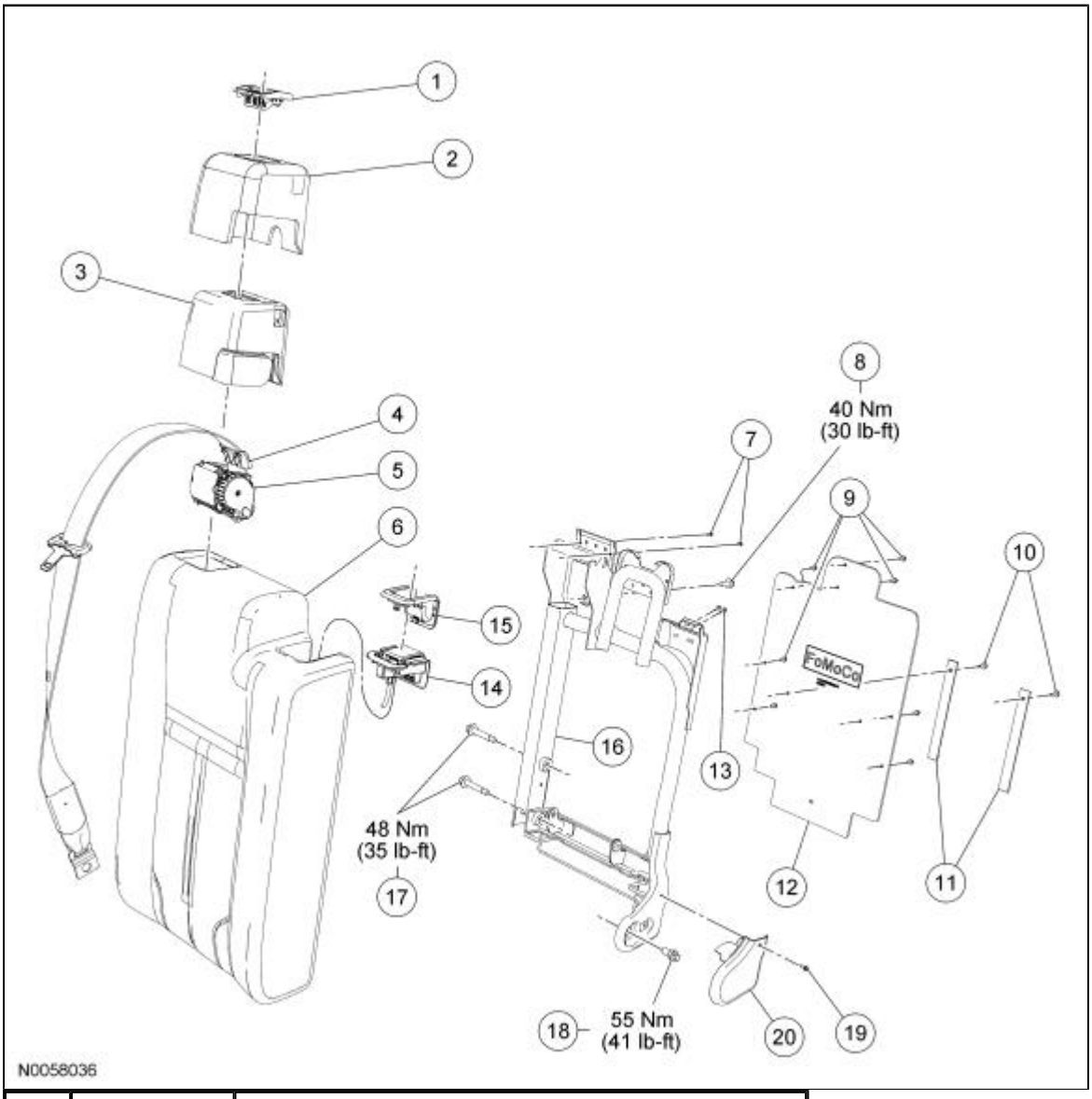
7. Install the seat-to-floor rear bolt cover.

8. Check the seat for correct operation.
    - With the seat in the upright or the load floor position, both latch feet must lock to the strikers.
    - When releasing the seat to the E-Z entry position, the latches must release freely and not bind to the strikers.
    - Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat — Exploded View, Second Row

Printable View (507 KB)

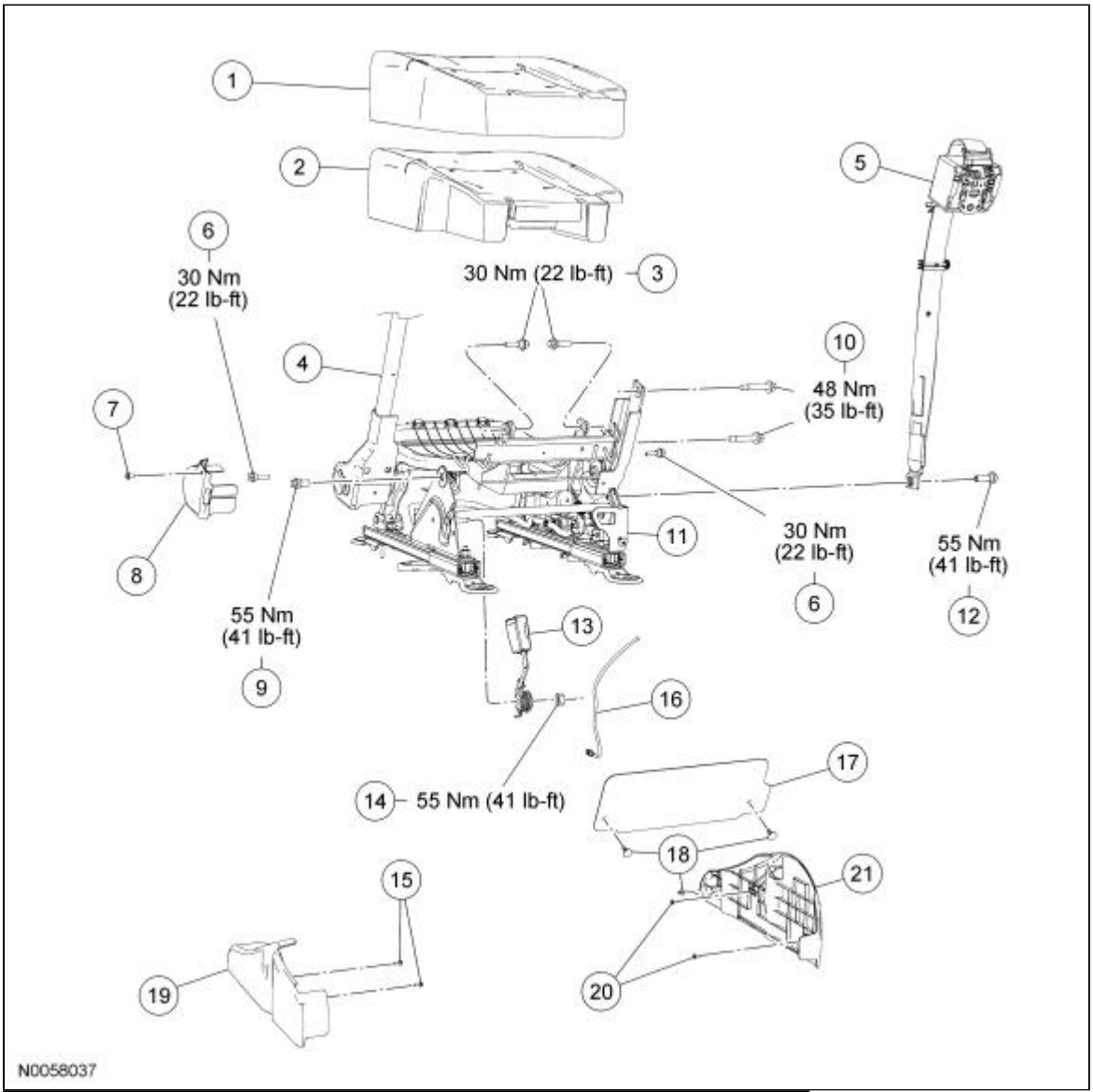
Seat Backrest — 20 Percent



Item	Part Number	Description
1	666C04	Safety belt guide cover
2	611D52	Foam, safety belt retractor cover
3	613C46	Safety belt retractor cover
4	—	Safety belt retractor guide (part of 611B64)
5	611B64	Safety belt retractor
6	66600/66800	Backrest trim cover/foam pad
7	W504042	Safety belt retractor cover screws (2 required)
8	W505274	Safety belt retractor bolt

9	—	Backrest support panel screws (8 required) (part of 613A38)
10	W701259	Pin-type retainers (2 required)
11	63518	Attaching straps (2 required)
12	613A38	Backrest support panel
13	—	Screws, release handle (2 required)
14	62418	Release handle
15	624A08	Release handle bezel
16	613A38	Backrest frame
17	W506542	Backrest-to-cushion bolts (2 required)
18	613F18	Pivot bolt
19	W504042	Screw, pivot bolt cover
20	62178	Pivot bolt cover

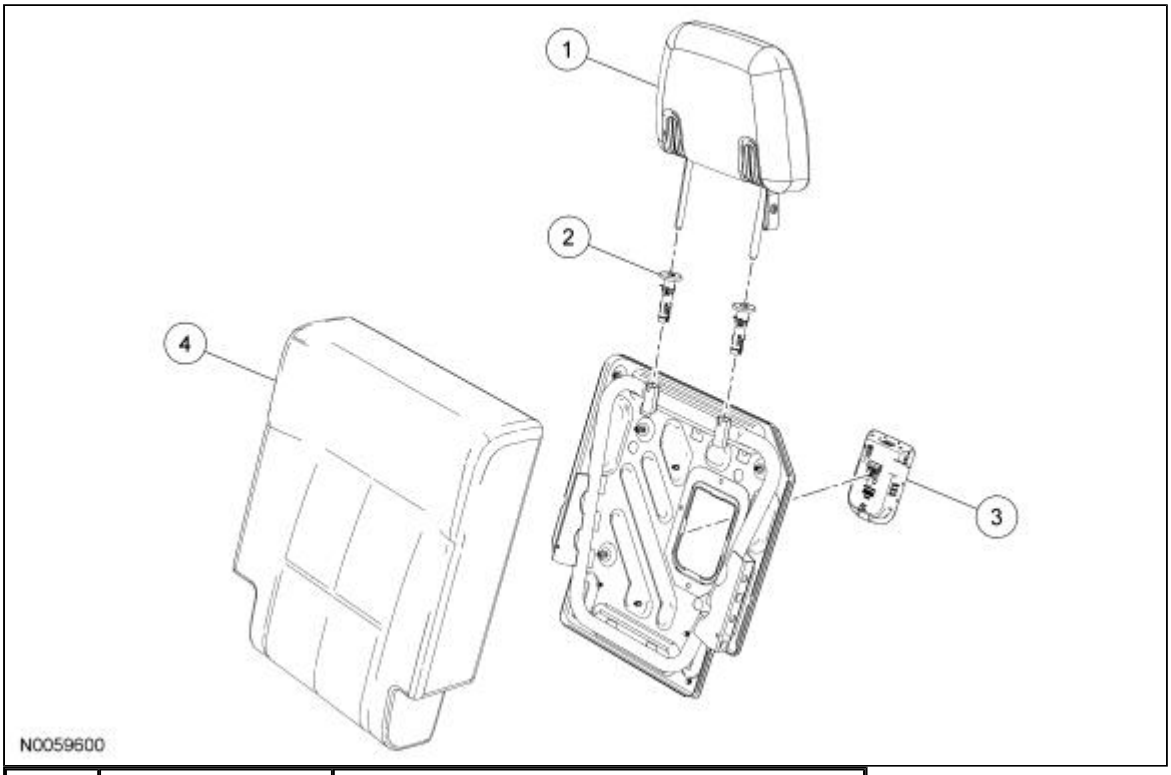
Seat Cushion — 20 Percent



Item	Part Number	Description
1	63804	Cushion trim cover
2	63840	Cushion foam pad
3	613F18	Swivel bolts
4	613A38	Backrest frame
5	611B64	Safety belt retractor
6	613F18	Seat riser-to-cushion frame bolts (2 required)
7	W504042	Screw, LH pivot bolt cover
8	62178	Pivot bolt cover
9	613F18	Pivot bolt
10	W506542	Backrest-to-cushion bolts (2 required)
11	63160	Cushion frame
12	—	Safety belt anchor bolt (part of 611B64)
13	60044	Safety belt buckle
14	N620483	Safety belt buckle nut
15	W704655	LH side shield screws (2 required)
16	—	Recliner cable
17	—	Lower panel
18	—	Pin-type retainers (3 required)
19	613A97	LH side shield
20	W704655	RH side shield screws (2 required)
21	63386	RH side shield

Seat Backrest — 40 Percent

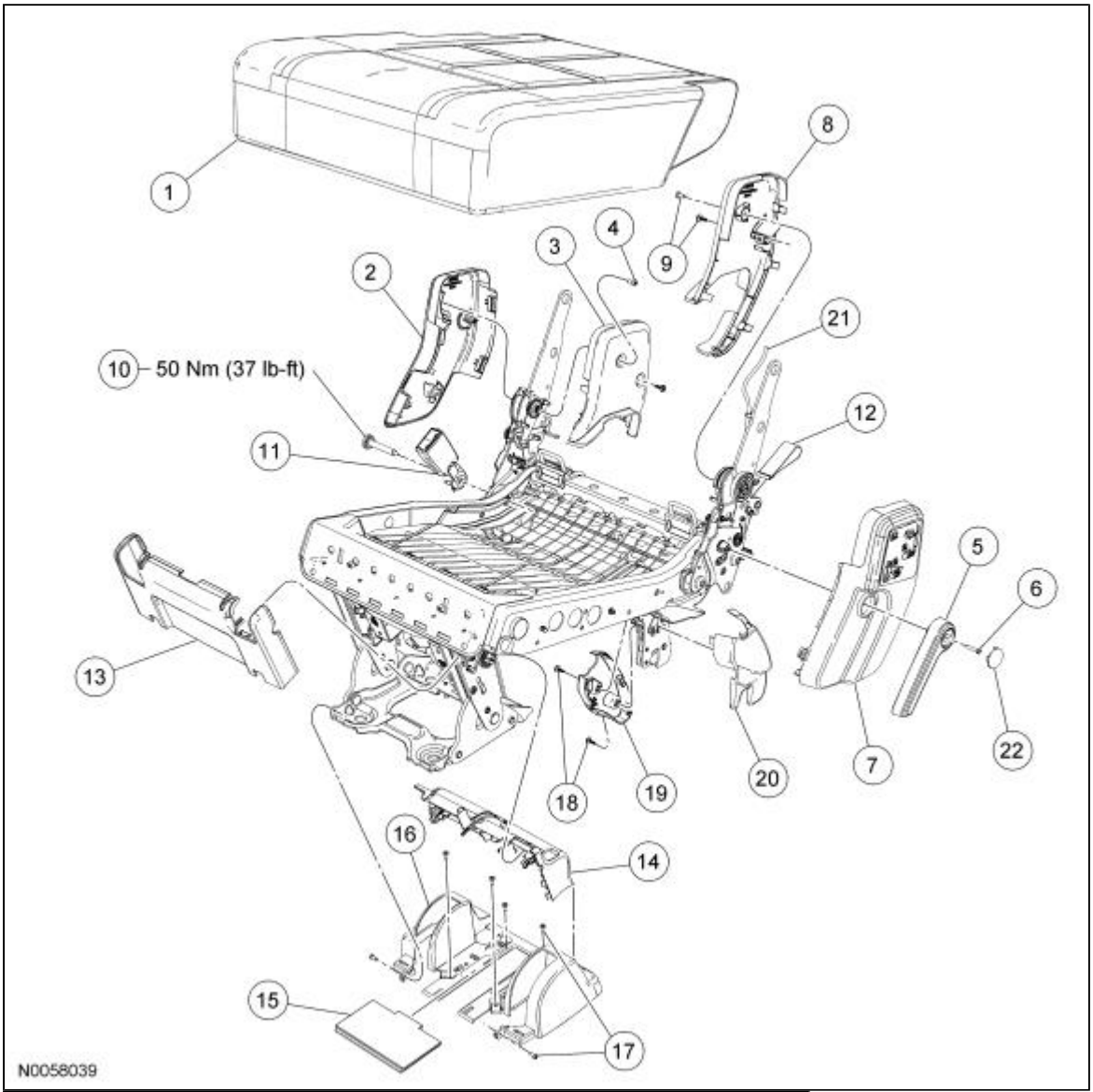
NOTE: LH seat shown, RH similar.



Item	Part Number	Description
1	611A08	Head restraint
2	610A16	Head restraint guide (2 required)
3	62418	Kneeling release handle
4	66800/66801	Backrest trim cover/foam pad

Seat Cushion — 40 Percent Seat

NOTE: LH seat shown, RH seat similar.



Item	Part Number	Description
1	63805/63841	Cushion trim cover/foam pad
2	666L76	Outer recliner shield, inboard
3	61349	Inner recliner shield, inboard
4	—	Screw, inboard recliner shield (2 required)
5	617D35	Recliner handle
6	—	Screw, recliner handle
7	67460	Outer recliner shield, outboard
8	67460	Inner recliner shield, outboard
9	—	Screws, outboard recliner shield (2 required)
10	—	Bolt, safety belt buckle (part of 613D99)
11	613D99	Safety belt buckle
12	605W00	Release strap
13	600A47	Front upper pedestal cover
14	600A47	Rear upper pedestal cover

15	63388	Lower pedestal screw cover
16	63388	Lower pedestal cover
17	—	Screws, lower pedestal cover (6 required)
18	—	Screw, latch foot cover (5 required)
19	63388	Latch foot inner cover (2 required) (outboard side shown)
20	63388	Latch foot outer cover (2 required) (outboard side shown)
21	601L60	Load floor release cable
22	617D68	Recliner handle screw cover

1. For additional information, refer to the procedures in this section.

Seat Backrest — Second Row, 20 Percent

Printable View (132 KB)

Removal and Installation

1. Remove the 20 percent seat from the vehicle. For additional information, refer to Seat — Second Row, 20 Percent in this section.

2. Remove the screw and pivot bolt cover.
   - Route the attaching strap through the pivot bolt cover.

3. Release the 2 lower backrest trim cover J-clips.

4. Remove the pin-type retainer and detach the LH side attaching strap.

5. Remove the 2 screws and RH side shield.
   - Raise the backrest upright to access and remove the center screw.
   - Release the 2 pin-type retainers.

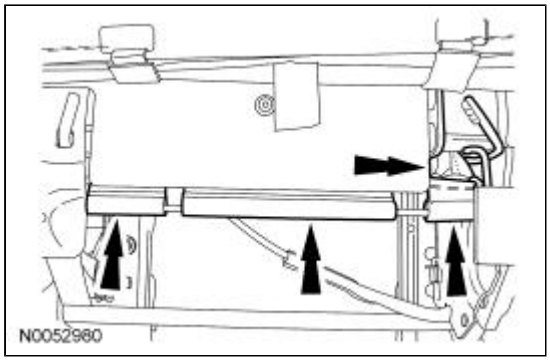
6. **NOTE:** Note attaching strap routing for installation.

   Remove the pin-type retainer and detach the RH attaching strap.

7. Remove the bolt and detach the safety belt retractor anchor.
   - To install, tighten to 55 Nm (41 lb-ft).

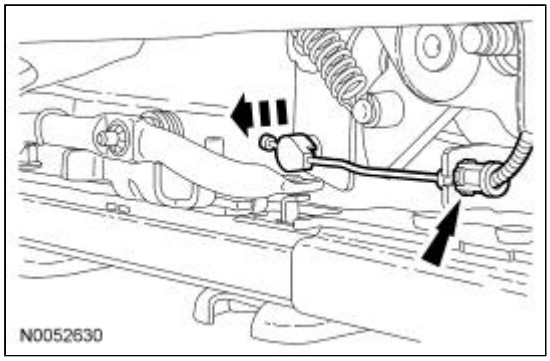
8. Remove the 2 pin-type retainers and lower panel.

9. Release the 3 lower backrest J-clips and route the RH trim cover flap through the child safety seat lower anchor and tether for children (LATCH) anchor.



10. Detach the 2 J-clips and remove the attaching straps.

11. Detach the cable end and latch release cable from the seat base.



12. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-an-loop strip can be torn from the cushion foam pad.**

    Partially invert the backrest trim cover to access the backrest fasteners.

13. Position aside the foam pad and remove the 2 swivel bolts.
    - To install, tighten to 30 Nm (22 lb-ft).

14. Remove the pivot bolt.
    - To install, tighten to 55 Nm (41 lb-ft).

15. Remove the 2 backrest-to-cushion bolts.
    - To install, tighten to 40 Nm (30 lb-ft).

16. **NOTE:** Note cable routing for installation.

    Remove the seat backrest.
    - Route out the latch release cable.

17. To install, reverse the removal procedure.

Seat Backrest Cover — Second Row, 20 Percent

Printable View (102 KB)

Removal and Installation

1. Remove the 20 percent seat from the vehicle. For additional information, refer to Seat — Second Row, 20 Percent in this section.

2. Remove the screw and pivot bolt cover.
   - Route the attaching strap through the pivot bolt cover.

3. Release the 2 lower backrest trim cover J-clips.

4. Remove the pin-type retainer and detach the LH side attaching strap.

5. Remove the 2 screws and RH side shield.
   - Raise the backrest upright to access and remove the center screw.
   - Release the 2 pin-type retainers.

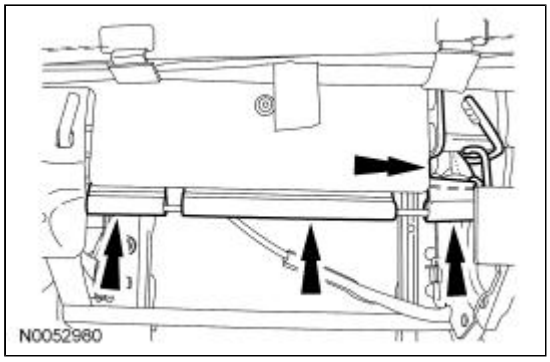
6. **NOTE:** Note attaching strap routing for installation.

   Remove the pin-type retainer and detach the RH attaching strap.

7. Remove the bolt and detach the safety belt retractor anchor.
   - To install, tighten to 55 Nm (41 lb-ft).

8. Remove the 2 pin-type retainers and lower panel.

9. Release the 3 lower backrest J-clips and route the RH trim cover flap through the child safety seat lower anchor and tether for children (LATCH) anchor.



10. Detach the 2 J-clips and remove the attaching straps.

11. Remove the safety belt guide cover.
    - Insert an appropriate tool into the holes and release the 3 locking tabs.
    - Detach the safety belt guide cover.
    - Route the safety belt webbing through the slot.

12. Remove the latch release handle bezel.
    - Release the upper tab and separate the bezel from the latch release handle.

13. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-an-loop strip can be torn from the backrest foam pad.**

    Separate the hook-and-loop strips and invert the backrest trim cover to the row of hog rings.

14. Remove the row of hog rings.

15. Continue inverting and remove the backrest trim cover.
    - Route the safety belt webbing through the trim cover opening.

16. To install, reverse the removal procedure.

Seat Backrest Cover — Second Row, 40 Percent

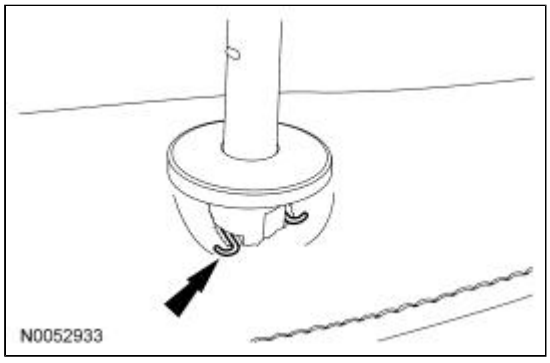
Printable View (110 KB)

Removal and Installation

1. **NOTE:** Note the spring clip position for installation.

   NOTE: Use care when releasing the spring clips. They can fall inside the backrest frame.

   Remove the head restraint.
   - Pull the trim cover material away from the head restraint guide to access the spring clips.
   - Release the 2 spring clips by pushing on the side shown.
   - Raise and remove the head restraint.

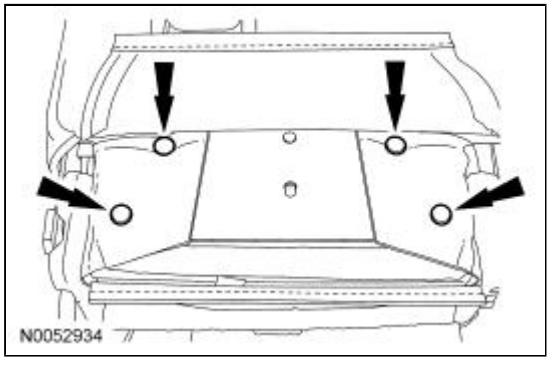


2. Position the backrest downward.

3. Remove the kneeling release (cargo mode) handle.
   - Raise the handle to access the cable.
   - Detach the cable jacket from the kneeling release handle.
   - Release the retainers and position aside the kneeling release handle.

4. Release the lower backrest trim cover J-clip.

5. Position aside the backrest trim cover rear flap and remove the 4 pin-type retainers.



6. Raise the backrest upright and route the backrest trim cover from between the cushion and backrest.

7. **CAUTION: Use care when separating the seat backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat backrest foam pad.**

   Invert the backrest trim cover to the row of hog rings.
   - Separate the hook-and-loop strips.

8. Remove the row of hog rings.

9. Continue inverting the backrest trim cover to the head restraint guides.

10. **CAUTION: Be careful not to tear the material when separating the head restraints and spring clips from the backrest trim cover.**

    Pinch the head restraint guide ends to release and remove the 2 head restraint guides.
    - Separate the head restraint guides from the backrest trim cover.

11. Remove the backrest trim cover.

12. To install, reverse the removal procedure.

Seat Cushion Cover — Second Row, 20 Percent

Printable View (80 KB)

Removal and Installation

1. Remove the 20 percent seat. For additional information, refer to Seat — Second Row, 20 Percent in this section.

2. Release the 2 backrest trim cover lower J-clips.

3. Remove the screw and pivot bolt cover.
   - Route out the attaching strap.

4. Remove the 2 pin-type retainers and lower panel.

5. Release the cushion trim cover rear J-clip.
   - Position the backrest downward to aid in trim cover removal.
   - Route the cushion trim cover rear flap and J-clip from between the cushion and backrest.

6. Release the hook-and-loop strip and remaining cushion J-clips.

7. Remove the cushion foam pad and trim cover.

8. **CAUTION: Use care when separating the seat cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat cushion foam.**

   Release the hook-and-loop strips and invert the cushion trim cover to the row of hog rings.

9. Remove the hog rings and cushion trim cover.

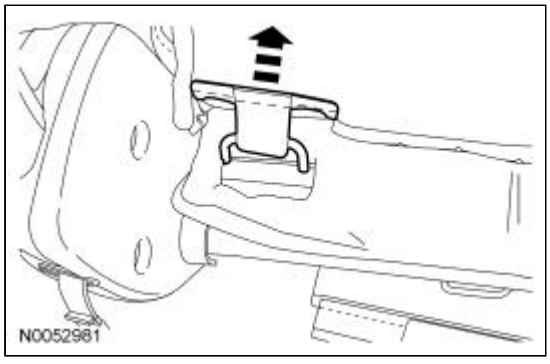
10. To install, reverse the removal procedure.

Seat Cushion Cover — Second Row, 40 Percent

Printable View (99 KB)

Removal and Installation

1. Place the seat in the E-Z entry position.
2. Release the trim cover J-clips from both sides of the cushion.
3. Release the outer and inner rear J-clips from the cushion.
4. Latch the seat to the floor and raise the backrest.
5. Release the front J-clip from the cushion.
6. Release the 2 cushion trim cover retainers from the 2 child safety seat LATCH anchors.
   - Pull the cushion trim cover rearward and release the 2 clips.



7. **CAUTION: Use care when separating the seat cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat cushion foam.**

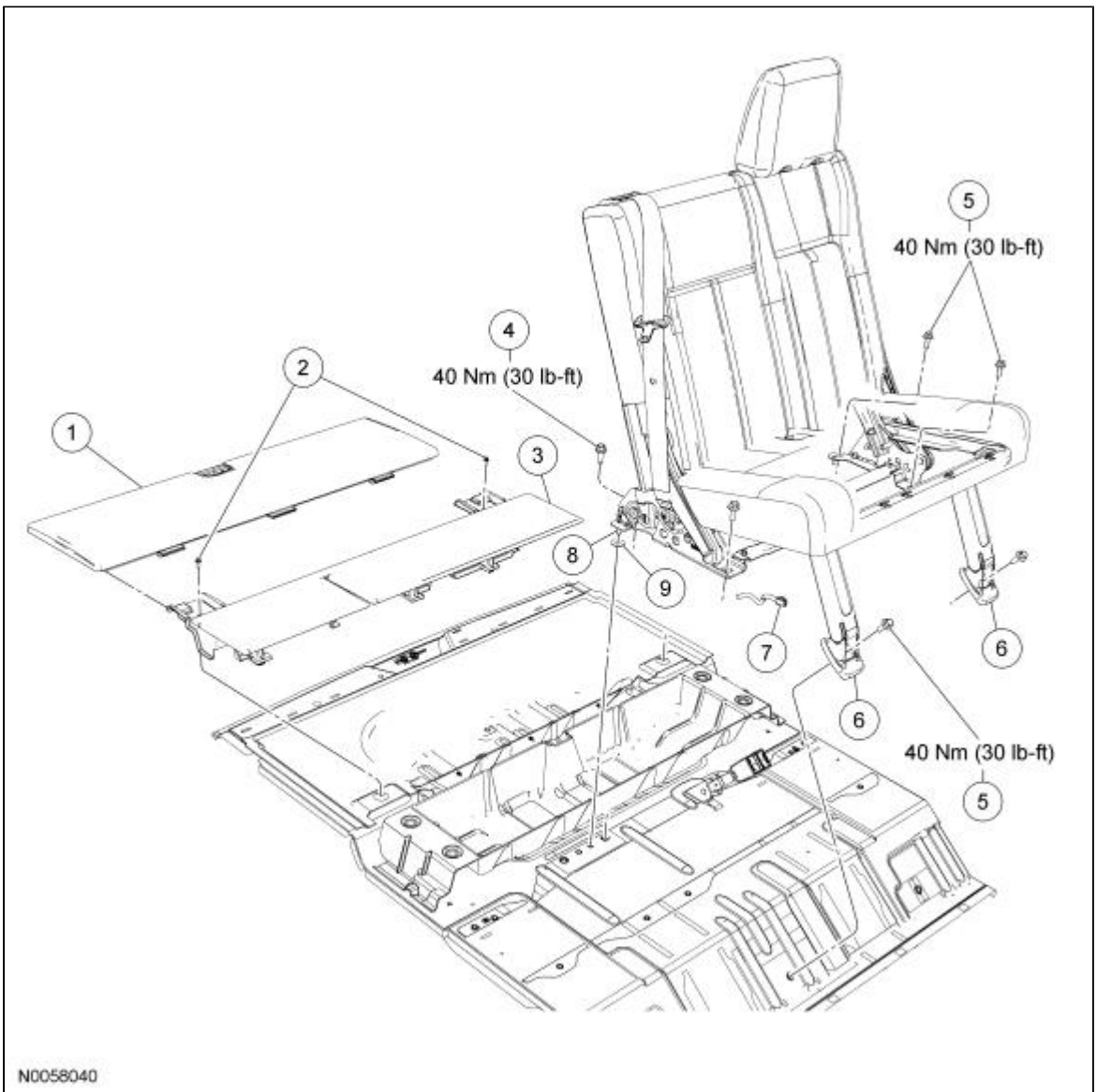
   Separate the hook-and-loop strips and invert the cushion trim cover to the row of hog rings.
8. Remove the row of hog rings.
9. Remove the cushion trim cover.
   - Route the trim cover from between the cushion and backrest.
10. To install, reverse the removal procedure.

Seat — Third Row

Printable View (260 KB)

NOTE: 60 percent seat shown, 40 percent seat similar.

NOTE: For torque specifications and torque sequence, refer to the procedure steps.



Item	Part Number	Description
1	W708818	Load floor panel
2	—	Mid-floor panel support bolts
3	—	Mid-floor panel support
4	W505284	Seat-to-floor bolt, rear inboard
5	W708175	Seat-to-floor bolts (5 required)
6	666C00	Seat-to-floor bolt front covers (2 required)
7	—	Electrical connector

8	—	Locator pin (part of 600M47)
9	60108K	Gasket (2 required)

Removal and Installation

CAUTION: To prevent possible damage to the third row seat or the safety belts, make sure that the safety belts are not fastened when moving the seat to the load floor position.

CAUTION: Make sure that no objects such as books, purses or briefcases on the floor in front of the third row seats or on the seat cushion before lowering the backrest(s).

NOTE: The third row seat backrests need to be in the raised position for removal of the third row seats.

NOTE: LH seat shown, RH seat similar.

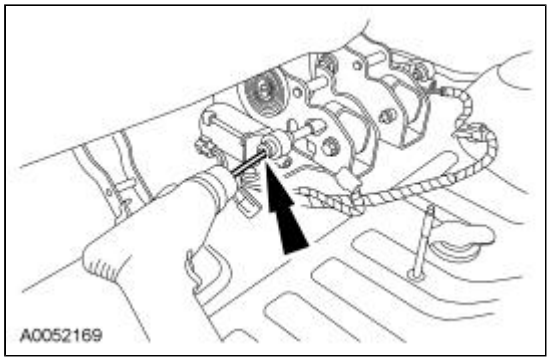
All seats

1. Remove the load floor panel.

2. Remove the 2 bolts and mid-floor panel support.
   - Detach the 3 pin-type retainers.

Power-fold seats with inoperative motor, backrest in down position

3. Using a suitable tool, insert it in the outboard side of the third row power seat motor. Raise the seat backrest.
   - If the power seat motor is seized, remove the power-fold seat motor. For additional information, refer to Power-Fold Seat Motor in this section.
     - Rotate the power seat torque shaft in the seat actuator to raise the backrest.



Power-fold seats

4. Detach the wire harness pin-type retainer and disconnect the power-fold seat motor electrical connector.

All seats

5. Remove the 6 seat-to-floor bolts.
   - Access and remove the 2 seat-to-floor front bolts.
     - To install, tighten to 40 Nm (30 lb-ft).
   - Remove the 2 seat-to-floor center bolts.
     - To install, tighten to 40 Nm (30 lb-ft).
   - Remove the 2 seat-to-floor rear bolts.

        - To install, tighten to 40 Nm (30 lb-ft).

6. **NOTE:** Do not scuff the safety belt buckles when removing the 60 percent seat.

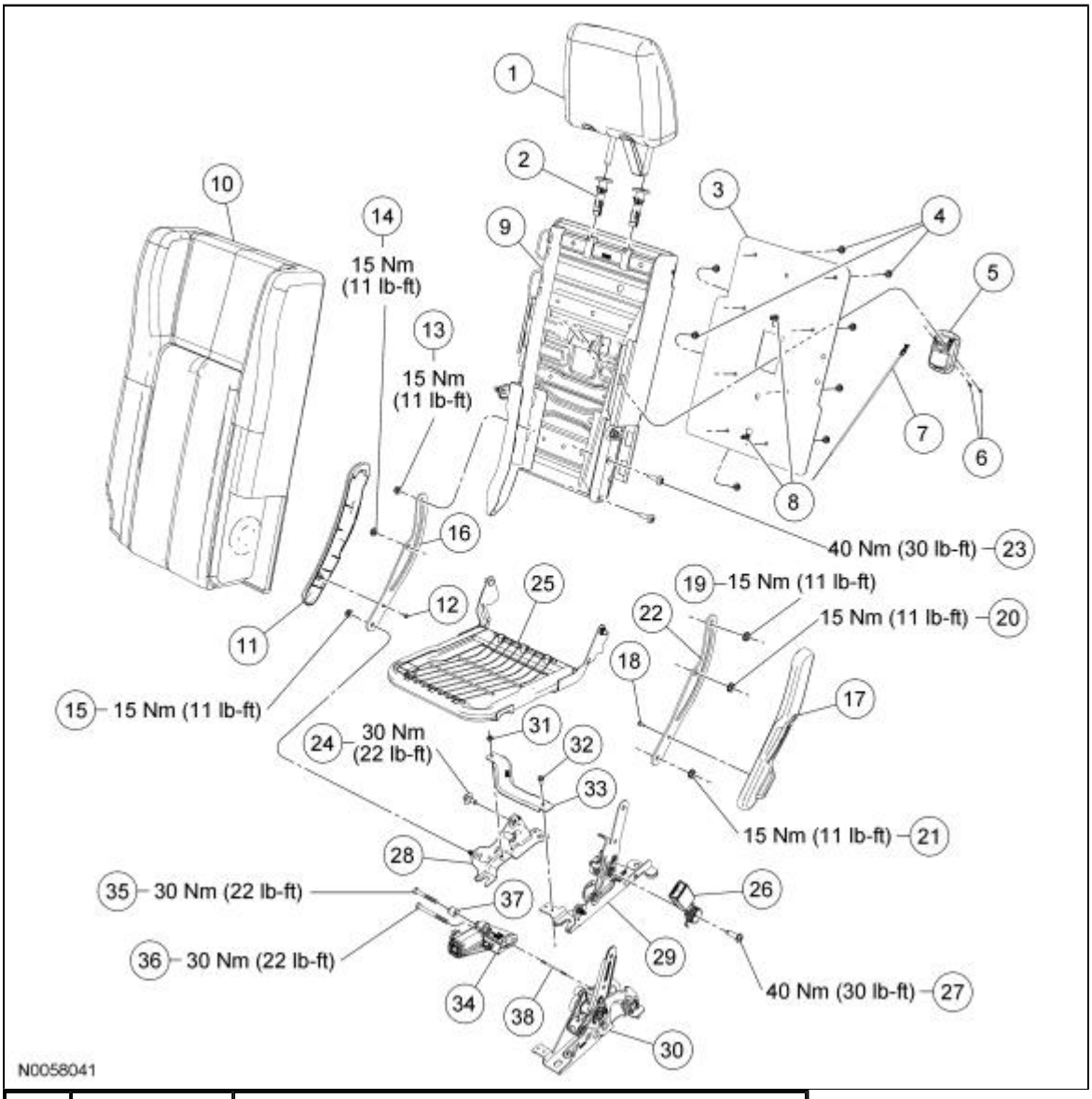
   Lift and remove the seat from the vehicle.
   - For 60 percent seat, raise the seat support bar over the safety belt buckles.
   - To install, align the 2 locator pins to the holes in the floor.
     - For installation, make sure the 2 gaskets are positioned to the locator pins.

7. To install, reverse the removal procedure.
   - Make sure the safety belts and buckles are accessible to the occupants after installation.
   - For 60 percent seat, make sure the safety belt retractor operates without excessive effort or binding.

Seat — Exploded View, Third Row

Printable View (617 KB)

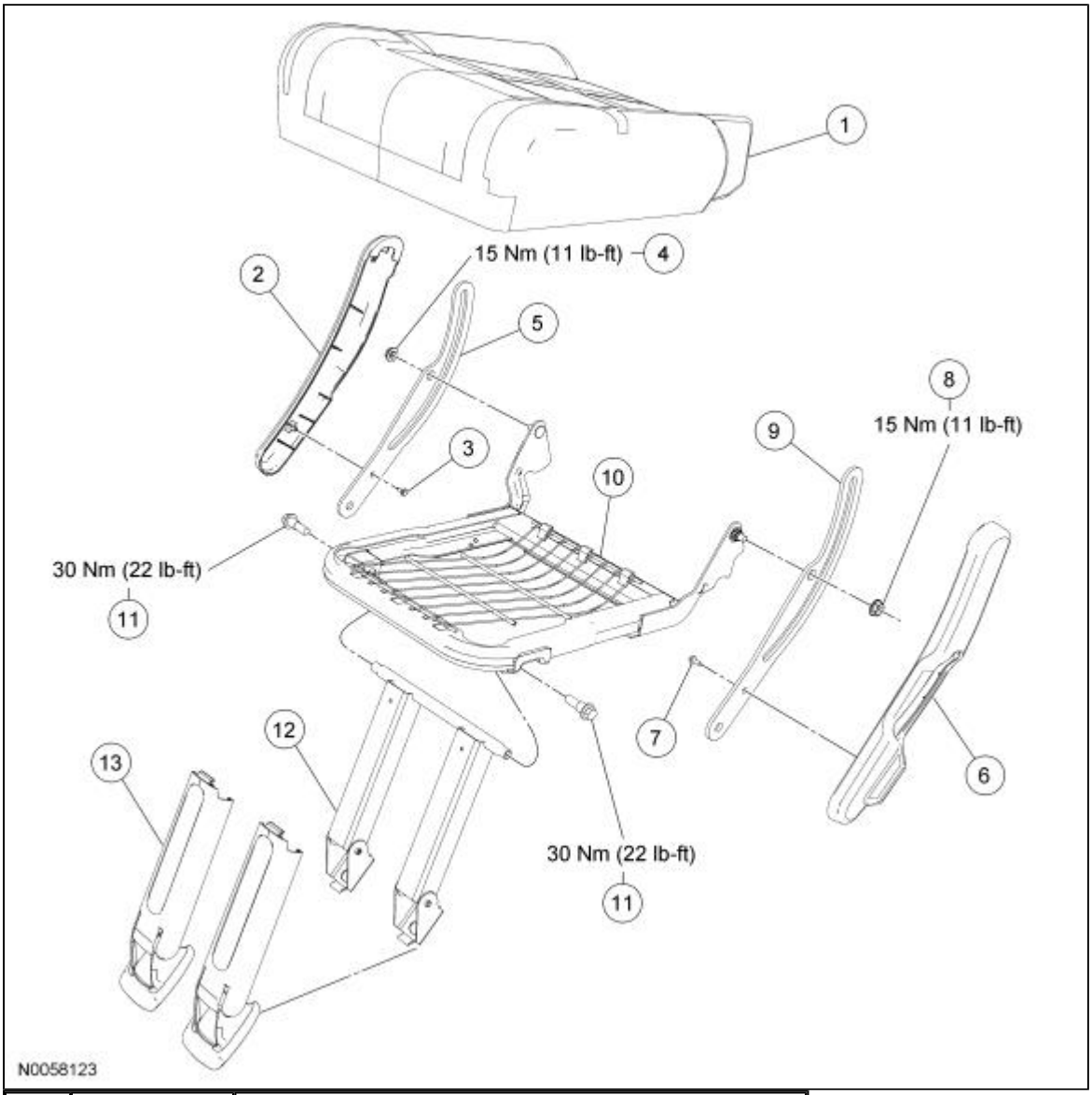
Seat Backrest — 40 percent



Item	Part Number	Description
1	611A08	Head restraint assembly
2	610A16	Head restraint guides
3	—	Backrest support panel (part of 613A38)
4	—	Backrest support panel-to-backrest frame screw (8 required) (part of 613A38)
5	666C02	Manual latch handle
6	W505274	Manual latch handle-to-backrest support panel screw (2 required)

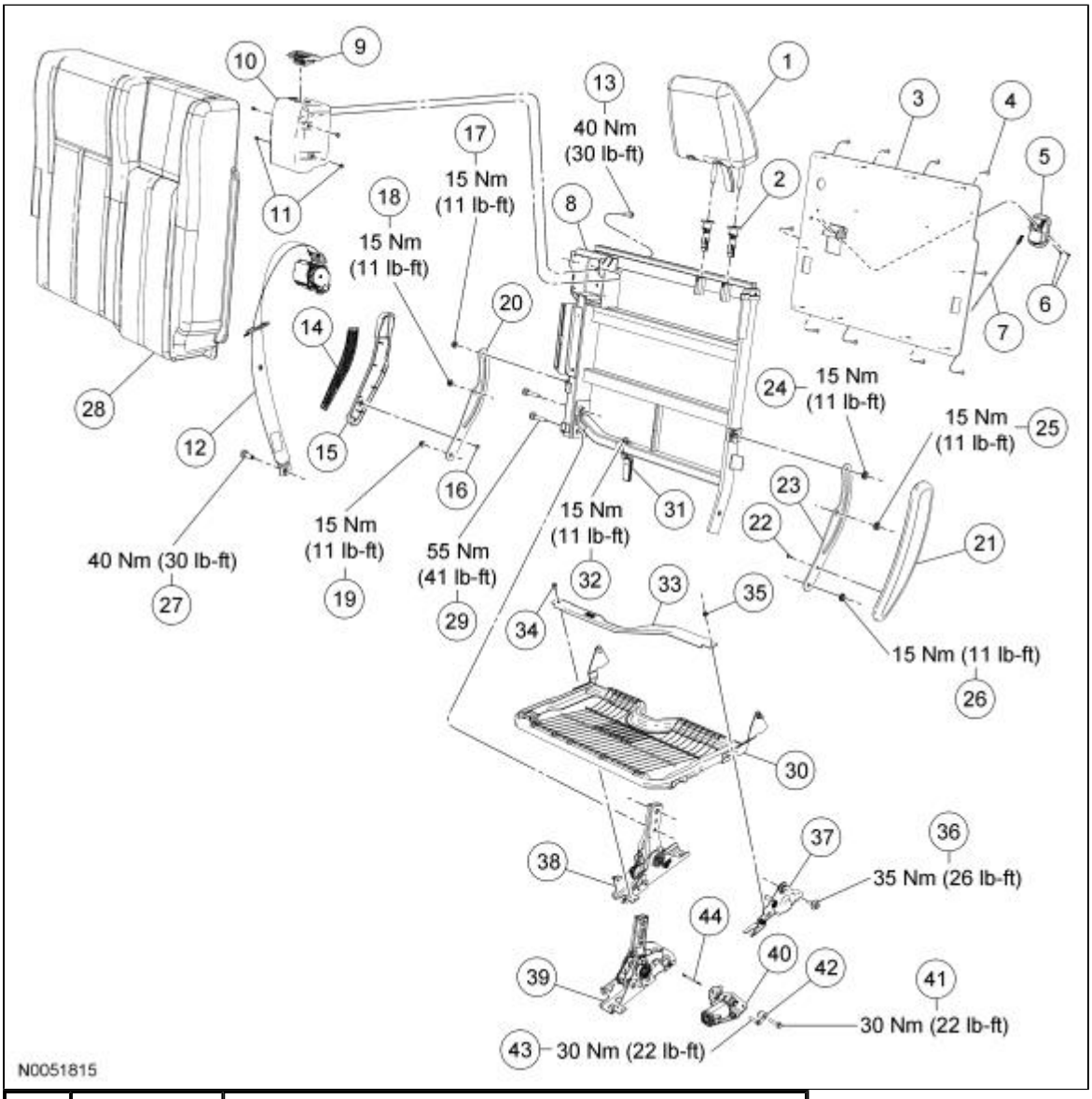
7	—	Manual latch release cable
8	—	Pin-type retainers
9	613A38	Backrest frame
10	66600/66800	Backrest trim cover/foam pad
11	624C32	Outboard slide bracket cover
12	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
13	613F18	Outboard slide bracket-to-backrest frame nut
14	613F18	Outboard slide bracket-to-cushion frame nut
15	613F18	Outboard slide bracket-to-outboard latch nut
16	624C30	Outboard slide bracket
17	624C33	Inboard slide bracket cover
18	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
19	613F18	Inboard slide bracket-to-backrest frame nut
20	613F18	Inboard slide bracket-to-cushion frame nut
21	613F18	Inboard slide bracket-to-inboard latch nut
22	624C30	Inboard slide bracket
23	W700883	Inboard latch-to-backrest frame bolts
24	613F18	Outboard latch-to-cushion frame bolt
25	63160	Cushion frame
26	60044	Safety belt buckle
27	N807750	Safety belt buckle bolt (part of 60044)
28	613D60	Outboard latch
29	613D61	Inboard manual latch
30	600M46	Inboard power latch
31	N620480	Nut, support bar
32	—	Bolt, support bar
33	—	Support bar
34	14547	Power-fold seat motor and bracket
35	—	Bolt, bracket-to-pivot (part of 14547)
36	—	Bolt, bracket-to-latch (part of 14547)
37	—	Bushing, power-fold seat motor (part of 14547)
38	—	Torque shaft, power-fold seat motor (part of 14547)

Seat Cushion — 40 Percent



Item	Part Number	Description
1	63804/63840	Cushion trim cover/foam pad
2	624C32	Outboard slide bracket cover
3	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
4	613F18	Outboard slide bracket-to-cushion frame nut
5	624C30	Outboard slide bracket
6	624C33	Inboard slide bracket cover
7	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
8	613F18	Inboard slide bracket-to-cushion frame nut
9	624C30	Inboard slide bracket
10	63160	Cushion frame
11	613F18	Riser-to-cushion frame bolts (2 required)
12	613E52	Riser
13	666C00	Riser covers (2 required)

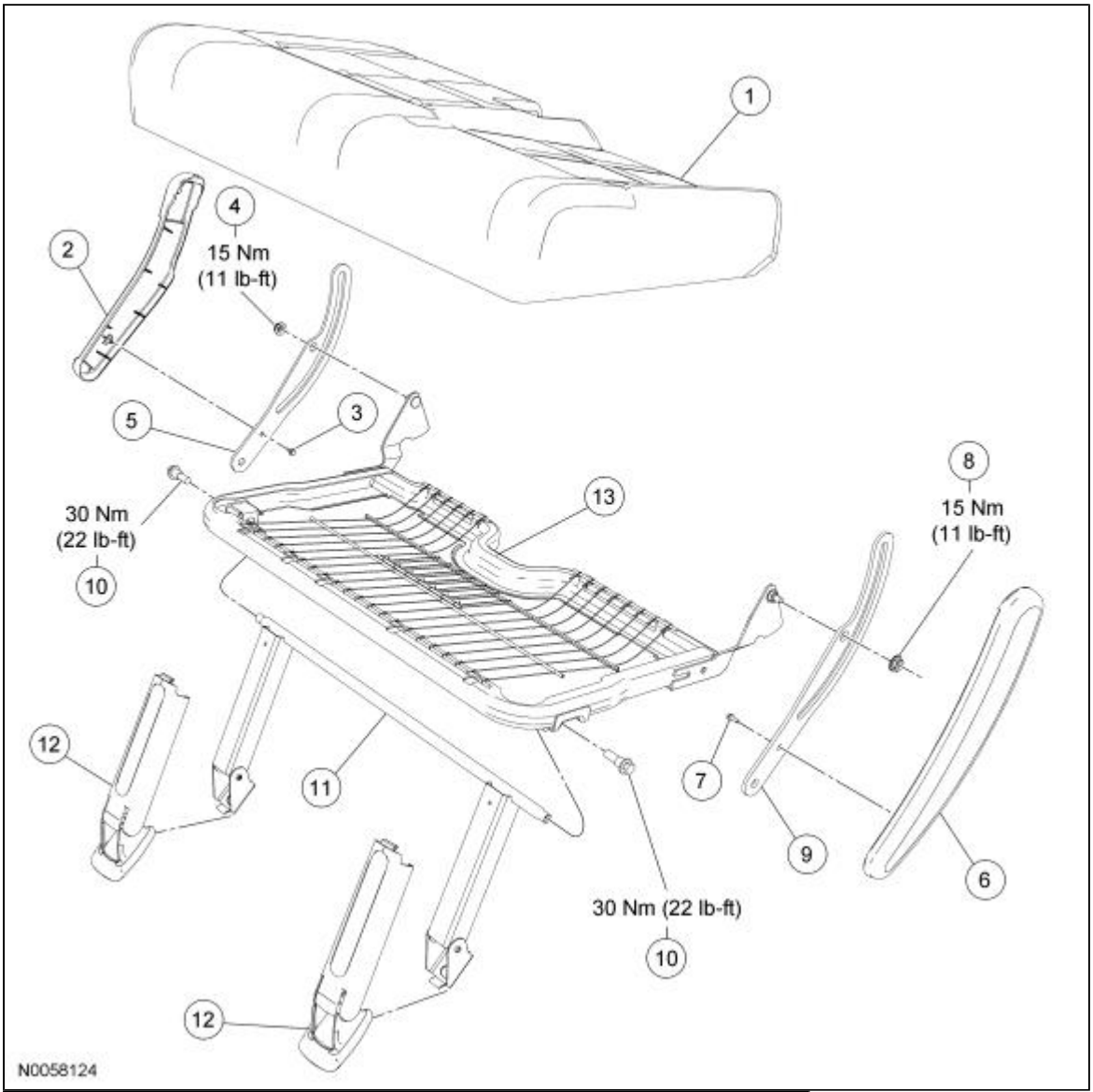
Seat Backrest — 60 Percent



Item	Part Number	Description
1	611A08	Head restraint assembly
2	610A16	Head restraint guide (2 required)
3	—	Backrest support panel
4	W505274	Backrest support panel-to-backrest frame screws (15 required)
5	666C02	Manual latch handle
6	W505274	Manual latch handle-to-backrest support panel screws (2 required)
7	—	Backrest release cable (part of 666C02)
8	613A39	Backrest frame
9	666C04	Safety belt guide cover
10	613C46	Safety belt retractor cover

11	W505274	Safety belt retractor cover screw (4 required)
12	611B64	Safety belt retractor
13	W505274	Safety belt retractor bolt (part of 611B64)
14	—	Cover, safety belt webbing
15	624C32	Inboard slide bracket cover
16	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
17	613F18	Inboard slide bracket-to-backrest frame nut
18	613F18	Inboard slide bracket-to-cushion frame nut
19	613F18	Inboard slide bracket-to-inboard latch nut
20	624C30	Inboard slide bracket
21	624C33	Outboard slide bracket cover
22	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
23	624C30	Outboard slide bracket
24	613F18	Outboard slide bracket-to-backrest frame nut
25	613F18	Outboard slide bracket-to-cushion frame nut
26	613F18	Outboard slide bracket-to-outboard latch nut
27	—	Safety belt anchor bolt (part of 611B64)
28	66801	Backrest trim cover/foam pad
29	613F18	Inboard latch-to-backrest frame bolts (2 required)
30	63161	Cushion frame
31	—	Child safety seat tether anchor (part of 613A39)
32	—	Child safety seat tether anchor bolt (part of 613A39)
33	—	Support bracket
34	—	Bolt, support bracket
35	N620480	Nut, support bracket
36	613F18	Outboard latch-to-cushion frame bolt
37	613D61	Outboard latch
38	600M47	Inboard manual latch
39	600M46	Inboard power latch
40	14547	Power-fold seat motor and bracket
41	—	Bolt, bracket-to-pivot (part of 14547)
42	—	Bushing, power-fold seat motor (part of 14547)
43	—	Bolt, bracket-to-latch (part of 14547)
44	—	Torque shaft, power-fold seat motor (part of 14547)

Seat Cushion — 60 Percent



Item	Part Number	Description
1	63805/63841	Cushion trim cover/foam pad
2	624C32	Inboard slide bracket cover
3	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
4	613F18	Inboard slide bracket-to-cushion frame nut
5	624C30	Inboard slide bracket
6	624C33	Outboard slide bracket cover
7	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
8	613F18	Outboard slide bracket-to-cushion frame nut
9	624C30	Outboard slide bracket
10	613F18	Riser-to-cushion frame bolts
11	613E53	Riser
12	666C00	Riser covers (2 required)
13	63161	Cushion frame

1. For additional information, refer to the procedures in this section.

Seat Backrest — Third Row, 40 Percent

Printable View (83 KB)

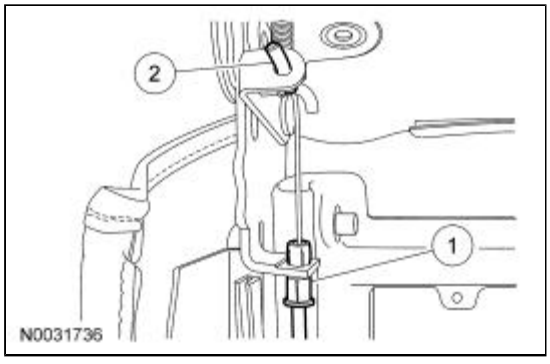
Removal and Installation

All seats

1. Remove the third row 40 percent seat. For additional information, refer to Seat — Third Row in this section.
2. Remove the 2 screws and the inboard and outboard slide bracket covers.
3. Release the backrest trim cover lower and inboard J-clips.

Manual fold seat

4. Remove the manual seat cable.
    1. Pinch the cable end and remove the cable from the retainer.
    2. Release the cable end hook from the retaining hole.



All seats

5. Remove the outboard slide bracket-to-backrest frame and outboard slide bracket-to-outboard latch nuts.
    - To install, tighten to 15 Nm (11 lb-ft).
6. Remove the inboard slide bracket-to-backrest frame and inboard slide bracket-to-inboard latch nuts.
    - To install, tighten to 15 Nm (11 lb-ft).
7. Remove the backrest from the cushion.
8. To install, reverse the removal procedure.

Seat Backrest — Third Row, 60 Percent

Printable View (85 KB)

Removal and Installation

All seats

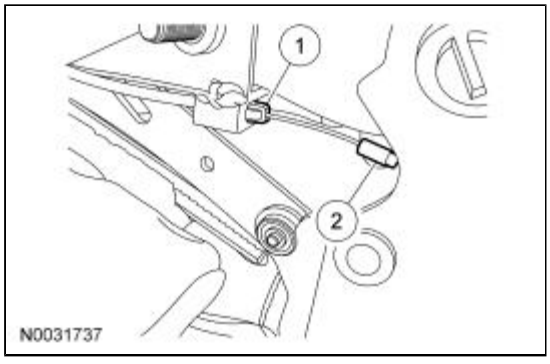
1. Remove the third row 60 percent seat. For additional information, refer to Seat — Third Row in this section.

2. Remove the 2 screws and the inboard and outboard slide bracket covers.

3. Release the backrest trim cover lower and inboard J-clips.

Manual fold seats

4. Remove the manual seat cable.
    1. Pinch the cable end and remove the cable from retainer.
    2. Release the cable end hook from the retaining hole.



All seats

5. Remove the outboard slide bracket-to-backrest frame and outboard slide bracket-to-outboard latch nuts.
    - To install, tighten to 15 Nm (11 lb-ft).

6. Remove the inboard slide bracket-to-backrest frame and inboard slide bracket-to-inboard latch nuts.
    - To install, tighten to 15 Nm (11 lb-ft).

7. Remove the backrest from the cushion.

8. To install, reverse the removal procedure.

Seat Backrest Cover — Third Row

Printable View (105 KB)

Removal and Installation

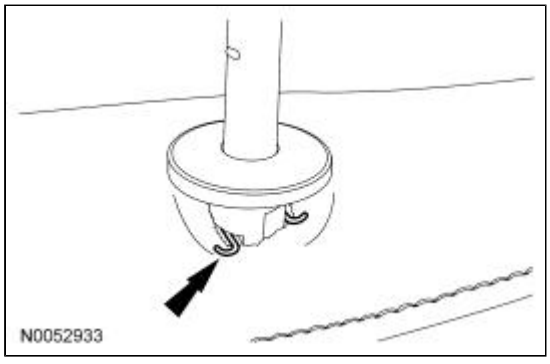
NOTE: LH seat shown, RH seat similar.

All seats

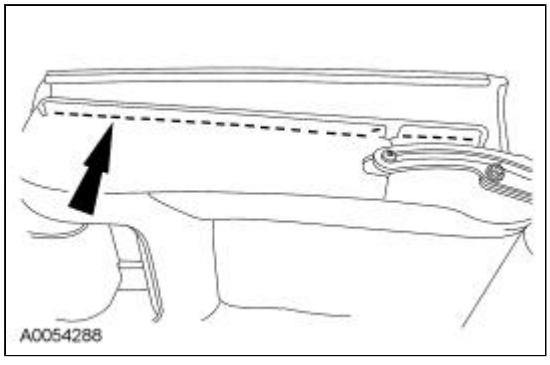
1. Remove the affected seat. Refer to Seat — Third Row in this section.
2. Remove the seat backrest. Refer to Seat Backrest — Third Row, 40 Percent or Seat Backrest — Third Row, 60 Percent in this section.
3. **NOTE:** Note the spring clip position for installation.

   NOTE: Use care when releasing the spring clips. They can fall inside the backrest frame.

   Remove the head restraint.
   - Pull the trim cover material away from the head restraint guide to access the spring clips.
   - Release the 2 spring clips by pushing on the side shown.
   - Raise and remove the head restraint.



4. Release all the backrest trim cover J-clips.
5. Remove all the staples.



LH seat

6. Release the hook-and-loop strip.

7. Remove the safety belt anchor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

8. Remove the safety belt guide cover.

Manual fold seat

9. **NOTE:** Note cable routing for installation.

    Remove the 2 screws and the manual latch handle and cable assembly.
    - Route out the cable.

All seats

10. **NOTE:** The head restraint sleeve pins are not interchangeable. Note location for installation.

    Reach up into backrest and squeeze the head restraint guide ends together to release and pull the 2 head restraint guides out.

11. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

    Separate the hook-and-loop strips and invert the backrest trim cover to the row of hog rings.

12. Remove the row of hog rings.

13. Remove the trim cover.
    - For LH seat backrest, route the safety belt webbing through the trim cover.

14. To install, reverse the removal procedure.

Seat Cushion Cover — Third Row

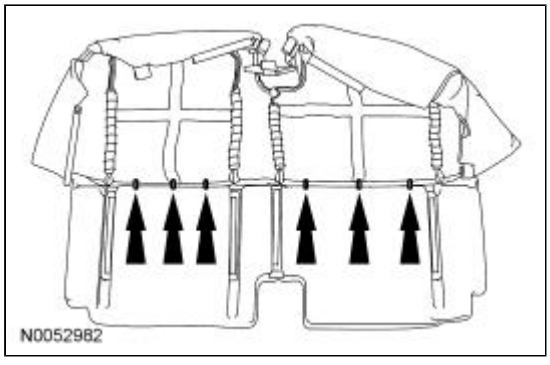
Printable View (102 KB)

Removal and Installation

NOTE: LH seat shown, RH seat similar.

1. Remove the affected seat. Refer to Seat — Third Row in this section.
2. Raise the cushion and release the trim cover hook-and-loop strips and J-clips.
3. Remove the cushion trim cover and foam pad from the cushion frame.
4. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Separate the hook-and-loop strips and invert the trim cover to the row of hog rings.



5. Remove the row of hog rings and remove the trim cover.
6. To install, reverse the removal procedure.

Power-Fold Seat Motor

Printable View (79 KB)

Removal and Installation

NOTE: LH seat shown, RH seat similar.

1. Remove the load floor panel.

2. Remove the 2 bolts and mid-floor panel support.
   - Detach the 3 pin-type retainers.

3. Detach the wiring harness pin-type retainer and disconnect the affected power seat motor electrical connector.

4. **NOTE:** Note position of bushing shoulder for installation.

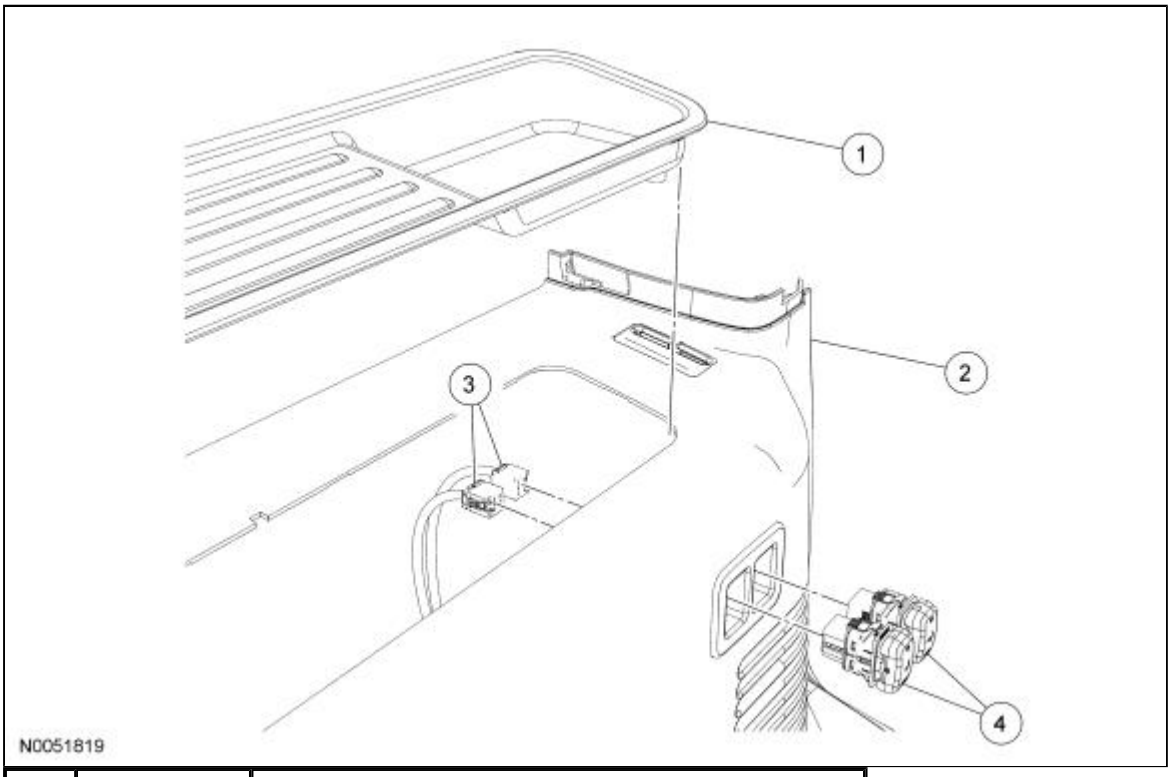
   Remove the bracket-to-pivot bolt and bushing from the power-fold seat motor.
   - To install, tighten to 30 Nm (22 lb-ft).

5. Remove the bracket-to-latch bolt and power-fold seat motor.
   - Slide the power-fold seat motor and bracket away from the latch and torque shaft.
     - For installation, slightly rotate the torque shaft until seated into the power-fold seat motor.
   - To install, tighten to 30 Nm (22 lb-ft).

6. To install, reverse the removal procedure.

Seat Control Switch — Third Row

Printable View (136 KB)



Item	Part Number	Description
1	13530	Tray, RH rear quarter trim panel
2	31012	RH rear quarter trim panel
3	—	Electrical connectors (part of wire harness 13A409)
4	14C715	LH and RH third row seat control switches

Removal and Installation

1. Release and remove the tray from the RH rear quarter trim panel.

2. **NOTE:** The LH and RH switch wiring harness electrical connectors are not interchangeable.

   Remove the affected seat control switch.
   - Reach a hand behind the RH rear quarter trim panel and squeeze together the 2 tabs on the affected seat control switch to release.
   - Pull the seat control switch through the opening and disconnect the electrical connector.

3. To install, reverse the removal procedure.

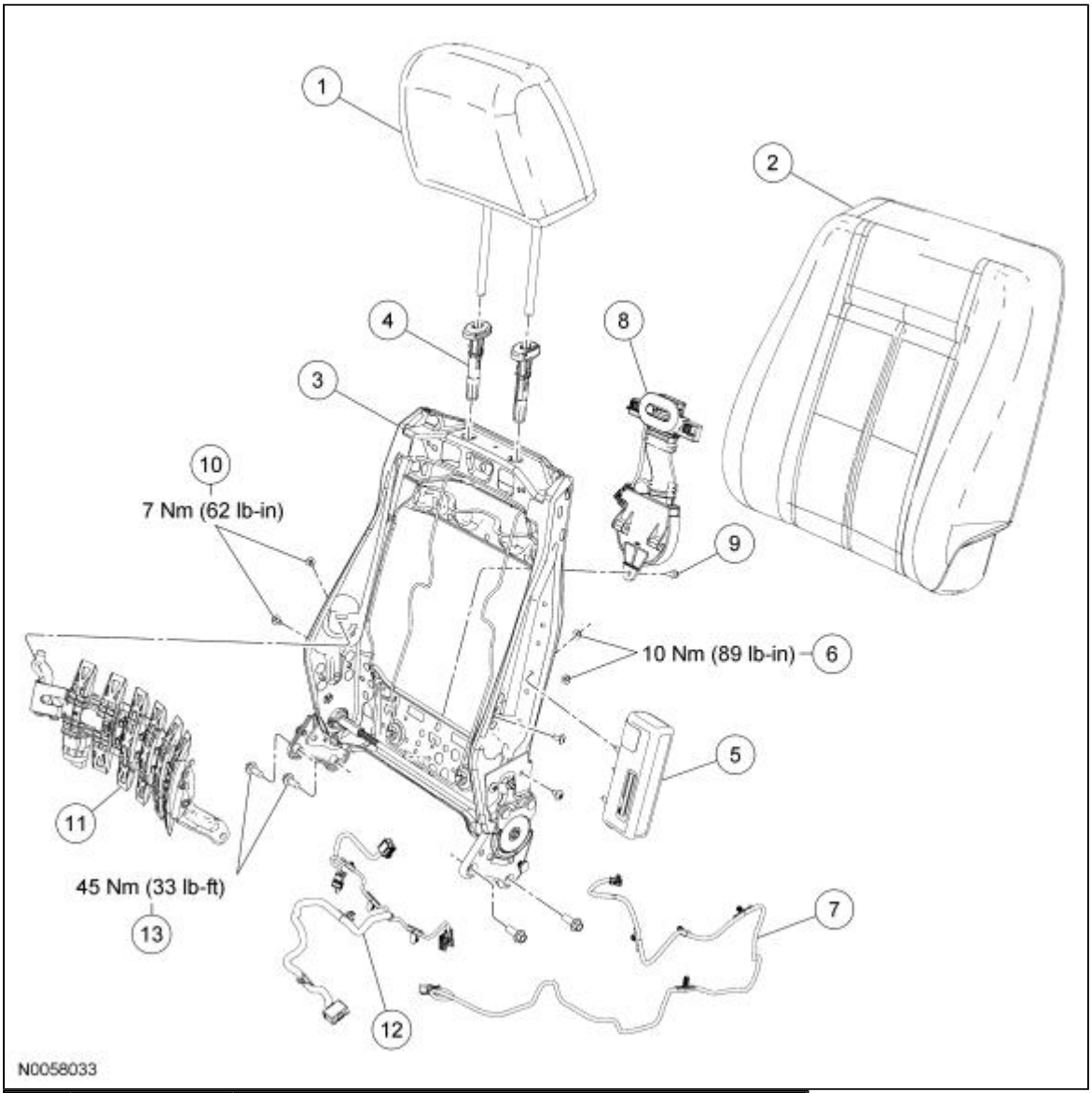
Seat Backrest — Front

Printable View (280 KB)

NOTE: Driver backrest shown, passenger similar.

NOTE: 40 Percent seat backrest shown, 60 percent seat backrest similar.

NOTE: Backrest with power recline shown, backrest with manual recline similar.



Item	Part Number	Description
1	611A08	Head restraint
2	64416/64810	Backrest trim cover/foam pad
3	61019	Backrest frame assembly
4	610A16	Head restraint guide (2 required)
5	611D10	Side air bag module

6	N620480	Nuts, side air bag module
7	14K155	Wiring harness, side air bag
8	14C712	Backrest thermo-electric device (TED)
9	N803946	Scrivet
10	—	Screws, lumbar (4 required)
11	65500	Lumbar assembly
12	14A699	Wiring harness
13	—	Backrest-to-cushion bolts (4 required) (part of hardware kit 000A25)

Disassembly and Assembly

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module and nuts must be installed. The seat back frame should be replaced if necessary.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

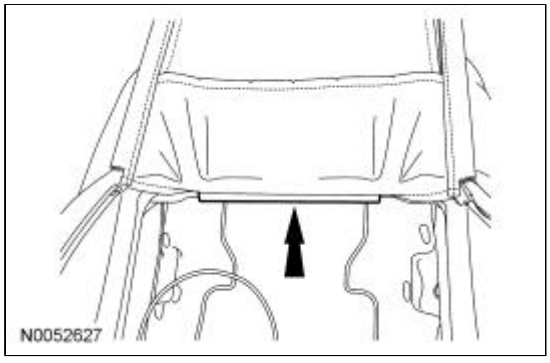
All seats

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent or Seat — Front, 60 Percent in this section.

2. Remove the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent or Seat Backrest — Front, 60 Percent in this section.

3. Remove the head restraint.
   - Push in the RH guide button to release and remove the head restraint.

4. Raise the rear trim cover flap and release the inner J-clip.

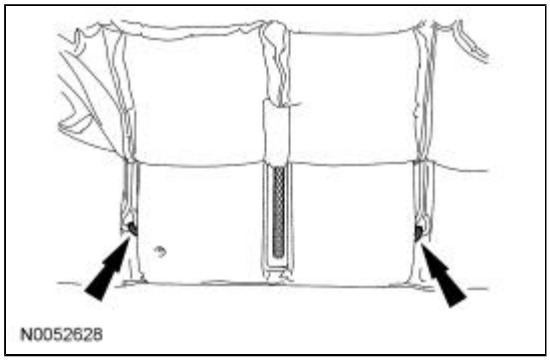


5. **NOTE:** The head restraint guides are not interchangeable. Note location for installation.

   Remove the headrest guides.
   - Reach into the backrest and pinch the headrest guide ends together to release from the backrest frame.
   - Pull the backrest trim cover away from the spring clips while pulling out the headrest guides.

6. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

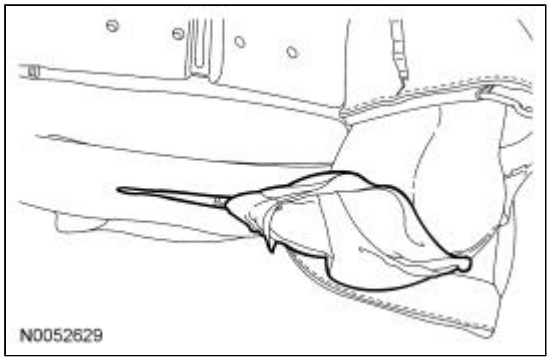
   Partially invert the backrest trim cover and remove the lower hog rings from the support wires.



7. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   NOTE: Note the side air bag module deployment chute routing for installation.

   Continue to invert the trim cover and remove the upper hog rings.
   - Route the side air bag module deployment chute through the slot in the foam pad.



8. Remove the backrest trim cover.

9. Release the lower flap from the backrest frame hooks and remove the backrest foam pad.

10. Remove the 4 bolts and lumbar assembly.
    - To install, tighten to 7 Nm (62 lb-in).
    - If equipped, disconnect the electrical connector from the lumbar assembly.
    - If equipped, route out the manual lumbar cable.

Climate controlled seats

11. Remove the climate controlled seat thermo-electric device (TED).
    - Disconnect the TED electrical connector.
    - Remove the scrivet.
    - Detach the 2 retainer clips from the backrest frame support wires.

Seats with power recliner

12. Disconnect the recliner motor electrical connector.

Power and climate controlled seats

13. **NOTE:** Note the wiring harness routing for installation.

    Detach the clip and pin-type retainer and remove the backrest wiring harness.

All seats

14. **WARNING: Check the air bag deployment chute for damage. The air bag deployment chute must not be repaired. If there is any damage to the deployment chute, a new seat back trim cover and deployment chute must be installed as a unit. Failure to do so may result in personal injury, in the event of an air bag deployment.**

    WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

    WARNING: If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

    To assemble, reverse the disassembly procedure.

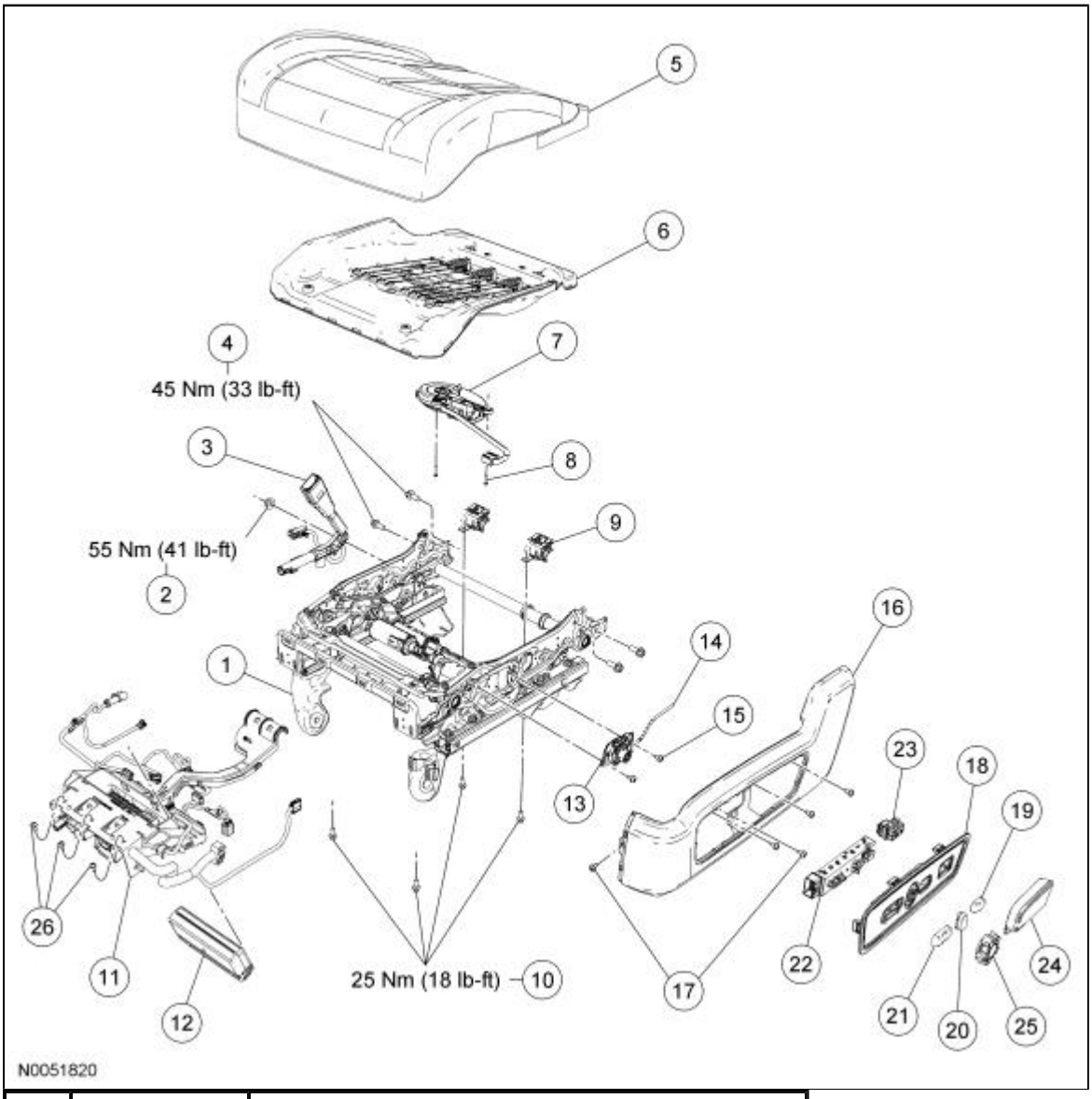
15. Install the backrest assembly. For additional information, refer to Seat Backrest — Front, 40 Percent or Seat Backrest — Front, 60 Percent in this section.

16. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent or Seat — Front, 60 Percent in this section.

Seat Cushion — Front, 40 Percent

Printable View (464 KB)

NOTE: Driver memory seat shown, driver and passenger power seat similar.



Item	Part Number	Description
1	61704	Seat track assembly
2	W520114	Nut, safety belt buckle pretensioner
3	61203	Safety belt buckle pretensioner
4	—	Bolts, backrest-to-cushion (4 required) (part of hardware kit 000A25)
5	62900/632A22	Cushion trim cover/foam pad
6	63100	Seat cushion frame
7	18D508	Cushion thermo-electric device (TED) (if equipped)

8	—	Screws, TED (2 required) (if equipped)
9	617D44/63518	Cushion frame rear clip and strap (2 sets required)
10	—	Cushion frame-to-seat track bolts (4 required) (part of hardware kit 000A25)
11	14A699	Wiring harness and bracket assembly
12	14C708	Driver seat module (if equipped)
13	65501	Manual lumbar actuator (if equipped)
14	—	Manual lumbar cable (if equipped) (part of 65501)
15	—	Screw, manual lumbar actuator (2 required) (if equipped) (part of hardware kit 000A25)
16	62187	Cushion side shield
17	—	Screws, cushion side shield (5 required)
18	14A707	Side shield cover
19	14711	Knob, power lumbar switch (if equipped)
20	14711	Knob, power recliner switch (if equipped)
21	14711	Knob, seat control switch
22	14A701	Seat control switch
23	14776	Memory set switch (if equipped)
24	61737	Recliner handle (if equipped)
25	62622	Manual lumbar knob (if equipped)
26	—	Screw, wiring harness bracket (3 required) (part of hardware kit 000A25)

Disassembly and Assembly

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

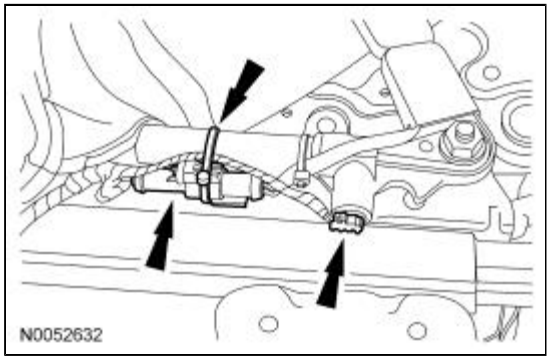
All seats

1. Remove the affected seat and depower the supplemental restraint system (SRS). For additional information, refer to Seat — Front, 40 Percent .

2. Remove the seat backrest. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

3. Release the cushion trim cover front and rear J-clips and rear hook-and-loop strip.

4. Remove the safety belt buckle pretensioner.
    - Remove the tie strap.
    - Disconnect the 2 safety belt buckle pretensioner electrical connectors.
    - Remove the nut and safety belt buckle pretensioner.
        - To install, tighten to 55 Nm (41 lb-ft).

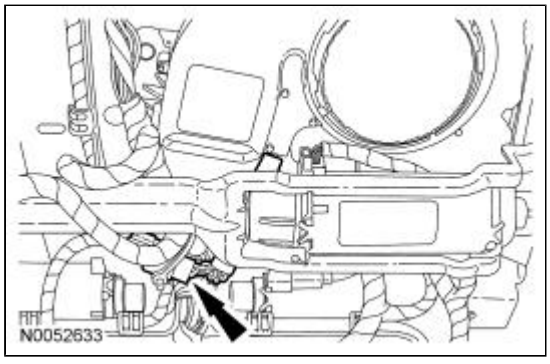


Climate controlled seats

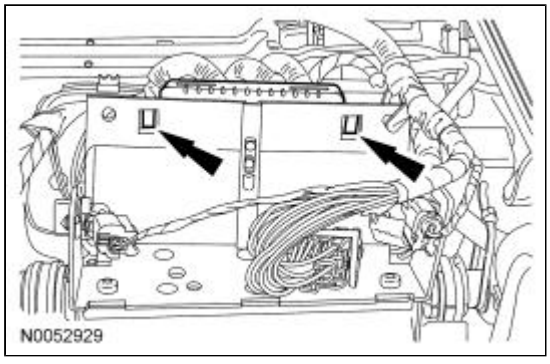
5. **NOTE:** Use care when removing the thermo-electric device (TED). The U-nuts can slip into the cushion frame.

   NOTE: Note wiring harness routing for installation.

   Remove the climate controlled seat thermo-electric device (TED).
    - Disconnect the electrical connector.
    - Detach the pin-type retainer and wiring harness.
    - Remove the 2 screws.
    - Route the wiring harness and remove the TED.



6. Release the 2 tabs and slide out the climate control seat module (CCSM).

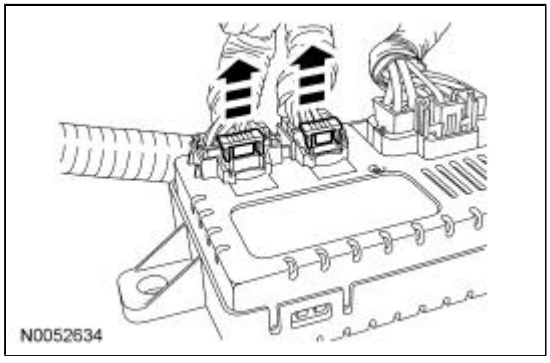


7. **NOTE:** When installing a new climate control seat module (CCSM), it is necessary to carry out

programmable module installation (PMI). For additional information, refer to Section 418-01 .

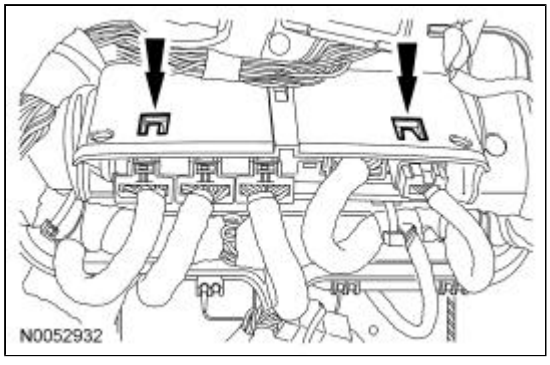
If passenger seat, remove the CCSM.

- Cut and remove the wiring harness tie strap.
- Release the 2 locking wedges.
- Disconnect the 3 electrical connectors.



Driver memory seat

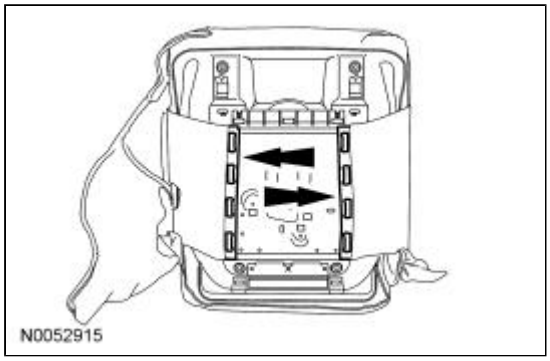
8. Remove the driver seat module (DSM).
   - Disconnect the 5 electrical connectors.
   - Release the 2 tabs and slide out the DSM.



All seats

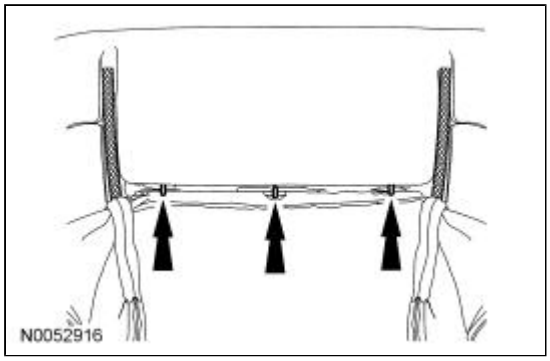
9. Remove the cushion frame from the seat track.
   - Remove the 4 cushion frame-to-seat track bolts.
     - To install, tighten to 25 Nm (18 lb-ft).
   - Release the 2 cushion frame rear clips and straps from the seat track and remove the cushion frame.

10. Release the 2 cushion trim cover retainer clips and remove the trim cover and foam pad from the cushion frame.



11. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

    Remove the cushion trim cover.
    - Partially invert the cushion trim cover and separate the hook-and-loop strips.
    - Remove the hog rings and separate the trim cover and foam pad.



Driver seat

12. Disconnect the SRS seat position sensor electrical connector and detach the wiring harness pin-type retainer.

Power seat

13. Disconnect the seat track motor electrical connectors.
    - For power seat track, disconnect the 3 motor electrical connectors.
    - For memory seat track, disconnect the 6 motor electrical connectors.

14. **NOTE:** Note wiring harness routing for installation.

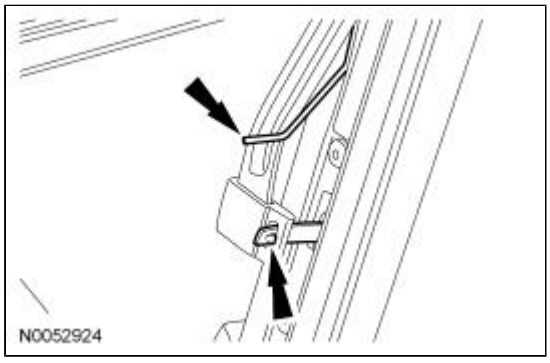
    Remove the wiring harness.
    - Remove the 3 wiring harness bracket screws.
    - Remove the tie strap and release the rear wiring harness bracket clip from the seat track.
    - Separate the electrical connectors and wiring harness from the seat track.
    - Route and remove the wiring harness and bracket.

Manual seat

15. Remove the inboard and outboard seat track rails.
    - Remove the 6 seat track rail-to-seat track nuts from the inboard and outboard seat track rails.
        - To install, tighten to 30 Nm (22 lb-ft).

- Remove the inboard and outboard seat track rails.
- Release and separate the seat track adjust handle from the seat track rails.
  - **NOTE:** Note the spring position for installation.

    Disconnect the spring.
  - Slightly bend the tab and detach the seat adjust handle from the inboard seat track rail.



All seats

16. To assemble, reverse the disassembly procedure.

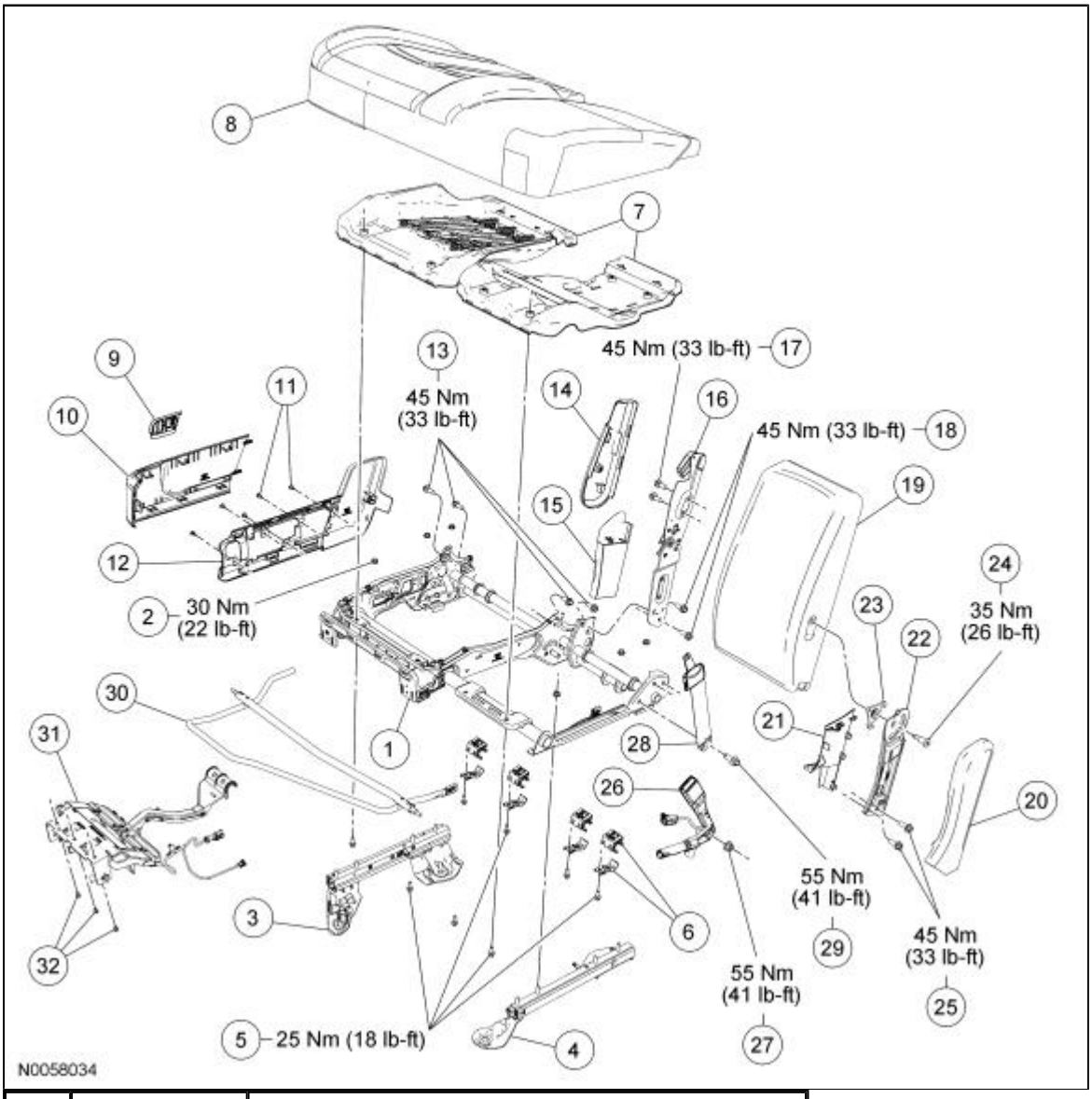
17. Install the seat backrest. For additional information, refer to Seat Backrest — Front, 40 Percent in this section.

18. Install the seat and repower the SRS. For additional information, refer to Seat — Front, 40 Percent in this section.

Seat Cushion — Front, 60 Percent

Printable View (403 KB)

NOTE: Sixty percent manual seat track shown, 40 percent manual seat track similar.



Item	Part Number	Description
1	61705	Seat track
2	—	Nut, seat track rail-to-seat track (6 required) (part of hardware kit 000A25)
3	—	Outboard seat track rail (part of 61705)
4	—	Inboard seat track rail (part of 61705)
5	—	Cushion frame-to-seat track bolts (8 required) (part of hardware kit 000A25)
6	617D44	Cushion frame rear clip and strap (4 sets required)

7	63100	Cushion frames
8	62900/632A22	Cushion trim cover/foam pad
9	61737	Manual recliner lever handle
10	14A706	Side shield cover
11	—	Screws, cushion side shield (5 required) (part of hardware kit 000A25)
12	62186	Cushion side shield
13	—	Bolts, backrest-to-cushion (4 required)
14	672A32	Armrest latch upper cover
15	672A32	Armrest latch lower cover
16	645A04	Armrest latch
17	—	Armrest latch-to-armrest bolts (2 required)
18	—	Armrest latch-to-seat track bolts (2 required)
19	65478	Armrest
20	—	Armrest bracket outer cover
21	672A28	Armrest bracket inner cover
22	63076	Armrest bracket
23	654A76	Armrest spacer
24	W707769	Armrest pivot bolt and washer
25	N804266	Armrest bracket-to-seat track bolts (2 required)
26	61202	Safety belt buckle pretensioner
27	W520014	Nut, safety belt buckle and pretensioner
28	611B60	Center seat safety belt
29	—	Bolt, center seat safety belt (part of 611B60)
30	603A86	Seat track adjust handle
31	14A699	Wiring harness and bracket assembly
32	—	Screws, wiring harness and bracket (3 required) (part of hardware kit 000A25)

Disassembly and Assembly

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

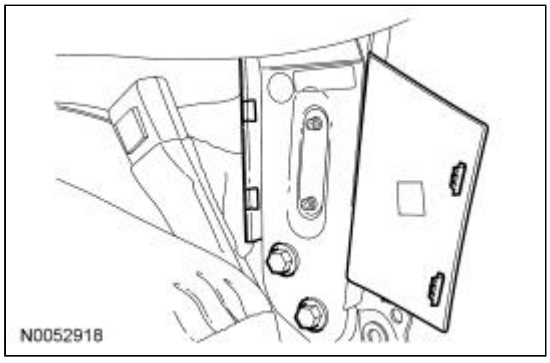
1. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

2. Remove the 60 percent seat. For additional information, refer to Seat — Front, 60 Percent in this section.

3. Remove the 60 percent seat backrest. For additional information, refer to Seat Backrest — Front, 60 Percent in this section.

4. Separate and remove the armrest bracket inner and outer covers.

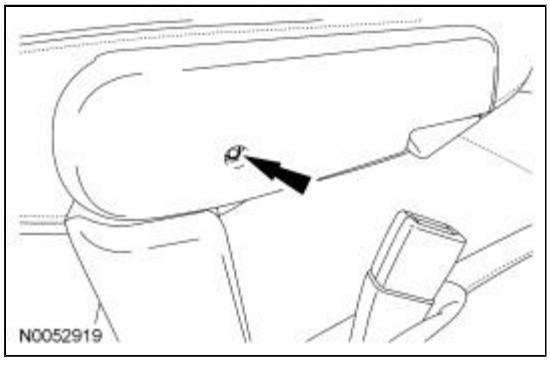
5. Open the armrest latch lower cover.



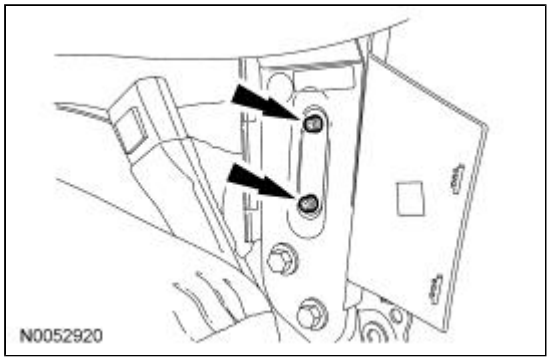
6. Remove the armrest and brackets from the seat track.
    - Remove the 2 armrest latch-to-seat track bolts.
        - To install, tighten to 45 Nm (33 lb-ft).
    - Remove the 2 armrest bracket-to-seat track bolts.
        - To install, tighten to 45 Nm (33 lb-ft).

Armrest disassembly

7. Remove the screw, release the clips and remove the armrest latch upper cover.



8. Detach the 2 pin-type retainers and remove the armrest latch lower cover.



9. Remove the armrest pivot bolt and armrest bracket.
    - To install, tighten to 35 Nm (26 lb-ft).

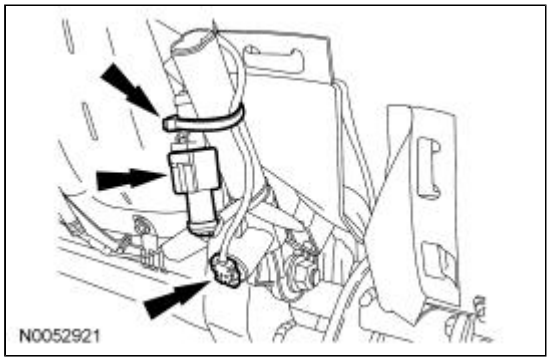
10. Remove the 2 armrest latch bolts and armrest latch.
    - To install, tighten to 45 Nm (33 lb-ft).

All seats

11. Release the cushion trim cover front and rear J-clips.

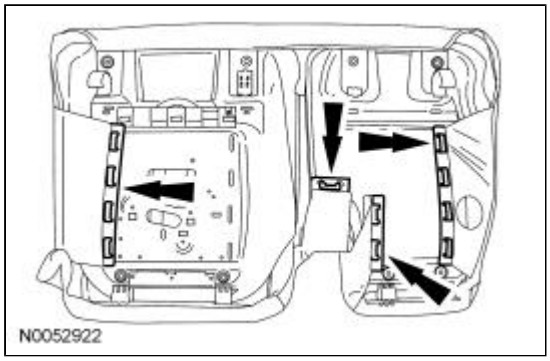
12. Remove the center seat safety belt bolt and center seat safety belt.
    - To install, tighten to 55 Nm (41 lb-ft).

13. Remove the safety belt buckle pretensioner.
    - Remove the tie strap.
    - Disconnect the 2 safety belt buckle pretensioner electrical connectors.
    - Remove the nut and safety belt buckle pretensioner.
        - To install, tighten to 55 Nm (41 lb-ft).



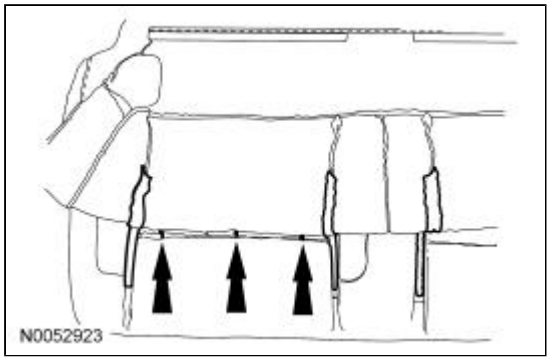
14. Remove the 2 cushion frames from the seat track.
    - Remove the 8 cushion frame-to-seat track bolts.
        - To install, tighten to 25 Nm (18 lb-ft).
    - Release the 4 cushion frame rear clips and straps from the seat track and remove both cushion frames.

15. Release the 4 cushion trim cover retainer clips and remove the trim cover and foam pad from the cushion frames.



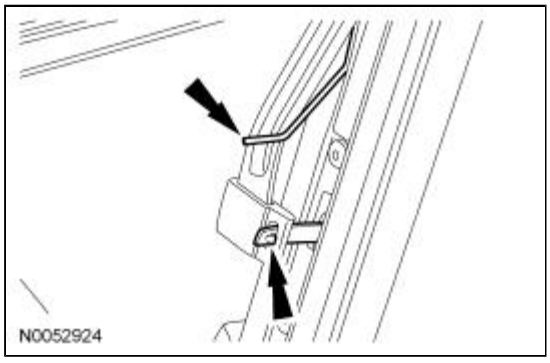
16. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

    Remove the cushion trim cover.
    - Partially invert the cushion trim cover and separate the hook-and-loop strips.
    - Remove the hog rings and separate the trim cover and foam pad.



17. Remove the inboard and outboard seat track rails.
    - Remove the 6 seat track rail-to-seat track nuts from the inboard and outboard seat track rails.
        - To install, tighten to 30 Nm (22 lb-ft).
    - Remove the inboard and outboard seat track rails.
    - Release and separate the seat track adjust handle from the seat track rails.
        - **NOTE:** Note the spring position for installation.

          Disconnect the spring.
        - Slightly bend the tab and detach the seat adjust handle from the inboard seat track rail.



18. **NOTE:** Note wiring harness routing for installation.

Remove the wiring harness.

- Remove the 3 wiring harness bracket screws.
- Remove the tie strap and release the rear wiring harness bracket clip from the seat track.
- Separate the electrical connectors and wiring harness from the seat track.
- Route and remove the wiring harness and bracket.

19. To assemble, reverse the disassembly procedure.

20. Install the 60 percent seat backrest. For additional information, refer to Seat Backrest — Front, 60 Percent in this section.

21. Install the 60 percent seat. For additional information, refer to Seat — Front, 60 Percent in this section.

22. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Backrest — Second Row, 20 Percent

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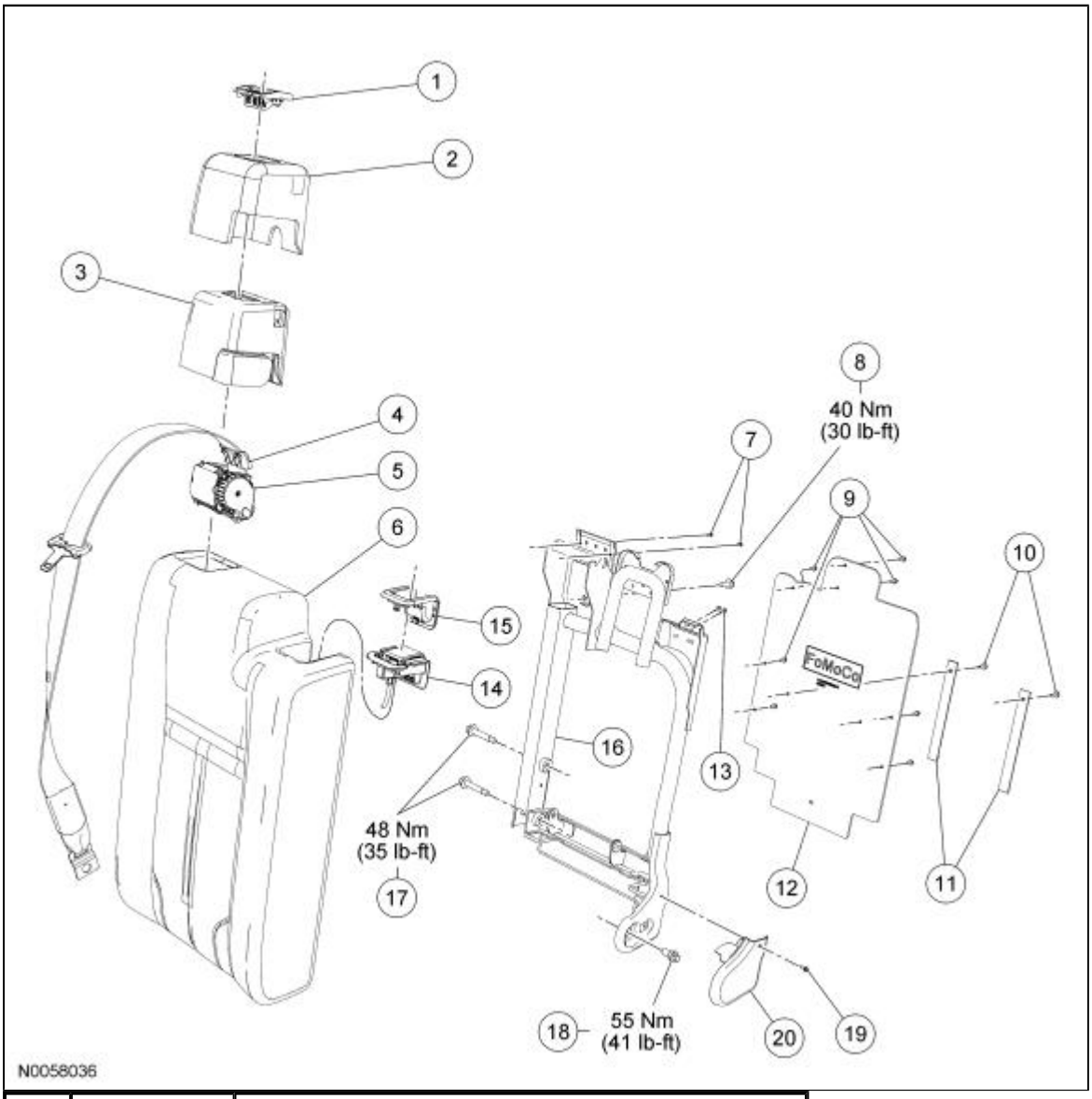


Item	Part Number	Description
1	666C04	Safety belt guide cover
2	611D52	Foam, safety belt retractor cover
3	613C46	Safety belt retractor cover
4	—	Safety belt retractor guide (part of 611B64)
5	611B64	Safety belt retractor
6	66600/66800	Backrest trim cover/foam pad
7	W504042	Safety belt retractor cover screws (2 required)
8	W505274	Safety belt retractor bolt
9	—	Backrest support panel screws (8 required) (part of 613A38)

10	W701259	Pin-type retainers (2 required)
11	63518	Attaching straps (2 required)
12	613A38	Backrest support panel
13	—	Screws, release handle (2 required)
14	62418	Release handle
15	624A08	Release handle bezel
16	613A38	Backrest frame
17	W506542	Backrest-to-cushion bolts (2 required)
18	613F18	Pivot bolt
19	W504042	Screw, pivot bolt cover
20	62178	Pivot bolt cover

Disassembly and Assembly

1. Remove the 20 percent seat. For additional information, refer to Seat — Second Row, 20 Percent in this section.

2. Remove the 20 percent seat backrest. For additional information, refer to Seat Backrest — Second Row, 20 Percent in this section.

3. Remove the safety belt guide cover.
   - Insert an appropriate tool into the holes and release the 3 locking tabs.
   - Detach the safety belt guide cover.
   - Route the safety belt webbing through the slot.

4. Remove the latch release handle bezel.
   - Release the upper tab and separate the bezel from the latch release handle.

5. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Separate the hook-and-loop strips and invert the backrest trim cover to the row of hog rings.

6. Remove the row of hog rings.

7. Continue inverting and remove the backrest trim cover.
   - Route the safety belt webbing through the trim cover opening.

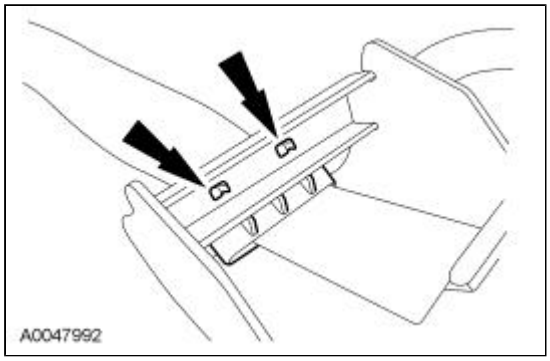
8. Remove the 2 pin-type retainers and foam pad.

9. Remove the safety belt retractor foam cover.

10. Remove the 2 screws and safety belt retractor cover.

11. Remove the safety belt retractor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

12. Release the 2 tabs and detach the safety belt retractor guide.



13. **NOTE:** Note safety belt routing for installation.

    NOTE: Make sure the safety belt webbing is not twisted prior to installation.

    Remove the safety belt retractor.
    - Route out the safety belt webbing, guide, tongue and anchor through the backrest frame.

14. Release the pin-type retainer and detach the release cable from the backrest frame.

15. **NOTE:** Note cable routing for installation.

    Remove the 2 screws and latch release handle.
    - Route out the release cable.

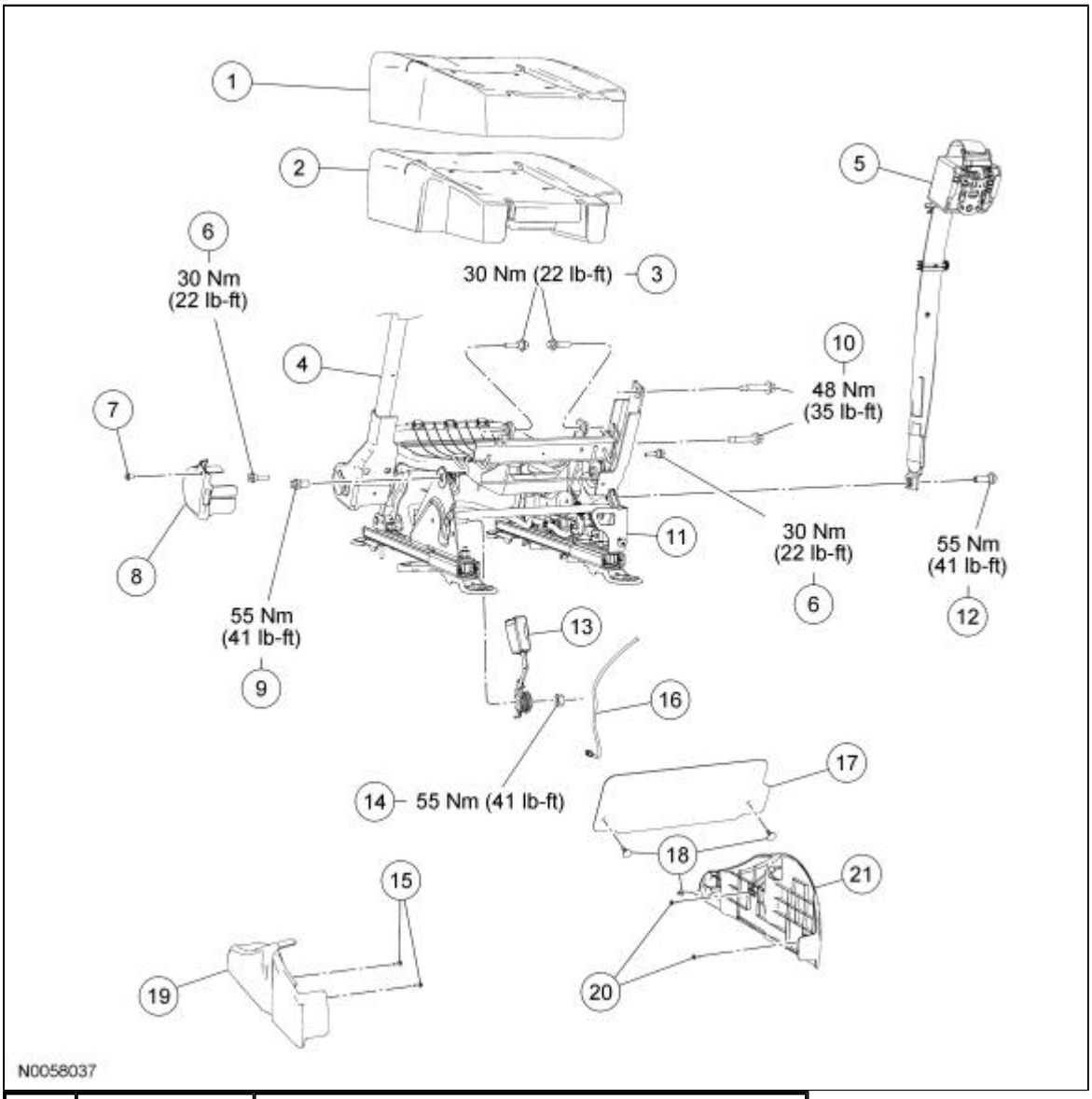
16. Remove the 2 pin-type retainers and 2 attaching straps.

17. Remove the 8 backrest support panel screws.

18. To assemble, reverse the disassembly procedure.
    - Verify the safety belt retractor operates without excessive effort or binding.

Seat Cushion — Second Row, 20 Percent

Printable View (179 KB)



Item	Part Number	Description
1	63804	Cushion trim cover
2	63840	Cushion foam pad
3	613F18	Swivel bolts
4	613A38	Backrest frame
5	611B64	Safety belt retractor
6	613F18	Seat riser-to-cushion frame bolts (2 required)
7	W504042	Screw, LH pivot bolt cover
8	62178	Pivot bolt cover
9	613F18	Pivot bolt
10	W506542	Backrest-to-cushion bolts (2 required)

11	63160	Cushion frame
12	—	Safety belt anchor bolt (part of 611B64)
13	60044	Safety belt buckle
14	N620483	Safety belt buckle nut
15	W704655	LH side shield screws (2 required)
16	—	Recliner cable
17	—	Lower panel
18	—	Pin-type retainers (3 required)
19	613A97	LH side shield
20	W704655	RH side shield screws (2 required)
21	63386	RH side shield

Disassembly and Assembly

1. Remove the 20 percent seat. For additional information, refer to Seat — Second Row, 20 Percent in this section.

2. Remove the 20 percent seat backrest. For additional information, refer to Seat Backrest — Second Row, 20 Percent in this section.

3. Remove the 2 screws and LH side shield.

4. Remove the nut and safety belt buckle.
    - To install, align the anti-rotation tab.
        - To install, tighten to 55 Nm (41 lb-ft).

5. Release the cushion trim cover front J-clip.

6. Remove the 2 riser-to-cushion frame bolts and cushion frame.
    - To install, tighten to 30 Nm (22 lb-ft).

7. Release the hook-and-loop strip and remaining cushion J-clips.

8. Remove the cushion frame from the foam pad and trim cover.

9. **CAUTION: Use care when separating the seat cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat cushion foam.**

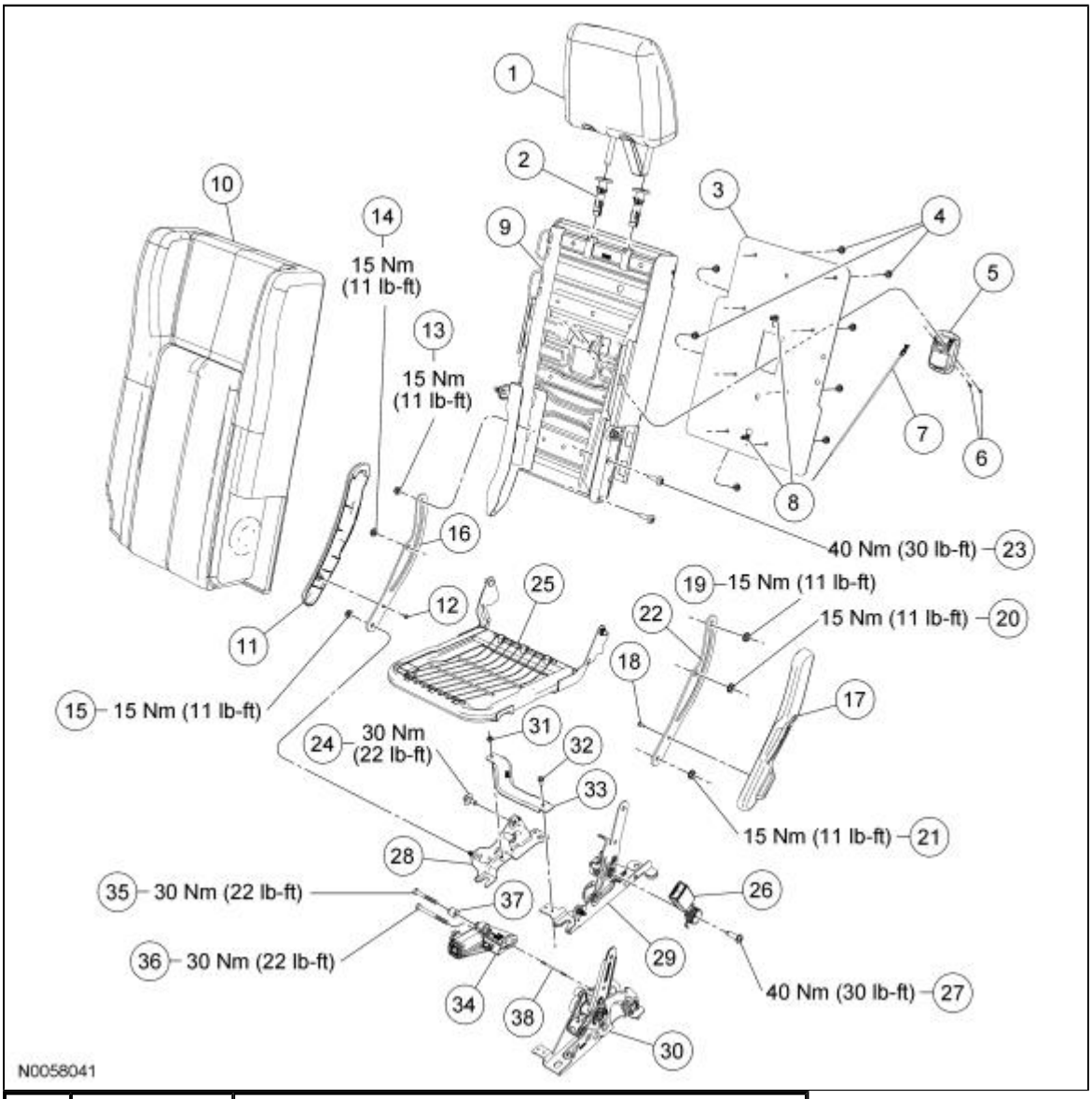
   Release the hook-and-loop strips and invert the cushion trim cover to the row of hog rings.

10. Remove the hog rings and cushion trim cover.

11. To assemble, reverse the disassembly procedure.

Seat Backrest — Third Row, 40 Percent

Printable View (261 KB)



Item	Part Number	Description
1	611A08	Head restraint assembly
2	610A16	Head restraint guides
3	—	Backrest support panel (part of 613A38)
4	—	Backrest support panel-to-backrest frame screw (8 required) (part of 613A38)
5	666C02	Manual latch handle
6	W505274	Manual latch handle-to-backrest support panel screw (2 required)
7	—	Manual latch release cable
8	—	Pin-type retainers

9	613A38	Backrest frame
10	66600/66800	Backrest trim cover/foam pad
11	624C32	Outboard slide bracket cover
12	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
13	613F18	Outboard slide bracket-to-backrest frame nut
14	613F18	Outboard slide bracket-to-cushion frame nut
15	613F18	Outboard slide bracket-to-outboard latch nut
16	624C30	Outboard slide bracket
17	624C33	Inboard slide bracket cover
18	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
19	613F18	Inboard slide bracket-to-backrest frame nut
20	613F18	Inboard slide bracket-to-cushion frame nut
21	613F18	Inboard slide bracket-to-inboard latch nut
22	624C30	Inboard slide bracket
23	W700883	Inboard latch-to-backrest frame bolts
24	613F18	Outboard latch-to-cushion frame bolt
25	63160	Cushion frame
26	60044	Safety belt buckle
27	N807750	Safety belt buckle bolt (part of 60044)
28	613D60	Outboard latch
29	613D61	Inboard manual latch
30	600M46	Inboard power latch
31	N620480	Nut, support bar
32	—	Bolt, support bar
33	—	Support bar
34	14547	Power-fold seat motor and bracket
35	—	Bolt, bracket-to-pivot (part of 14547)
36	—	Bolt, bracket-to-latch (part of 14547)
37	—	Bushing, power-fold seat motor (part of 14547)
38	—	Torque shaft, power-fold seat motor (part of 14547)

Disassembly and Assembly

All seats

1. Remove the third row 40 percent seat. For additional information, refer to Seat — Third Row in this section.

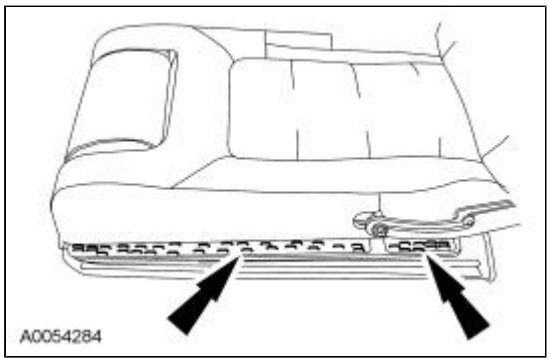
2. Remove the third row 40 percent seat backrest. For additional information, refer to Seat Backrest — Third Row, 40 Percent in this section.

3. Remove the bolt and the safety belt buckle.
    - During assembly make sure anti-rotation tab is engaged into seat locator.

- To install, tighten to 40 Nm (30 lb-ft).

4. Release the backrest trim cover outboard J-clip.

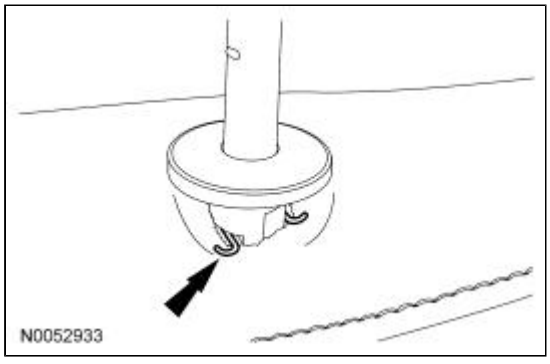
5. Remove all the staples.



6. **NOTE:** Note the spring clip position for installation.

   NOTE: Use care when releasing the spring clips. They can fall inside the backrest frame.

   Remove the head restraint.
   - Pull the trim cover material away from the head restraint guide to access the spring clips.
   - Release the 2 spring clips by pushing on the side shown.
   - Raise and remove the head restraint.



Manual seat

7. **NOTE:** Note cable routing for installation.

   Remove the 2 screws and the manual latch handle and cable assembly.
   - Route out the cable.

All seats

8. **NOTE:** The head restraint guides are not interchangeable. Note location for installation.

   Reach up into backrest and squeeze the head restraint guide ends together to release and pull the 2 head restraint guides out.

9. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

Separate the hook-and-loop strips and invert the backrest trim cover to the row of hog rings.

10. Remove the row of hog rings and backrest trim cover.

11. Remove the nut, screw and support bracket.

12. Remove the 2 inboard latch-to-backrest frame bolts and the inboard latch.
    - To install, tighten to 40 Nm (30 lb-ft).

13. Remove the outboard latch-to-cushion frame bolt and the outboard latch.
    - To install, tighten to 30 Nm (22 lb-ft).

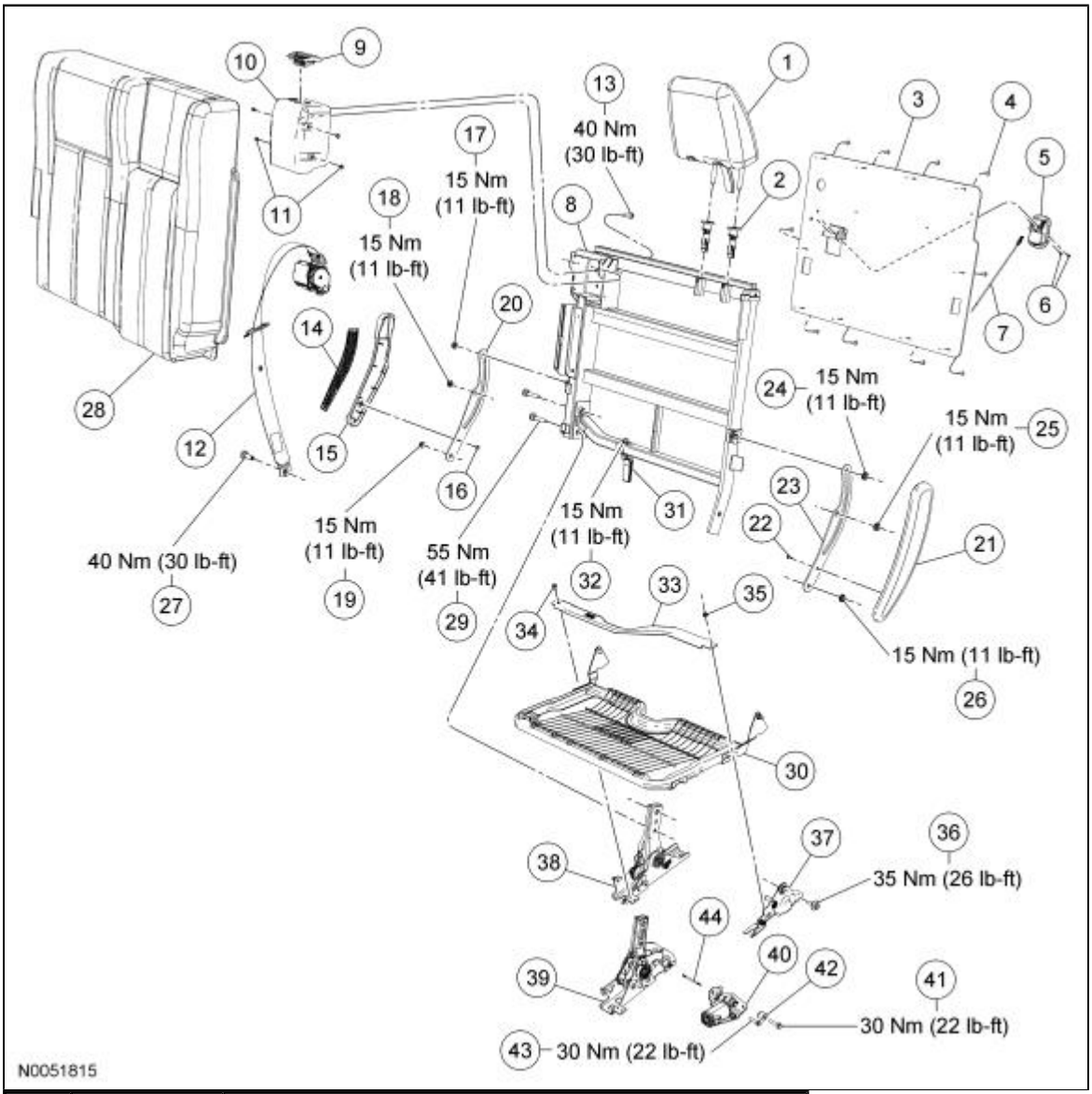
14. Remove the 6 screws and the backrest support panel.

15. To assemble, reverse the disassembly procedure.

Seat Backrest — Third Row, 60 Percent

Printable View (286 KB)

60 Percent Backrest



Item	Part Number	Description
1	611A08	Head restraint assembly
2	610A16	Head restraint guide (2 required)
3	—	Backrest support panel
4	W505274	Backrest support panel-to-backrest frame screws (15 required)
5	666C02	Manual latch handle
6	W505274	Manual latch handle-to-backrest support panel screws (2 required)

7	—	Backrest release cable (part of 666C02)
8	613A39	Backrest frame
9	666C04	Safety belt guide cover
10	613C46	Safety belt retractor cover
11	W505274	Safety belt retractor cover screw (4 required)
12	611B64	Safety belt retractor
13	W505274	Safety belt retractor bolt (part of 611B64)
14	—	Cover, safety belt webbing
15	624C32	Inboard slide bracket cover
16	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
17	613F18	Inboard slide bracket-to-backrest frame nut
18	613F18	Inboard slide bracket-to-cushion frame nut
19	613F18	Inboard slide bracket-to-inboard latch nut
20	624C30	Inboard slide bracket
21	624C33	Outboard slide bracket cover
22	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
23	624C30	Outboard slide bracket
24	613F18	Outboard slide bracket-to-backrest frame nut
25	613F18	Outboard slide bracket-to-cushion frame nut
26	613F18	Outboard slide bracket-to-outboard latch nut
27	—	Safety belt anchor bolt (part of 611B64)
28	66801	Backrest trim cover/foam pad
29	613F18	Inboard latch-to-backrest frame bolts (2 required)
30	63161	Cushion frame
31	—	Child safety seat tether anchor (part of 613A39)
32	—	Child safety seat tether anchor bolt (part of 613A39)
33	—	Support bracket
34	—	Bolt, support bracket
35	N620480	Nut, support bracket
36	613F18	Outboard latch-to-cushion frame bolt
37	613D61	Outboard latch
38	600M47	Inboard manual latch
39	600M46	Inboard power latch
40	14547	Power-fold seat motor and bracket
41	—	Bolt, bracket-to-pivot (part of 14547)
42	—	Bushing, power-fold seat motor (part of 14547)
43	—	Bolt, bracket-to-latch (part of 14547)
44	—	Torque shaft, power-fold seat motor (part of 14547)

Disassembly and Assembly

All seats

1. Remove the third row 60 percent seat. For additional information, refer to Seat — Third Row in this section.

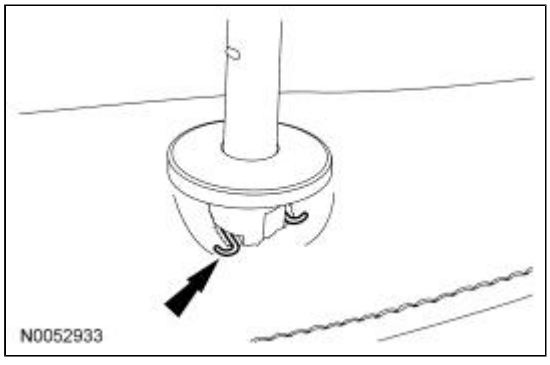
2. Remove the third row 60 percent seat backrest. For additional information, refer to Seat Backrest — Third Row, 60 Percent in this section.

3. Remove the safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

4. **NOTE:** Note the spring clip position for installation.

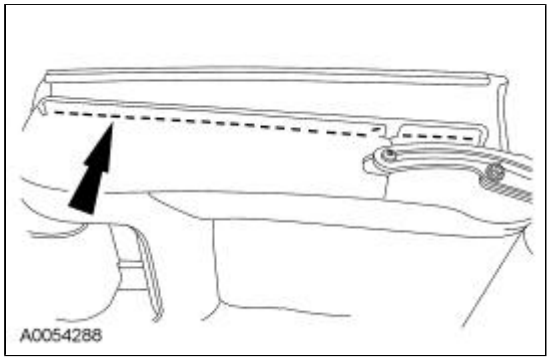
   NOTE: Use care when releasing the spring clips. They can fall inside the backrest frame.

   Remove the head restraint.
   - Pull the trim cover material away from the head restraint guide to access the spring clips.
   - Release the 2 spring clips by pushing on the side shown.
   - Raise and remove the head restraint.



5. Release all the backrest trim cover J-clips.

6. Remove all the staples.



7. Release the hook-and-loop strip.

Manual seat

8. **NOTE:** Note cable routing for installation.

   Remove the 2 screws and the manual latch handle and cable assembly.
   - Route out the cable.

All seats

9. Remove the safety belt guide cover.

10. **NOTE:** The head restraint sleeve pins are not interchangeable. Note location for installation.

    Reach up into the backrest and squeeze the head restraint guide ends together to release and pull the 2 head restraint guides out.

11. **CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

    Separate the hook-and-loop strips and invert the backrest trim cover to the row of hog rings.

12. Remove the row of hog rings.

13. Remove the trim cover.
    - Route the safety belt webbing through the trim cover.

14. Remove the backrest foam pad.

15. Remove the nut, screw and support bracket.

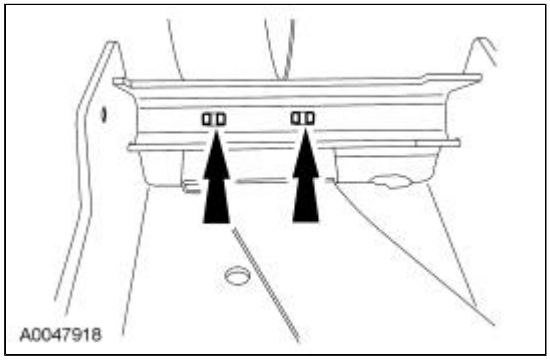
16. Remove the outboard latch-to-cushion frame bolt and outboard latch.
    - To install, tighten to 35 Nm (26 lb-ft).

17. Remove the 2 inboard latch-to-backrest frame bolts and the inboard latch.
    - To install, tighten to 55 Nm (41 lb-ft).

18. Remove the 4 screws and the safety belt retractor cover.

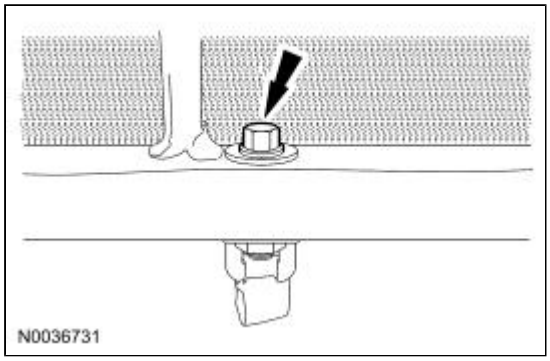
19. Remove the safety belt retractor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

20. Pinch to release the safety belt guide and remove the safety belt retractor.
    - Route through the backrest frame.



21. Remove the 15 screws and the backrest support panel.

22. Remove the bolt and child safety seat tether anchor.
    - To install, tighten to 15 Nm (11 lb-ft).

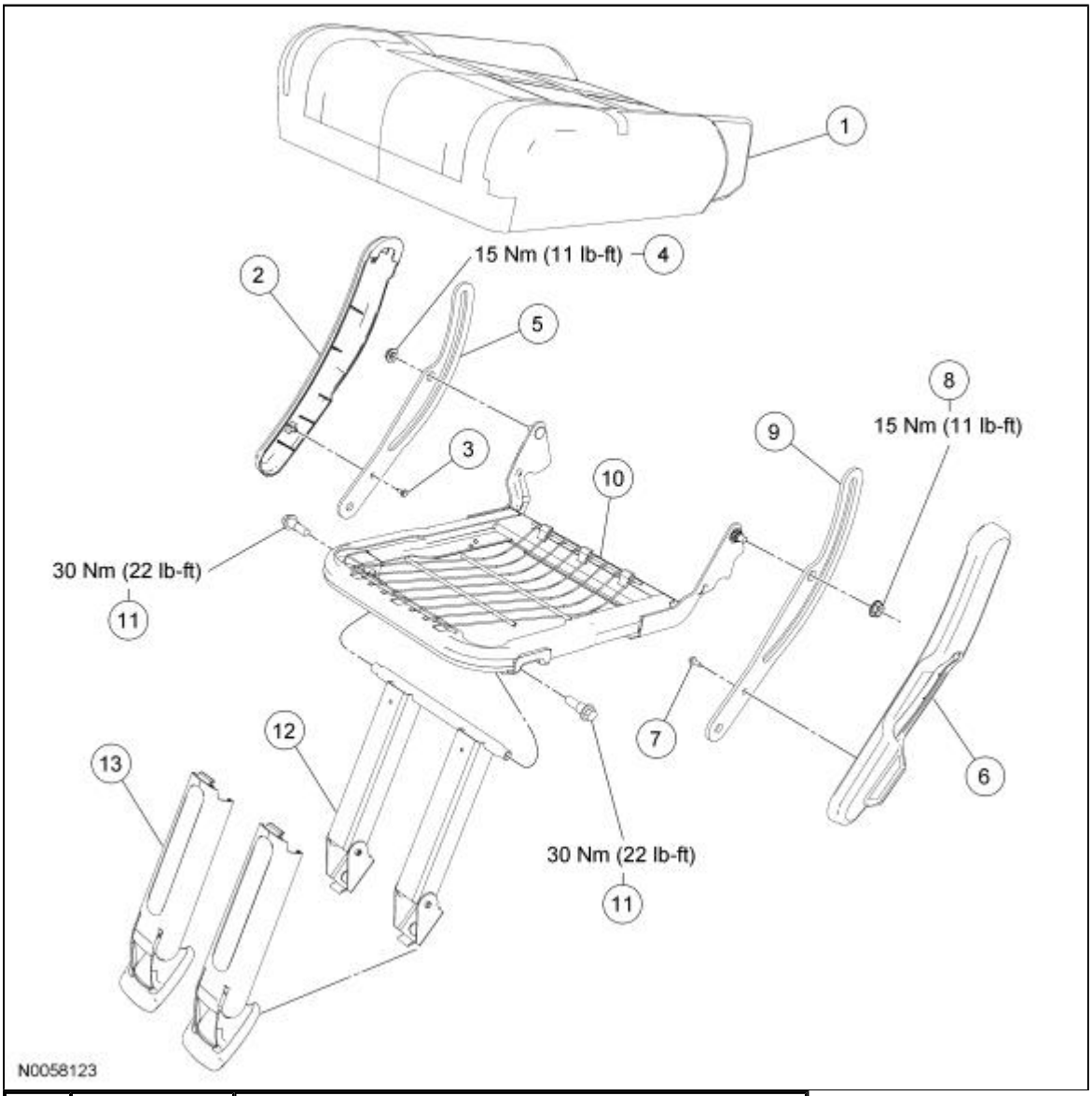


23. To assemble, reverse the disassembly procedure.

Seat Cushion — Third Row, 40 Percent

Printable View (191 KB)

40 Percent Cushion



Item	Part Number	Description
1	63804/63840	Cushion trim cover/foam pad
2	624C32	Outboard slide bracket cover
3	W708686	Outboard slide bracket cover-to-outboard slide bracket screw
4	613F18	Outboard slide bracket-to-cushion frame nut
5	624C30	Outboard slide bracket
6	624C33	Inboard slide bracket cover
7	W708686	Inboard slide bracket cover-to-inboard slide

		bracket screw
8	613F18	Inboard slide bracket-to-cushion frame nut
9	624C30	Inboard slide bracket
10	63160	Cushion frame
11	613F18	Riser-to-cushion frame bolts (2 required)
12	613E52	Riser
13	666C00	Riser covers (2 required)

Disassembly and Assembly

1. Remove the third row 40 percent seat. For additional information, refer to Seat — Third Row in this section.

2. Remove the third row 40 percent seat backrest. For additional information, refer to Seat Backrest — Third Row, 40 Percent in this section.

3. Remove the inboard and outboard slide bracket-to-cushion frame nuts and remove the slide bracket from both sides of the seat cushion.
   - To install, tighten to 15 Nm (11 lb-ft).

4. Remove the 2 seat riser-to-cushion frame bolts and the riser.
   - To install, tighten to 30 Nm (22 lb-ft).

5. Release the cushion trim cover J-clips and remove the cushion frame.

6. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Separate the hook-and-loop strips and invert the trim cover to the row of hog rings.

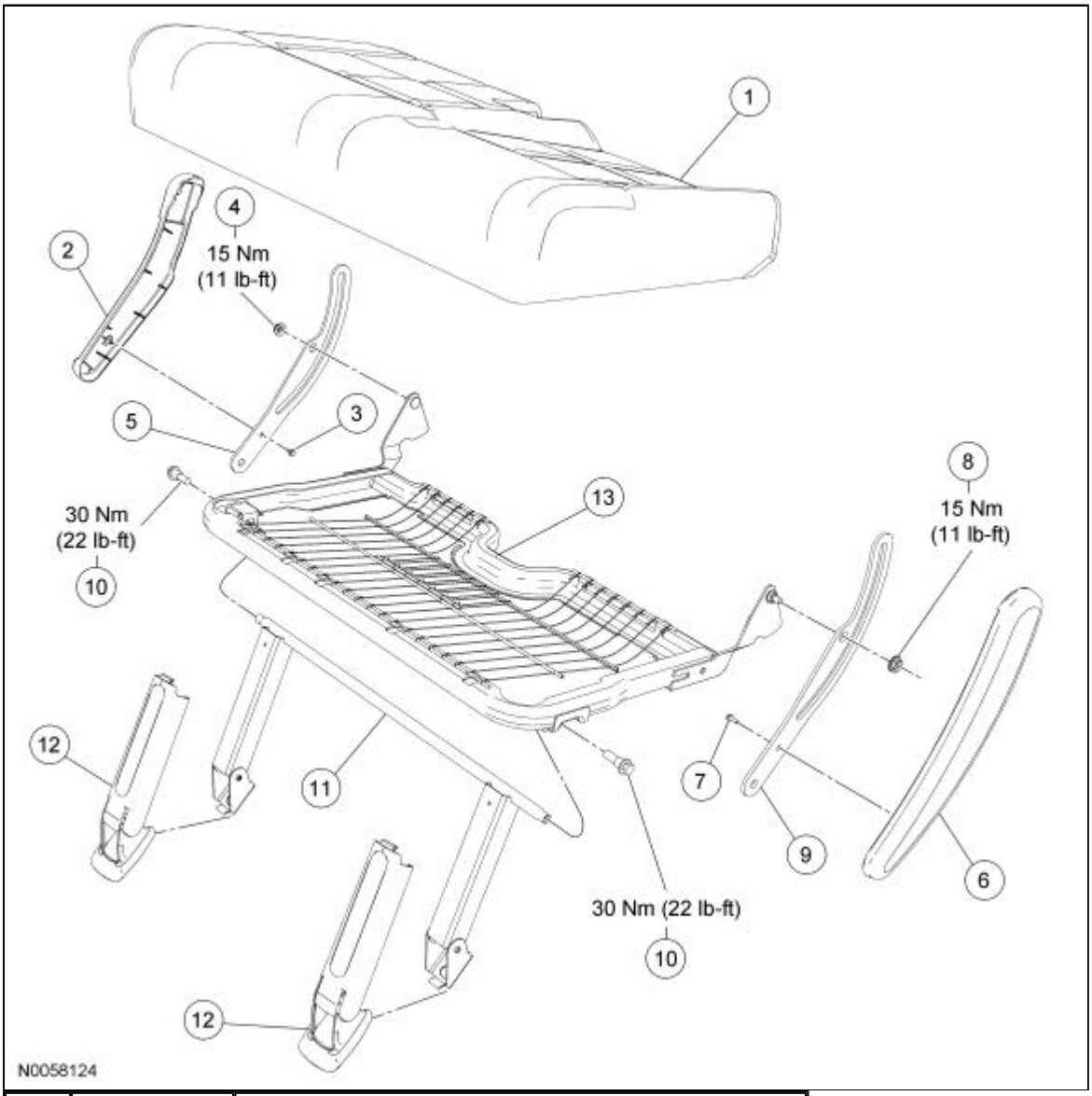
7. Remove the row of hog rings and remove the trim cover.

8. To assemble, reverse the disassembly procedure.

Seat Cushion — Third Row, 60 Percent

Printable View (224 KB)

60 Percent Cushion



Item	Part Number	Description
1	63805/63841	Cushion trim cover/foam pad
2	624C32	Inboard slide bracket cover
3	W708686	Inboard slide bracket cover-to-inboard slide bracket screw
4	613F18	Inboard slide bracket-to-cushion frame nut
5	624C30	Inboard slide bracket
6	624C33	Outboard slide bracket cover
7	W708686	Outboard slide bracket cover-to-outboard slide

		bracket screw
8	613F18	Outboard slide bracket-to-cushion frame nut
9	624C30	Outboard slide bracket
10	613F18	Riser-to-cushion frame bolts
11	613E53	Riser
12	666C00	Riser covers (2 required)
13	63161	Cushion frame

Disassembly and Assembly

1. Remove the third row 60 percent seat. For additional information, refer to Seat — Third Row in this section.

2. Remove the third row 60 percent seat backrest. For additional information, refer to Seat Backrest — Third Row, 60 Percent in this section.

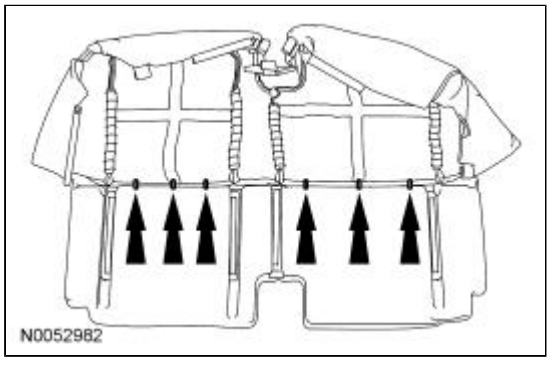
3. Remove the inboard and outboard slide bracket-to-cushion frame nuts and remove the slide bracket from both sides of the seat cushion.
   - To install, tighten to 15 Nm (11 lb-ft).

4. Remove the 2 seat riser-to-cushion frame bolts and the riser.
   - To install, tighten to 30 Nm (22 lb-ft).

5. Release the cushion trim cover J-clips and remove the cushion frame.

6. **CAUTION: Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Separate the hook-and-loop strips and invert the trim cover to the row of hog rings.



7. Remove the row of hog rings and remove the trim cover.

8. To assemble, reverse the disassembly procedure.

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General Specifications

Item	Specification
Sealers and Primers	
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B1
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	—
Threadlock 262 TA-26	WSK-M2G351-A6
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A
Lacquer Touch-up Paint (match color to exterior grid wire) PM-19500-XXXXX or PMP-19500-XXXXX	ESR-M2P100-C
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	—
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	—
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	—
Sika Urethane Metal and Glass Primer Sika 206 G+P	—
Polypropylene Film Fine Line Tape (commercially available)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Door glass regulator frame bolts	11	8	—
Front door glass channel bolt	11	8	—
Front door window glass clamp bolts	11	8	—
Liftgate glass hinge-to-body fastener	12	9	—
Liftgate glass-to-hinge bolts	8	—	71
Power window motor bolts	7	—	62
Rear door glass channel bolts	11	8	—
Rear door stationary glass screw	5	—	44
Rear door window glass clamp bolt	11	8	—
Rear quarter window glass nuts	2	—	18
Rear quarter window regulator motor bolts	9	—	80
Window regulator bolts	11	8	—
Window regulator motor bolts	7	—	62

Glass, Frames and Mechanisms

Printable View (68 KB)

The glass, frames and mechanisms consist of the:

- front door window glass.
- front door window motor.
- front door window regulator.
- rear quarter window glass.
- rear quarter window glass frame.
- rear quarter motor and window regulator.
- rear door window glass.
- rear door window motor.
- rear door window regulator.
- liftgate glass.
- windshield glass.

The glass, frames and mechanisms include:

- standard plastic and laminate safety glass.
- liftgate glass which houses the rear defrost grid and rear wiper arm.
- windshield glass which is bonded to the opening flange with a urethane sealant.
- on Expedition, standard power windows which include one-touch down (LF only) and lock out feature.
- on Navigator, standard power windows which include one-touch up/down (LF and RF only) and lock out feature.
- power vented rear quarter windows.
- fixed rear quarter windows (Expedition only).
- RH quarter window glass antenna.

The window regulator control switch:

- is located on each door trim panel.
- may be used to raise or lower all windows from the master control on the driver side, or the individual side window from the individual door switch.
- on Expedition, includes a one-touch down double detent feature (LF only).
- on Navigator, includes a one-touch up and one-touch down double detent feature (LF and RF).
- can manually lower the driver side window when the master control is depressed halfway (first detent).
- will completely lower the driver side window when the master control is fully depressed and then released (second detent).
- on Navigator, will completely raise the driver side window when the master control is pulled up and then released (second detent).
- on Navigator, will completely lower the passenger front window when the RF control switch is fully depressed and then released (second detent).
- on Navigator, will completely raise the passenger front window when the RF control switch is pulled up and then released (second detent).
- can lock out passenger front (Expedition only) and rear control switches.

The rear quarter glass regulator control switches:

- are located in the overhead console.
- may be used to open and close the RH or LH rear quarter windows.
- stop the rear quarter glass in any position when released.

The power window system will operate if the ignition switch is in the RUN or ACC position, or the delayed accessory feature is active.

Passenger windows may be raised or lowered using the LF master control switches or the appropriate passenger window switch. Passenger window switches receive power when the delayed accessory relay is active and the LF remote lock-out switch is in the UNLOCK position. When in the LOCK-OUT position, the passenger windows are deactivated (Expedition only). When in the lock-out position, the rear windows are deactivated (Navigator only).

The delayed accessory relay provides power for the operation of the power windows and the power moon roof. For Navigator front windows, the delayed accessory relay provides a low current signal to allow window movement. The delayed accessory feature is active when the ignition switch is in the RUN or the ACC position, or when the ignition switch is changed from RUN or ACC to the OFF/LOCK position and the LF and RF doors are closed.

The delayed accessory feature will deactivate when:

- the LF door is ajar and the ignition switch is in the OFF/LOCK or KEY-OUT position.
- the RF door is ajar and the ignition switch is in the OFF/LOCK or KEY-OUT position.
- 10 minutes have elapsed since the ignition switch was changed from ACC or RUN to the OFF/LOCK position.

Feature inputs:

- LF door open warning switch (open circuit with door closed, grounded with door ajar)
- RF door open warning switch (open circuit with door closed, grounded with door ajar)
- Ignition switch RUN position (battery potential on both the RUN and RUN/ACC inputs)
- Ignition switch ACC position (battery potential on the RUN/ACC input)
- Ignition switch OFF/LOCK position (absence of battery potential on the RUN, RUN/ACC and START inputs)

Feature outputs:

- Delayed accessory relay (grounded when activated, open circuit when deactivated)

The electronic automatic temperature control module (EATC) or electronic manual temperature control (EMTC) controls the state of the rear window defrost/mirror relay. When the rear window defrost switch is pressed, the EATC or EMTC will activate the heated grid relay. When the heated grid relay is active, both the rear window defrost grid and heated mirror elements will be energized.

The EATC or EMTC will deactivate the heated grid relay when one of the following conditions is met:

- The rear window defrost switch is pressed when the feature is active
- Ignition switch state is changed from RUN to OFF/LOCK
- The 10 minute timing function is completed

Feature inputs:

- Ignition switch RUN position (12V on both RUN and RUN/ACC inputs)
- Rear window defrost switch (momentary contact to ground when switch is pressed)

Feature outputs:

- Rear window defrost relay control (grounded when activated, open circuit when deactivated)

Glass, Frames and Mechanisms

Printable View (637 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and integrated diagnostic system (IDS) software with appropriate adapters, or equivalent scan tool

Principles of Operation

Navigator — One-Touch Up/Down, Front Windows

NOTE: The LF and RF window motors are not on the multiplex link.

The LF and RF window motors have 8 pins and contain integral electronics. The master window control switch sends 3 separate signals to the LF or RF window motor (the passenger window control switch sends 3 separate signals to the RF window motor only): UP, DOWN and AUTO. The master window control switch or passenger window control switch provide a 12-volt signal to the motor to request an up or down operation. When AUTO up or AUTO down are requested, the window control switch provides a 12-volt signal on the UP or DOWN line and a ground signal on the AUTO line simultaneously. The UP, DOWN and AUTO contacts are floating within the front control switches (LF, RF) when the switches are in the NEUTRAL position. The LF and RF window motors pull the UP and DOWN inputs to ground and the AUTO input to 12 volts when the wire harness is connected to the motor and signals are not being provided by the window switches. The up, down and auto feeds to the motor are all low current.

The window motor plastic pinion gear is mated to the drum housing of a dual rail drum and cable window regulator. The motor is attached to the drum housing (plastic) by 3 screws. The motor uses internal Hall-effect sensor feedback coupled to the microprocessor to determine window position and operate the window. If the Hall-effect pulses are not being received by the microprocessor, the motor will run for approximately 1/10 second each switch press. The motor contains a thermal breaker to protect the motor windings from overcurrent/overtemperature operation. Continued successive operation of the motor will cause the thermal breaker to open, causing a loss of function until the motor cools.

The window motor operates with the ignition switch in the RUN/ACC positions only (and delayed accessory) and is sensed via the delayed accessory input. The motor is supplied with B+ power and draws a key-off load of approximately 3/4 mA. All of the high current required to move the window is supplied through the B+ and motor ground inputs. The loss of motor ground will cause this system to become inoperative. For correct functionality, both power feeds and the ground feed must be intact at the motor.

During an auto up or auto down function, movement of the window can be stopped by actuating the switch to any position (UP, DOWN, AUTO up, AUTO down). The switch must then be released before the window will perform the next commanded movement.

When an obstacle has been detected in the window opening as the window is moving upward, the window will automatically reverse direction and move toward the fully open position (in both proportional up and one-touch up modes). This is known as "bounce-back". Once the window stops at its bounce-back position, and within 2 seconds the switch is released, then held in the AUTO UP position, the window will travel up with no bounce-back protection (security override). If the switch is released before the window reaches fully closed, the window will stop with bounce-back automatically re-enabled for the next window up movement. If the ignition switch is turned to OFF or START (without delayed accessory), the window will stop. The only exception is when an obstacle is detected while delayed accessory is lost. In this case the window will bounce back, then stop. Ice, contaminant buildup and environmentally induced tight spots in the window seals are all possible uses for the security override feature.

If an obstruction occurs while the window is moving up, the window will bounce back 125 mm (4.9 in) from where the obstruction occurs. If an obstruction occurs when the window is 125 mm (4.9 in) or less from the DOWN position, the bounce back position will be the full DOWN position.

The LF and RF window motor will retain its initialization (memory) if power (B+) is removed while the window is not in motion. If power (B+) is disconnected from the LF or RF window motor while the window is in motion, the motor will enter position recovery mode when power is restored (AUTO up and AUTO down functions are disabled). Position recovery mode allows proportional down (and up) movement of the window until the window motor stalls the window glass in the full DOWN position. If no internal or external faults are present, the motor will automatically resume normal (full) operation.

The master window control switch and passenger window control switch are supplied with illumination power and illumination ground inputs used to illuminate the switch when the headlamp switch is turned to the PARK or ON position (the AUTOLAMP position may also energize this input). These switch inputs do not directly affect operation of the LF or RF window. The master window control switch and passenger window control switch use the delayed accessory power input which is transferred to the UP or DOWN outputs via closing of a switch contact. The master window control switch and passenger window control switch each have separate ground switch inputs which are transferred to the auto output via closing of a switch contact. If the delayed accessory feed to the window control switch is missing, none of the windows will function. If the master window control switch ground signal is missing, the auto functions will be inoperative and the LR and RR windows will also be inoperative. The RF window auto functions will still operate correctly from the passenger window control switch as long as the ground feed to that switch is present.

If the window control switch, or its associated wiring, develops an open circuit, that function will become inoperative. If the UP contact or associated wiring develops an open circuit, the window will only move down or one-touch down. If the DOWN contact or associated wiring develops an open circuit, the window will only move up or one-touch up. If the auto contact or associated wiring develops an open circuit, the window will only move proportionally up or down.

The window motor will suspend window operation if a switch error exists. A switch error is defined as UP and DOWN, AUTO without UP or DOWN, or UP and DOWN and AUTO energized at the same time. The window will appear to be inoperative if a switch error is present.

A new LF or RF window motor will be in proportional up/down mode prior to initialization. The motor will respond to a proportional UP or DOWN switch actuation only and bounce back is disabled. If the switch is actuated to the AUTO up or AUTO down position and released, window movement will stop when the UP or DOWN contact in the master window control switch or passenger window control switch is released. If the window motor is removed from the window regulator drum housing, or if a new window motor is installed, the window motor must be initialized. Refer to Window Motor Initialization in the General Procedures portion of this section.

The window motor will automatically adjust to system changes throughout its life: changes in seal drag and slight changes in the fully open position will occur and are automatically compensated for. Once initialized, for the most part, the window motor will soft stall into the lower position contributing to extended durability of the system. If the window does not seal completely in the full up position, the window switch can be actuated to the proportional up position and the window will be energized long enough to fully seal. If the window does not travel fully down, the window switch can be activated to the proportional DOWN position and the window will be energized long enough to travel to the full DOWN position. In both cases, the new positions will be learned.

Expedition — One-Touch Down

The one-touch down feature for the Expedition is controlled by the master window control switch.

Rear Window Defrost

When the rear window defrost switch is pressed, the electronic automatic climate control (EATC) or electronic manual temperature control (EMTC) will activate the heated backlight relay located in the battery junction box (BJB). When the heated backlight relay is active, the heated backlight will be energized.

Inspection and Verification

1. Verify the customer concern by operating the power window system.

2. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical

• Window regulator assembly
• Window glass
• Window control switch
	• Central junction box (SJB) circuit breaker 47 (30A)
	• Delayed accessory relay
	• SJB fuse(s):
	  ▪ 1 (30A)
	  ▪ 4 (30A)
	  ▪ 41 (15A)
	• Circuitry
	• Window control switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** The Navigator front window motors are not on the multiplex link.

   NOTE: Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the smart junction box (SJB).

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1302	Accessory Delay Relay Coil Circuit Failure	If the accessory delay is always on, Go To Pinpoint Test N . If the accessory delay is inoperative, Go To Pinpoint Test M .
B1304	Accessory Delay Relay Coil Circuit Short To Battery	Go To Pinpoint Test N .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• All power windows are inoperative — Expedition	• Circuit breaker • Fuse • Delayed accessory relay • Circuitry • Master window control switch	• Go To Pinpoint Test A .
• All power windows are inoperative — Navigator	• Delayed accessory relay	• Go To Pinpoint Test M .
• A single power window is inoperative — LF, Expedition	• Circuitry • Master window control switch • LF power window motor	• Go To Pinpoint Test B .
• A single power window is inoperative — LF, Navigator	• Fuse(s) • Circuitry • Master window control switch • LF power window motor	• Go To Pinpoint Test C .

• A single power window is inoperative — LF or RF power window will not close (bounces back), Navigator	• The window system was repaired and the LF or RF motor was not reinitialized	• REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Glass runs are not fully seated	• Carefully use a rubber mallet to reseat the glass runs, then REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Dirt or contaminants are present in the glass runs or beltline moulding	• REMOVE/CLEAN the glass runs or beltlines, then REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Binding in the inner/outer beltline moulding	• REMOVE and REINSTALL the inner/outer beltlines, INSTALL new if necessary, then REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Window regulator is out of position	• Using the security override function, POSITION the glass in the full UP position. REFER to the Description and Operation portion of this section. LOOSEN the 4 window regulator rail bolts. TIGHTEN the 4 window regulator rail bolts. REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Front glass channel (lower portion) is out of position	• LOWER the glass to the full DOWN position. LOOSEN the glass channel bolt. TIGHTEN the glass channel bolt. REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
	• Window system components are loose	• CHECK the torque on the LF or RF motor screws, window glass to regulator bolts, regulator rail bolts, glass channel bolt and the door carrier fasteners. REINITIALIZE the LF or RF motor. REFER to Window Motor Initialization .
• A single power window is inoperative — RF, Expedition	• Circuitry • Master window control switch • RF window control switch • RF power window motor	• Go To Pinpoint Test D .
• A single power window is inoperative — RF, Navigator	• Circuitry • RF window control switch • RF power window motor	• Go To Pinpoint Test E .

• A single power window is inoperative — LR or RR, Expedition	• Circuitry • Master window control switch • LR window control switch • LR power window motor • RR window control switch • RR power window motor	• Go To Pinpoint Test F .
• A single power window is inoperative — LR or RR, Navigator	• Circuitry • Master window control switch • LR window control switch • LR power window motor • RR window control switch • RR power window motor	• Go To Pinpoint Test G .
• The one-touch down feature is inoperative — Expedition	• Master window control switch	• INSTALL a new master window control switch. REFER to Window Control Switch in this section.
• The one-touch up/down feature is inoperative — Navigator	• LF or RF power window motor • Circuitry • LF or RF power window motor is not initialized • Power (B+) was lost while LF or RF window was moving	• For LF window, Go To Pinpoint Test H . • For RF window, Go To Pinpoint Test I .
• The left or right power window is inoperative — Rear vent window	• Fuse • Relay • Power vent window motor • Power vent window switch • Circuitry	• Go To Pinpoint Test J .
• The defrost system is inoperative	• Fuse(s) • Circuitry • Rear window defrost switch • Rear window defrost relay	• Go To Pinpoint Test K .
• The defrost system will not shut off automatically	• Circuitry • Rear window defrost switch • Rear window defrost relay	• Go To Pinpoint Test L .
• The delayed accessory is inoperative	• Circuit breaker • Fuse • SJB • Circuitry • Delayed accessory relay	• Go To Pinpoint Test M .

• The delayed accessory does not turn off	• SJB • Circuitry • Delayed accessory relay	• Go To Pinpoint Test N .

Pinpoint Tests

Pinpoint Test A: All Power Windows are Inoperative — Expedition

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

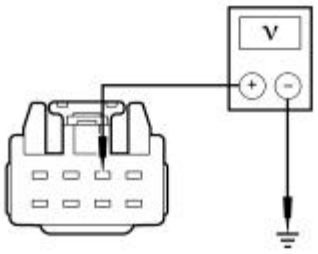
Power is sent to the master window control switch through circuit CBP47 (GN/BU) from the accessory delay relay. The master window control switch is grounded through circuit GD143 (BK/VT).

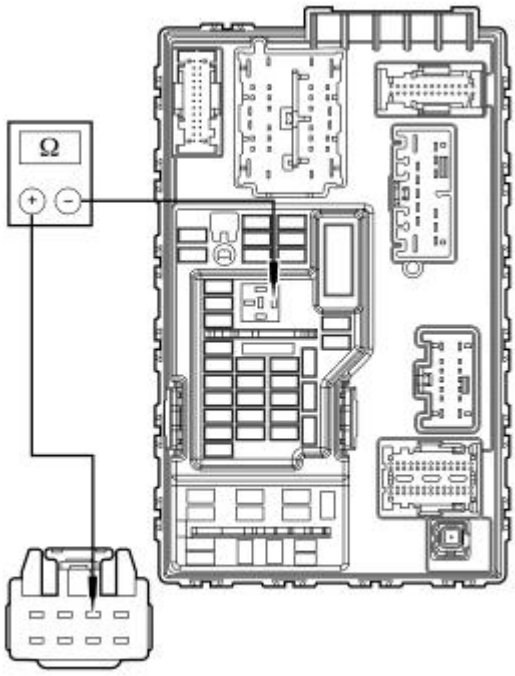
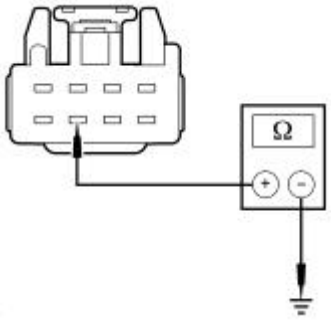
Possible Causes

- Circuit breaker
- Open in circuit CBP47 (GN/BU) or GD143 (BK/VT)
- Window control switch

CAUTION: Be careful when probing the SJB, battery junction box or any connectors. Damage will result to the connector receptacle if the probe being used is too large.

PINPOINT TEST A: ALL POWER WINDOWS ARE INOPERATIVE — EXPEDITION

Test Step	Result / Action to Take
A1 CHECK CIRCUIT CBP47 (GN/BU) FOR VOLTAGE	**Yes** GO to A3 . **No** GO to A2 .
• Disconnect: Master Window Control Switch C504A. • Key in ON position. • Measure the voltage between master window control switch C504A-2, circuit CBP47 (GN/BU) and ground.  N0054111 • **Is the voltage greater than 10 volts?**	
A2 CHECK CIRCUIT CBP47 (GN/BU) FOR AN OPEN	**Yes** Go To Pinpoint Test M to diagnose the accessory delay relay system.
• Key in OFF position. • Disconnect: Accessory Delay Relay. • Measure the resistance between master window control switch C504A-2, circuit CBP47 (GN/BU) and accessory delay relay socket pin 87.	

 N0054112 • **Is the resistance less than 5 ohms?**	**No** VERIFY the smart junction box (SJB) circuit breaker 47 (30A) is OK. If OK, REPAIR circuit CBP47 (GN/BU) for an open. TEST the system for normal operation.
A3 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: Master Window Control Switch C504B. • Measure the resistance between master window control switch C504B-7, circuit GD143 (BK/VT) and ground.  N0054113 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new master window control switch. REFER to Window Control Switch in this section. **No** REPAIR circuit GD143 (BK/VT) for an open. TEST the system for normal operation.

Pinpoint Test B: A Single Power Window is Inoperative — LF, Expedition

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

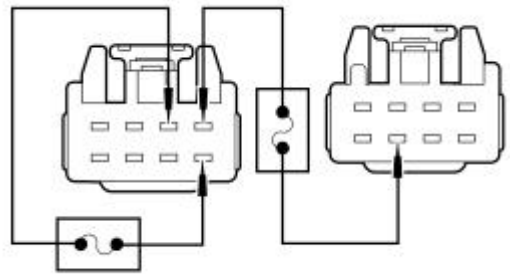
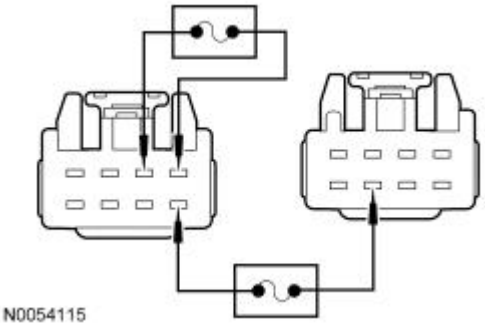
Normal Operation

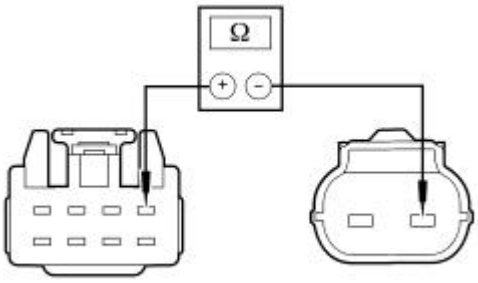
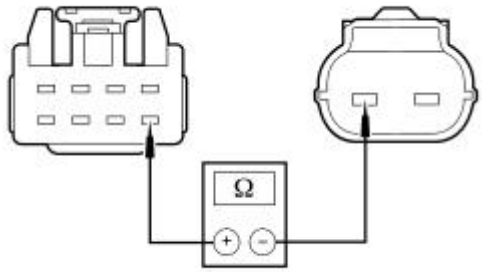
Under normal operation, the master window control switch provides power to the power window motor through circuit CPW10 (YE/VT) and ground through circuit CPW11 (BU/GY) to operate the driver window down, and power through circuit CPW11 (BU/GY) and ground through circuit CPW10 (YE/VT) to operate the driver window up.

Possible Causes

- Open in circuit CPW10 (YE/VT) or CPW11 (BU/GY)
- Window control switch
- Front door window regulator motor

PINPOINT TEST B: A SINGLE POWER WINDOW IS INOPERATIVE — LF, EXPEDITION

Test Step	Result / Action to Take
B1 CHECK THE POWER WINDOW SWITCH	
• Key in ON position. • Disconnect: Master Window Control Switch C504A and C504B. • Connect a fused jumper wire between C504B-7, circuit GD143 (BK/VT) and C504A-1, circuit CPW10 (YE/VT) and connect a second fused jumper wire between C504A-2, circuit CBP47 (GN/BU) and C504A-5, circuit CPW11 (BU/GY). The window should operate in the up direction.  N0054114 • Connect a fused jumper wire between C504B-7, circuit GD143 (BK/VT) and C504A-5, circuit CPW11 (BU/GY) and connect a second fused jumper wire between C504A-2, circuit CBP47 (GN/BU) and C504A-1, circuit CPW10 (YE/VT). The window should operate in the down direction.  N0054115 • **Does the window operate correctly?**	**Yes** INSTALL a new master window control switch. REFER to Window Control Switch in this section. **No** GO to B2.
B2 CHECK CIRCUIT CPW10 (YE/VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: LF Power Window Motor C518. • Measure the resistance between power window motor C518-1, circuit CPW10 (YE/VT) harness side, and master window control switch C504A-1, circuit CPW10 (YE/VT) harness side.	**Yes** GO to B3. **No** REPAIR circuit CPW10 (YE/VT) for an open. TEST the system for normal operation.

 N0054116 • **Is the resistance less than 5 ohms?**	
B3 CHECK CIRCUIT CPW11 (BU/GY) FOR AN OPEN • Measure the resistance between LF power window motor C518-2, circuit CPW11 (BU/GY) harness side, and master window control switch C504A-5, circuit CPW11 (BU/GY) harness side.  N0054117 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LF window regulator motor. REFER to Window Regulator Motor — Front Door . TEST the system for normal operation. **No** REPAIR the circuit CPW11 (BU/GY) for an open. TEST the system for normal operation.

Pinpoint Test C: A Single Power Window is Inoperative — LF, Navigator

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LF power window motor microprocessor receives power at all times through circuit SBP01 (RD) and from the accessory delay relay through circuit CBP41 (BU). Ground is provided at all times through circuit GD143 (BK/VT). The master window control switch provides voltage input to the power window motor microprocessor through circuit CPW10 (YE/VT) to operate the driver window down, and voltage input through circuit CPW11 (BU/GY) to operate the driver window up.

Possible Causes

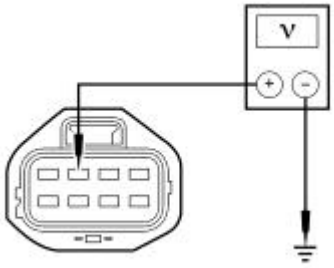
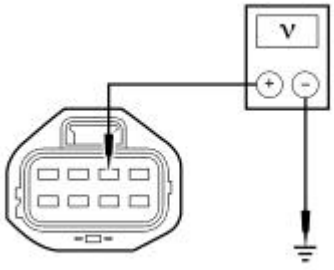
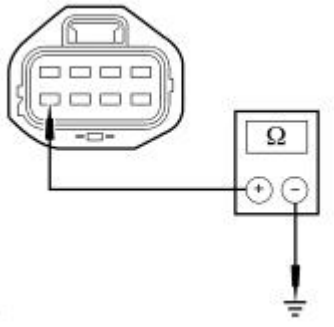
- Fuse(s)
- Open in circuit SBP01 (RD), CPB41 (BU), CPW11 (BU/GY), CPW10 (YE/VT), CPW29 (VT/GY) or GD143 (BK/VT)
- Window control switch
- Front door window regulator motor

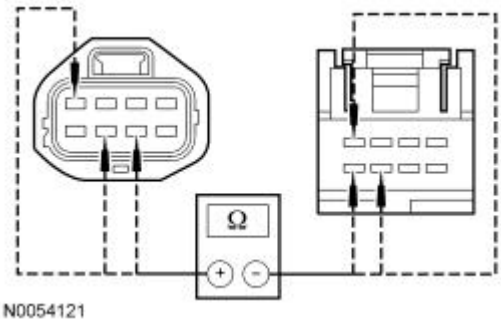
PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE — LF, NAVIGATOR

NOTE: The LF power window motor is not on the multiplex link.

NOTE: A new LF power window motor will be in proportional up/down mode until initialized. Refer to Window Motor Initialization in this section.

NOTE: The LF power window motor must be reinitialized whenever: the motor is removed from the window regulator drum housing, a new motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and any operation in which grease or lubricants are applied to the window system.

Test Step	Result / Action to Take
C1 CHECK THE POWER TO THE WINDOW MOTOR • Key in OFF position. • Disconnect: LF Window Power Window Motor C540. • Measure the voltage between LF power window motor C540-3, circuit SBP01 (RD) harness side and ground.  N0054118 • **Is the voltage greater than 10 volts?**	**Yes** GO to C2 . **No** VERIFY the SJB fuse 1 (30A) is OK. If OK, REPAIR circuit SBP01 (RD) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
C2 CHECK THE LF WINDOW MOTOR DELAYED ACCESSORY FEED • Key in ON position. • Measure the voltage between LF power window motor C540-2, circuit CBP41 (BU) harness side and ground.  N0054119 • **Is the voltage greater than 10 volts?**	**Yes** GO to C3 . **No** VERIFY SJB fuse 41 (15A) is OK. If OK, REPAIR circuit CPB41 (BU) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
C3 CHECK THE LF MOTOR GROUND • Key in OFF position. • Open the front door to disable delayed accessory power. • Measure the resistance between LF power window motor C540-8, circuit GD143 (BK/VT) harness side and ground.  N0057830 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR circuit GD143 (BK/VT) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.

C4 CHECK THE FRONT WINDOW SWITCH TO LF MOTOR FEEDS	
• Disconnect: Master Window Control Switch C535A. • Measure the resistance between LF power window motor C540-7, circuit CPW11 (BU/GY) and master window control switch C535A-4, circuit CPW11 (BU/GY); C540-4, circuit CPW10 (YE/VT) and C535A-7, circuit CPW10 (YE/VT); C540-6, circuit CPW29 (VT/GY) and C535A-8, circuit CPW29 (VT/GY) harness side.  N0054121 • **Are the resistances less than 5 ohms?**	**Yes** GO to C5 . **No** REPAIR circuit CPW11 (BU/GY), circuit CPW10 (YE/VT) or circuit CPW29 (VT/GY) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
C5 CHECK THE MASTER WINDOW CONTROL SWITCH	
• Carry out the window control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the window control switch pass the component test?**	**Yes** INSTALL a new LF power window motor. REFER to Window Regulator Motor — Front Door in this section. REINITIALIZE the LF door window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation. **No** INSTALL a new master window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.

Pinpoint Test D: A Single Power Window is Inoperative — RF, Expedition

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

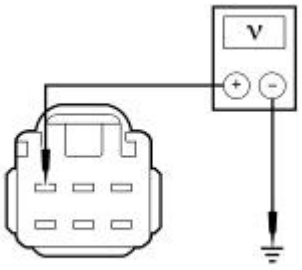
Under normal operation, the RF window control switch receives power from the master window control switch through circuit CPW30 (GY/YE). The RF window control switch provides power to the power window motor through circuit CPW20 (WH/OG) and ground through circuit CPW19 (VT) to operate the passenger front window up, and power through circuit CPW19 (VT) and ground through circuit CPW20 (WH/OG) to operate the passenger front window down.

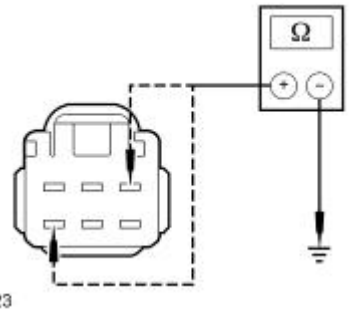
When operating the passenger front window using the master window control switch, power is sent to the RF window control switch through circuit CPW12 (GN/OG) and ground through circuit CPW13 (BN/YE) to operate the passenger front window up, and power through circuit CPW13 (BN/YE) and ground through circuit CPW12 (GN/OG) to operate the passenger front window down.

Possible Causes

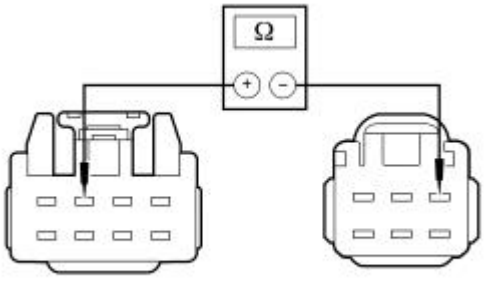
- Open in circuit CPW30 (GY/YE), CPW19 (VT) or CPW20 (WH/OG)
- Open or short to ground in circuit CPW13 (BN/YE) or CPW12 (GN/OG)
- Window control switch
- Front door window regulator motor

PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE — RF, EXPEDITION

Test Step	Result / Action to Take
D1 CHECK THE VOLTAGE TO THE PASSENGER WINDOW REGULATOR CONTROL SWITCH	
• Disconnect: RF Window Control Switch C624. • Key in ON position. • **NOTE:** Set the window lock switch to the UNLOCK position. • Measure the voltage between RF window control switch C624-3, circuit CPW30 (GY/YE) and ground.  N0054122 • **Is the voltage greater than 10 volts?**	**Yes** GO to D2 . **No** REPAIR circuit CPW30 (GY/YE) for an open. TEST the system for normal operation.
D2 CHECK CIRCUITS CPW13 (BN/YE) AND CPW12 (GN/OG) FOR CONTINUITY TO GROUND	

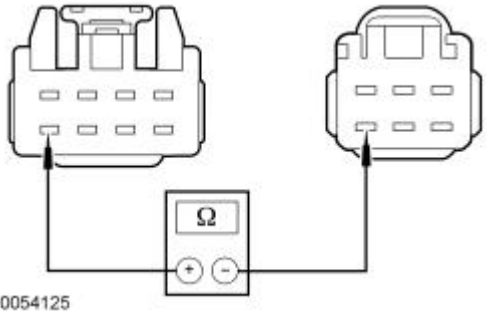
• Key in OFF position.
• Measure the resistance between ground and RF window control switch C624:
  ▪ pin 1, circuit CPW13 (BN/YE).
  ▪ pin 6, circuit CPW12 (GN/OG).
 
 	
N0054123
• **Are the resistances less than 5 ohms?**
	Yes
	GO to D4 .
	
	No
	GO to D3 .

D3 CHECK CIRCUITS CPW13 (BN/YE) AND CPW12 (GN/OG) FOR AN OPEN	
• Disconnect: Master Window Control Switch C504A. • Measure the resistance between master window control switch C504A-3, circuit CPW13 (BN/YE) and RF window control switch C624-1, circuit CPW13 (BN/YE) harness side.	**Yes** INSTALL a new master window control switch.



N0054124

- Measure the resistance between master window control switch C504A-8, circuit CPW12 (GN/OG) and RF window control switch C624-6, circuit CPW12 (GN/OG) harness side.



N0054125

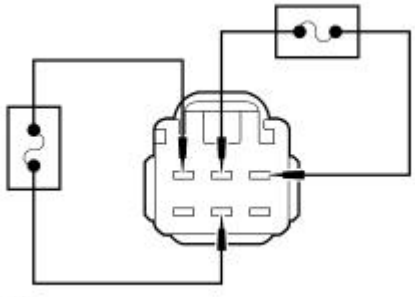
- **Is the resistance less than 5 ohms?**

REFER to Window Control Switch . TEST the system for normal operation.

No
REPAIR circuit CPW13 (BN/YE) or CPW12 (GN/OG) for an open. TEST the system for normal operation.

D4 CHECK THE RF POWER WINDOW SWITCH

- Key in ON position.
- Connect a fused jumper wire between C624-1, circuit CPW13 (BN/YE) and C624-2, circuit CPW19 (VT) and connect a second fused jumper wire between C624-3, circuit CPW30 (GY/YE) and C624-5, circuit CPW20 (WH/OG). The window should operate in the up direction.

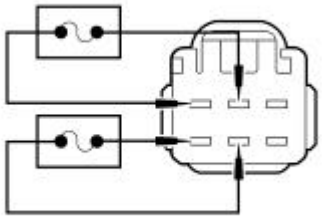


N0054126

- Connect a fused jumper wire between C624-6, circuit CPW12 (GN/OG) and C624-5, circuit CPW20 (WH/OG) and connect a second fused jumper wire between C624-3, circuit CPW30 (GY/YE) and C624-2, circuit CPW19 (VT). The window should operate in the down direction.

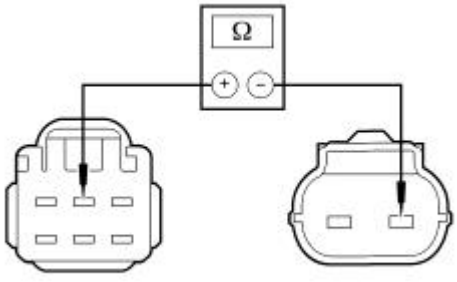
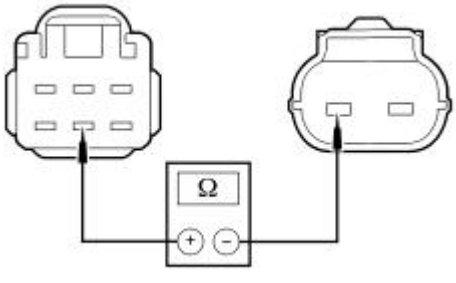
Yes
INSTALL a new RF window regulator control switch. REFER to Window Control Switch . TEST the system for normal operation.

No
GO to D5 .



N0054127

- **Does the window operate correctly?**

D5 CHECK CIRCUITS CPW19 (VT) AND CPW20 (WH/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: RF Window Motor C608. • Measure the resistance between RF window control switch C624-2, circuit CPW19 (VT) harness side, and between and RF window motor C608-1, circuit CPW19 (VT) harness side.  N0054128 • Measure the resistance between RF window control switch C624-5, circuit CPW20 (WH/OG) harness side, and between and RF window motor C608-2, circuit CPW20 (WH/OG) harness side.  N0054129 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new RF window regulator motor. REFER to Window Regulator Motor — Front Door . TEST the system for normal operation. **No** REPAIR circuit CPW19 (VT) or CPW20 (WH/OG) for an open. TEST the system for normal operation.

Pinpoint Test E: A Single Power Window is Inoperative — RF, Navigator

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the RF power window motor microprocessor receives power at all times through circuit SBP04 (GN/RD) and from the accessory delay relay through circuit CBP41 (BU). Ground is provided at all times through circuit GD138 (BK/WH). The master window control switch or passenger window control switch provides a voltage input to the power window motor microprocessor through circuit CPW19 (VT) to operate the RF window down, and voltage input through circuit CPW20 (WH/OG) to operate the RF window up.

Possible Causes

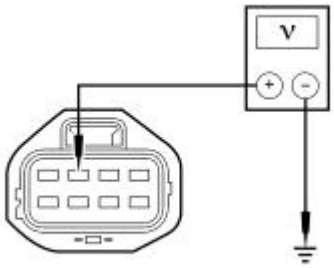
- Fuse(s)
- Open in circuit SBP04 (GN/RD), CPB41 (BU), CPW20 (WH/OG), CPW19 (VT), CPW31 (GN/WH) or GD138 (BK/WH)
- Window control switch
- Front door window regulator motor

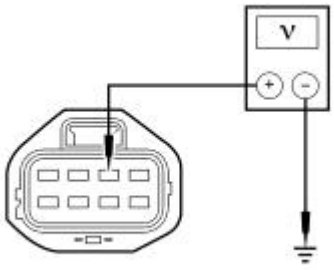
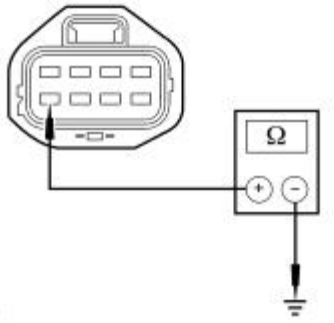
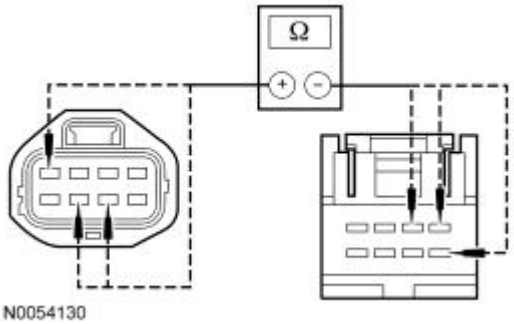
PINPOINT TEST E: A SINGLE POWER WINDOW IS INOPERATIVE — RF, NAVIGATOR

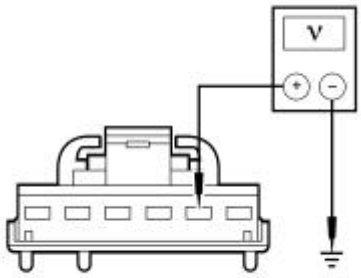
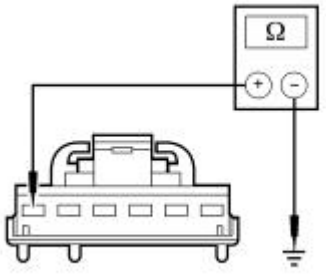
NOTE: The RF power window motor is not on the multiplex link.

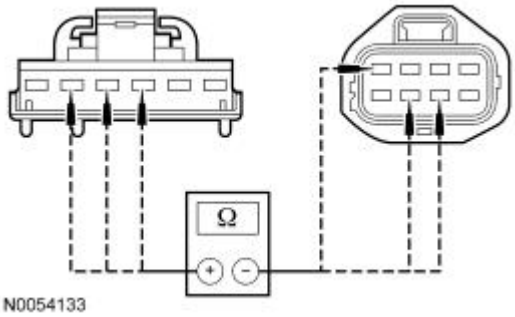
NOTE: A new RF power window motor will be in proportional up/down mode until initialized. Refer to Window Motor Initialization in this section.

NOTE: The RF power window motor must be reinitialized whenever: the motor is removed from the window regulator drum housing, a new motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and any operation in which grease or lubricants are applied to the window system.

Test Step	Result / Action to Take
E1 CHECK THE MASTER WINDOW CONTROL SWITCH OPERATION	
• Attempt to operate the RH window using the master window control switch. • **Does the RH window operate when using the master window control switch?**	**Yes** GO to E7. **No** GO to E2.
E2 CHECK THE POWER TO THE WINDOW MOTOR	
• Key in OFF position. • Disconnect: RF Window Power Window Motor C646. • Measure the voltage between RF power window motor C646-3, circuit SBP04 (GN/RD) harness side and ground.  N0054118 • **Is the voltage greater than 10 volts?**	**Yes** GO to E3. **No** VERIFY the SJB fuse 4 (30A) is OK. If OK, REPAIR circuit SBP04 (GN/RD) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E3 CHECK THE RF WINDOW MOTOR DELAYED ACCESSORY FEED	
• Key in ON position. • Measure the voltage between RF power window motor C646-2, circuit CBP41 (BU) harness side and ground.	**Yes** GO to E4. **No** VERIFY SJB fuse 41 (15A) is OK. If OK, REPAIR circuit CBP41 (BU) for an open. REINITIALIZE the RF power window motor.

 N0054119 • **Is the voltage greater than 10 volts?**	REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E4 CHECK THE RF MOTOR GROUNDS	
• Key in OFF position. • Open the front door to disable delayed accessory power. • Measure the resistance between RF power window motor C646-8, circuit GD138 (BK/WH) harness side and ground.  N0057830 • **Is the resistance less than 5 ohms?**	**Yes** GO to E5 . **No** REPAIR circuit GD138 (BK/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E5 CHECK THE FRONT WINDOW SWITCH TO RF MOTOR FEEDS	
• Disconnect: Master Window Control Switch C535A. • Measure the resistance between RF power window motor C646-7, circuit CPW20 (WH/OG) and master window control switch C535A-5, circuit CPW20 (WH/OG); C646-4, circuit CPW19 (VT) and C535A-2, circuit CPW19 (VT); C646-6, circuit CPW31 (GN/WH) and C535A-1, circuit CPW31 (GN/WH) harness side.  N0054130 • **Are the resistances less than 5 ohms?**	**Yes** GO to E6 . **No** REPAIR circuit CPW20 (WH/OG), circuit CPW19 (VT) or circuit CPW31 (GN/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E6 CHECK THE MASTER WINDOW CONTROL SWITCH	
• Carry out the window control switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the window control switch pass the component test?**	**Yes** INSTALL a new RF power window motor. REFER to Window Regulator Motor — Front Door in this section. REINITIALIZE the RF door window motor. REFER to

	Window Motor Initialization in this section. TEST the system for normal operation. **No** INSTALL a new master window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.
E7 CHECK CIRCUIT CBP41 (BU) FOR AN OPEN • Disconnect: Passenger Window Control Switch C647. • Key in ON position. • Measure the voltage between passenger window control switch C647-2, circuit CBP41 (BU) harness side and ground.  N0054131 • **Is the voltage greater than 10 volts?**	**Yes** GO to E8 . **No** REPAIR circuit CBP41 (BU) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E8 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN • Key in OFF position. • Measure the resistance between passenger front window control switch C647-6, circuit GD138 (BK/WH) harness side and ground.  N0054132 • **Is the resistance less than 5 ohms?**	**Yes** GO to E9 . **No** REPAIR circuit GD138 (BK/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
E9 CHECK THE FRONT WINDOW SWITCH TO RF MOTOR FEEDS • Measure the resistance between RF power window motor C646-7, circuit CPW20 (WH/OG) and passenger window control switch C647-3, circuit CPW20 (WH/OG); C646-4, circuit CPW19 (VT) and C647-5, circuit CPW19 (VT); C646-6, circuit CPW31 (GN/WH) and C647-4, circuit CPW31 (GN/WH) harness side.	**Yes** INSTALL a new passenger window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPW20 (WH/OG), circuit CPW19

 • **Are the resistances less than 5 ohms?**	(VT) or circuit CPW31 (GN/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test F: A Single Power Window is Inoperative — LR or RR, Expedition

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LR and RR window control switch receive power from the master window control switch through circuit CPW30 (GY/YE). The LR window control switch provides power to the LR power window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT) to operate the LR window down and power through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN) to operate the LR window up. The RR window control switch provides power to the RR power window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT) to operate the RR window down and power through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY) to operate the RR window up.

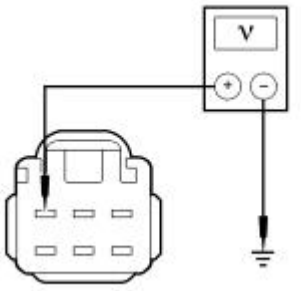
When operating the LR window using the master window control switch, power is sent to the LR window control switch through circuit CPW15 (YE) and ground through circuit CPW16 (BU/OG) to operate the LR window down and power through circuit CPW16 (BU/OG) and ground through circuit CPW15 (YE) to operate the LR window up. When operating the RR window using the master window control switch, power is sent to the RR window control switch through circuit CPW17 (BN/GN) and ground through circuit CPW18 (GY/VT) to operate the RR window down and power through circuit CPW18 (GY/VT) and ground through circuit CPW17 (BN/GN) to operate the RR window up.

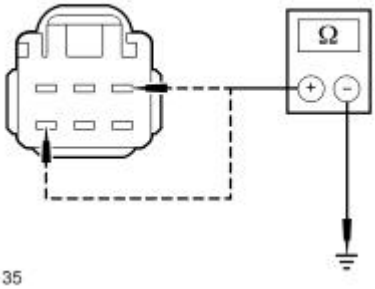
Possible Causes

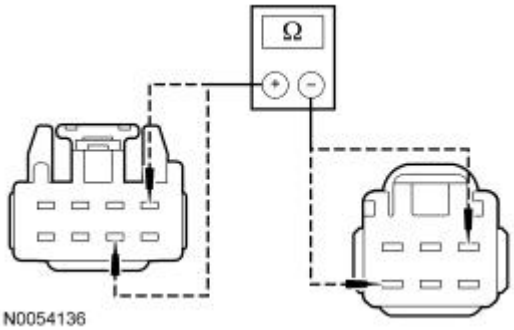
- Window control switch
- Open in circuit CPW30 (GY/YE), CPW21 (BN), CPW22 (GN/VT), CPW23 (GY), CPW24 (WH/VT), CPW15 (YE), CPW16 (BU/OG), CPW17 (BN/GN) or CPW18 (GY/VT)
- Rear door window regulator motor

PINPOINT TEST F: A SINGLE POWER WINDOW IS INOPERATIVE — LR OR RR, EXPEDITION

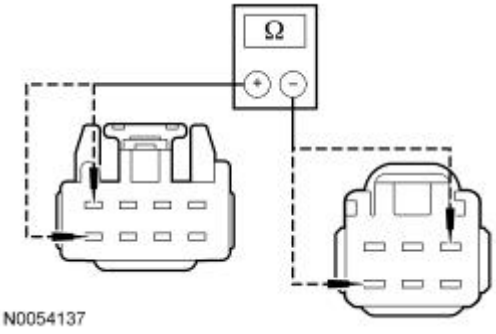
Test Step	Result / Action to Take
F1 CHECK THE VOLTAGE TO THE LR OR RR WINDOW CONTROL SWITCH	
• Disconnect: Inoperative Rear Window Control Switch C701 (LR) or C801 (RR). • Key in ON position. • **NOTE:** Set the window lock switch to the UNLOCK position. • Measure the voltage between the inoperative rear window switch C701-3 or C801-3, circuit CPW30 (GY/YE) harness side and ground.	**Yes** GO to F2 . **No** REPAIR circuit CPW30 (GY/YE) for an open. TEST the

 N0054134 • **Is the voltage greater than 10 volts?**	system for normal operation.
F2 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH	

• Key in OFF position.
• Measure the resistance between the inoperative rear window switch connector and ground.
  ▪ For an inoperative LR window, measure the resistance between LR window switch C701-1, circuit CPW15 (YE), harness side and ground; and between C701-6, circuit CPW16 (BU/OG), harness side and ground.
  ▪ For an inoperative RR window, measure the resistance between RR window switch C801-1, circuit CPW17 (BN/GN), harness side and ground; and between C801-6, circuit CPW18 (GY/VT), harness side and ground.
 
N0054135
• **Are the resistances less than 5 ohms?**
	Yes
	GO to F4 .
	
	No
	GO to F3 .

F3 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN	
• Key in OFF position. • Disconnect: Master Window Control Switch C504B. • For an inoperative LR window, measure the resistance between master window control switch C504B-1, circuit CPW15 (YE) and LR window control switch C701-1, circuit CPW15 (YE); and between master window control switch C504B-6, circuit CPW16 (BU/OG) and LR window control switch C701-6, circuit CPW16 (BU/OG).  N0054136 • For an inoperative RR window, measure the resistance between	**Yes** INSTALL a new master window control switch. REFER to Window Control Switch . TEST the system for normal operation. **No** REPAIR circuit CPW15 (YE), CPW16 (BU/OG), CPW17 (BN/GN) or CPW18 (GY/VT) for an open. TEST the system for normal operation.

master window control switch C504B-4, circuit CPW17 (BN/GN) and RR window control switch C801-1, circuit CPW17 (BN/GN); and between master window control switch C504B-8, circuit CPW18 (GY/VT) and RR window control switch C801-6, circuit CPW18 (GY/VT).

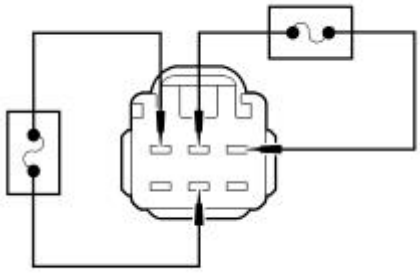


N0054137

- **Are the resistances less than 5 ohms?**

F4 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH

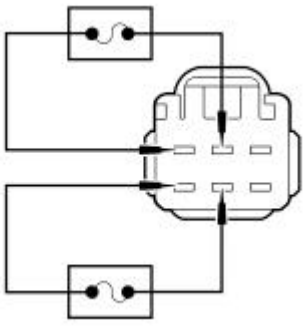
- Connect: Master Window Control Switch C504B.
- Key in ON position.
- Connect fused jumper wires between the inoperative power window switch as shown.
  - For an inoperative LR window, connect a fused jumper wire between LR window control switch C701-5, circuit CPW22 (GN/VT) and C701-3, circuit CPW30 (YE) and connect a second fused jumper wire between C701-2, circuit CPW21 (BN) and C701-1, circuit CPW15 (YE). The window should operate in the up direction.
  - For an inoperative RR window, connect a fused jumper wire between RR window control switch C801-5, circuit CPW24 (WH/VT) and C801-3, circuit CPW30 (YE) and connect a second fused jumper wire between C801-2, circuit CPW23 (GY) and C801-1, circuit CPW17 (BN/GN). The window should operate in the up direction.


N0054138

- Connect fused jumper wires between the inoperative power window switch as shown.
  - For an inoperative LR window, connect a fused jumper wire between LR window control switch C701-5, circuit CPW22 (GN/VT) and C701-6, circuit CPW16 (BU/OG) and connect a second fused jumper wire between C701-2, circuit CPW21 (BN) and C701-3, circuit CPW30 (GY/YE). The window should operate in the down direction.
  - For an inoperative RR window, connect a fused jumper wire between RR window control switch C801-5, circuit CPW24 (WH/VT) and C801-6, circuit CPW18 (GY/VT) and connect a second fused jumper wire between C801-2, circuit CPW23 (GY) and C801-3, circuit CPW30 (GY/YE). The window should operate in the down direction.

Yes
INSTALL a new rear window control switch. REFER to Window Control Switch . TEST the system for normal operation.

No
GO to F5 .



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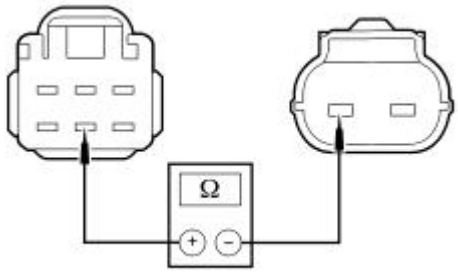
- **Does the window operate correctly?**

F5 CHECK POWER WINDOW MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Inoperative Power Window Motor C703 (LR) or C803 (RR).
- Measure the resistance between inoperative window control switch and the inoperative window motor.
  - For an inoperative LR window, measure the resistance between LR window control switch C701-5, circuit CPW22 (GN/VT), harness side and LR power window motor C703-2, circuit CPW22 (GN/VT) harness side.
  - For an inoperative RR window, measure the resistance between RR window control switch C801-5, circuit CPW24 (WH/VT), harness side and RR power window motor C803-2, circuit CPW24 (WH/VT) harness side.



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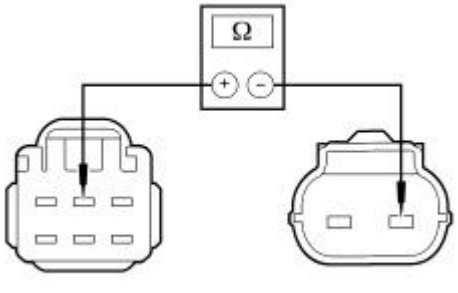
- Measure the resistance between inoperative window control switch and the inoperative window motor.
  - For an inoperative LR window, measure the resistance between LR window control switch C701-2, circuit CPW21 (BN), harness side and LR power window motor C703-1, circuit CPW21 (BN) harness side.
  - For an inoperative RR window, measure the resistance between RR window control switch C801-2, circuit CPW23 (GY), harness side and RR power window motor C803-1, circuit CPW23 (GY) harness side.



N0054141

Yes
INSTALL a new rear window regulator motor. REFER to Window Regulator Motor — Rear Door . TEST the system for normal operation.

No
REPAIR the circuit (s) for an open. TEST the system for normal operation.

• **Are the resistances less than 5 ohms?**	

Pinpoint Test G: A Single Power Window is Inoperative — LR or RR, Navigator

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

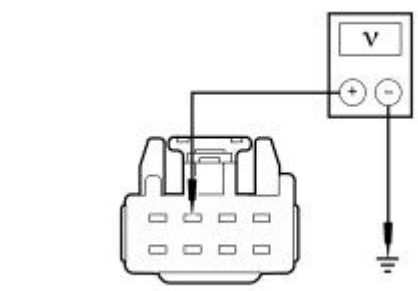
Under normal operation, the master window control switch receives power for the LR and RR window circuits through circuit CBP47 (GN/BU). The LR and RR window control switch receive power from the master window control switch through circuit CPW30 (GY/YE). The LR window control switch provides power to the LR power window motor through circuit CPW21 (BN) and ground through circuit CPW22 (CN/VT) to operate the LR window down, and power through circuit CPW22 (CN/VT) and ground through circuit CPW21 (BN) to operate the LR window up. The RR window control switch provides power to the RR power window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT) to operate the RR window down, and power through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY) to operate the RR window up.

When operating the LR window using the master window control switch, power is sent to the LR window control switch through circuit CPW15 (YE) and ground through circuit CPW16 (BU/OG) to operate the LR window down, and power through circuit CPW16 (BU/OG) and ground through circuit CPW15 (YE) to operate the LR window up. When operating the RR window using the master window control switch, power is sent to the RR window control switch through circuit CPW17 (BN/GN) and ground through circuit CPW18 (GY/VT) to operate the RR window down, and power through circuit CPW18 (GY/VT) and ground through circuit CPW17 (BN/GN) to operate the RR window up.

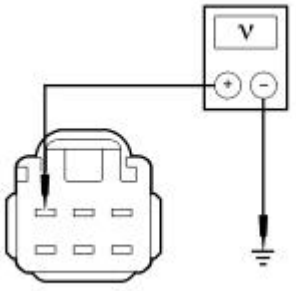
Possible Causes

- Fuse
- Window control switch
- Open in circuit CBP47 (GN/BU), CPW30 (GY/YE), CPW15 (YE), CPW16 (BU/OG), CPW17 (BN/GN), CPW18 (GY/VT), CPW21 (BN), CPW22 (CN/VT), CPW23 (GY) or CPW24 (WH/VT)
- Rear door window regulator motor

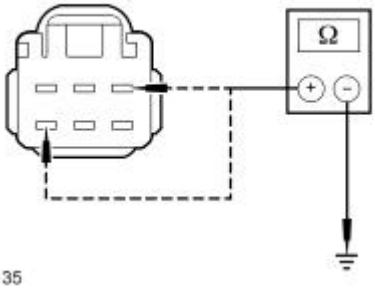
PINPOINT TEST G: A SINGLE POWER WINDOW IS INOPERATIVE — LR OR RR, NAVIGATOR

Test Step	Result / Action to Take
G1 CHECK CIRCUIT CBP47 (GN/BU) FOR VOLTAGE	
• Disconnect: Master Window Control Switch C504B. • Key in ON position. • Measure the voltage between master window control switch C504B-3, circuit CBP47 (GN/BU) and ground.  N0054142 • **Is the voltage greater than 10 volts?**	**Yes** GO to G2 . **No** VERIFY the smart junction box (SJB) circuit breaker 47 (30A) is OK. If OK, REPAIR circuit CBP47 (GN/BU) for an open. TEST the system for normal operation.

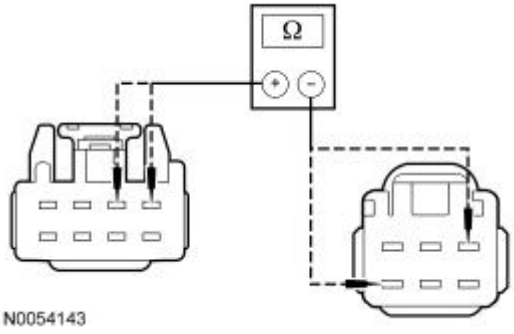
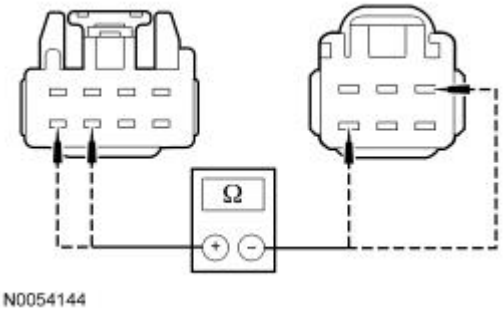
G2 CHECK THE VOLTAGE TO THE LR OR RR WINDOW CONTROL SWITCH	

• Connect: Master Window Control Switch C504B.
• Disconnect: Inoperative Rear Window Control Switch C717 (LR) or C819 (RR).
• Key in ON position.
• **NOTE:** Set the window lock switch to the UNLOCK position.
• Measure the voltage between the inoperative rear window control switch connector and ground.
  ▪ For an inoperative LR window, measure the voltage between LR window control switch C717-3, circuit CPW30 (GY/YE), harness side and ground.
  ▪ For an inoperative RR window, measure the voltage between RR window control switch C819-3, circuit CPW30 (GY/YE), harness side and ground.
 
N0054134
• **Is the voltage greater than 10 volts?**
	Yes
	GO to G3 .
	
	No
	REPAIR circuit CPW30 (GY/YE) for an open. TEST the system for normal operation.

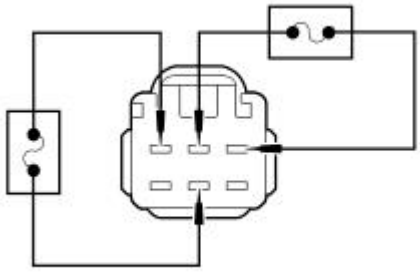
G3 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH	

• Key in OFF position.
• Measure the resistance between the inoperative window control switch and ground.
  ▪ For an inoperative LR window, measure the resistance between LR window control switch C717-1, circuit CPW15 (YE), harness side and ground; and between C717-6, circuit CPW16 (BU/OG), harness side and ground.
  ▪ For an inoperative RR window, measure the resistance between RR window control switch C819-1, circuit CPW15 (YE), harness side and ground; and between C819-6, circuit CPW16 (BU/OG), harness side and ground.
 
N0054135
• **Are the resistances less than 5 ohms?**
	Yes
	GO to G5 .
	
	No
	GO to G4 .

G4 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN	
• Key in OFF position. • Disconnect: Master Window Control Switch C535B. • For an inoperative LR window, measure the resistance between	**Yes** INSTALL a new master window

master window control switch C535B-1, circuit CPW15 (YE), harness side and LR window control switch C717-1, circuit CPW15 (YE) harness side; and between master window control switch C535B-2, circuit CPW16 (BU/OG), harness side and LR window control switch C717-6, circuit CPW16 (BU/OG) harness side.  N0054143 • For an inoperative RR window, measure the resistance between master window control switch C535B-7, circuit CPW17 (BN/GN), harness side and RR window control switch C819-1, circuit CPW17 (BN/GN) harness side; and between master window control switch C535B-8, circuit CPW18 (GY/VT), harness side and RR window control switch C819-6, circuit CPW18 (GY/VT) harness side.  N0054144 • **Are the resistances less than 5 ohms?**	control switch. REFER to Window Control Switch . TEST the system for normal operation. **No** REPAIR the circuit (s) for an open. TEST the system for normal operation.
G5 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH	

• Connect: Master Window Control Switch C535B.
• Key in ON position.
• Connect fused jumper wires between the inoperative power window switch as shown.
  ▪ For an inoperative LR window, connect a fused jumper wire between LR window control switch C717-1, circuit CPW15 (YE) and C717-2, circuit CPW21 (BN) and connect a second fused jumper wire between C717-5, circuit CPW22 (GN/VT) and C717-3, circuit CPW30 (YE). The window should operate in the up direction.
  ▪ For an inoperative RR window, connect a fused jumper wire between RR window control switch C819-1, circuit CPW17 (BN/GN) and C819-2, circuit CPW23 (GY) and connect a second fused jumper wire between C819-5, circuit CPW24 (WH/VT) and C819-3, circuit CPW30 (YE). The window should operate in the up direction.
	Yes
	INSTALL a new rear window regulator control switch.
	REFER to Window Control Switch .
	TEST the system for normal operation.
	
	No
	GO to G6 .



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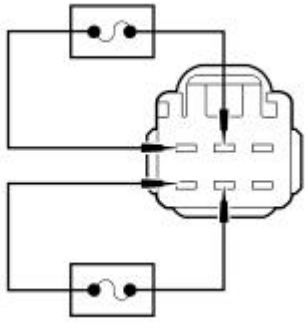
- Connect fused jumper wires between the inoperative power window switch as shown.
  - For an inoperative LR window, connect a fused jumper wire between LR window control switch C717-3, circuit CPW30 (YE) and C717-2, circuit CPW21 (BN) and connect a second fused jumper wire between C717-5, circuit CPW22 (GN/VT) and C717-6, circuit CPW16 (BU/OG). The window should operate in the down direction.
  - For an inoperative RR window, connect a fused jumper wire between RR window control switch C819-3, circuit CPW30 (YE) and C819-2, circuit CPW23 (GY) and connect a second fused jumper wire between C819-5, circuit CPW24 (WH/VT) and C819-6, circuit CPW18 (GY/VT). The window should operate in the down direction.



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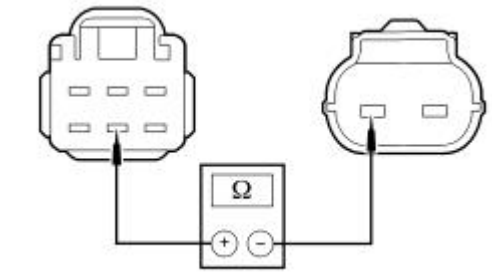
- **Does the window operate correctly?**

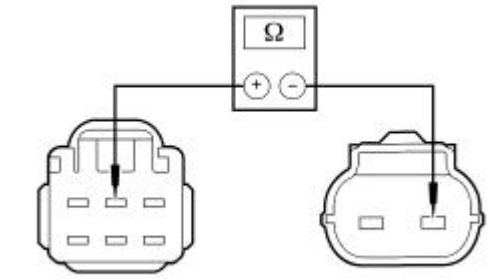
G6 CHECK THE POWER WINDOW MOTOR CIRCUITS	

• Key in OFF position.
• Disconnect: Inoperative Power Window Motor C703 (LR) or C803 (RR).
• Measure the resistance between inoperative window control switch and the inoperative window motor.
  ▪ For an inoperative LR window, measure the resistance between LR window control switch C717-5, circuit CPW22 (GN/VT), harness side and LR power window motor C703-2, circuit CPW22 (GN/VT) harness side.
  ▪ For an inoperative RR window, measure the resistance between RR window control switch C819-5, circuit CPW24 (WH/VT), harness side and RR power window motor C803-2, circuit CPW24 (WH/VT) harness side.
	Yes
	INSTALL a new window motor. REFER to Window Regulator Motor — Front Door . TEST the system for normal operation.
	
	No
	REPAIR circuit CPW21 (BN), CPW22 (GN/VT), CPW23 (GY) or CPW24 (WH/VT) for an open. TEST the system for normal operation.



N0054140

- Measure the resistance between inoperative window control switch and the inoperative window motor.
  - For an inoperative LR window, measure the resistance between LR window control switch C717-2, circuit CPW21 (BN), harness side and LR power window motor C703-1, circuit CPW21 (BN) harness side.
  - For an inoperative RR window, measure the resistance between RR window control switch C819-2, circuit CPW23 (GY), harness side and RR power window motor C803-1, circuit CPW23 (GY) harness side.



N0054141

- **Are the resistances less than 5 ohms?**

Pinpoint Test H: The One-Touch Up/Down Feature is Inoperative — LF, Navigator

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LF power window motor microprocessor receives power at all times through circuit SBP01 (RD) and from the accessory delay relay through circuit CBP41 (BU). Ground is provided at all times through circuit GD143 (BK/VT). The master window control switch provides voltage input to the power window motor microprocessor through circuit CPW10 (YE/VT) to operate the driver window down, and voltage input through circuit CPW11 (BU/GY) to operate the driver window up. To operate the one-touch feature, the master window control switch provides a ground input to the LF power window motor microprocessor through circuit CPW29 (VT/GY) in addition to the up or down request.

Possible Causes

- Fuse(s)
- Open in circuit CPW11 (BU/GY), CPW10 (YE/VT), CPW29 (VT/GY), GD143 (BK/VT), SBP01 (RD) or CPB41 (BU)
- Window control switch

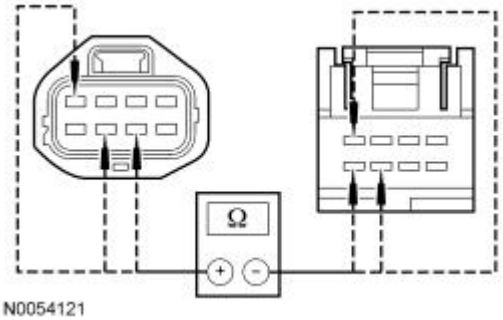
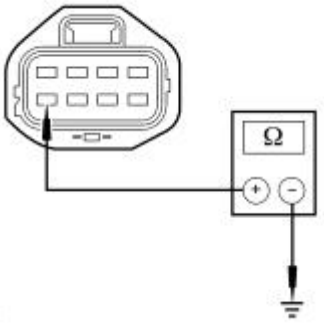
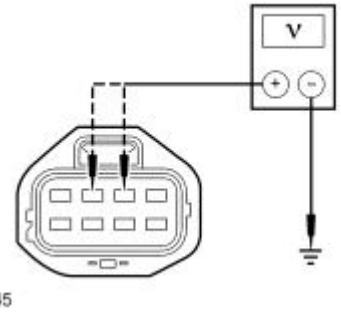
PINPOINT TEST H: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE — LF, NAVIGATOR

NOTE: The LF power window motor is not on the multiplex link.

NOTE: A new LF power window motor will be in proportional up/down mode until initialized. Refer to Window Motor Initialization in this section.

NOTE: The LF power window motor must be reinitialized whenever: the motor is removed from the window regulator drum housing, a new motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and when carrying out any operation in which grease or lubricants are applied to the window system.

Test Step	Result / Action to Take
H1 CHECK FOR POWER (B+) LOSS DURING LF WINDOW OPERATION	
• Verify if power (B+) was lost during LF window operation. • **Was power (B+) lost while LF window was in operation?**	**Yes** LOWER the LF window to the full open position. MAKE SURE the window glass stalls in the full down position for at least a half second. Normal functionality should resume. TEST the system for normal operation. **No** GO to H2.
H2 INITIALIZE THE LF MOTOR	
• Carry out the LF window motor initialization procedure. Refer to Window Motor Initialization in this section. • **Are the one-touch up/down functions operating correctly?**	**Yes** Repair is complete. TEST the system for normal operation. **No** GO to H3.
H3 CHECK THE MASTER WINDOW CONTROL SWITCH	
• Carry out the front window switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the front window switch pass the component test?**	**Yes** GO to H4. **No** INSTALL a new master window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.
H4 CHECK THE FRONT WINDOW SWITCH TO LF MOTOR FEEDS	
• Key in OFF position. • Open the front door to disable delayed accessory power. • Disconnect: Master Power Window Control Switch C535A. • Disconnect: LF Power Window Motor C540. • Measure the resistance between LF power window motor C540-7, circuit CPW11 (BU/GY) and master window control switch C535A-4, circuit CPW11 (BU/GY); C540-4, circuit CPW10 (YE/VT) and C535A-7, circuit CPW10 (YE/VT); C540-6, circuit CPW29 (VT/GY) and C535A-8, circuit CPW29 (VT/GY) harness side.	**Yes** GO to H5. **No** REPAIR circuit CPW11 (BU/GY), circuit CPW10 (YE/VT), circuit CPW29 (VT/GY) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the

 N0054121 • **Are the resistances less than 5 ohms?**	system for normal operation.
H5 CHECK FOR AN INTERMITTENT GROUND CONNECTION	
• Key in OFF position. • Measure the resistance between LF power window motor C540-8, circuit GD143 (BK/VT) harness side and ground.  N0057830 • Wiggle the harness while measuring the resistances. • **Is the resistance less than 5 ohms?**	**Yes** GO to H6 . **No** REPAIR circuit GD143 (BK/VT) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
H6 CHECK FOR INTERMITTENT POWER CONNECTIONS	
• Key in ON position. • Measure the voltage between LF power window motor C540-3, circuit SBP01 (RD) and C540-2, circuit CPB41 (BU) harness side and ground.  N0054145 • Wiggle the harness while measuring the voltages. • **Are the voltages greater than 10 volts?**	**Yes** INSTALL a new LF power window motor. REFER to Window Regulator Motor — Front Door in this section. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation. **No** VERIFY SJB fuse 1 (30A) and fuse 41 (15A) are OK. If OK, REPAIR circuit SBP01 (RD) or circuit CPB41 (BU) for an open. REINITIALIZE the LF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test I: The One-Touch Up/Down Feature is Inoperative — RF, Navigator

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the RF power window motor microprocessor receives power at all times through circuit SBP04 (GN/RD) and from the accessory delay relay through circuit CBP41 (BU). Ground is provided at all times through circuit GD138 (BK/WH). The master window control switch or RF window control switch provides voltage input to the power window motor microprocessor through circuit CPW19 (VT) to operate the RF window down, and voltage input through circuit CPW20 (WH/OG) to operate the RF window up. To operate the one-touch feature, the master window control switch or RF window control switch provides a ground input to the RF power window motor microprocessor through circuit CPW31 (GN/WH) in addition to the up or down request.

Possible Causes

- Fuse(s)
- Open in circuit CPW20 (WH/OG), CPW19 (VT), CPW31 (GN/WH), GD138 (BK/WH), SBP04 (GN/RD) or CBP41 (BU)
- Window control switch

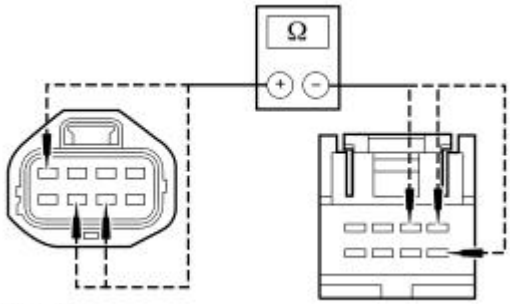
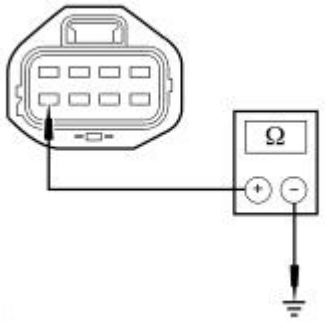
PINPOINT TEST I: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE — RF, NAVIGATOR

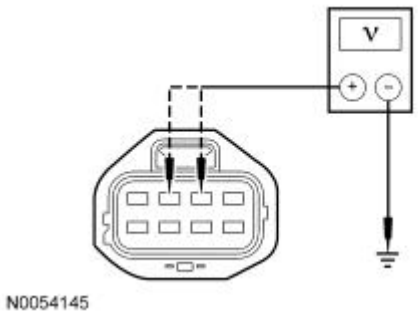
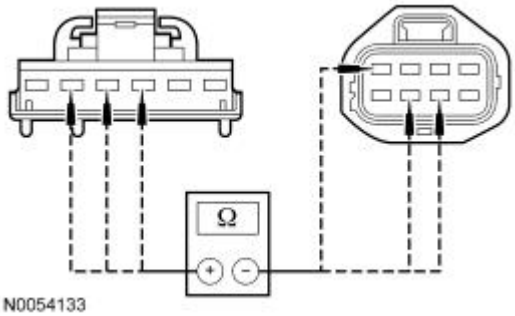
NOTE: The RF power window motor is not on the multiplex link.

NOTE: A new RF power window motor will be in proportional up/down mode until initialized. Refer to Window Motor Initialization in this section.

NOTE: The RF power window motor must be reinitialized whenever: the motor is removed from the window regulator drum housing, a new motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and when carrying out any operation in which grease or lubricants are applied to the window system.

Test Step	Result / Action to Take
I1 CHECK THE MASTER WINDOW CONTROL SWITCH OPERATION	
• Attempt to operate the RH window in one-touch up/down mode using the master window control switch. • **Does the RH window operate in one-touch up/down mode when using the master window control switch?**	**Yes** GO to I8 . **No** GO to I2 .
I2 CHECK FOR POWER (B+) LOSS DURING RF WINDOW OPERATION	
• Verify if power (B+) was lost during RF window operation. • **Was power (B+) lost while RF window was in operation?**	**Yes** LOWER the RF window to the full open position. MAKE SURE the window glass stalls in the full down position for at least a half second. Normal functionality should resume. TEST the system for normal operation. **No** GO to I3 .
I3 INITIALIZE THE RF MOTOR	
• Carry out the RF window motor initialization procedure. Refer to Window Motor Initialization in this section. • **Are the one-touch up/down functions operating**	**Yes** Repair is complete. TEST the system for normal

correctly?	operation. **No** GO to I4 .
I4 CHECK THE MASTER WINDOW CONTROL SWITCH	
• Carry out the front window switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the front window switch pass the component test?**	**Yes** GO to I5 . **No** INSTALL a new master window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.
I5 CHECK THE FRONT WINDOW SWITCH TO RF MOTOR FEEDS	
• Key in OFF position. • Open the front door to disable delayed accessory power. • Disconnect: Power Window Switch C535A. • Disconnect: RF Power Window Motor C646. • Measure the resistance between RF power window motor C646-7, circuit CPW20 (WH/OG) and master window control switch C535A-5, circuit CPW20 (WH/OG); C646-4, circuit CPW19 (VT) and C535A-2, circuit CPW19 (VT); C646-6, circuit CPW31 (GN/WH) and C535A-1, circuit CPW31 (GN/WH) harness side.  N0054130 • **Are the resistances less than 5 ohms?**	**Yes** GO to I6 . **No** REPAIR circuit CPW20 (WH/OG), circuit CPW19 (VT) or circuit CPW31 (GN/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
I6 CHECK FOR AN INTERMITTENT GROUND CONNECTION	
• Key in OFF position. • Measure the resistance between RF power window motor C646-8, circuit GD138 (BK/WH) harness side and ground.  N0057830 • Wiggle the harness while measuring the resistances. • **Is the resistance less than 5 ohms?**	**Yes** GO to I7 . **No** REPAIR circuit GD138 (BK/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization Initialization in this section. TEST the system for normal operation.
I7 CHECK FOR INTERMITTENT POWER CONNECTIONS	
• Key in ON position.	**Yes**

• Measure the voltage between RF power window motor C646-3, circuit SBP04 (GN/RD) and C646-2, circuit CBP41 (BU) harness side and ground.  N0054145 • Wiggle the harness while measuring the voltages. • **Are the voltages greater than 10 volts?**	INSTALL a new RF power window motor. REFER to Window Regulator Motor — Front Door in this section. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation. **No** VERIFY SJB fuse 4 (30A) and fuse 41 (15A) are OK. If OK, REPAIR circuit SBP04 (GN/RD) or circuit CBP41 (BU) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.
I8 CHECK THE FRONT WINDOW SWITCH TO RF MOTOR FEEDS	
• Measure the resistance between RF power window motor C646-7, circuit CPW20 (WH/OG) and passenger window control switch C647-3, circuit CPW20 (WH/OG); C646-4, circuit CPW19 (VT) and C647-5, circuit CPW19 (VT); C646-6, circuit CPW31 (GN/WH) and C647-4, circuit CPW31 (GN/WH) harness side.  N0054133 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new passenger window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPW20 (WH/OG), circuit CPW19 (VT) or circuit CPW31 (GN/WH) for an open. REINITIALIZE the RF power window motor. REFER to Window Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test J: The Left or Right Power Window is Inoperative — Rear Vent Window

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

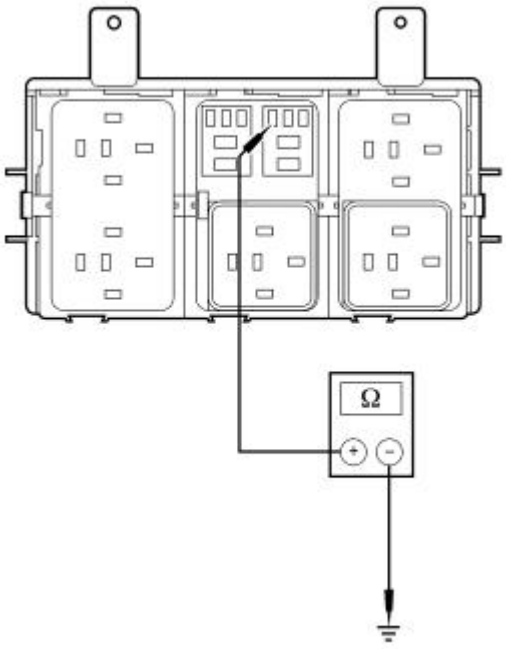
Under normal operation, the quarter window control switch, quarter window close relay and quarter window open relay receive power from the accessory delay relay through circuit CBP41 (BU). Ground is provided to the quarter window close relay and quarter window open relay through circuit GD151 (BK/GN). The quarter window control switch activates the quarter window open relay by supplying a ground input through circuit CPW26 (BU/BN) and activates the quarter window close relay by supplying a ground input through circuit CPW25 (YE/BU). When the quarter window open relay is activated, power is supplied to the LH and RH quarter window motors through circuit CPW27 (GN) and ground through circuit CPW28 (WH/BN) through the quarter window close relay circuit GD151 (BK/GN) to operate the quarter windows open. When the quarter window close relay is activated, power is supplied to the LH and RH quarter window motors through circuit CPW28 (WH/BN) and ground through circuit CPW27

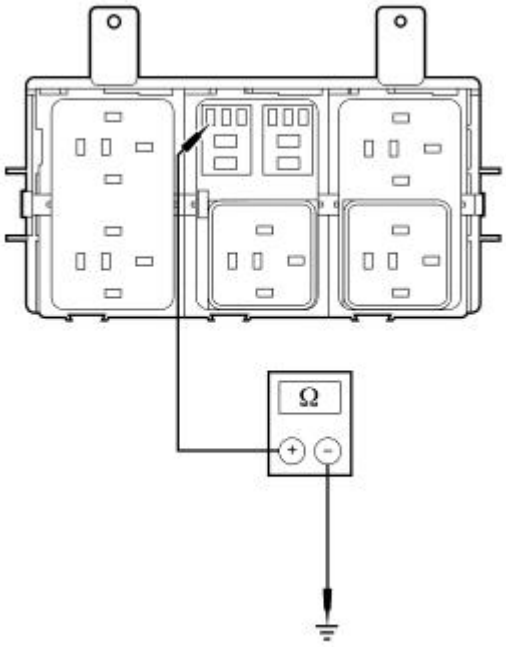
(GN) through the quarter window open relay circuit GD151 (BK/GN) to operate the quarter windows closed.

Possible Causes

- Fuse
- Quarter window close relay
- Quarter window open relay
- Open in circuit CBP41 (BU), GD151 (BK/GN), CPW25 (YE/BU) or CPW26 (BU/BN), CPW27 (GN) or CPW28 (WH/BN)
- Quarter window control switch
- Rear quarter window regulator motor

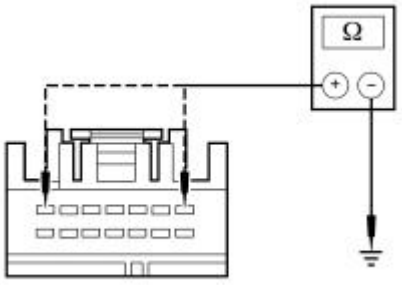
PINPOINT TEST J: THE LEFT OR RIGHT POWER WINDOW IS INOPERATIVE — REAR VENT WINDOW

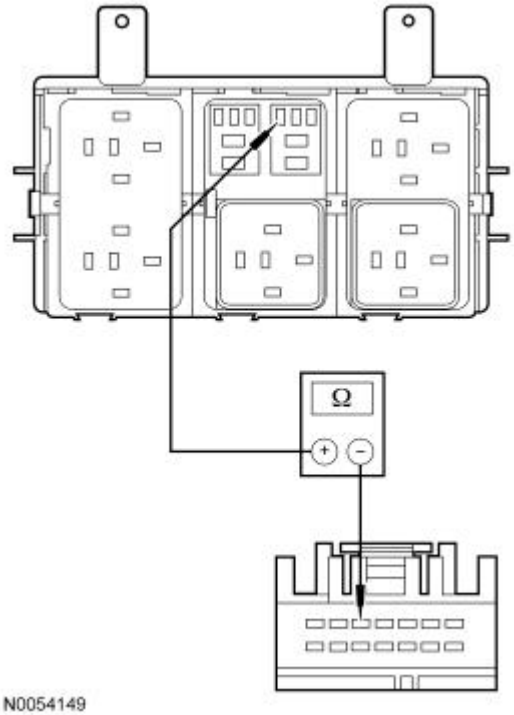
Test Step	Result / Action to Take
J1 CHECK THE VENT WINDOW OPERATION	
• Attempt to operate the vent windows while observing both LR and RR vent window operation. • **Are both the LH and RH vent windows inoperative?**	**Yes** GO to J2 . **No** GO to J8 .
J2 CHECK FOR GROUND INPUT TO THE VENT WINDOW OPEN AND CLOSE RELAYS	
• Disconnect: Quarter Window Open Relay and Quarter Window Close Relay. • While holding the quarter window control switch in the CLOSE position, measure the resistance between quarter window close relay pin 2, circuit CPW25 (YE/BU), harness side and ground.  N0054146 • While holding the quarter window control switch in the OPEN position, measure the resistance between quarter window open relay pin 2, circuit CPW26 (BU/BN), harness side and ground.	**Yes** GO to J5 . **No** GO to J3 .



N0054147

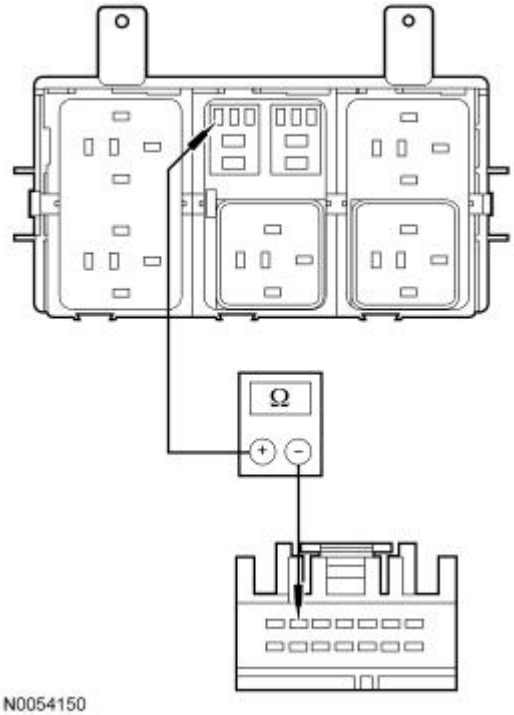
- **Are the resistances less than 5 ohms?**

J3 CHECK FOR GROUND AT THE VENT WINDOW SWITCH	
• Disconnect: Overhead Console Switch C930. • Measure the resistance between quarter window control switch C930-1, circuit GD150 (BK/WH), harness side and ground; and between quarter window control switch C930-7, circuit GD150 (BK/WH), harness side and ground.  N0054148 • **Are the resistances less than 5 ohms?**	**Yes** GO to J4 . **No** REPAIR circuit GD150 (BK/WH) for an open. TEST the system for normal operation.
J4 CHECK CIRCUIT CPW25 (YE/BU) AND CIRCUIT CPW26 (BU/BN) FOR AN OPEN	
• Measure the resistance between power vent window close relay pin 2, circuit CPW25 (YE/BU), harness side and power vent window switch C930-5, circuit CPW25 (YE/BU), harness side.	**Yes** INSTALL a new vent power window switch. REFER to Window Control Switch . TEST the system for normal operation. **No** REPAIR the open circuit CPW25 (YE/BU) or CPW26 (BU/BN) for an open. TEST the system for normal operation.



N0054149

- Measure the resistance between power vent window open relay pin 2, circuit CPW26 (BU/BN), harness side and power vent window switch C930-6, circuit CPW26 (BU/BN), harness side.

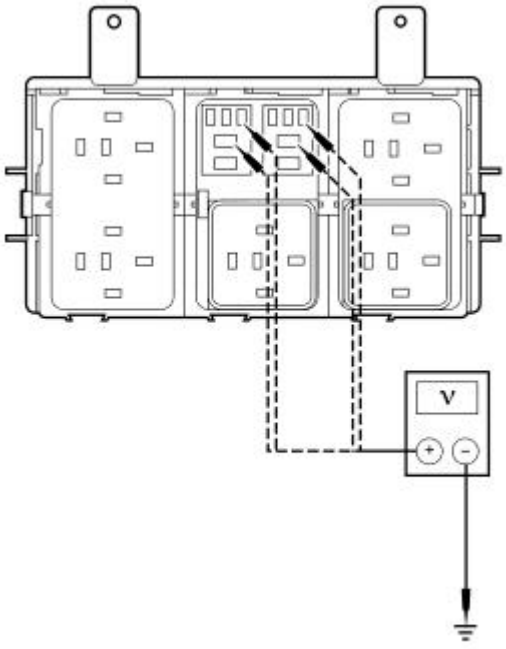


N0054150

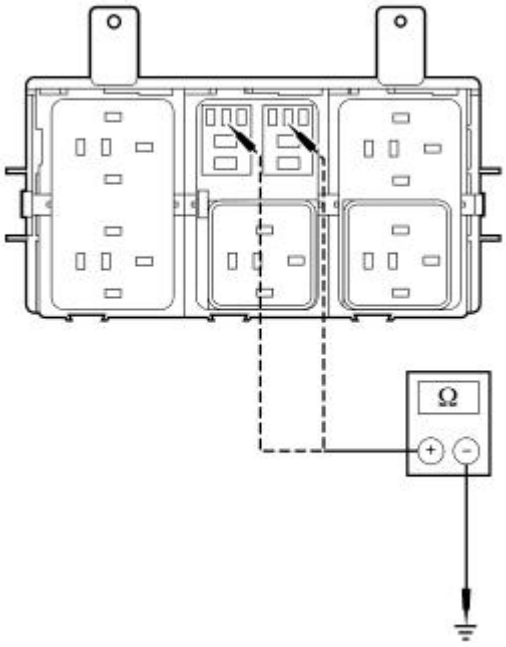
- **Are the resistances less than 5 ohms?**

J5 CHECK THE POWER VENT WINDOW OPEN AND CLOSE RELAY	
• Carry out the relay component test on the power vent window open and close relays. • Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the power vent window open and close relay pass the**	**Yes** GO to J6 . **No** INSTALL a new relay. TEST the system for

component test?	normal operation.
J6 CHECK FOR POWER TO THE VENT WINDOW OPEN AND CLOSE RELAYS	

• Key in ON position.
• Measure the voltage between quarter window open relay and close relay, harness side and ground.
  ▪ Pin 1, circuit CBP41 (BU)
  ▪ Pin 5, circuit CBP41 (BU)
 
 	
N0054151
• **Is the voltage greater than 10 volts?**
	Yes
	GO to J7 .
	
	No
	VERIFY SJB fuse 41 (15A) is OK. If OK, REPAIR circuit CBP41 (BU) for an open. TEST the system for normal operation.

J7 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between quarter window open relay and close relay, harness side and ground. ▪ Pin 4, circuit GD151 (BK/GN)	**Yes** GO to J8 . **No** REPAIR circuit GD151 (BK/GN) for an open. TEST the system for normal operation.

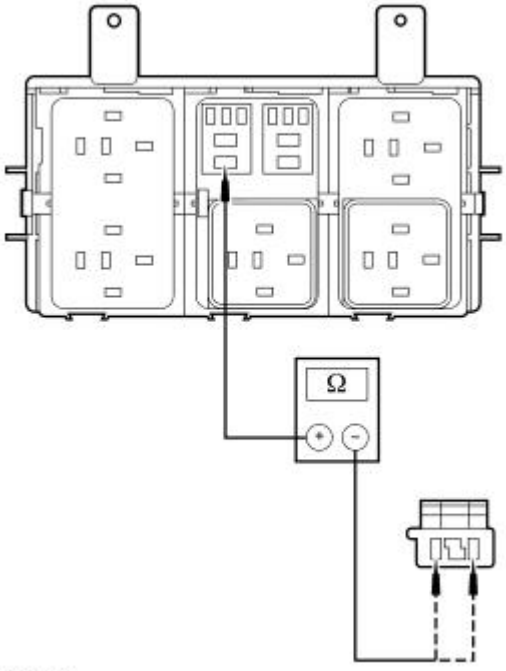


N0054152

- **Are the resistances less than 5 ohms?**

J8 CHECK THE MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Power Vent Window Motor C4047 (LH) or C4090 (RH).
- Measure the resistance between power vent window open relay pin 3, circuit CPW27 (GN), harness side and inoperative power vent window motor:
  - (RH) C4090-1, circuit CPW27 (GN).
  - (LH) C4047-2, circuit CPW27 (GN).



N0054153

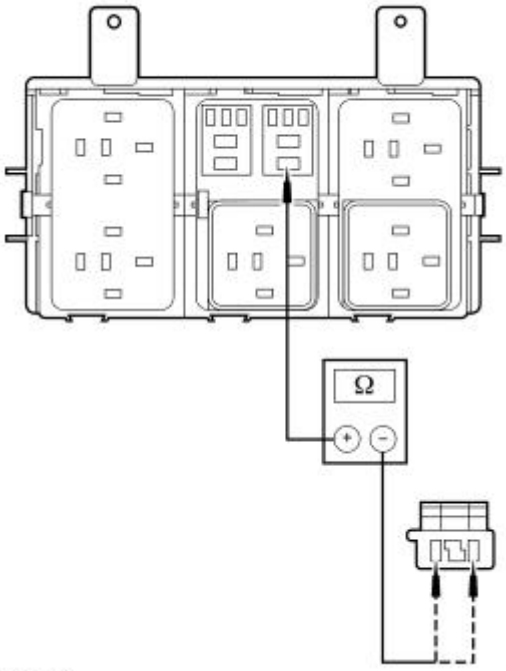
- Measure the resistance between power vent window close relay

Yes
INSTALL a new power vent window regulator motor. REFER to Window Regulator Motor — Rear Quarter . TEST the system for normal operation.

No
REPAIR circuit(s). TEST the system for normal operation.

pin 3, circuit CPW28 (WH/BN), harness side and power vent window motor:

- (RH) C4090-2, circuit CPW28 (WH/BN).
- (LH) C4047-1, circuit CPW28 (WH/BN).



- **Are the resistances less than 5 ohms?**

Pinpoint Test K: The Defrost System is Inoperative

Refer to Wiring Diagrams Cell 56 , Heated Window for schematic and connector information.

Normal Operation

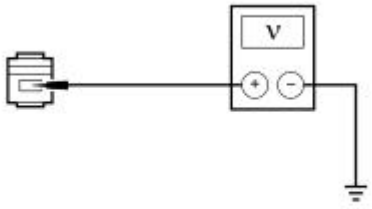
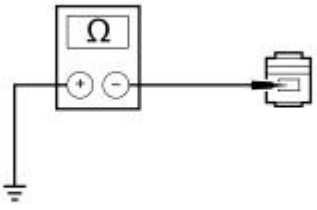
During normal operation, the electronic automatic temperature control (EATC) module or electronic manual temperature control (EMTC) activates the rear window defrost relay by grounding the relay coil through circuit CH122 (WH/OG). When the defrost relay is activated, power is supplied from the relay to the rear window defrost grid through circuit CRD06 (BN/YE) and also to the LH/RH exterior rear view mirror heaters through circuit CBB23 (BN/YE). Ground is supplied to the rear window defrost grid and exterior mirror heaters through circuit GD150 (BK/WH).

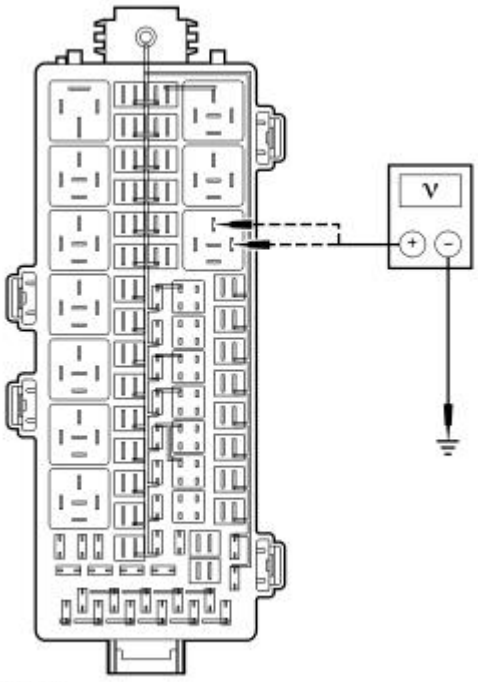
Possible Causes

- Fuse(s)
- Rear window defrost relay
- Open in circuit CH122 (WH/OG), CRD06 (BN/YE) or GD150 (BK/WH)
- EATC module
- EMTC module
- Open or short in rear window defrost grid

PINPOINT TEST K: THE DEFROST SYSTEM IS INOPERATIVE

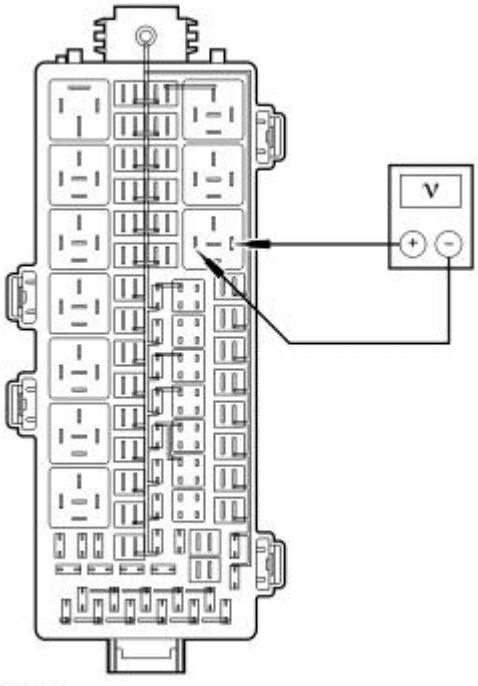
Test Step	Result / Action to Take

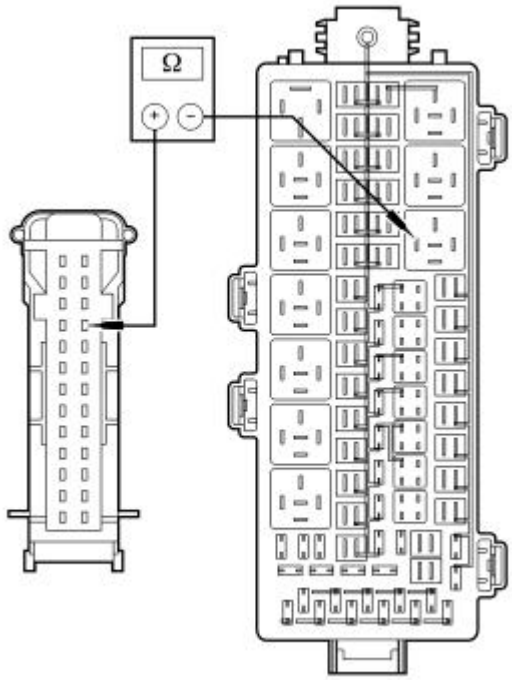
K1 CHECK THE REAR WINDOW DEFROST GRID VOLTAGE	
• Disconnect: Rear Window Defrost Grid Power C402A. • Key in ON position. • Activate the rear defrost switch and measure the voltage between rear window defrost grid power C402A, circuit CRD06 (BN/YE) and ground.  A0010207 • **Is the voltage greater than 10 volts?**	**Yes** GO to K2 . **No** GO to K3 .
K2 CHECK THE REAR WINDOW DEFROST GRID GROUND	
• Key in OFF position. • Disconnect: Rear Window Defrost Grid Ground C402B. • Measure the resistance between rear window defrost grid ground C402B, circuit GD150 (BK/WH) and ground.  A0010216 • **Is the resistance less than 5 ohms?**	**Yes** Carry out the Grid Wire Test in this section. REPAIR the rear window defrost grid or INSTALL a new liftgate glass. REFER to Window Grid Wire Repair . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
K3 CHECK THE POWER TO THE RELAY	
• Key in OFF position. • Disconnect: Rear Window Defrost Relay. • Key in ON position. • Measure the voltage between rear window defrost relay socket pin 86 and pin 30 harness side and ground.	**Yes** GO to K4 . **No** VERIFY the battery junction box (BJB) fuse 28 (40A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.



N0054155

- **Is the voltage greater than 10 volts?**

K4 CHECK THE EATC/EMTC OUTPUT	
• Activate the rear defrost switch and measure the voltage between rear window defrost relay socket pin 85 and pin 86, circuit CH122 (WH/OG), harness side.  N0054156 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new rear window defrost relay. TEST the system for normal operation. **No** GO to K5 .
K5 CHECK CIRCUIT CH122 (WH/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Electronic Automatic Temperature Control (EATC) C228B or Electronic Manual Temperature Control (EMTC) C294B.	**Yes** GO to K6 . **No**

• Measure the resistance between rear window defrost relay socket pin 85, circuit CH122 (WH/OG), harness side and C228B-23 (EATC) or C294B-23, circuit CH122 (WH/OG), harness side.  N0054157 • **Is the resistance less than 5 ohms?**	REPAIR the circuit. TEST the system for normal operation.
K6 CHECK FOR CORRECT EATC/EMTC OPERATION	

• Disconnect all EATC/EMTC connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all EATC/EMTC connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new EATC/EMTC. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test L: The Defrost System Will Not Shut Off Automatically

Refer to Wiring Diagrams Cell 56 , Heated Window for schematic and connector information.

Normal Operation

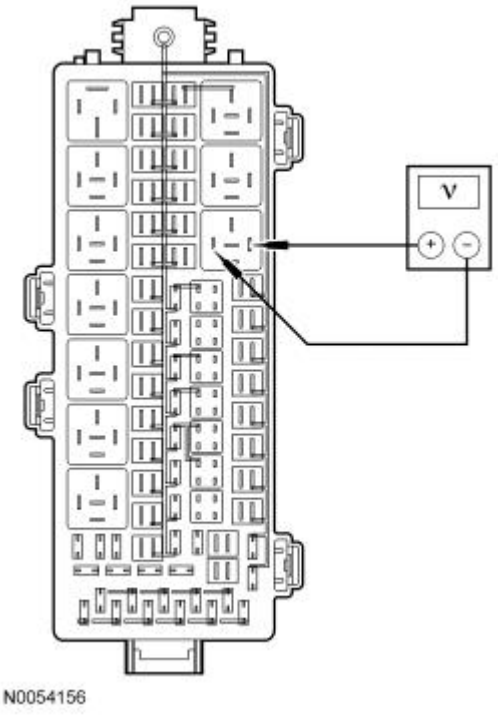
During normal operation, the EATC or EMTC activates the rear window defrost relay by providing grounding the relay coil through circuit CH122 (WH/OG). When the defrost relay is activated, power is supplied from the rear window defrost relay through circuit CRD06 (BN/YE) to the rear window defrost grid. Ground is supplied to the rear window defrost grid through circuit GD150 (BK/WH).

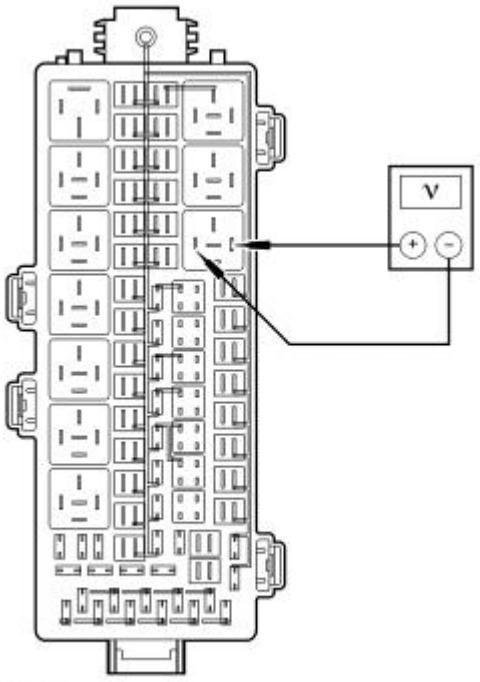
Possible Causes

- Short to voltage in circuit CRD06 (BN/YE)
- Short to ground in circuit CH122 (WH/OG)
- Rear window defrost relay

- EATC or EMTC

PINPOINT TEST L: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY

Test Step	Result / Action to Take
L1 CHECK CIRCUIT CRD06 (BN/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: Rear Window Defrost Relay. • Key in ON position. • **Is the rear window defrost ON?**	**Yes** REPAIR circuit CRD06 (BN/YE) for a short to voltage. TEST the system for normal operation. **No** GO to L2 .
L2 CHECK THE REAR WINDOW DEFROST RELAY	
• Key in ON position. • Measure the voltage between rear window defrost relay socket pin 85 and pin 86, circuit CH122 (WH/OG), harness side.  N0054156 • **Is the voltage greater than 10 volts?**	**Yes** GO to L3 . **No** INSTALL a new rear window defrost relay. TEST the system for normal operation.
L3 CHECK THE EATC or EMTC MODULE	
• Disconnect: Electronic Automatic Temperature Control (EATC) C228B or Electronic Manual Temperature Control (EMTC) C294B. • Measure the voltage between rear window defrost relay socket pin 85 and pin 86, circuit CH122 (WH/OG), harness side.	**Yes** REPAIR short to ground in circuit CH122 (WH/OG). TEST the system for normal operation. **No** GO to L4 .

 N0054156 • **Is the voltage greater than 10 volts?**	
L4 CHECK FOR CORRECT EATC/EMTC OPERATION	

• Disconnect all EATC/EMTC connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all EATC/EMTC connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new EATC/EMTC. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test M: The Delayed Accessory is Inoperative

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

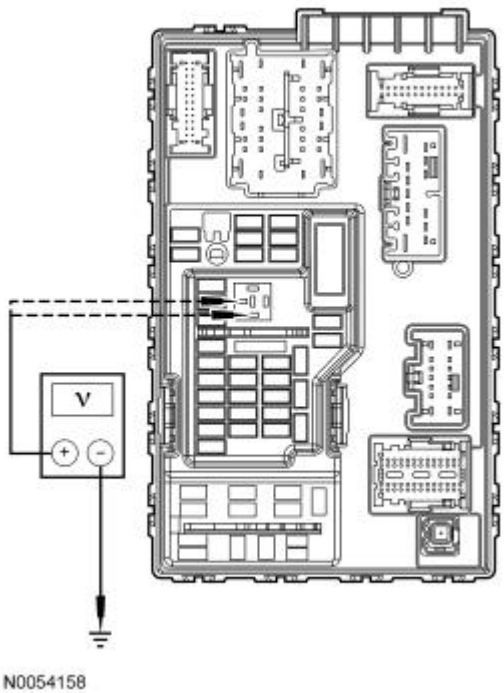
Normal Operation

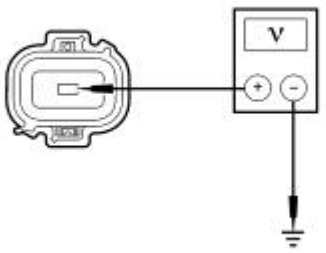
The delayed accessory relay, which is integral to the smart junction box (SJB), receives power at all times through circuit SDC04 (RD). When the ignition key is turned ON, the SJB activates the delayed accessory relay, which provides power to the LH front window switch (Expedition) through circuit CBP47 (GN/BU). For Navigator, delayed accessory power is provided to the LF and RF power window motors, RH front window switch and front window circuits in the LH front window switch through circuit CBP41 (BU). The rear window circuits are powered by circuit CBP47 (GN/BU).The delayed accessory feature remains active for 10 minutes after the ignition key is turned OFF or until either front door is opened.

Possible Causes

- Fuse
- Circuit breaker
- Delayed accessory relay
- Open in circuit SDC04 (RD), CBP47 (GN/BU) or CBP41 (BU) (Navagitor only)
- Smart junction box (SJB)

PINPOINT TEST M: THE DELAYED ACCESSORY IS INOPERATIVE

Test Step	Result / Action to Take
M1 CHECK THE DELAYED ACCESSORY RELAY	
• Open and close the front doors. Verify the interior lights turn on when the doors are open, and off when the doors are closed. • **Do the interior lights operate normally?**	**Yes** GO to M2 . **No** REFER to Section 417-02 to diagnose the interior lighting and door ajar switches.
M2 CHECK THE DELAYED ACCESSORY RELAY	
• Disconnect: Delayed Accessory Relay. • Carry out the delayed accessory relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the delayed accessory relay pass the component test?**	**Yes** GO to M3 . **No** INSTALL a new delayed accessory relay. TEST the system for normal operation.
M3 CHECK THE POWER TO THE RELAY	
• Key in ON position. • Measure the voltage between delayed accessory relay socket pin 86, circuit SDC04 (RD), harness side and ground; and between delayed accessory relay socket pin 30, circuit SDC04 (RD), harness side and ground.  N0054158 • **Is the voltage greater than 10 volts for both measurements?**	**Yes** GO to M5 . **No** GO to M4 .
M4 CHECK CIRCUIT SDC04 (RD) FOR AN OPEN	
• Key in OFF position. • Open the front door to disable delayed accessory power.	**Yes** GO to M5 .

• Disconnect: Smart Junction Box (SJB) C2280C. • Measure the voltage between SJB C2280C-1, circuit SDC04 (RD), harness side and ground.  N0054159 • **Is the voltage greater than 10 volts?**	**No** REPAIR circuit SDC04 (RD) for an open. TEST the system for normal operation.
M5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all SJB connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test N: The Delayed Accessory Does Not Turn Off

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

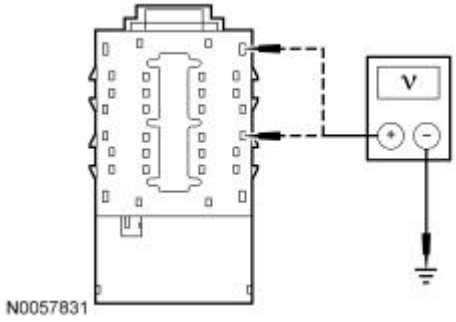
The delayed accessory relay, which is integral to the smart junction box (SJB), receives power at all times through circuit SDC04 (RD). When the ignition key is turned ON, the SJB activates the delayed accessory relay, which provides power to the LH front window switch (Expedition) through circuit CBP47 (GN/BU). For Navigator, delayed accessory power is provided to the LF and RF power window motors, RH front window switch and front window circuits in the LH front window switch through circuit CBP41 (BU). The rear window circuits are powered by circuit CBP47 (GN/BU). The delayed accessory feature remains active for 10 minutes after the ignition key is turned OFF or until either front door is opened.

Possible Causes

- Delayed accessory relay
- Short to voltage in circuit CBP47 (GN/BU) or CBP41 (BU) (Navigator only)
- Smart junction box (SJB)

PINPOINT TEST N: THE DELAYED ACCESSORY DOES NOT TURN OFF

Test Step	Result / Action to Take
N1 CHECK FOR STUCK/STICKING ACCESSORY DELAY RELAY	

• Disconnect: Delayed Accessory Relay. • **Are any delayed accessory features still operative?**	**Yes** GO to N3 . **No** GO to N2 .
N2 CHECK THE DELAYED ACCESSORY RELAY	
• Carry out the delayed accessory relay component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the delayed accessory relay pass the component test?**	**Yes** GO to N4 . **No** INSTALL a new delayed accessory relay. TEST the system for normal operation.
N3 CHECK CIRCUIT CBP47 (GN/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: Smart Junction Box (SJB) C2280f. • Key in ON position. • Measure the voltage between SJB C2280f-32, circuit CBP47 (GN/BU), harness side and ground; and for Navigator, also measure the voltage between SJB C2280f-16, circuit CBP41 (BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR circuit CBP47 (GN/BU) or CBP41 (BU) for a short to voltage. TEST the system for normal operation. **No** GO to N4 .
N4 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all SJB connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire will appear as a brown spot.

2. Run the engine at idle. Set the heated rear window switch to ON. The indicator light should come on.

3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.

4. Contact a good ground point with the negative lead of the meter. The voltage reading should not change.

5. With the negative lead of the meter grounded, touch each grid line of the heated rear window glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates the line is good. A reading of 0 volts indicates the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates the circuit is broken between the midpoint of the grid line and ground.

6. Pinpointing the exact position of the break can be accomplished (if the voltmeter reads 0 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter) by moving the positive lead of the voltmeter toward the B+ side of the grid line and touching the grid line until the voltmeter reads 6 volts. If the voltmeter reads 12 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter, simply move the positive lead of the voltmeter toward the ground connection of the grid line and touch the grid line until the voltmeter reads 6 volts.

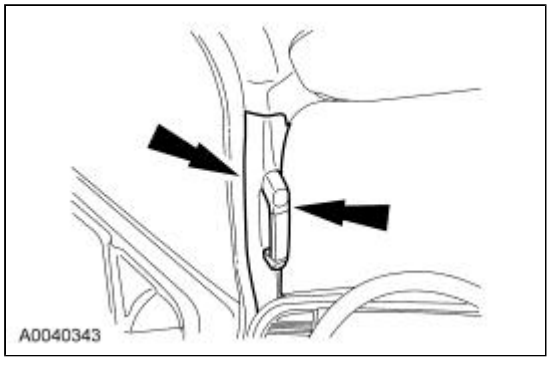
Windshield Reseal

Printable View (144 KB)

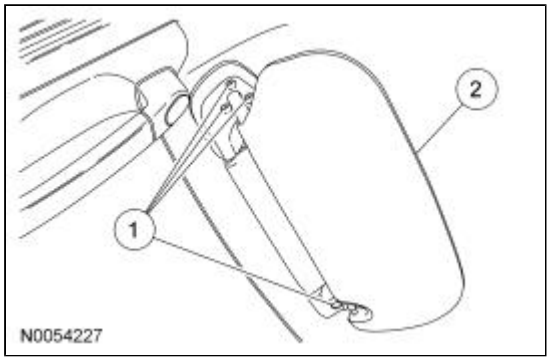
Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	—
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the cowl grille. For additional information, refer to Section 501-02 .
2. Remove the A-pillar trim panels.
   - Remove the bolt covers and bolts.



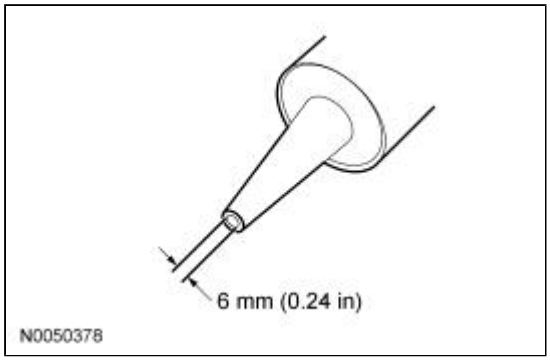
3. If equipped, remove the overhead console.
4. If equipped, remove the roof opening panel trim.
5. Remove the interior rear view mirror. For additional information, refer to Section 501-09 .
6. Remove the sun visors.
   1. Remove the 8 screws.
   2. Remove the 2 sun visor and visor arm clips.
      - If equipped, disconnect the electrical connectors.



7. Partially lower the front portion of the headliner near the windshield upper opening and block with a suitable material.

8. Clean the edge formed by the existing urethane and the glass on the inside at the top and sides, and outside on the bottom of the windshield with glass cleaner.

9. Cut the urethane applicator tip to specification.



10. **NOTE:** Use either a high-ratio electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

    Apply a bead of urethane adhesive to the cleaned area.

11. **NOTE:** Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

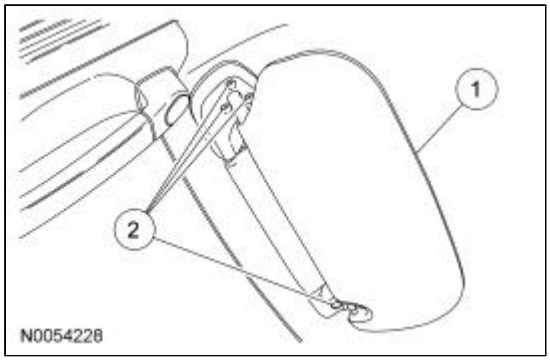
    Backfill the urethane application and clean the excess.

12. **CAUTION: The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.**

    After the urethane has cured, check the windshield seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.

13. Install the headliner.

14. Install the sun visors.
    1. Position the sun visors.
    2. Install the 8 screws.
        - If equipped, connect the electrical connectors.



15. Install the interior rear view mirror. For additional information, refer to Section 501-09 .
16. If equipped, install the roof opening panel trim.
17. If equipped, install the overhead console.
18. Install the A-pillar trim panels.
    - Install the bolts and covers.
19. Install the cowl grille. For additional information, refer to Section 501-02 .
20. Clean the interior and exterior of the windshield glass with glass cleaner.

Window Motor Initialization

Printable View (80 KB)

Window Motor Initialization

CAUTION: Make sure that no obstructions are present in the window system when carrying out this procedure.

NOTE: The LF/RF window motor is in proportional up/down mode until initialized.

NOTE: The LF/RF window motor must be reinitialized whenever: the motor is removed from window regulator drum housing, a new motor is installed, a new window regulator is installed, new window glass is installed, glass top run removal or installation or when carrying out any operation in which grease or lubricants are applied to the window system. Refer to the De-Initialization Procedure prior to performing this procedure (unless a new motor is being installed).

NOTE: All LF/RF window components (window glass, window regulator, window motor and glass top run) must be installed and tightened to specification before carrying out this procedure.

NOTE: If this procedure is only partially completed, the LF/RF window motor will remain un-initialized and only the proportional up/down functions will operate.

1. Start with the ignition key in the OFF position and with the LF/RF door open.
2. Turn the ignition key to the ON position.
3. Activate and hold the window control switch in the DOWN position until the window glass stalls for one second at the bottom of its travel and release the switch.
4. Activate and hold the window control switch in the UP position until the window glass stalls for one second into the glass top run and release the switch.
5. Verify correct operation of the LF/RF window by carrying out a one-touch down, one-touch up, proportional down and proportional up. If the window does not operate correctly, carefully repeat this procedure.

De-Initialization Procedure

NOTE: A motor which is initialized already (one-touch up and one-touch down are functional) must be de-initialized prior to carrying out the window motor initialization procedure.

1. Start with the ignition key in the RUN position and the LF/RF door open.
2. **NOTE:** Steps 2 and 3 must be performed within 8 seconds.

   Turn the ignition key from OFF to RUN 5 times.
3. Press the window control switch to the one-touch DOWN position (second detent) and release.
4. Verify that the window only performs proportional up and down movements. If the window still performs auto operations, carefully repeat this procedure.

Window Grid Wire Repair

Printable View (107 KB)

Material

Item	Specification
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A
Lacquer Touch-Up Paint (match color to exterior grid wire) PM-19500-XXXXX or PMP-19500-XXXXX	ESR-M2P100-C
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	—
Polypropylene Film Fine Line Tape (commercially available)	—

NOTE: If the first layer of the heated rear window grid (brown) is damaged or missing, it is necessary to apply touch up paint on the glass prior to applying the silver rear window defroster repair.

NOTE: The grid line material is not embedded into the glass but is baked to the glass surface and consequently can be scraped off. Inoperative lines may appear to the eye to be undamaged due to residue remaining on the glass and will require diagnosis with a voltmeter or 12V test lamp. For additional information, refer to Diagnosis and Testing in the section.

NOTE: An undamaged grid line will have small ridges that project above the surface of the glass and can easily be felt when running a fingernail across them. Grid lines that have been "razor bladed" will feel smooth when a fingernail is dragged across the affected area. There may be some residue left on the glass that appears to be grid material but a check with a voltmeter or 12V test lamp will confirm an open circuit.

NOTE: If the brown color under the grid line is damaged or missing (this is very rare), it will be necessary to apply lacquer touch-up paint for color match. This paint must meet specification and should be applied to the glass prior to applying the rear window defroster repair compound.

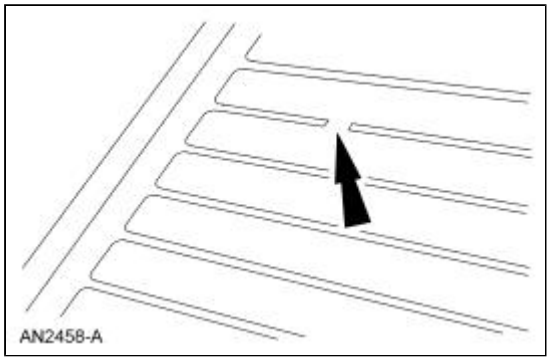
NOTE: The interior side of the grid lines are not painted, but due to the silver tarnishing will tend to change the grid to a gold or brown color. The repair area will be bright silver and will also tarnish over time to match the rest of the grid.

1. Bring the vehicle up to room temperature of at least 16°C (60°F) or above.

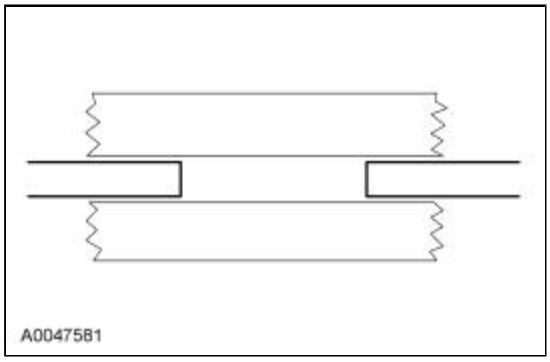
2. **NOTE:** Do not use scrapers, sharp instruments or abrasive window cleaners on the interior surface of the rear window glass as this may cause damage to the grid lines.

   Clean the entire grid line repair area with window cleaner and 0000 steel wool to remove all dirt, wax, grease, oil or other foreign material.

3. Mark the location of the grid break on the exterior of the rear window glass.



4. Using a polypropylene film fine line tape, mask the area directly above and below the grid break extending the tape 26 mm (1.02 in) beyond the concern area in both directions. The break area should be at the center of the mask.



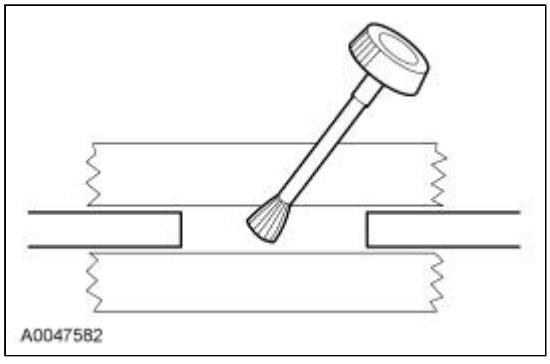
5. **NOTE:** If the brown layer is not broken or missing, apply only the silver grid repair compound to the break.

   NOTE: If both the brown and silver layers of the grid are broken or missing, apply a coating of the lacquer touch up paint across the break in the grid line first. Do not overlap the silver grid line with the paint. Several applications may be necessary to achieve a color match.

   NOTE: Extend the silver repair coating at least 6.35 mm (0.25 in) on both sides of the break area.

   NOTE: Allow at least 5 minutes of drying time between applications for the touch up paint or the silver repair coating. Applying fewer coats or not allowing adequate drying time between coats will produce repaired resistance that is greater than OEM resistance, resulting in poor defrost performance and excessive localized heating.

   Apply the repair coating to the grid break area in several smooth, continuous strokes.
   Apply a minimum of 6 applications of the grid repair compound.



6. After 5 minutes, or after the repair area has dried completely, remove the mask.

7. **CAUTION: Be careful not to damage the grid line with the razor blade. If this occurs, additional repair may be necessary.**

   Remove any excess repair compound above or below the grid line with a razor blade.

8. **NOTE:** The repair coating air-dries in approximately one minute and can be energized after 5 minutes.

   NOTE: Optimum adhesion occurs after approximately 24 hours.

   Test the system for normal operation.

Lead Terminal Repair

Printable View (90 KB)

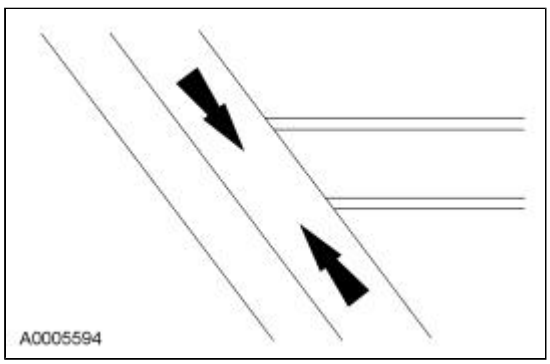
Material

Item	Specification
Terminal Kit — Back Glass 4F1Z-14421-AA	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. **NOTE:** The rear window glass must be at least 16°C (60°F) (room temperature) at the time of the repair.

   NOTE: The new terminal will cover the original terminal location, but it must be placed so that the terminal conductive areas will be placed on a good conductive base.

   Clean the bus bar in the area to be repaired with steel wool (3.0 to 4.0 grade), and then with window cleaner to remove all dirt, wax, grease, oil or other foreign material.

2. **CAUTION: Do not use any type of flame torch or flame heated soldering gun for this procedure. Use of these tools provide inadequate heat generation at the tip and the exhaust heat can cause damage to plastic trim parts in the area. Use only an electric soldering gun with 100 watts or more of power. Before using the soldering gun, be sure to melt a small amount of rosin core solder to the tip. The solder will assist in achieving better heat transfer from the soldering gun tip to the new terminal.**

   NOTE: The new terminal has pre-applied solder, flux and temperature-sensitive paint. The paint provides a visual indication when the terminal has reached the correct temperature to melt solder on the terminal. When the correct temperature is achieved the temperature paint will liquefy and change color.

   NOTE: Depending on the original terminal location, and whether the terminal is covered by pillar trim, will determine where to locate the new terminal. Some grid line buss-bars may only allow the placement of the terminal above or below the original tab location due to space limitations. For most vehicle applications the replacement tab location will cover the original tab location but still allow the replacement tab to attach to the buss-bar on good conductive material.

   Place the replacement terminal type A over the original tab location, making sure the conductive areas of the terminal will be on a good conductive area. Do not place the terminal tab foot on the original location which does not have conductive material.

3. Hold the terminal in place with an item such as a regular lead pencil at a 90 degree angle from the terminal. (Holding at other than a 90 degree angle may allow the terminal to slip when the solder liquefies.)

4. Place the soldering gun tip on the top of the terminal but not on the painted areas of the tab. Energize the soldering gun and watch for the painted area of the terminal to liquefy and change color. The paint should liquefy in approximately 25-45 seconds after heating. As soon as the paint color completely changes on either side of the terminal, de-energize the soldering gun and continue to hold the terminal in place with the soldering gun and pencil for an additional 30 seconds.

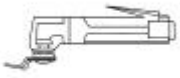
5. Remove the soldering gun and pencil from the terminal. The terminal should be allowed to cool for another 2 minutes before the wiring lead is attached to the terminal.

6. Attach the electrical lead connection to this terminal, turn on the heated rear window and verify the operation.

Windshield Glass

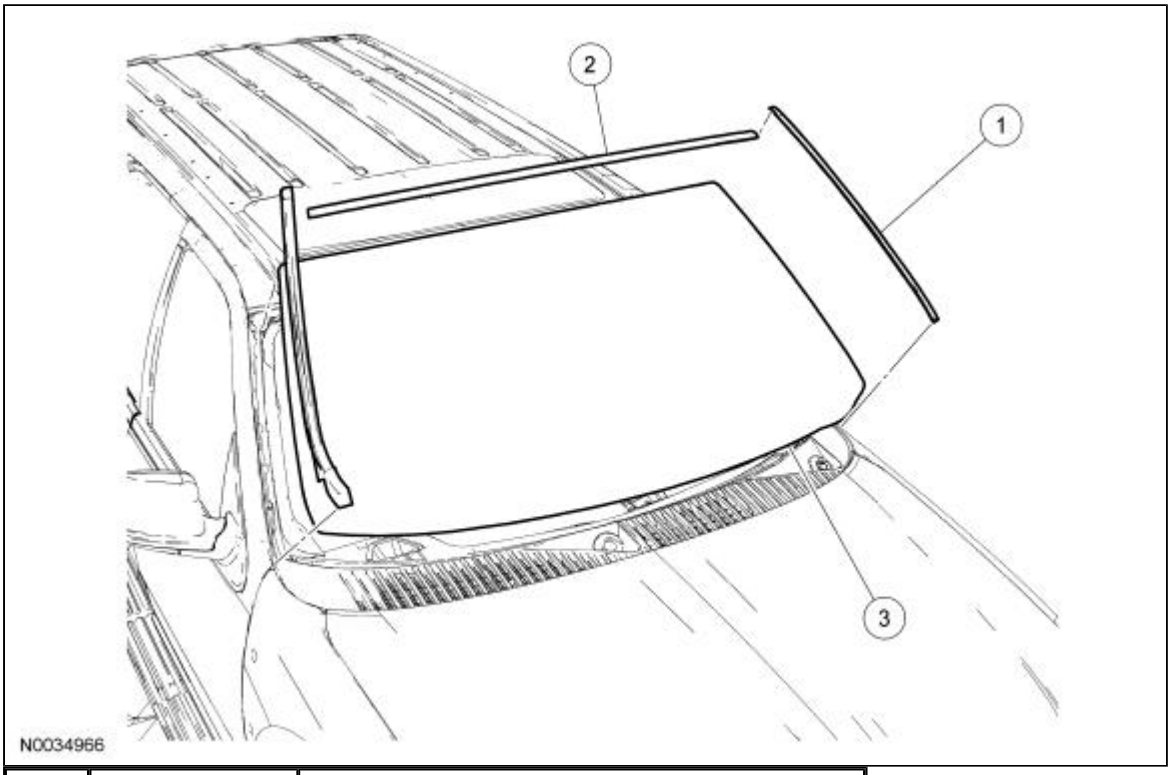
Printable View (361 KB)

Special Tool(s)

 ST1109-A	Rotunda Pneumatic Knife with Offset Blade 107-R1511 or equivalent
ST2085-A	The Pumper 164-R2459 or equivalent
ST1320-A	Rotunda Interior Auto Glass Cut-Out Knife Kit 164-R2450 or equivalent

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	—
Dow Urethane One Step Glass Primer Betaprime® 5500/5500A/5500SA	—
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	—
Sika Urethane Metal and Glass Primer Sika 206 G+P	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

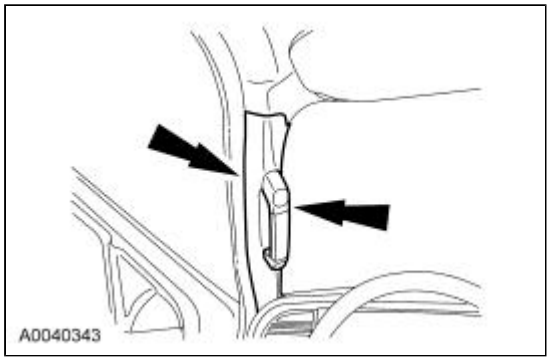


Item	Part Number	Description
1	51692	Windshield side mouldings (2 required)
2	03110	Windshield top weatherstrip
3	03100	Windshield glass

Removal

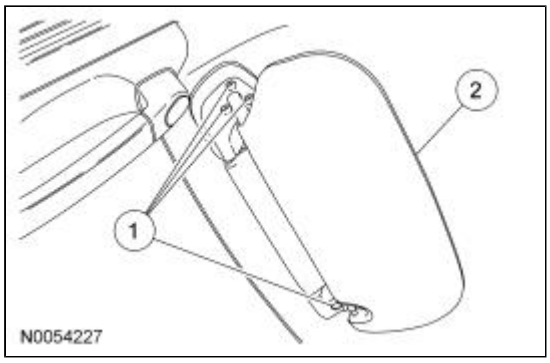
WARNING: To prevent glass splinters from entering eyes or cutting hands, wear safety glasses and heavy gloves when cutting glass from the vehicle.

1. Remove the cowl grille. For additional information, refer to Section 501-02 .
2. Remove the A-pillar trim panels.
   - Remove the bolt covers and bolts.



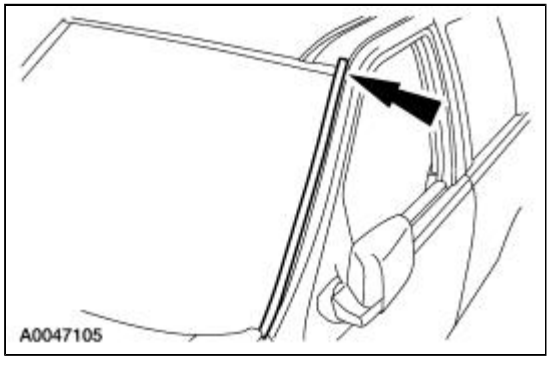
3. If equipped, remove the overhead console.
4. Remove the interior rear view mirror. For additional information, refer to Section 501-09 .
5. Remove the sun visors.

1. Remove the 8 screws.
2. Remove the 2 sun visor and visor arm clips.
    - If equipped, disconnect the electrical connectors.

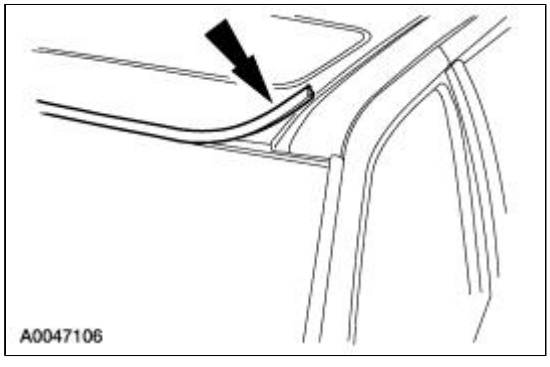


6. Lower the front portion of the headliner.

7. Remove the windshield side mouldings.
    - Pull out starting at the top corner.



8. Remove the upper windshield weatherstrip.
    - Pull out starting at the corner.



9. Mark the outside of the windshield glass with a wax pencil to avoid damaging the glass stops when cutting the urethane.

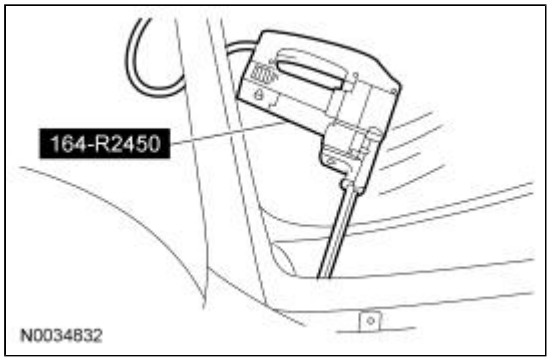
10. Using a soft brush or vacuum, remove any dirt and foreign material from the pinch weld.

11. **CAUTION: Care must be taken to avoid scratching the pinchweld.**

    NOTE: Lubricate the urethane adhesive with water to aid the special tool while cutting.

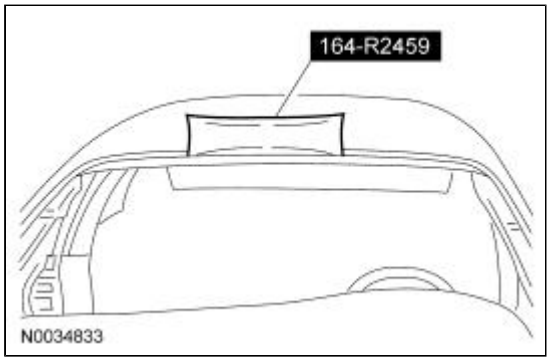
Using the special tool, cut the urethane adhesive from the windshield glass.

- Insert the blade into the urethane at the top middle of the glass and work toward the top corners.
- Insert the blade at the top corners and work down each side of the glass toward the bottom.



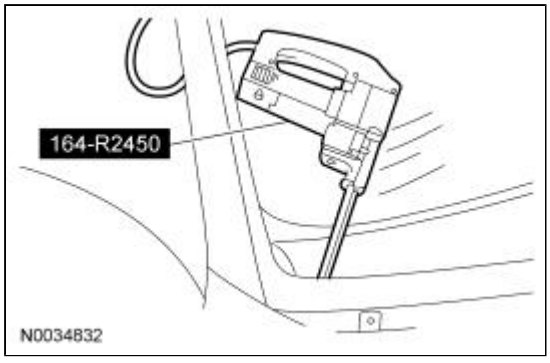
12. **CAUTION: Pump special tool 164-R2459 or equivalent slowly as cowl adhesive is cut to avoid breaking glass.**

    Using the special tool, distance the windshield from the body.



13. **NOTE:** Removing the windshield glass requires an assistant.

    Using the special tool, cut the remaining urethane adhesive and remove the windshield glass.



14. Using a soft brush or vacuum, remove any dirt and foreign material from the pinch weld.

Installation

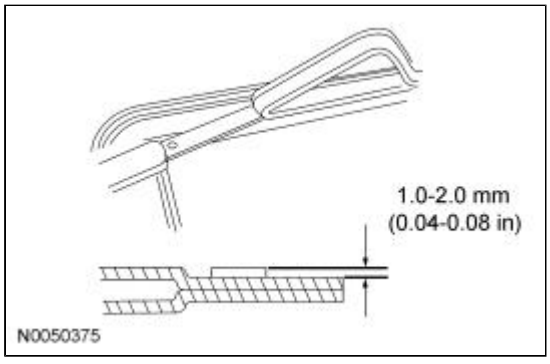
CAUTION: Do not drive the vehicle after installing windshield glass until the urethane adhesive has cured. Inadequate curing of the urethane adhesive adversely affects the strength of

the urethane adhesive bond.

1. Dry-fit the windshield glass by centering it side-to-side and by adjusting the setting blocks (if equipped) to get the correct position of the part top to bottom. Make the alignment marks with tape or non-staining grease pencil on both the glass and the vehicle body.

2. **CAUTION: Care must be taken to avoid scratching the pinch weld.**

   Trim the remaining urethane adhesive on the pinch weld to within specification.
   - The old urethane surface should be smooth and free of cuts and contamination.



3. If reinstalling the original windshield, remove excess urethane adhesive from the windshield glass.

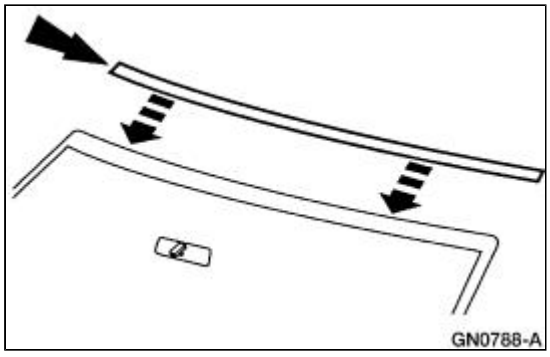
4. If installing a new windshield glass, clean the inside of the glass surface with glass cleaner to make sure the ceramic-coated area is clean.

5. **CAUTION: Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.**

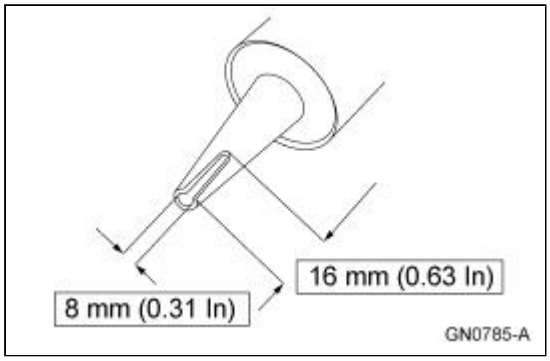
   NOTE: Sika uses the same black primer for the glass and pinch weld area.

   If installing a new windshield glass, apply urethane glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.

6. Install the upper windshield weatherstrip.

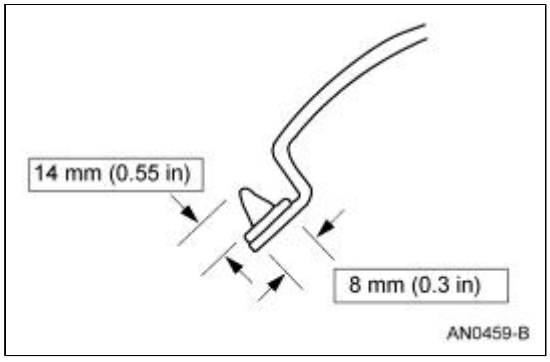


7. Cut the urethane applicator tip to specification.



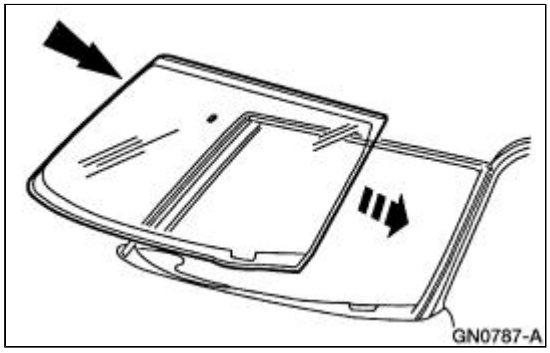
8. **CAUTION: Do not drive the vehicle after installing windshield glass until the urethane adhesive has cured. Inadequate curing of the urethane adhesive adversely affects the strength of the urethane adhesive bond.**

   Apply a bead of Urethane Adhesive to the pinch weld just outside the foam butyl dam over the top of the existing urethane bed.



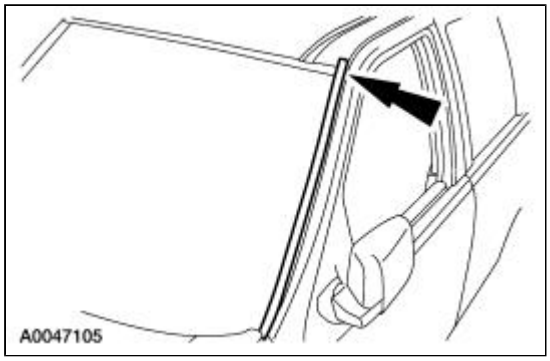
9. **CAUTION: Open the windows to prevent the windshield glass from being pushed out by air pressure if a door is closed.**

   Using the alignment marks, install the windshield glass.



10. Install the windshield side mouldings.

    NOTE: Be sure the moldings seat completely.

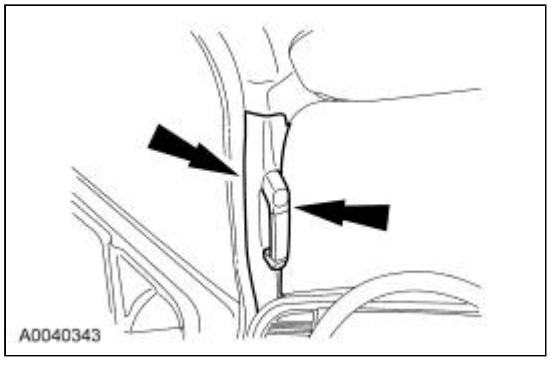


11. Install the headliner.

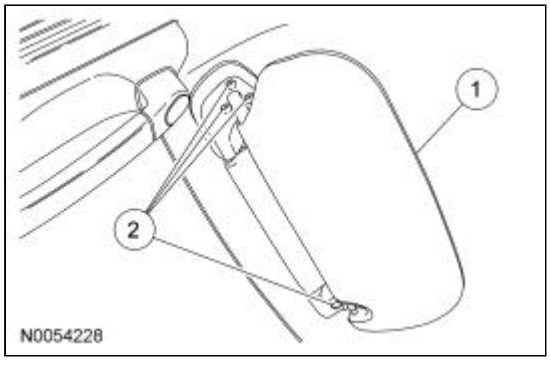
12. Install the interior rear view mirror. For additional information, refer to Section 501-09 .

13. Install the overhead console.

14. Install the A-pillar trim panels.
    - Install the bolts and covers.



15. Install the sun visors.
    1. Position the sun visors.
    2. Install the 8 screws.
        - If equipped, connect the electrical connectors.



16. Install the cowl grille. For additional information, refer to Section 501-02 .

17. Run the blower motor on defrost HIGH to check for glass that may have fallen into the defroster vents.

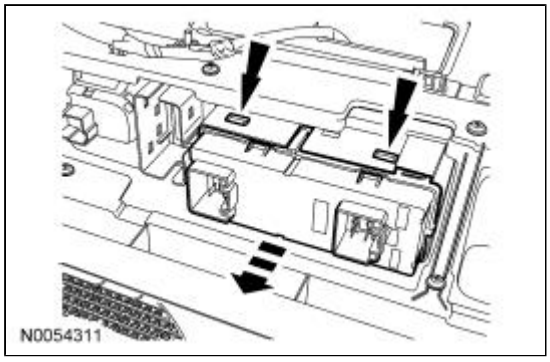
Window Control Switch

Printable View (114 KB)

Removal and Installation

NOTE: LF shown, all others similar.

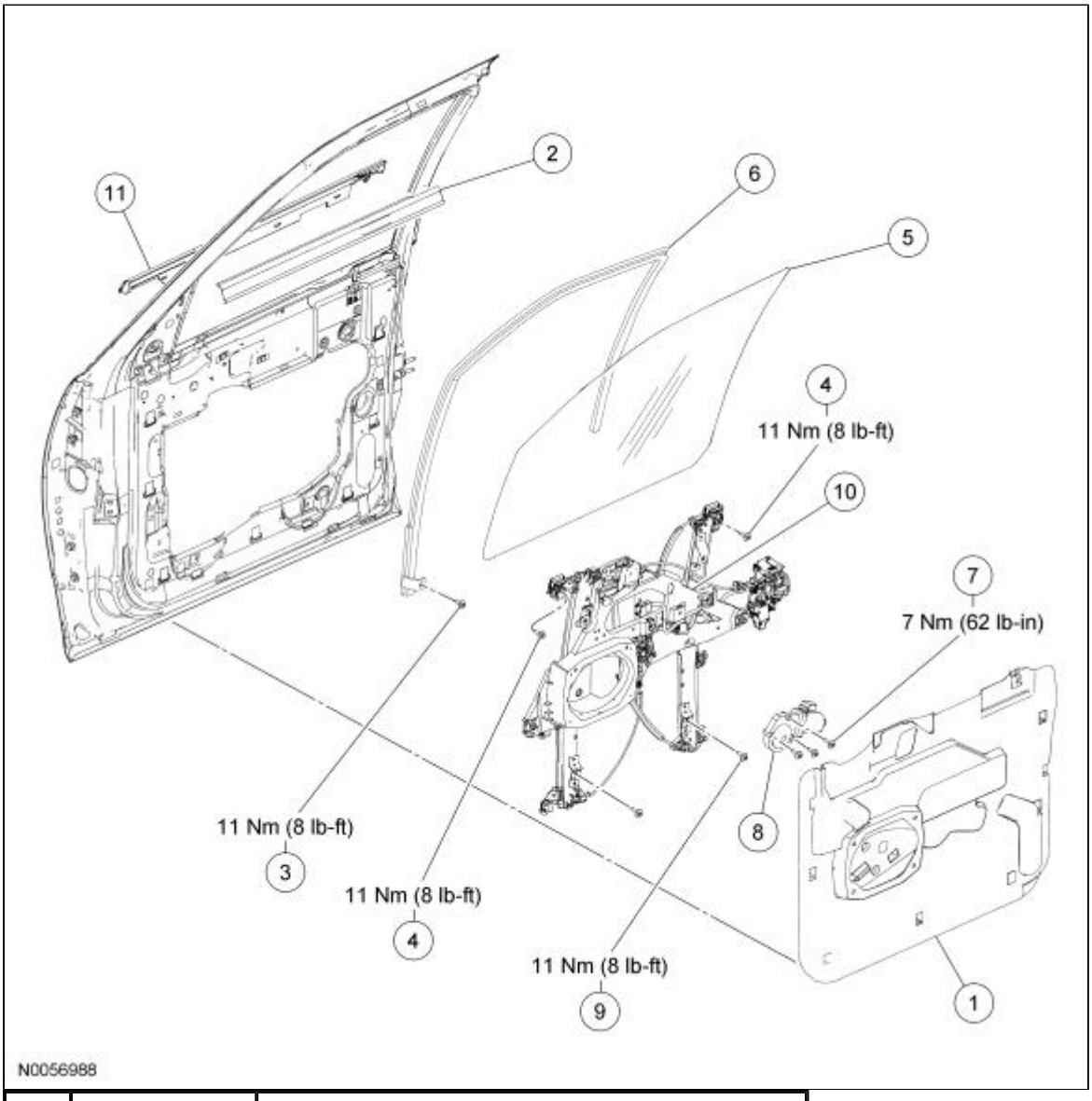
1. Remove the door trim panel. For additional information, refer to Section 501-05 .
2. Unlock the tabs and remove the window control switch from the door trim panel.



3. To install, reverse removal procedure.

Glass, Frames and Mechanisms — Exploded View, Front Door

Printable View (202 KB)



Item	Part Number	Description
1	—	Front door weathershield
2	21434	Inside glass weatherstrip
3	W710330-S439	Front door top run channel bolt
4	—	Window glass clamp bolts (2 required) (PIA)
5	21410	Front door glass
6	21596	Front door top run
7	—	Front door glass regulator motor bolts (3 required)
8	23394	Front door glass regulator motor

9	W710330	Front door glass regulator frame bolts (8 required)
10	23208	Front door glass regulator assembly
11	21452	Outer glass weatherstrip

1. For additional information, refer to the procedures in this section.

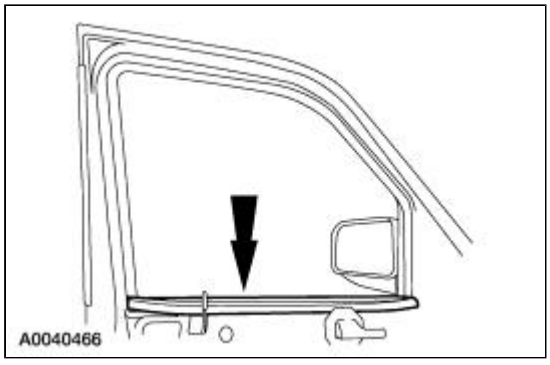
Door Glass Top Run — Front

Printable View (96 KB)

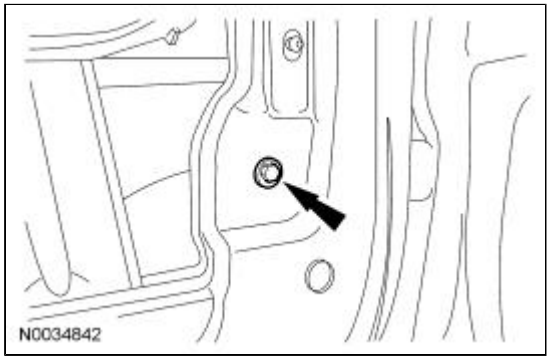
Removal and Installation

1. Remove the front door window glass. For additional information, refer to Window Glass — Front Door in this section.

2. Remove the inside glass weatherstrip.



3. Remove the front door glass channel bolt and front door glass top run.
   - To install, tighten to 11 Nm (8 lb-ft).



4. To install, reverse the removal procedure.

Window Glass — Front Door

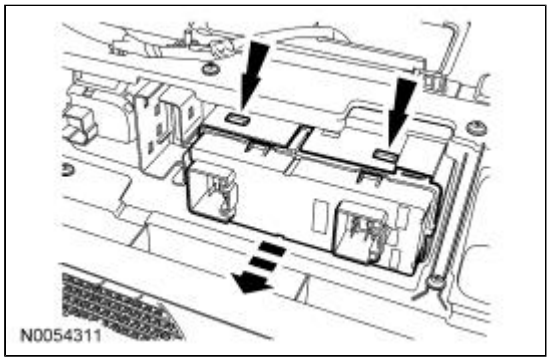
Printable View (247 KB)

Removal

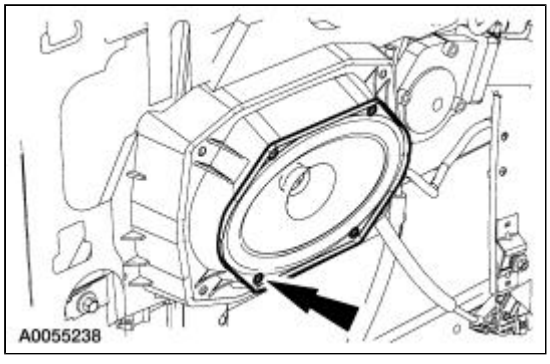
NOTE: For Navigator, the LF/RF door power window regulator motor must be reinitialized whenever the LF/RF motor is removed from the vehicle. For additional information, refer to Window Motor Initialization in this section.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

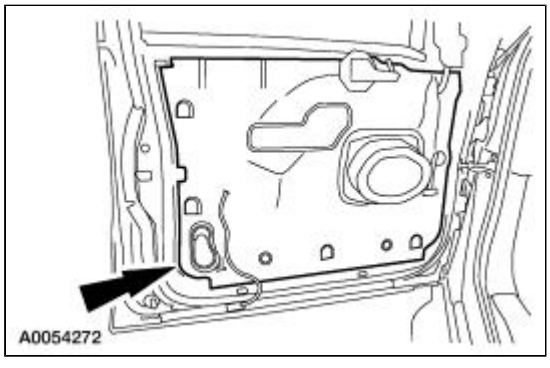
2. Unlock the tabs and remove the window control switch from the door trim panel.



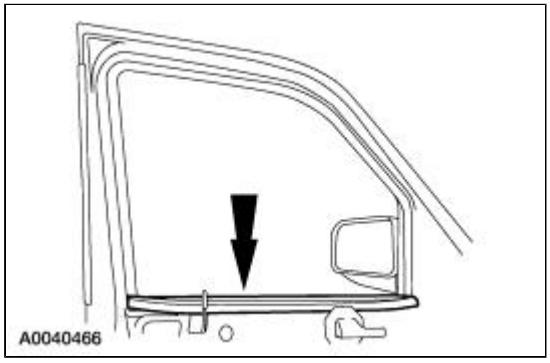
3. Remove the screws and the front door speaker.
   - Disconnect the electrical connector.



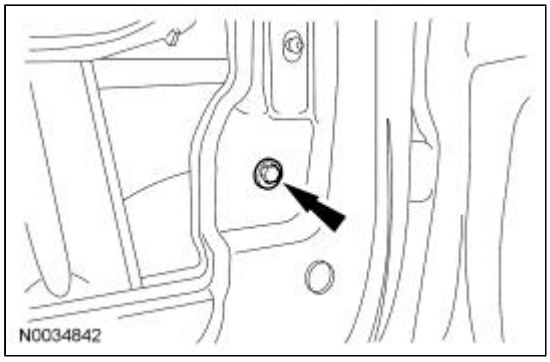
4. Remove the front door weathershield.



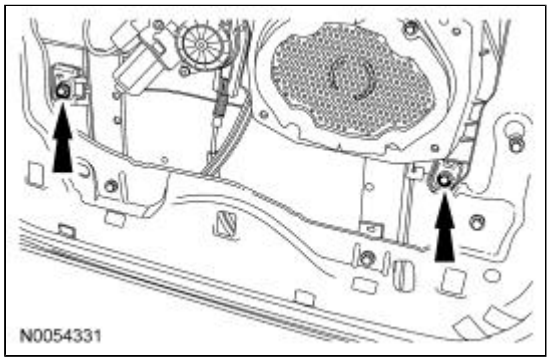
5. Re-connect the electrical connectors to the window control switch.
6. Lower the window glass to access the 2 window glass clamp bolts.
7. Remove the inside glass weatherstrip.



8. Remove the front door glass channel bolt and position aside the channel.

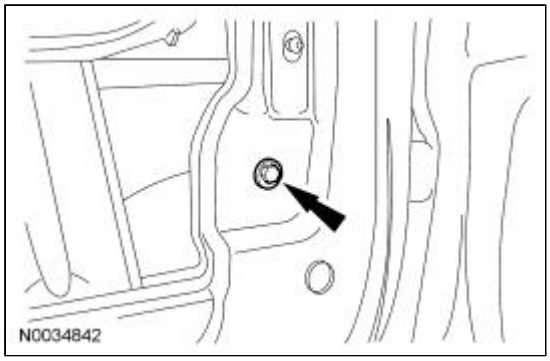


9. Loosen the window glass clamp bolts and remove the front door window glass.

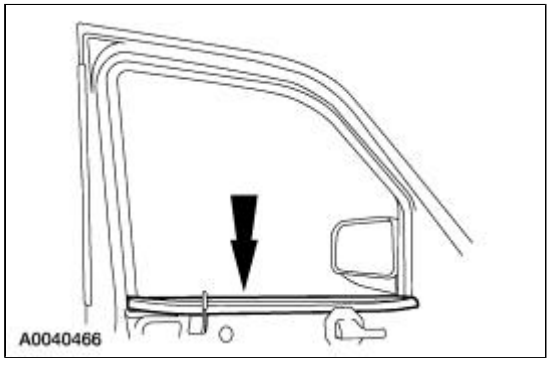


Installation

1. Install the front window glass but do not tighten the window glass clamp bolts.
2. Position the front door glass channel and tighten the bolt to 11 Nm (8 lb-ft).



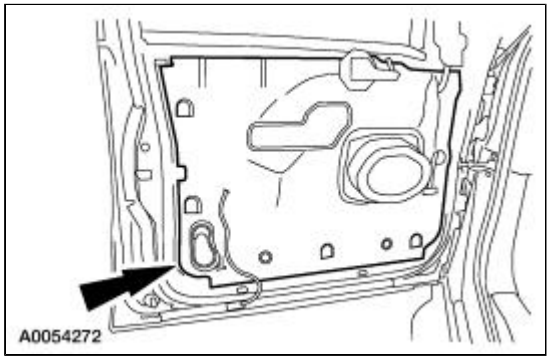
3. Install the inside glass weatherstrip.



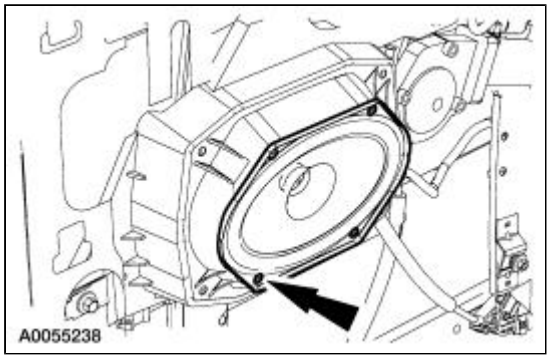
4. Raise the window glass until it stalls in the UP position. Tighten the window glass clamp bolts to 11 Nm (8 lb-ft).
    - For Navigator, the LF/RF door power window regulator motor must be reinitialized whenever the LF/RF motor is removed from the vehicle. For additional information, refer to Window Motor Initialization in this section.

5. Disconnect the window control switch electrical connectors and reinstall the switch into the door trim panel.

6. Install the front door weathershield.



7. Install the front door speaker.
    - Connect the electrical connector and install the screws.



8. Install the front door trim panel. For additional information, refer to Section 501-05 .

Window Regulator — Front Door

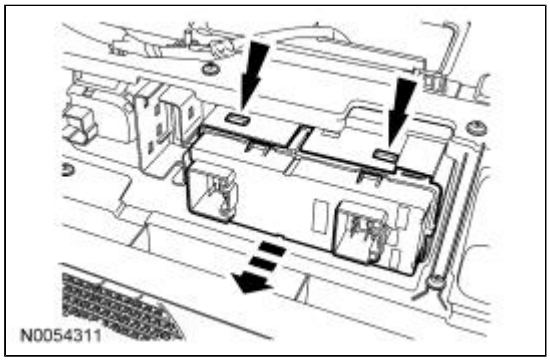
Printable View (357 KB)

Removal and Installation

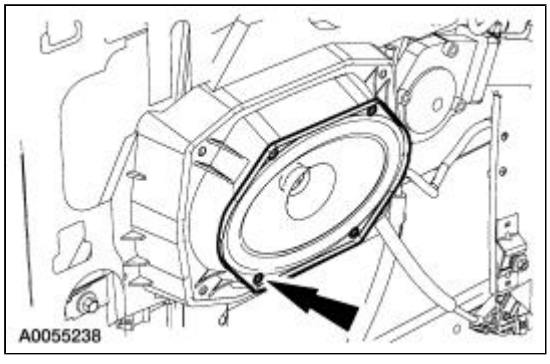
NOTE: For Navigator, the LF/RF door power window regulator motor must be reinitialized whenever the LF/RF window regulator is removed from the vehicle. For additional information, refer to Window Motor Initialization in this section.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

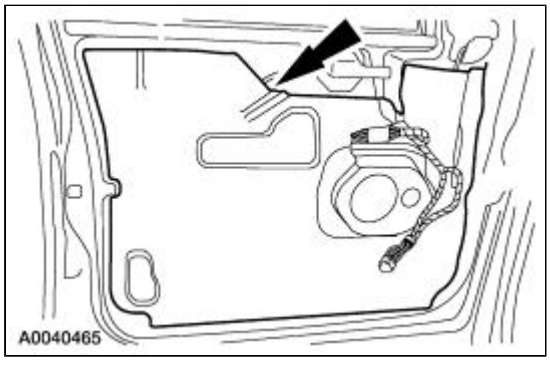
2. Unlock the tabs and remove the window control switch from the door trim panel.



3. Remove the screws and the front door speaker.
   - Disconnect the electrical connector.



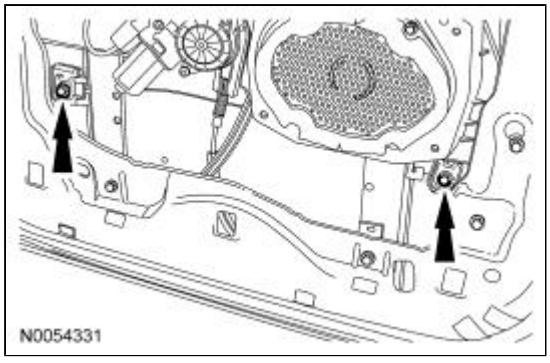
4. Remove the front door weathershield.



5. Re-connect the electrical connectors to the window control switch.

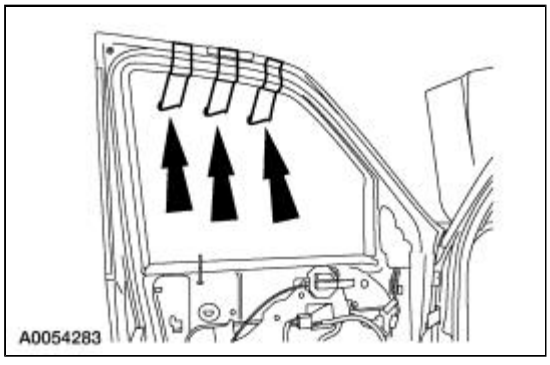
6. Lower the window glass to access the 2 window glass clamp bolts.

7. Loosen the window glass clamp bolts.
    - To install, raise the window glass until it stalls in the UP position. Tighten the window glass clamp bolts to 11 Nm (8 lb-ft).

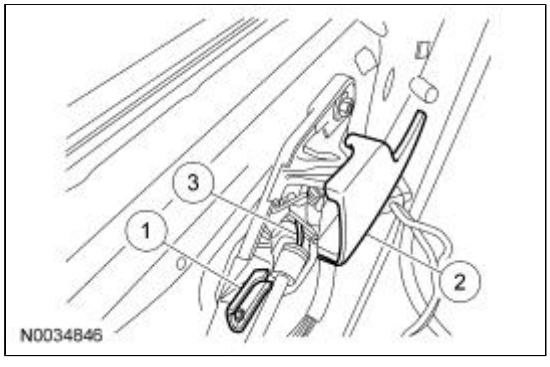


8. **NOTE:** Secure the front window glass in the full UP position.

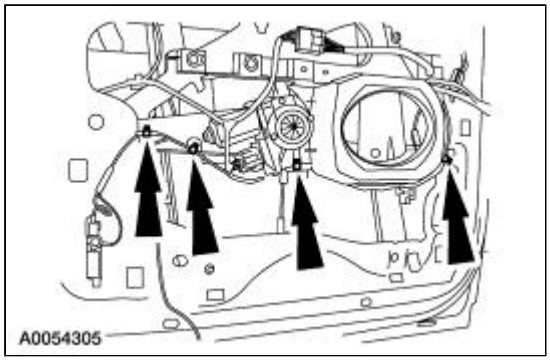
    Secure the front window glass with tape to the front door frame.



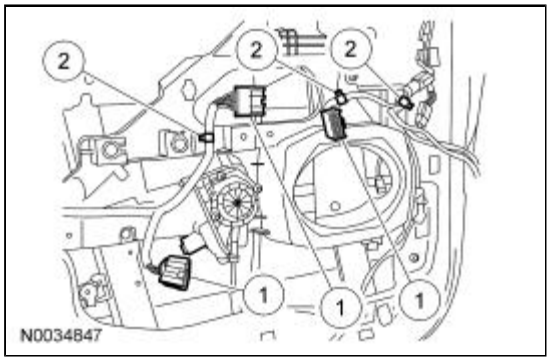
9. Position the interior door handle aside.
    1. Remove the cable conduit fitting from the carrier assembly.
    2. Lift upward on the interior door handle retaining bracket and pivot the interior door handle out of the bracket.
    3. Remove the cable from the door handle.



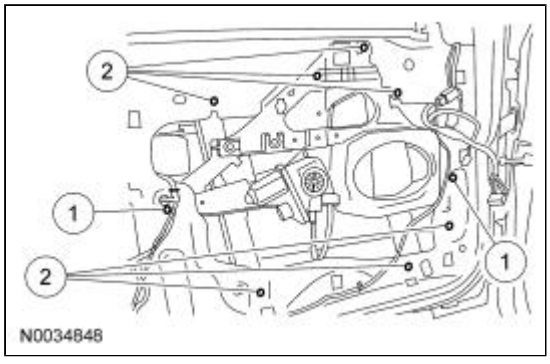
10. Release the crash sensor harness pin-type retainers.



11. Position the front door window regulator harness aside.
    1. Disconnect the electrical connectors.
    2. Release the pin-type retainers.



12. Remove the front window regulator.
    1. Loosen the 2 hanger bolts.
    2. Remove the front window regulator bolts and front top run channel bolt.
        - To install, tighten to 11 Nm (8 lb-ft).



13. To install, reverse the removal procedure.

14. For Navigator, reinitialize the LF/RF window regulator motor. For additional information, refer to Window Motor Initialization in this section.

Window Regulator Motor — Front Door

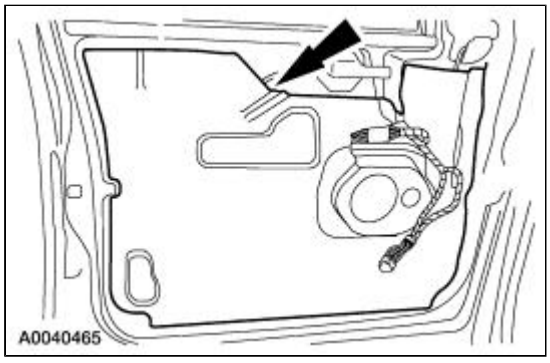
Printable View (135 KB)

Removal and Installation

NOTE: For Navigator, the LF/RF door power window regulator motor must be reinitialized whenever the LF/RF motor is removed from the vehicle. For additional information refer to Window Motor Initialization in this section.

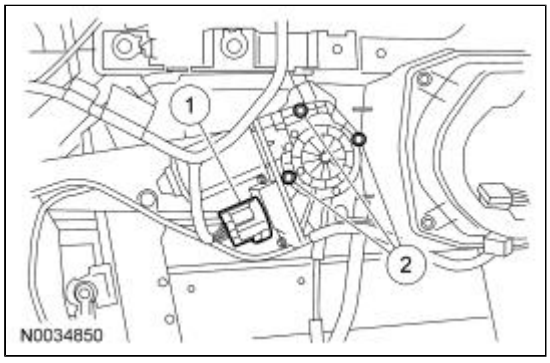
1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

2. Position the front door weathershield aside.



3. **NOTE:** Use a flat-blade screwdriver between the window regulator motor and window regulator assembly to hold the window regulator assembly drum in place.

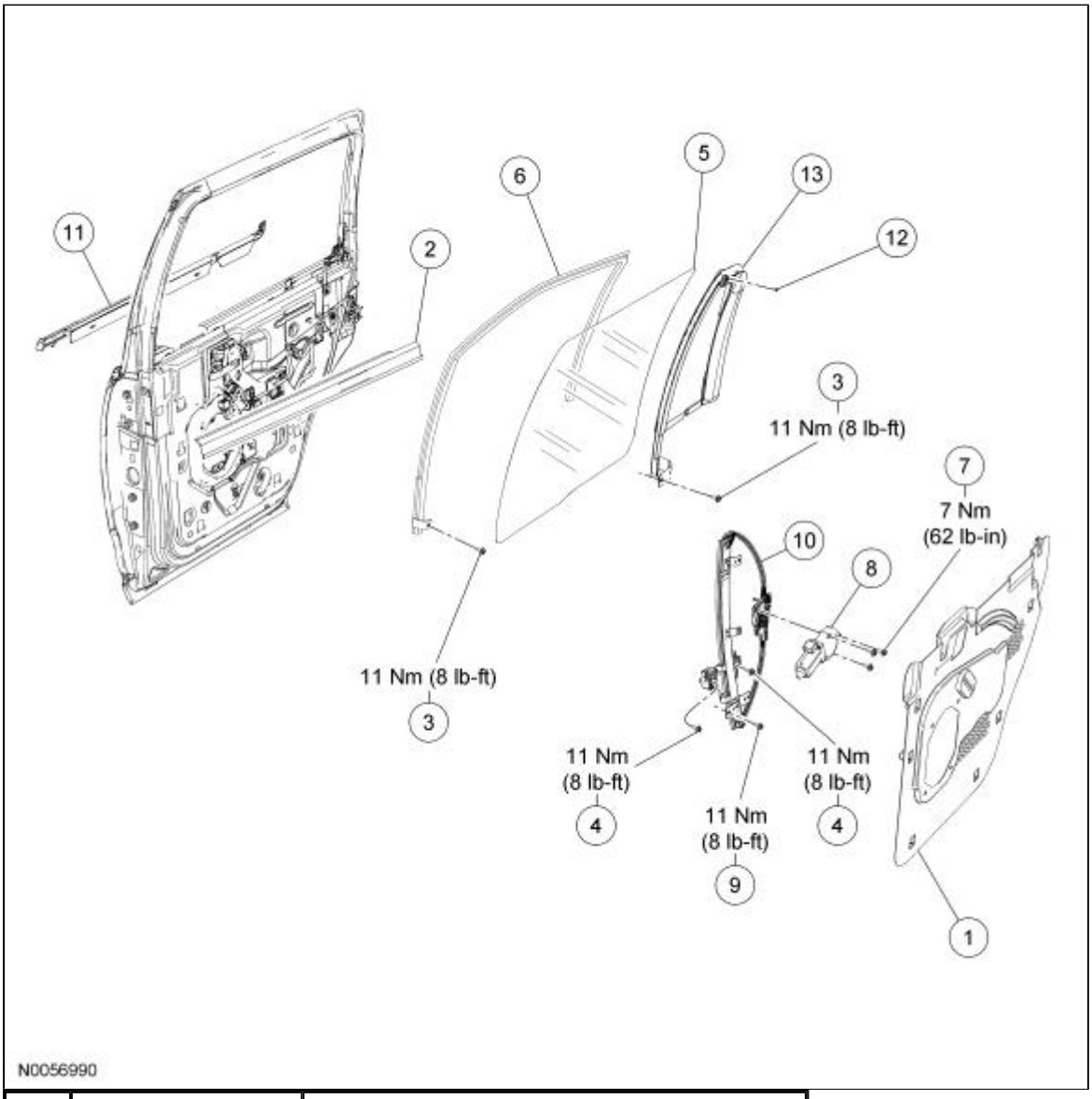
   Remove the bolts and the front door window regulator motor.
   1. Disconnect the electrical connector.
   2. Remove the bolts.
      - To install, tighten to 7 Nm (62 lb-in).



4. To install, reverse the removal procedure.
   - For Navigator, reinitialize the LF/RF window regulator motor. For additional information, refer to Window Motor Initialization in this section.
   - Cycle the window glass to make sure the gears engage.

Glass, Frames and Mechanisms — Exploded View, Rear Door

Printable View (174 KB)



Item	Part Number	Description
1	—	Rear door weathershield
2	25860	Inside glass weatherstrip
3	W710330	Rear door top run channel bolts (2 required)
4	—	Window glass clamp bolts (PIA)
5	25712 RH/ 25713 LH	Rear door glass
6	25766 RH/ 25767 LH	Rear door top run
7	—	Rear door glass regulator motor bolts (3 required)

8	23394	Rear door glass regulator motor
9	W710330	Rear door glass regulator frame bolts (8 required)
10	27008	Rear door glass regulator assembly
11	25596	Outer glass weatherstrip
12	W504041-S437	Rear door vent glass frame screw
13	25828	Rear door vent glass assembly

1. For additional information, refer to the procedures in this section.

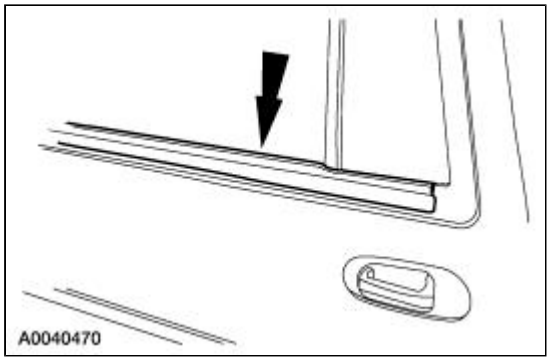
Window Glass — Fixed, Rear Door

Printable View (95 KB)

Removal and Installation

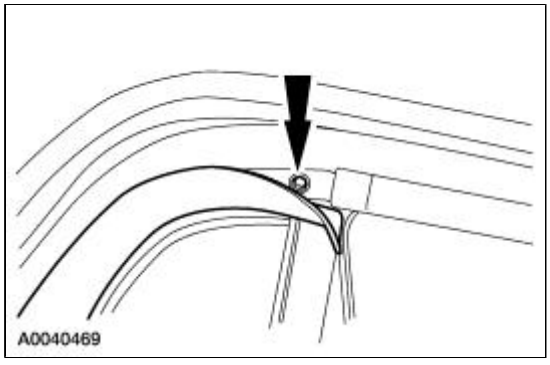
1. Remove the rear door window glass. For additional information, refer to Window Glass — Rear Door in this section.

2. Remove the rear door exterior glass moulding.

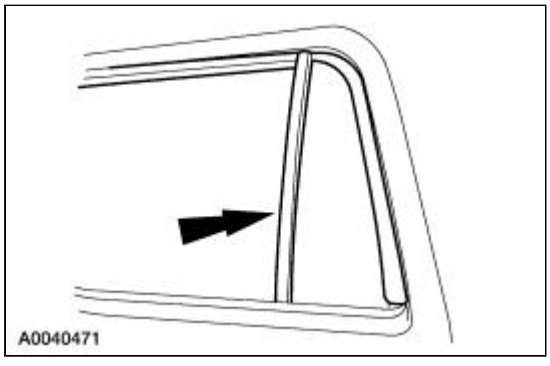


3. Remove the rear door glass top run. For additional information, refer to Door Glass Top Run — Rear in this section.

4. Remove the rear door stationary glass screw.



5. Remove the stationary rear door glass.



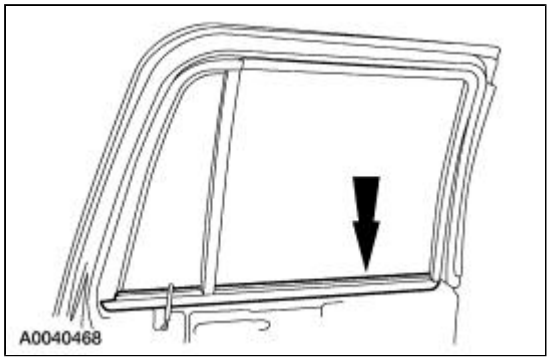
6. To install, reverse the removal procedure.

Door Glass Top Run — Rear

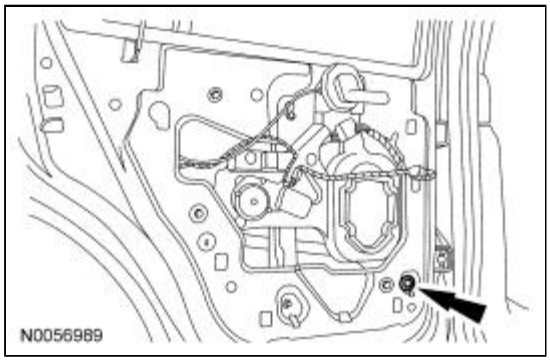
Printable View (114 KB)

Removal and Installation

1. Lower the rear door window glass.
2. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
3. Remove the inside glass weatherstrip.



4. Remove the rear door glass channel bolts.
   - To install, tighten to 11 Nm (8 lb-ft).



5. Remove the rear door glass top run.
6. To install, reverse the removal procedure.

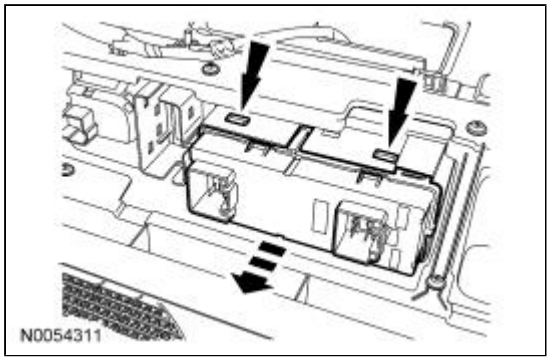
Window Glass — Rear Door

Printable View (186 KB)

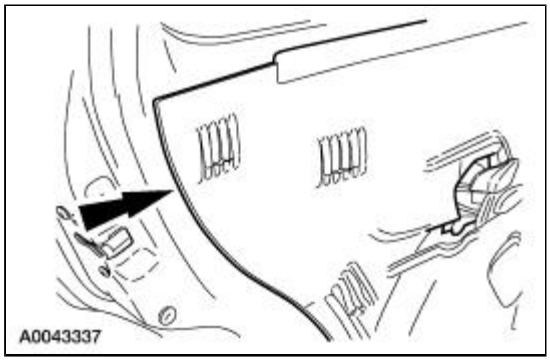
Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. **NOTE:** LF shown, LR and RR are similar.

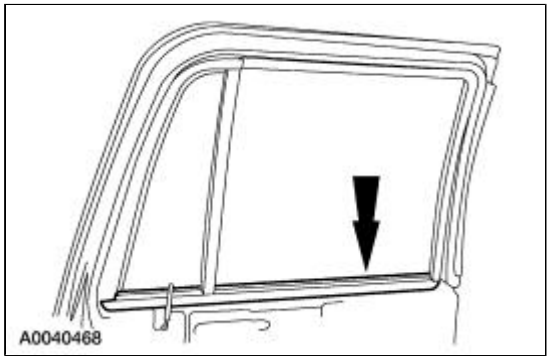
   Unlock the tabs and remove the window control switch from the door trim panel.



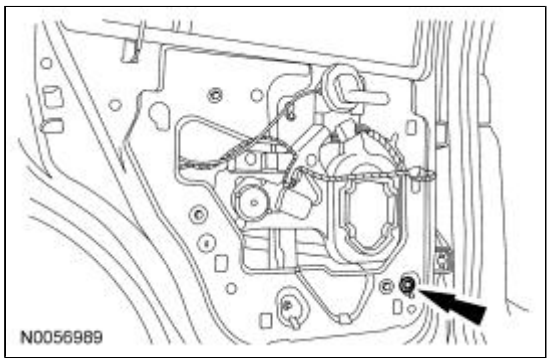
3. Position back the rear door weathershield.



4. Connect the window control switch.
5. Lower the window glass to access the window glass clamp bolts.
6. Remove the inside glass weatherstrip.



7. Remove the rear door glass channel bolt.
    - To install, tighten to 11 Nm (8 lb-ft).



8. Loosen the window glass clamp bolts and remove the rear door window glass.
    - To install, tighten to 11 Nm (8 lb-ft).

9. To install, reverse the removal procedure.

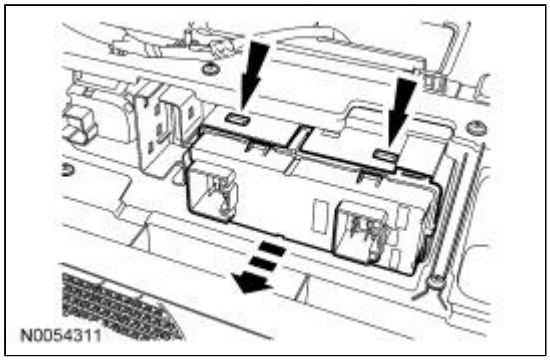
Window Regulator — Rear Door

Printable View (254 KB)

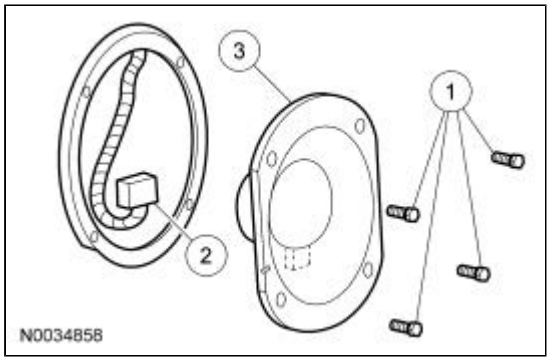
Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. **NOTE:** LF shown, LR and RR are similar.

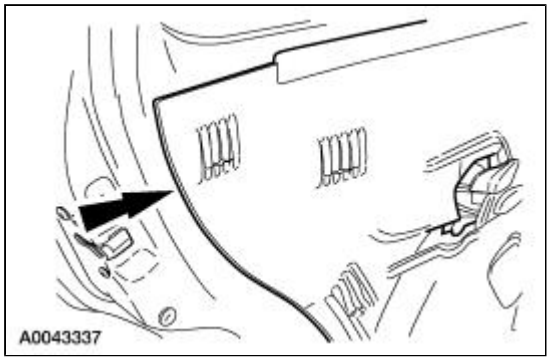
   Unlock the tabs and remove the window control switch from the door trim panel.



3. Remove the rear door speaker.
   1. Remove the screws.
   2. Disconnect the electrical connector.
   3. Remove the speaker.

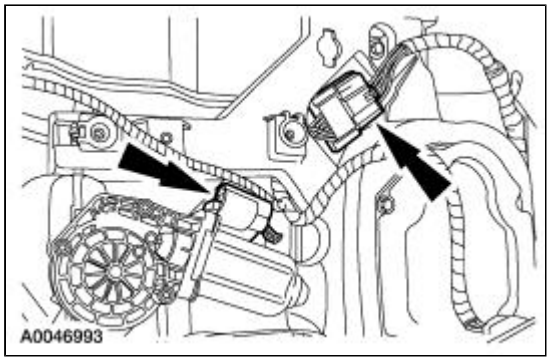


4. Remove the rear door weathershield.

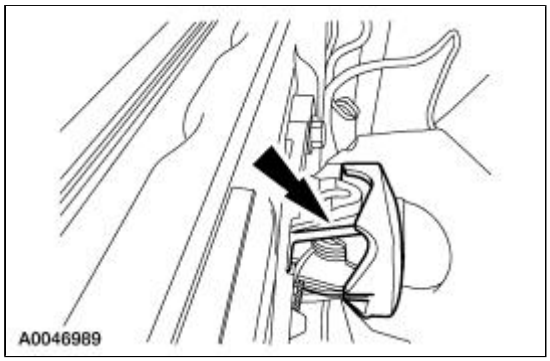


5. Connect the window control switch.
6. Lower the window glass to access the window glass clamp bolts.
7. Disconnect the window control switch.
8. Loosen the window glass clamp bolts and remove the rear door window glass.
    - To install, tighten to 11 Nm (8 lb-ft).
9. **NOTE:** Secure the rear window glass in the full UP position.

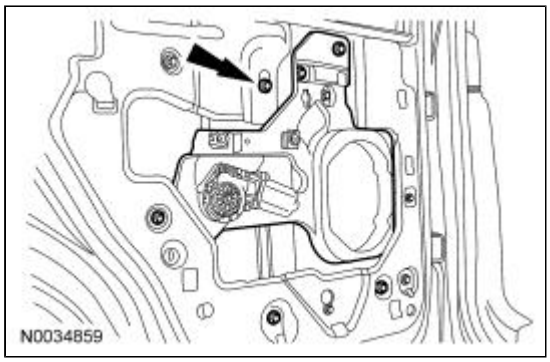
    Secure the rear window glass with tape to the front door frame.
10. Disconnect the rear door window regulator electrical connectors.



11. Position the interior door handle aside.
    - Lift upward on the interior door handle retaining bracket and pivot the interior door handle out of the bracket.



12. Remove the rear door window regulator assembly.
    - Remove the bolts.
        - To install, tighten to 11 Nm (8 lb-ft).



13. To install, reverse the removal procedure.

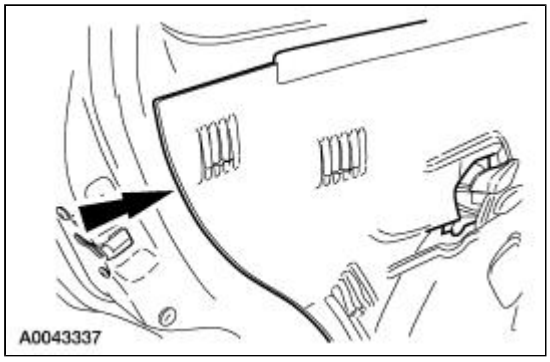
Window Regulator Motor — Rear Door

Printable View (140 KB)

Removal and Installation

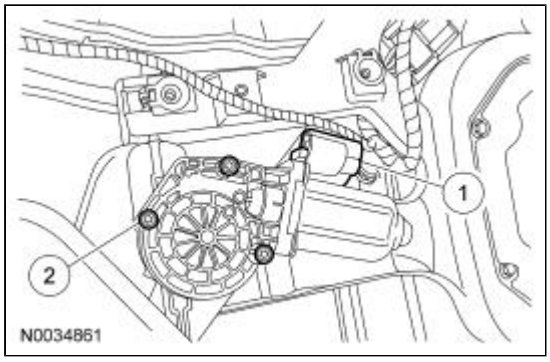
1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .

2. Position the rear door weathershield aside.



3. **NOTE:** Use a flat-blade screwdriver between the window regulator motor and the window regulator assembly to hold the window regulator assembly drum in place.

   Remove the rear door window regulator motor.
   1. Disconnect the electrical connector.
   2. Remove the bolts.
      - To install, tighten to 7 Nm (62 lb-in).



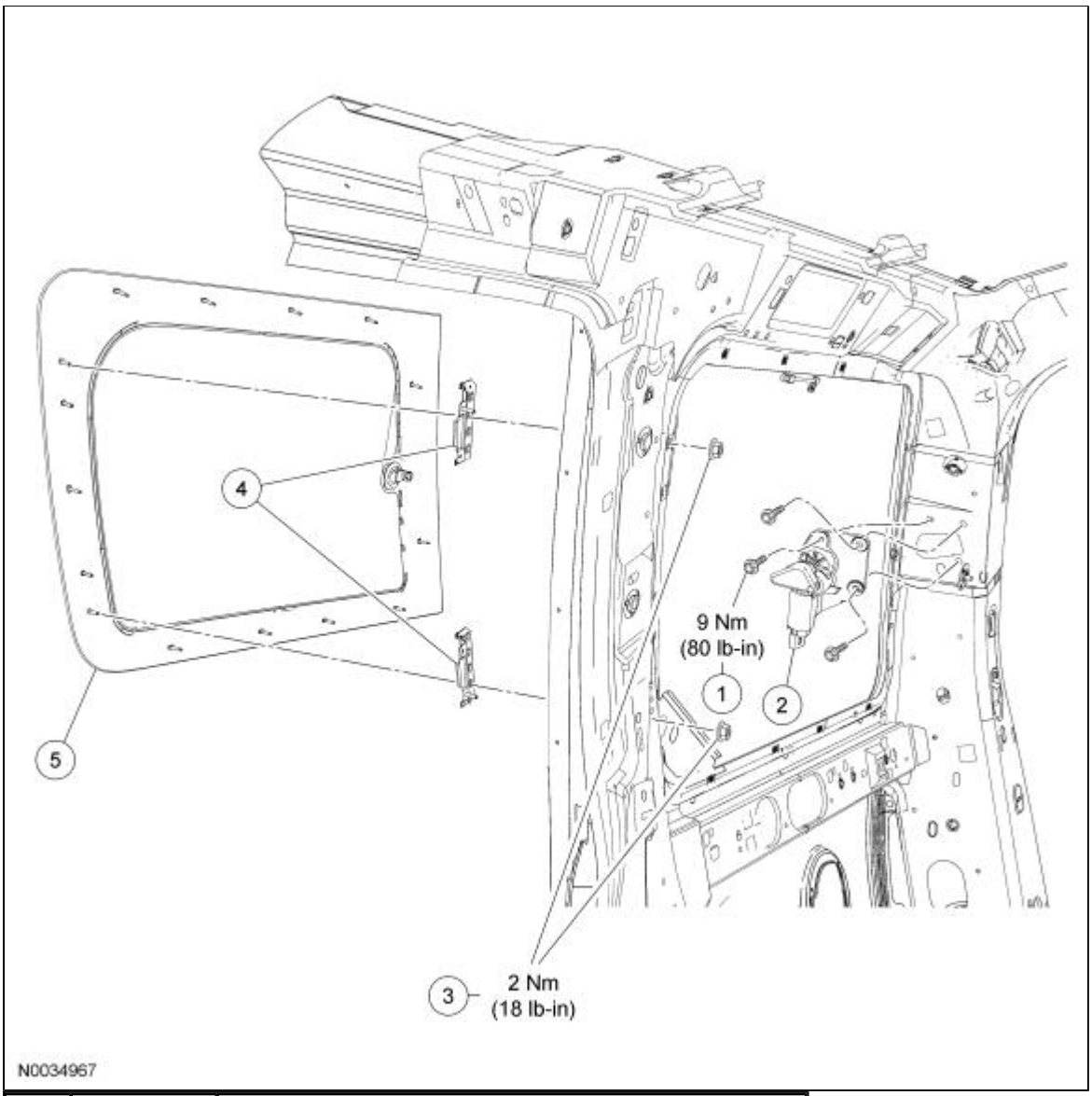
4. To install, reverse the removal procedure.
   - Cycle the door glass to make sure of gear engagement.

Window Glass — Rear Quarter

Printable View (345 KB)

Material

Item	Specification
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B1



Item	Part Number	Description
1	—	Rear quarter window regulator motor bolts (3 required)
2	30306	Rear quarter window regulator assembly
3	N621901	Rear quarter window glass nuts (15 required)

4	—	Rear quarter window hinge assembly (serviced with quarter glass assembly)
5	29600	Rear quarter window glass assembly

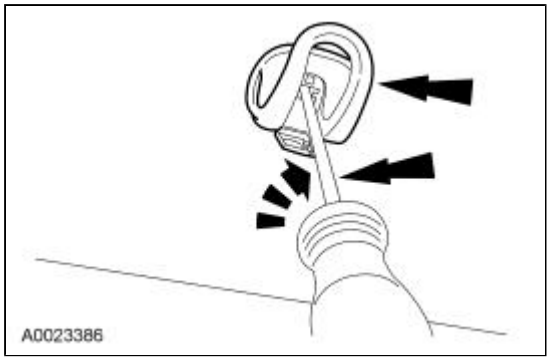
Removal

All vehicles

1. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .

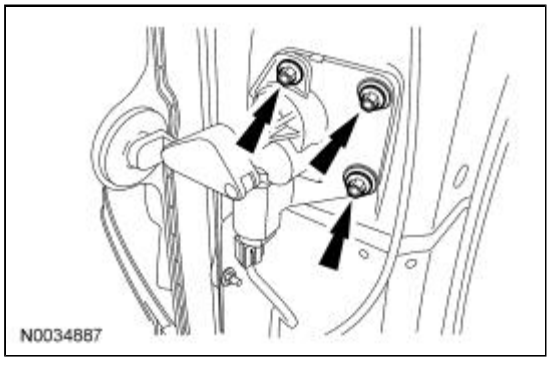
2. **CAUTION: To prevent damage to the coat hanger retainer, use a 3/16-inch flat-blade screwdriver for this step.**

   Remove the front and rear coat hooks and lower the headliner over the rear quarter window glass.
   - Open the access cover.
   - Insert a screwdriver into the coat hook slot and turn the screwdriver 90 degrees so that it engages in the plastic component slot. This will spread the steal attachment clip wings to allow the plastic component to disengage.



Vehicles with power vent window

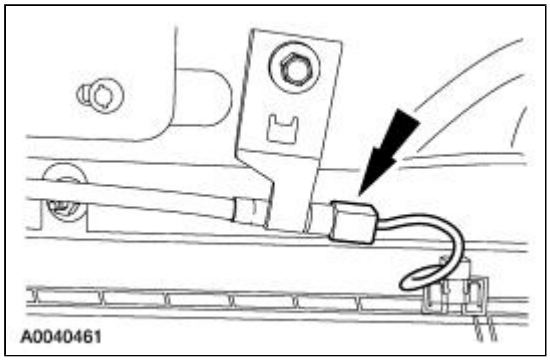
3. Remove the bolts and rear quarter window regulator motor.
   - Disconnect the electrical connector.



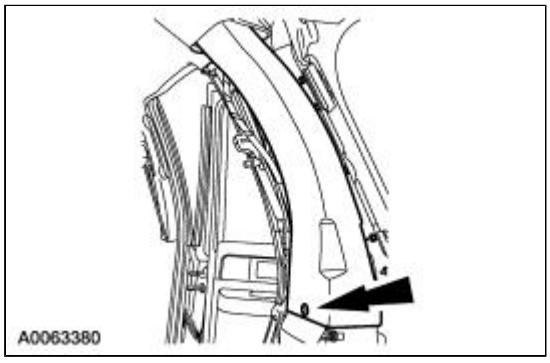
4. Disconnect the rear quarter window regulator.

All vehicles

5. Disconnect the audio antenna.

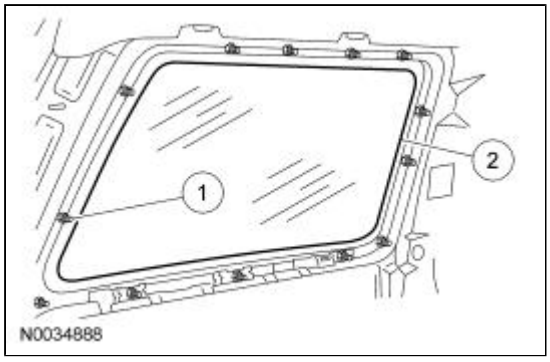


6. If equipped, remove the air duct.
    - Remove the pin-type retainer.

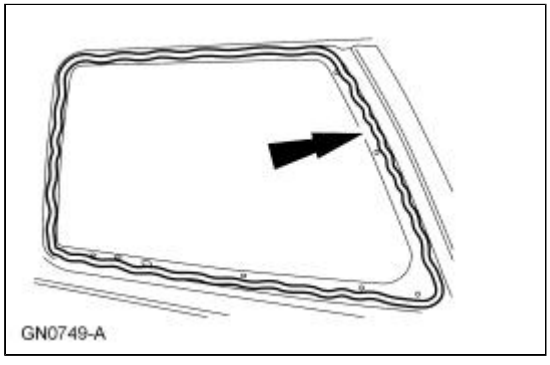


7. **CAUTION: Have an assistant hold the rear quarter window glass.**

    Remove the rear quarter window glass.
    1. Remove the nuts.
    2. Remove the rear quarter window glass.



8. Remove the excess foam core butyl from the window opening.

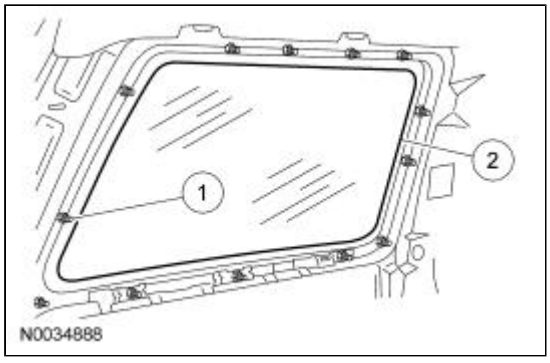


Installation

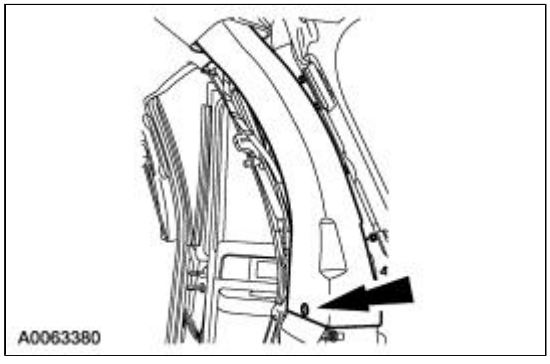
All vehicles

1. Apply 8 mm (0.32 in) Foam Core Butyl or equivalent meeting Ford specification WSB-M3G143-B1 to the rear quarter window glass frame.
    - Start at the bottom middle and work around the frame.

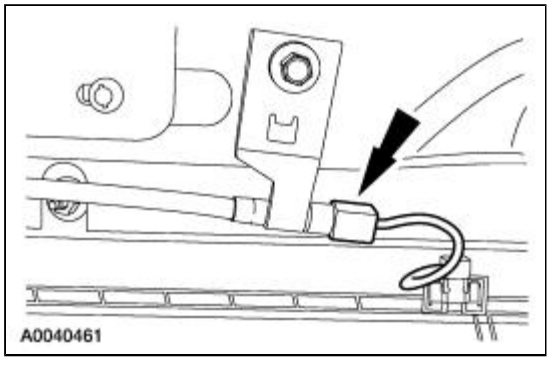
2. Install the rear quarter window glass.
    1. Position the rear quarter window glass.
    2. Install the rear quarter window glass nuts.
    - Tighten to 2 Nm (18 lb-in).



3. If equipped, install the air duct.
    - Install the pin-type retainer.

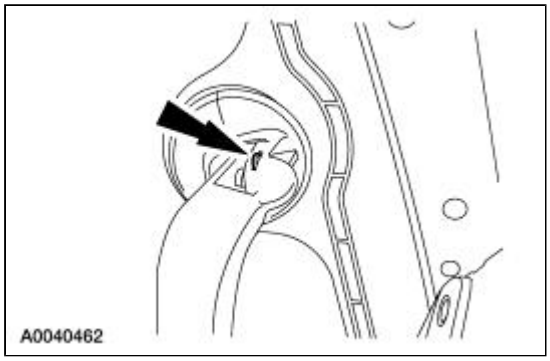


4. Connect the audio antenna.

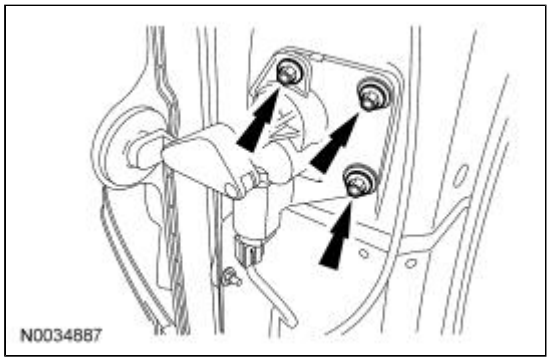


Vehicles with power vent windows

5. Install the rear quarter window regulator.



6. Install the bolts and rear quarter window regulator motor.
    - Tighten to 9 Nm (80 lb-in).
    - Connect the electrical connector.



All vehicles

7. Position the headliner and install the coat hooks.

8. Install the rear quarter trim panel. For additional information, refer to Section 501-05 .

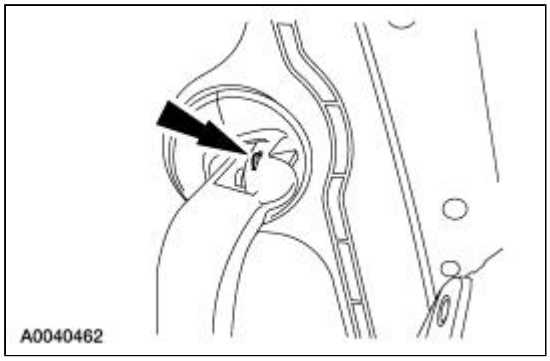
Window Regulator Motor — Rear Quarter

Printable View (109 KB)

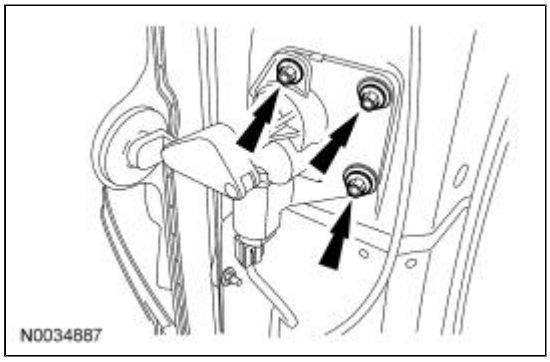
Removal

1. Remove the D-pillar trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the rear quarter window regulator motor.
   - Remove the retaining clip.



3. Remove the bolts and rear quarter window regulator motor.
   - To install, tighten to 9 Nm (80 lb-in).
   - Disconnect the electrical connector.



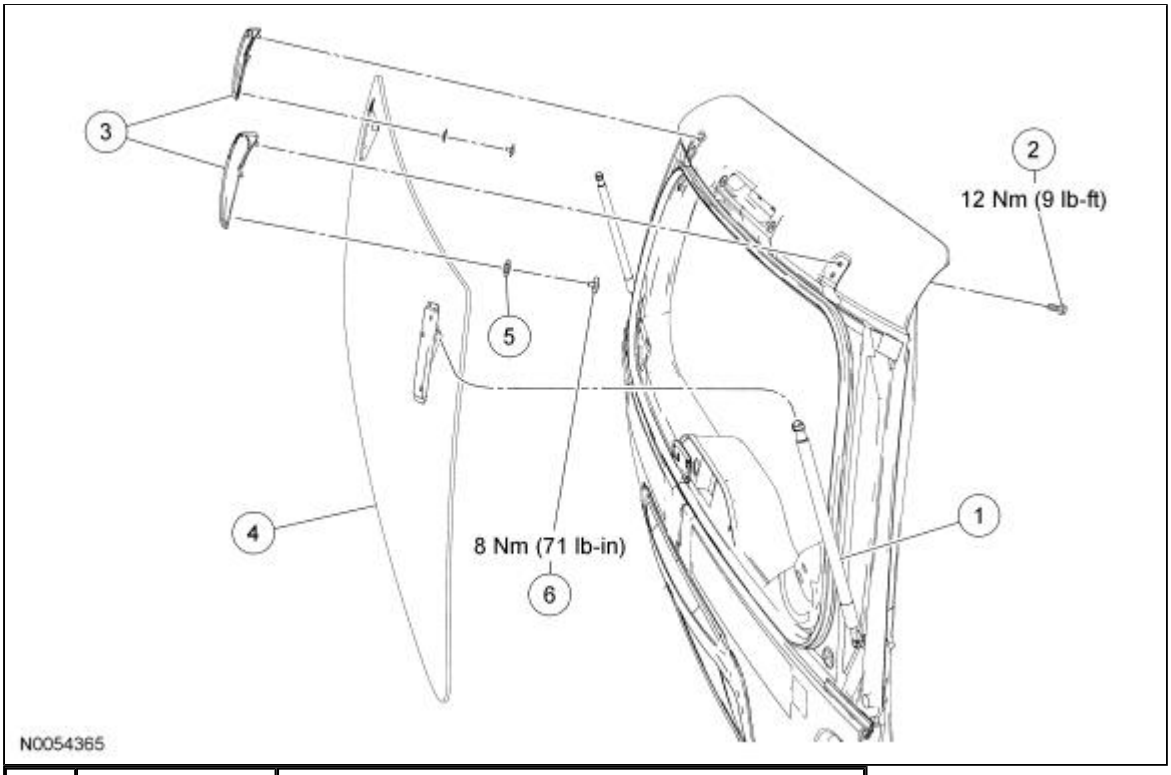
4. To install, reverse the removal procedure.

Window Glass — Liftgate

Printable View (222 KB)

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6

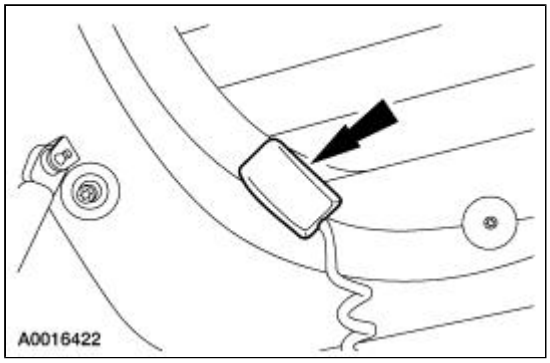


Item	Part Number	Description
1	42104	Liftgate glass assist cylinders (2 required)
2	W712536-S439	Liftgate glass hinge-to-body fastener (2 required)
3	420A68	Liftgate glass hinge assembly (2 required)
4	422A12	Liftgate glass assembly
5	40610	Nylon spacer
6	—	Liftgate glass-to-hinge bolt

Removal and Installation

Window glass assembly

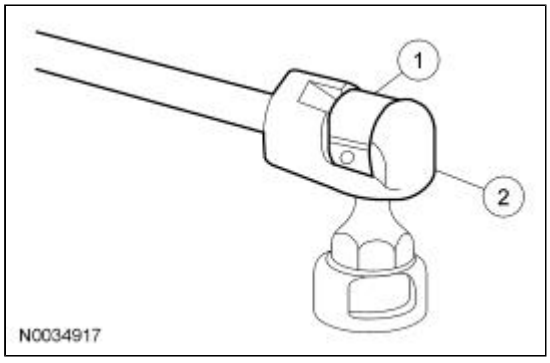
1. Remove the rear window wiper motor. For additional information, refer to Section 501-16 .
2. Disconnect the rear window defrost electrical connectors.



3. **CAUTION: The liftgate glass must be supported when removing and installing the liftgate assist cylinders.**

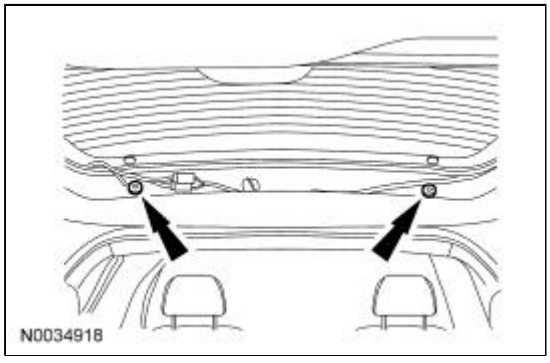
   CAUTION: Do not extend the socket clips more than 2.0 mm (0.08 in) or failure of the socket can occur.

   Disconnect the 2 liftgate glass assist cylinders.
   1. Insert a screwdriver blade under the socket clip and lift.
   2. Gently pull the socket off the ball stud.



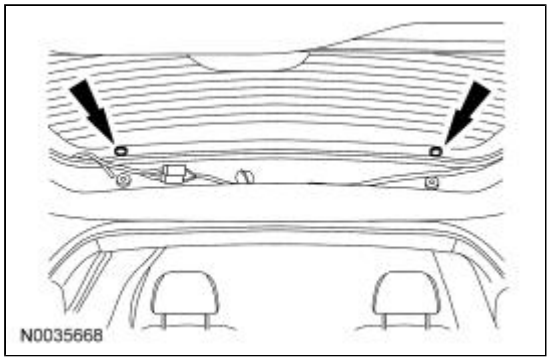
Window glass assembly or hinge assembly

4. Remove the liftgate glass hinge-to-body fasteners and remove the glass.
   - To install, tighten to 12 Nm (9 lb-ft).



Window hinge assembly

5. Remove the liftgate glass to hinge fasteners and remove the glass.
   - Apply Threadlock 262 to the liftgate glass to hinge fasteners during installation.
   - To install, tighten to 8 Nm (71 lb-in).



Window glass assembly or window hinge assembly

6. To install, reverse the removal procedure.

Printable View (65 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Assist handle bolts	6	—	53
Bulkhead electrical connector bolts	3	—	27
Front floor console screws	7	—	62
Front floor console bracket-to-floor bolts	40	30	—
Front floor console bracket-to-instrument panel bolts	9	—	80
Front floor console front bolts	11	8	—
Front floor console rear bolts	11	8	—
Hood release handle bolts	9	—	80
Instrument panel bolts	30	22	—
Instrument panel cowl bolts	30	22	—
Instrument panel floor brace bolts	9	—	80
Intermediate shaft pinch bolt	30	22	—
Parking brake release handle bolts	9	—	80
Rear floor console front bolts	12	9	—
Steering column reinforcement panel bolts	9	—	80

Instrument Panel

Printable View (63 KB)

The instrument panel consists of the following components:

- Instrument panel cluster finish panel
- Instrument panel defroster grille
- Analog clock (Navigator only)
- Instrument cluster
- Radio
- Climate control assembly
- Power points
- Instrument panel side finish panels
- Glove compartment
- Instrument panel center finish panel
- Instrument panel steering column cover
- Steering column reinforcement panel
- Switches: headlamp, dimmer, message center, power liftgate and hazard lights
- Audio input jack

Console — Front, Floor

Printable View (62 KB)

The front floor console may consist of the following components:

- A/C integral control assembly
- Auxiliary A/C controls
- Auxiliary power point
- Center console finish panel
- Console finish panel mat
- Shift lever
- Cup holders
- Audio input jack (Navigator only)
- Rear audio controls
- Satellite radio module and antenna

Console — Rear, Floor

Printable View (62 KB)

The rear console consists of the following components:

- Armrest
- Cup holders
- Storage bin

Console — Overhead

Printable View (62 KB)

There are 2 versions of the overhead console, with and without the roof opening panel.

The overhead console with the roof opening panel may contain the following:

- Climate controls (optional)
- Map lamps/switches
- Roof opening panel switch
- Rear quarter window switches (optional)

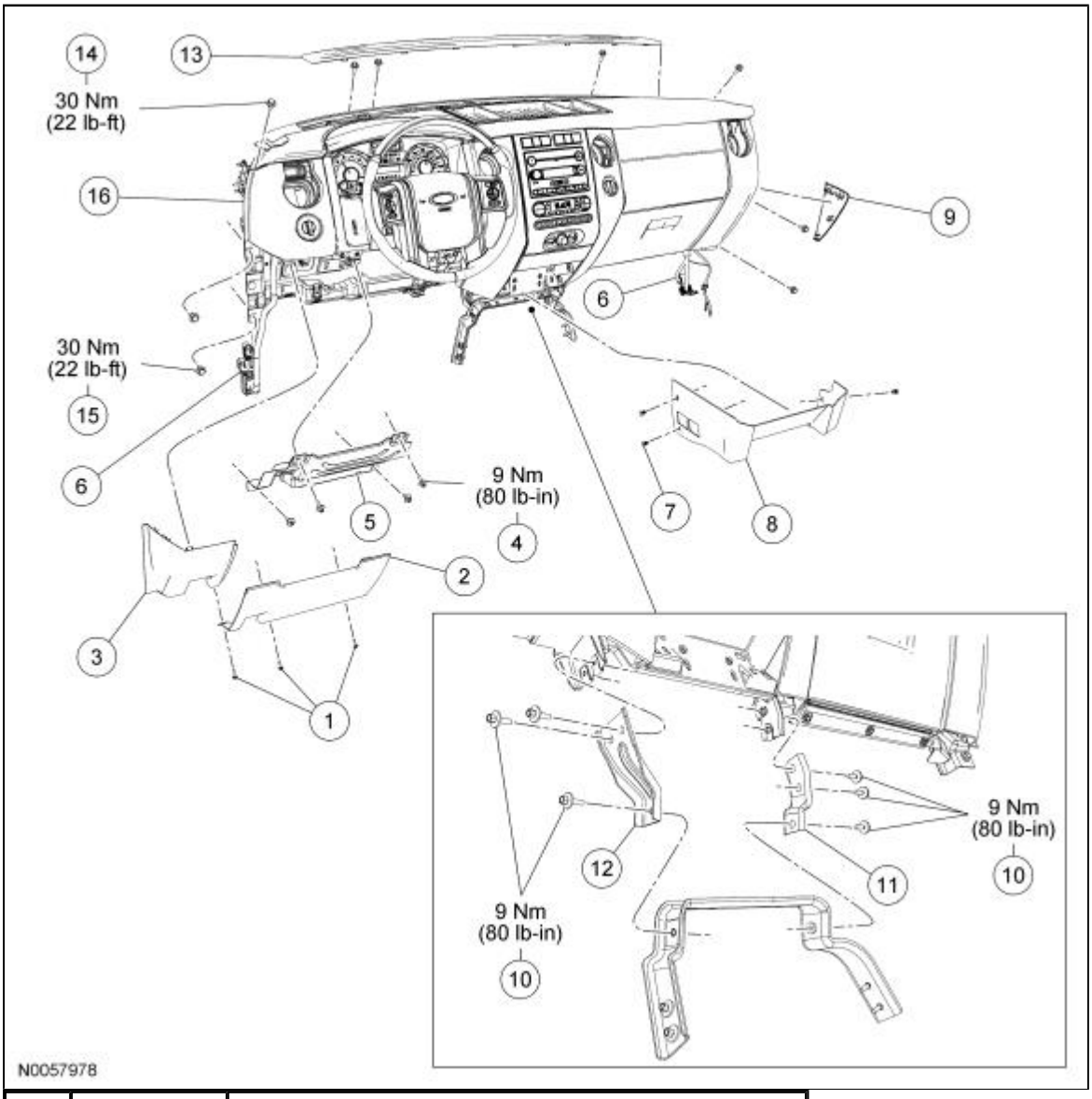
The overhead console without the roof opening panel may contain the following:

- Climate controls (optional)
- Glasses storage bin
- Map lamps/switches
- Rear quarter window switches (optional)
- Storage bin

Instrument Panel — Exploded View

Printable View (357 KB)

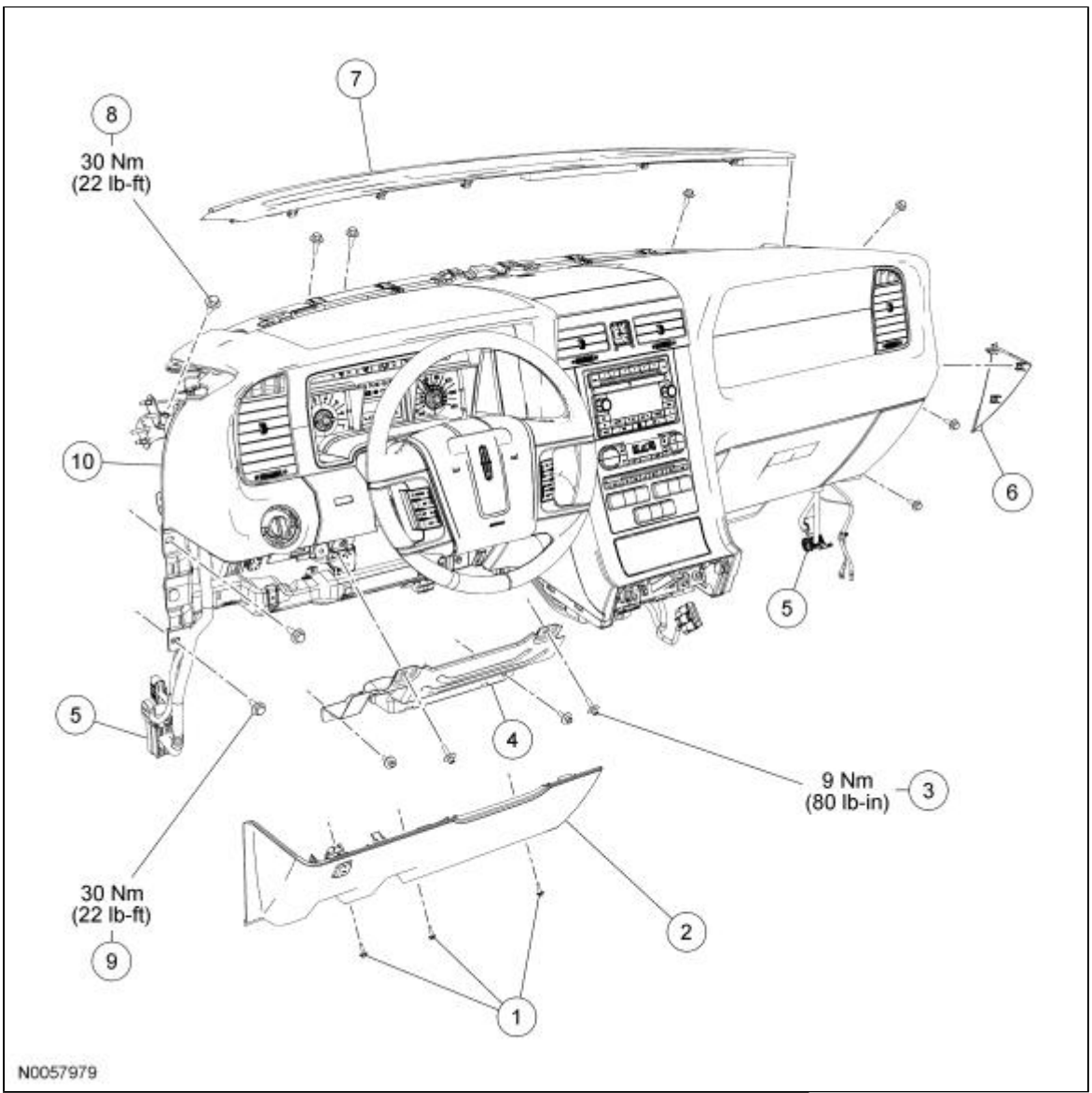
Expedition



Item	Part Number	Description
1	W707628	Instrument panel steering column cover screws (3 required)
2	04459	Instrument panel steering column cover
3	—	Instrument panel lower cover
4	W710879	Steering column reinforcement panel bolt (4 required)
5	017A28	Steering column reinforcement panel
6	14401	Instrument panel electrical wiring harness connectors

7	N811040	Pin-type retainer (3 required)
8	—	Valance panel
9	04480	Instrument panel side finish panel
10	W710879	Instrument panel floor brace bolts (6 required)
11	—	Instrument panel floor brace RH
12	—	Instrument panel floor brace LH
13	044E82	Instrument panel defroster grille
14	W706246	Instrument panel cowl bolt (5 required)
15	W706246	Instrument panel bolt (4 required)
16	04320	Instrument panel

Navigator



Item	Part Number	Description
1	W707628	Instrument panel steering column cover screws (3 required)

2	04459	Instrument panel steering column cover
3	W710879	Steering column reinforcement panel bolt (4 required)
4	017A28	Steering column reinforcement panel
5	14401	Instrument panel electrical wiring harness connectors
6	04480	Instrument panel side finish panel
7	044E82	Instrument panel defroster grille
8	W706246	Instrument panel cowl bolt (5 required)
9	W706246	Instrument panel bolt (4 required)
10	04320	Instrument panel

1. For additional information, refer to the procedures in this section.

Instrument Panel

Printable View (1184 KB)

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

All vehicles

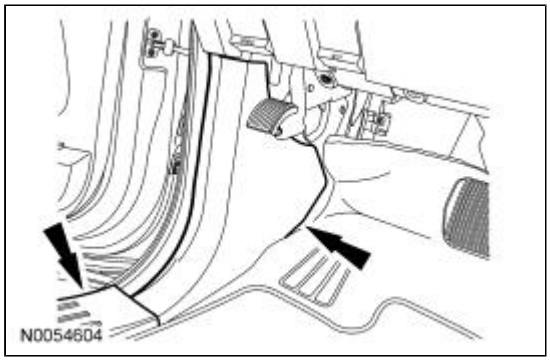
1. If equipped with adjustable pedals, move the pedals to the full forward position.

2. If equipped, remove the front floor console. For additional information, refer to Console — Front, Floor, Navigator or Console — Front, Floor, Expedition in this section.

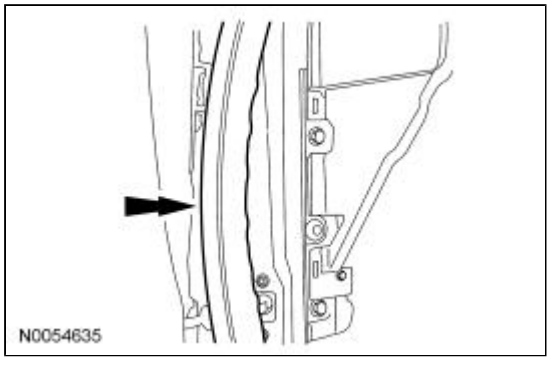
3. Depower the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .

4. If equipped, remove the RH instrument panel insulator.
   - Disconnect the instrument panel insulator lamp.

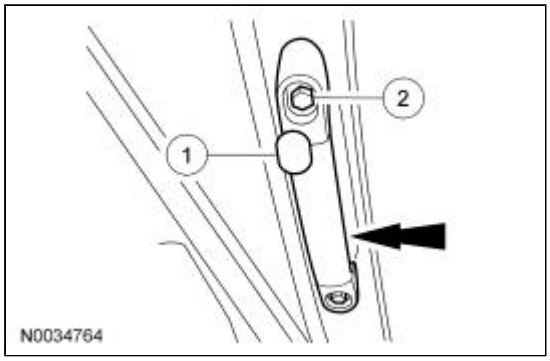
5. Remove the LH and RH cowl trim panels.
   - Remove the scuff plate.
   - Remove the cowl trim panel.



6. Position the LH and RH door weatherstrip seals aside.

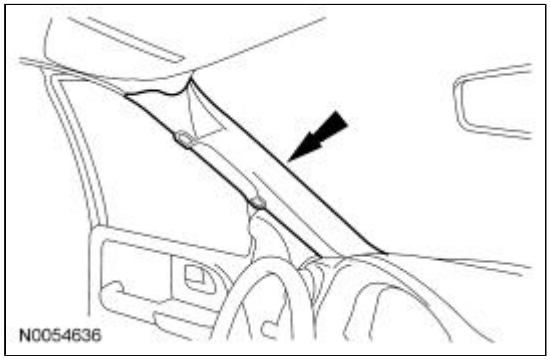


7. Remove the LH and RH assist handles.
   1. Remove the covers.
   2. Remove the bolts.
      - To install, tighten to 6 Nm (53 lb-in).



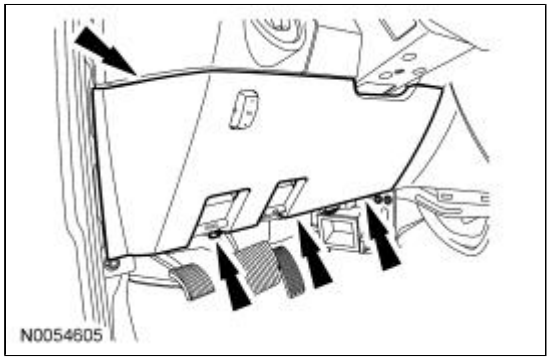
8. **NOTE:** Release the top attachments by pulling inboard first and then upward to release the lower hook.

   Remove the LH and RH A-pillar trim panels.

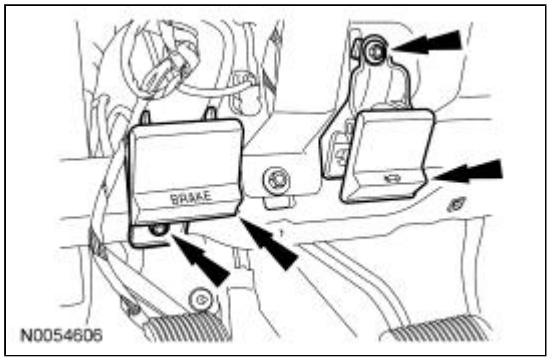


Navigator only

9. Remove the instrument panel steering column cover.
   - Remove the screws.
   - Release the cover from the instrument panel.
   - Disconnect the electrical connector, if equipped.

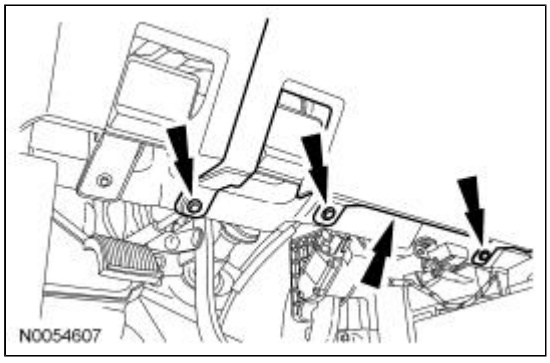


10. Position the hood release and parking brake release handles aside.
    - Remove the screws.
    - Position the release handles aside.
      - To install, tighten to 9 Nm (80 lb-in).



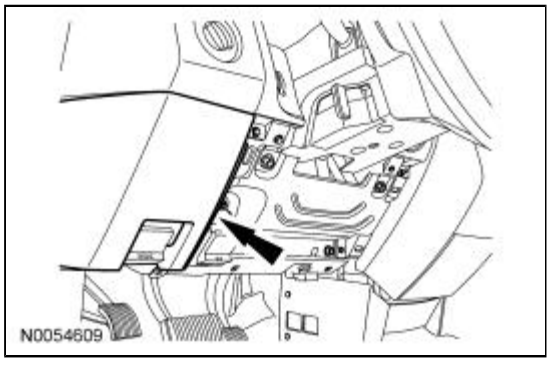
Expedition only

11. Remove the instrument panel steering column cover.
    - Remove the screws.
    - Release the cover from the instrument panel.

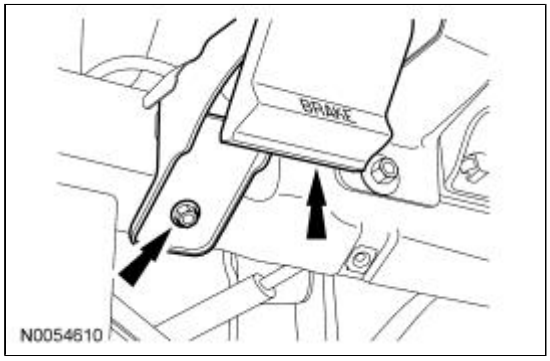


12. Remove the hood release handle bolt and position aside.
    - To install, tighten to 9 Nm (80 lb-in).

13. Remove the instrument panel lower cover.



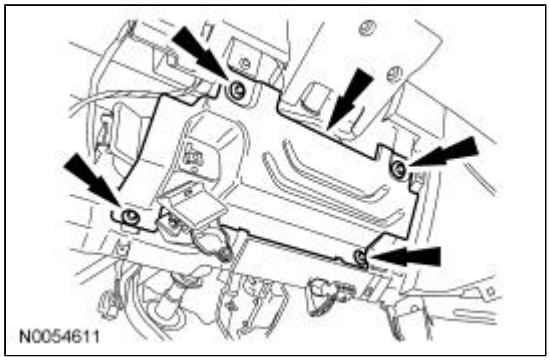
14. Remove the bolt from the parking brake handle and position aside.
    - To install, tighten to 9 Nm (80 lb-in).



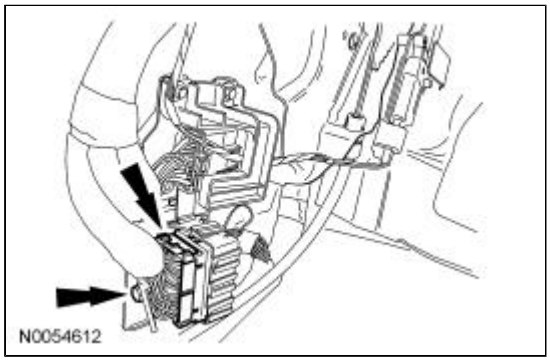
All vehicles

15. **NOTE:** Navigator shown, Expedition similar.

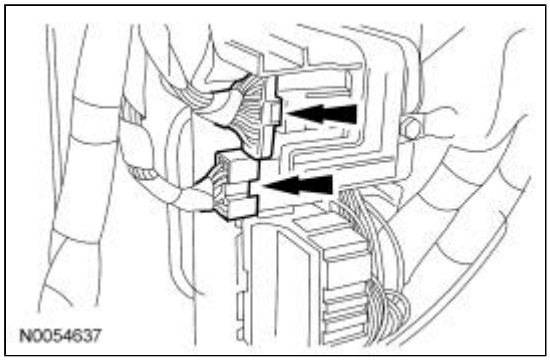
    Remove the bolts and the steering column reinforcement panel.
    - To install, tighten to 9 Nm (80 lb-in).



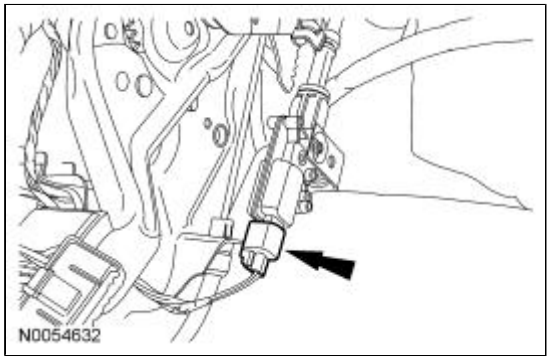
16. Loosen the bolt and disconnect the LH instrument panel bulkhead connector.
    - To install, tighten to 5 Nm (44 lb-in).



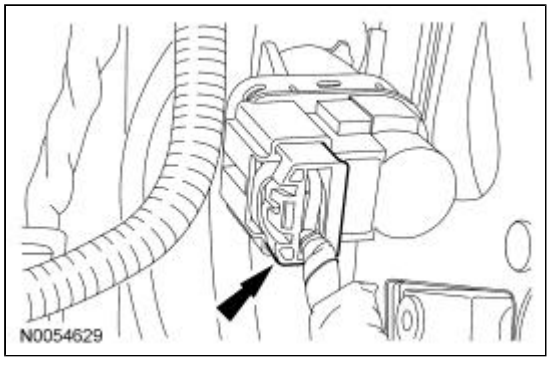
17. Disconnect the LH electrical connectors.



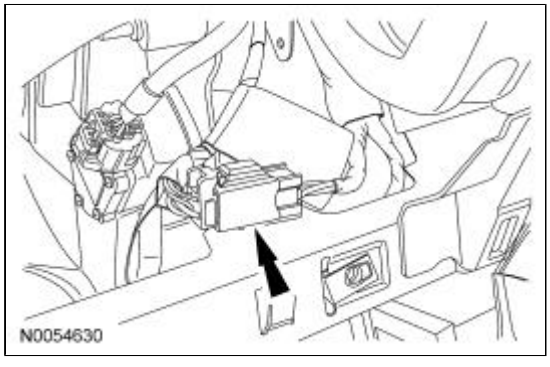
18. Disconnect the park brake indicator connector.



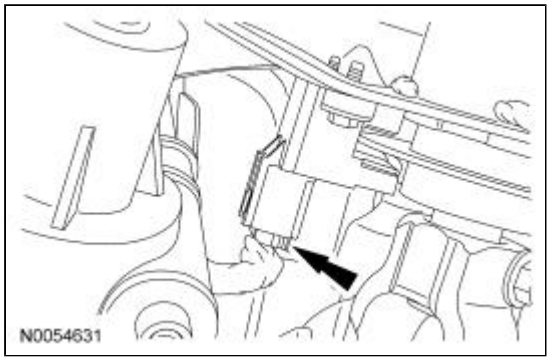
19. Disconnect the cruise control deactivator and the brake on/off switch electrical connector.



20. Disconnect the electrical connector located above the data link.

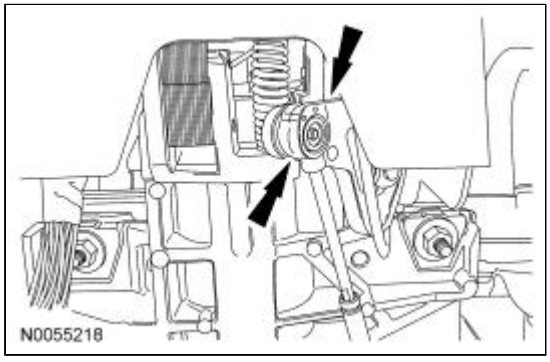


21. Disconnect the steering wheel position sensor electrical connector.

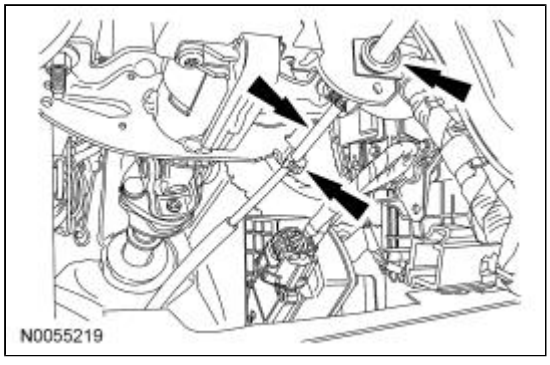


Expedition only

22. Disconnect the steering column shift cable from the shift lever.



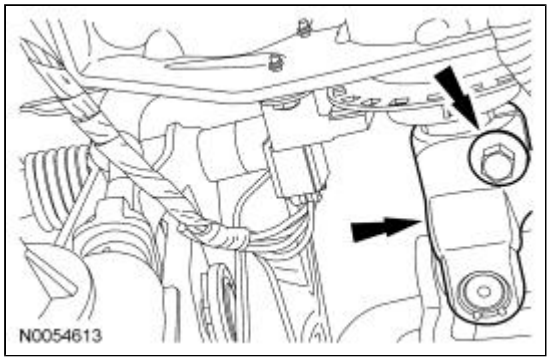
23. Remove the steering column shift cable and position aside.
    - Remove the shift cable from the bracket.
    - Remove the shift cable and retainer from the steering column.



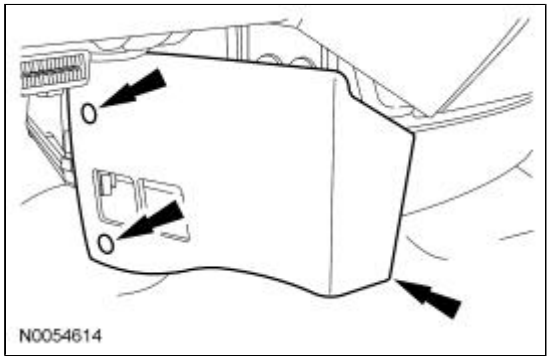
All vehicles

24. **CAUTION: Secure the steering wheel to prevent any rotation or damage to the clockspring.**

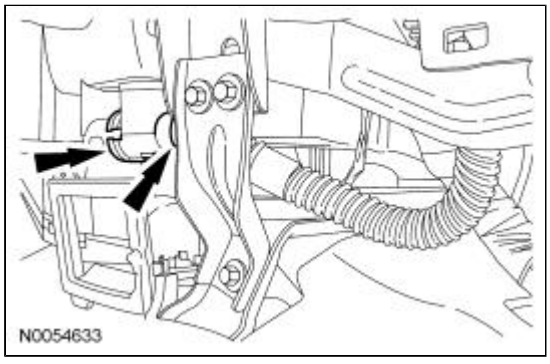
    Remove the pinch bolt and separate the intermediate shaft from the steering column.
    - To install, tighten to 30 Nm (22 lb-ft).



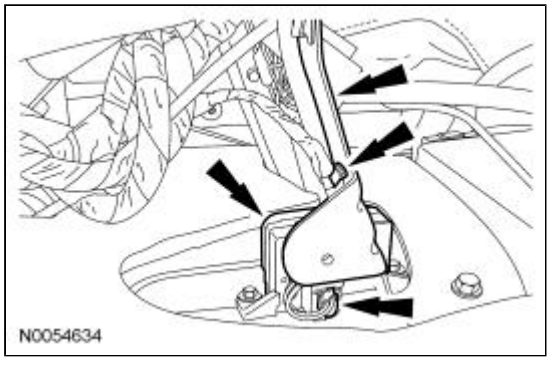
25. If equipped, remove the 3 pin-type retainers and the valance panel.



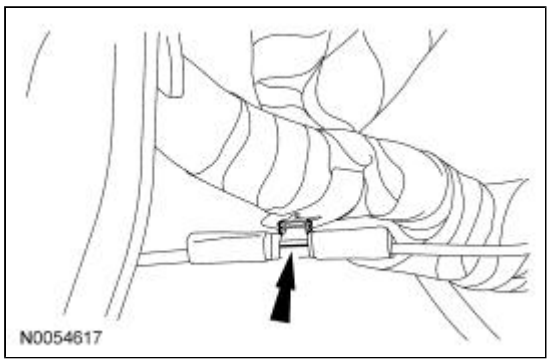
26. If equipped, disconnect the electronic automatic temperature control (EATC) hose from the evaporator case.



27. Disconnect the stability control sensor cluster electrical connector.
    - Disconnect the wiring harness from the console bracket.

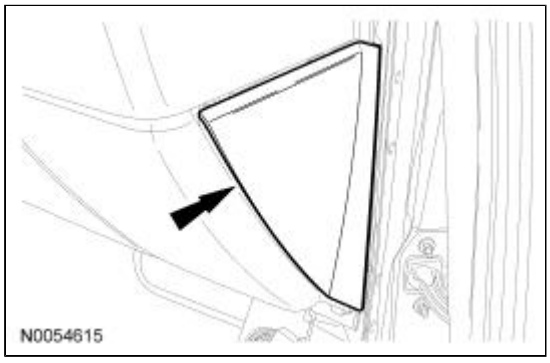


28. Remove the satellite radio antenna from the wiring harness, if equipped.

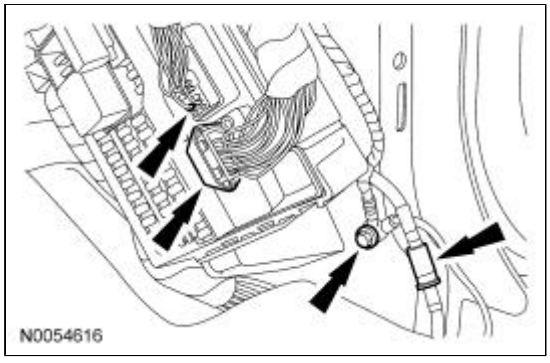


29. **NOTE:** Navigator shown, Expedition similar.

    Remove the RH instrument panel side finish panel.



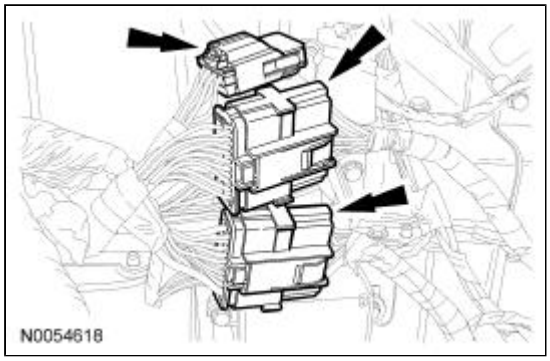
30. Disconnect the RH instrument panel electrical connectors.
    - Disconnect the electrical connectors.
    - Remove the RH ground bolt.
    - Disconnect the in-line antenna connector.



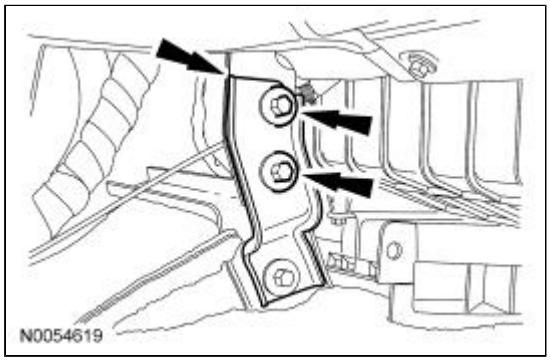
31. Lower the glove compartment.

32. **NOTE:** There are 6 electrical connectors, 3 are shown.

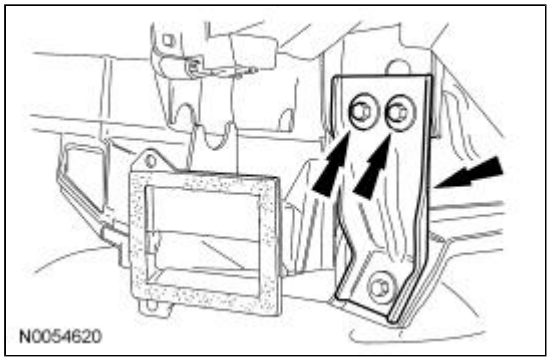
    Disconnect the electrical connectors.



33. Remove the 2 RH instrument panel floor brace bolts.
    - To install, tighten to 9 Nm (80 lb-in).

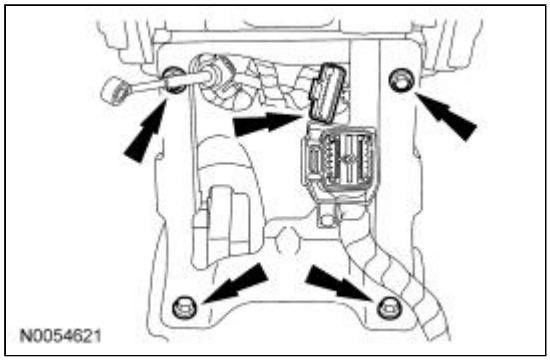


34. Remove the 2 LH instrument panel floor brace bolts.
    - To install, tighten to 9 Nm (80 lb-in).



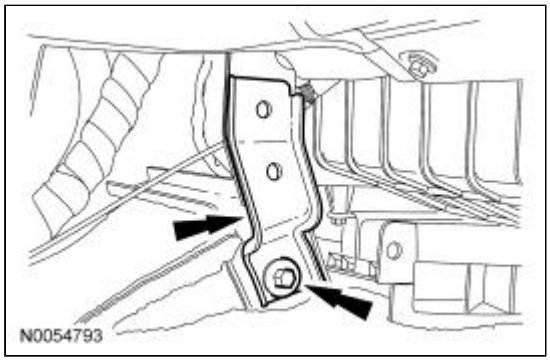
Navigator only

35. Remove the bolts and position the floor console bracket aside.
    - Disconnect the electrical connector from the bracket.
    - Remove the bracket-to-instrument panel bolts.
        - To install, tighten to 9 Nm (80 lb-in).
    - Remove the bracket-to-floor bolts.
        - To install, tighten to 40 Nm (30 lb-ft).



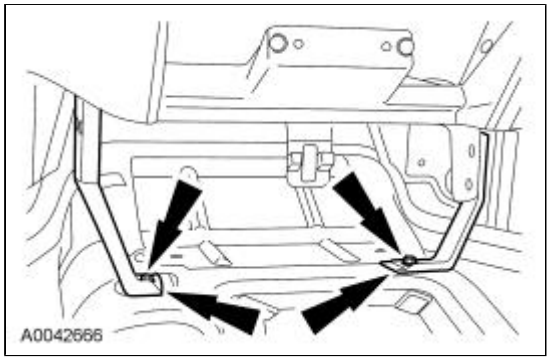
36. **NOTE:** RH brace shown, LH brace similar to Expedition.

    Position the carpet aside, remove the bolts and the instrument panel floor braces.
    - To install, tighten to 9 Nm (80 lb-in).



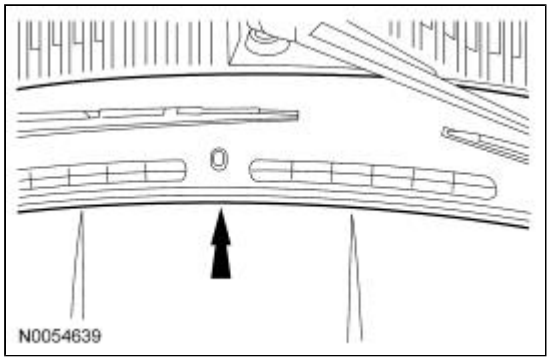
Expedition only

37. Position the carpet aside, remove the bolts and the instrument panel floor brace.
    - To install, tighten to 9 Nm (80 lb-in).

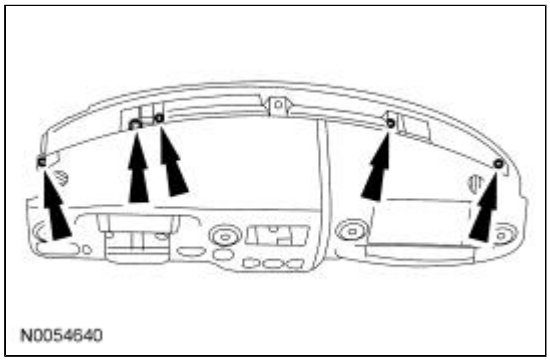


All vehicles

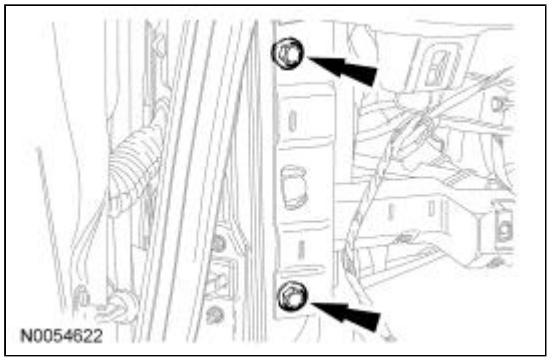
38. Remove the instrument panel defroster grille.



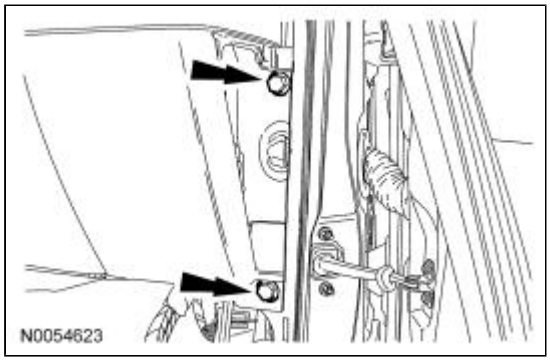
39. Remove the instrument panel cowl bolts.
    - To install, tighten to 30 Nm (22 lb-ft).



40. Remove the LH instrument panel bolts.
    - To install, tighten to 30 Nm (22 lb-ft).



41. Remove the RH instrument panel bolts.
    - To install, tighten to 30 Nm (22 lb-ft).



42. **NOTE:** This step requires an assistant.

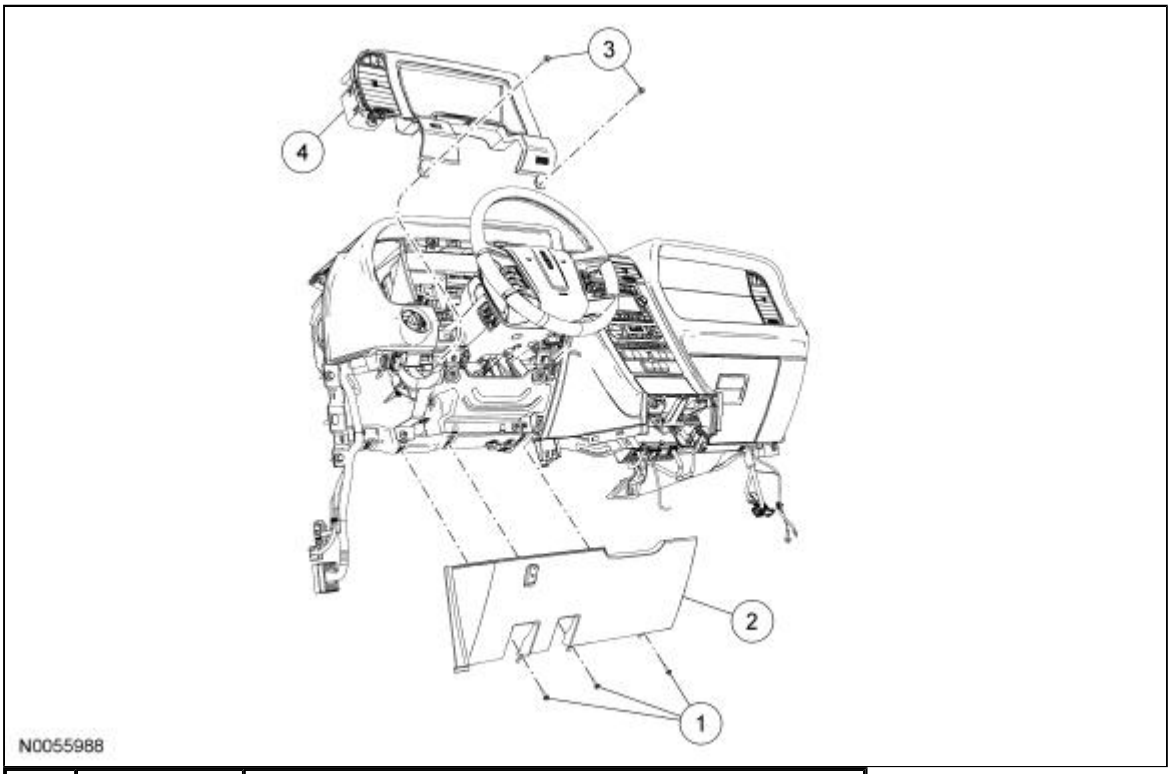
NOTE: Two bullet connectors align the instrument panel to the bulkhead.

Remove the instrument panel.

43. To install, reverse the removal procedure.

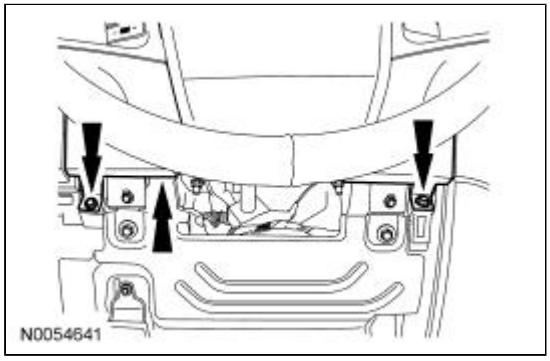
Instrument Cluster Finish Panel — Navigator

Printable View (223 KB)



Item	Part Number	Description
1	W707628	Instrument panel steering column cover screws (3 required)
2	04459	Instrument panel steering column cover
3	W707628	Instrument panel finish panel screws (2 required)
4	04320	Instrument panel finish panel

1. Remove the steering column multi-function switch, refer to Section 211-05 .
2. Remove the 2 instrument cluster finish panel screws.

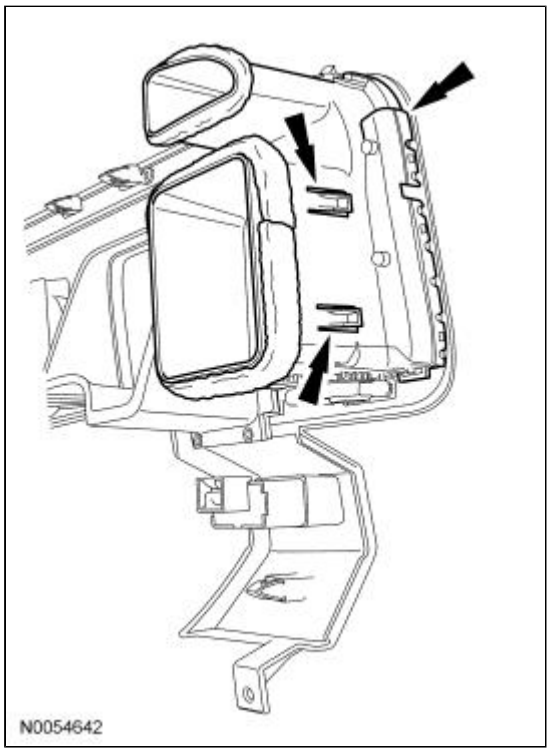


3. **NOTE:** There are 2 locking tabs on the outboard register that need to be depressed before the cluster finish panel is removed.

NOTE: Cluster finish panel removed for clarity.

Depress the 2 locking tabs and remove the cluster finish panel.

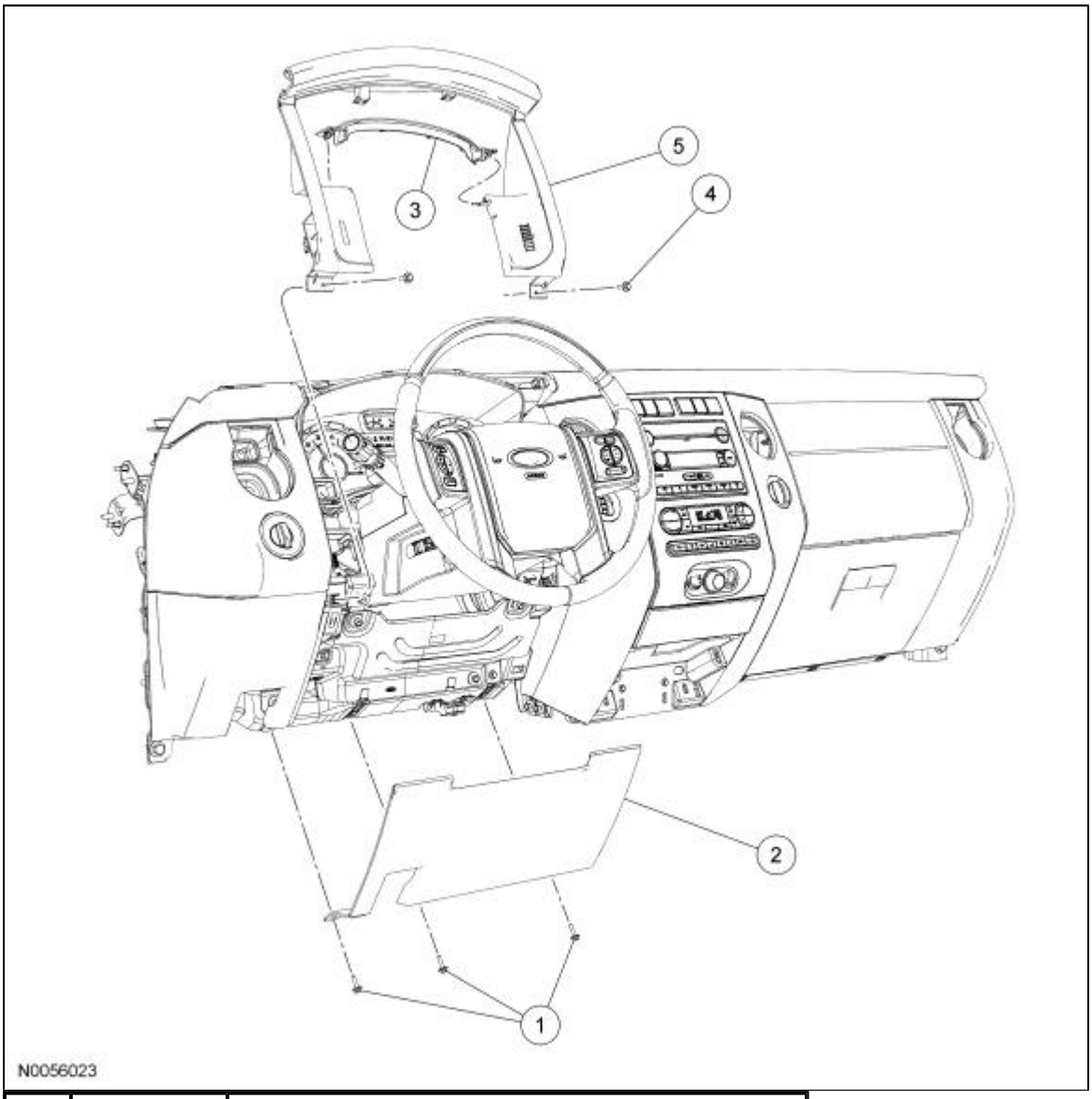
- Access the tabs from under the instrument panel.
- Disconnect the electrical connectors.



4. To install, reverse the removal procedure.

Instrument Cluster Finish Panel — Expedition

Printable View (226 KB)



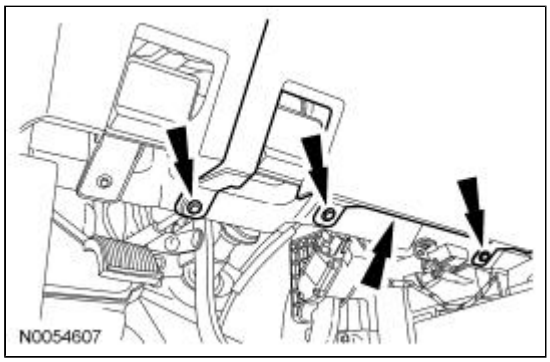
Item	Part Number	Description
1	W707628	Instrument panel steering column cover screws (3 required)
2	04459	Instrument panel steering column cover
3	—	Instrument panel finish panel bridge
4	W707628	Instrument panel finish panel screw (2 required)
5	04320	Instrument panel finish panel

Column shift vehicles only

1. Place the column shift lever to the 1 position.

All vehicles

2. Remove the instrument panel steering column cover.
    - Remove the 3 instrument panel steering column cover screws.
    - Release the instrument panel steering column cover from the instrument panel.



3. Tilt the steering wheel to the full down position.

4. Remove the instrument cluster finish panel bridge.
    - Pull upward and then left on the LH side of the finish panel bridge to release the retainer and remove the finish panel bridge.

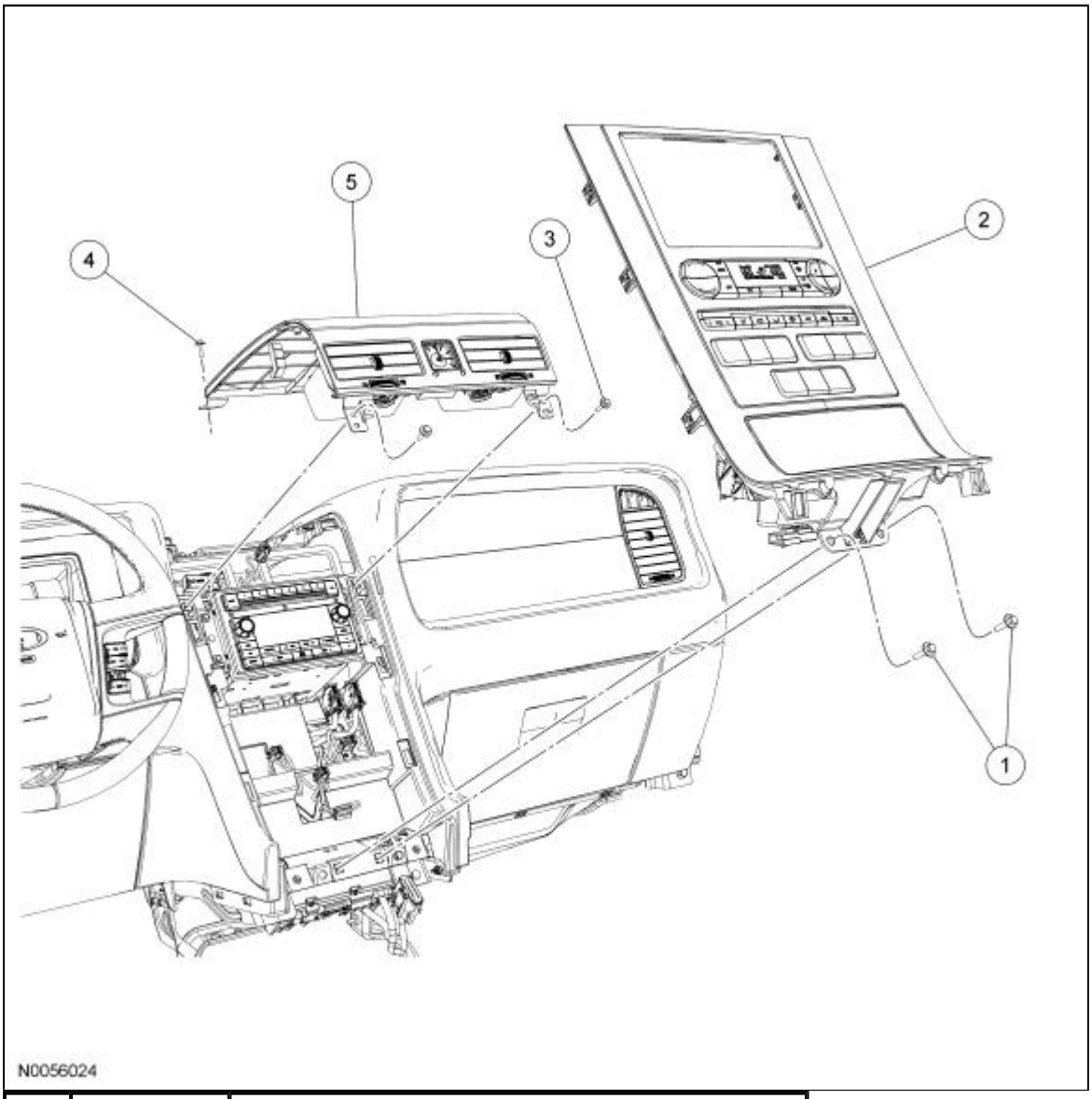
5. Remove the 2 instrument cluster finish panel screws.

6. Remove the instrument cluster finish panel.
    - Pull on the finish panel to release it from the retainers.
    - Disconnect the electrical connectors.

7. To install, reverse the removal procedure.

Instrument Cluster Center Finish Panel — Navigator

Printable View (266 KB)



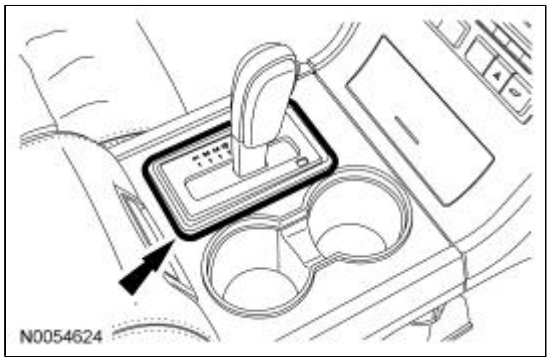
Item	Part Number	Description
1	W707628	Instrument cluster center finish panel screws (2 required)
2	04302	Lower instrument cluster center finish panel
3	W707628	Lower screws (2 required)
4	W704874	Upper screw (2 required)
5	—	Upper instrument cluster center finish panel

Removal and Installation

1. Apply the parking brake and move the shift lever to NEUTRAL.

2. Disconnect the battery. For additional information, refer to Section 414-01 .

3. Remove the shifter trim ring.

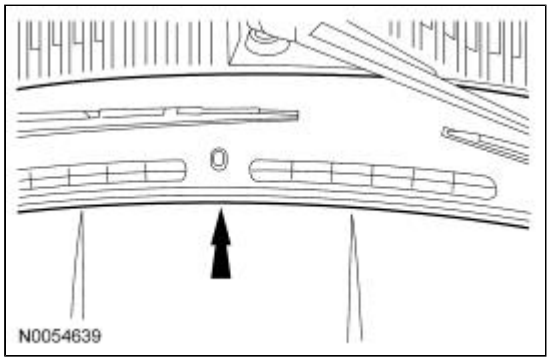


4. Remove the front floor console finish panel.

5. Remove the lower instrument cluster center finish panel.
    1. Remove the instrument cluster center finish panel screws.
    2. Pull out on the panel to disengage the clips.
    - Disconnect the electrical connectors.

6. Remove the 2 lower screws from the upper instrument cluster center finish panel.

7. Remove the instrument panel defroster grille.



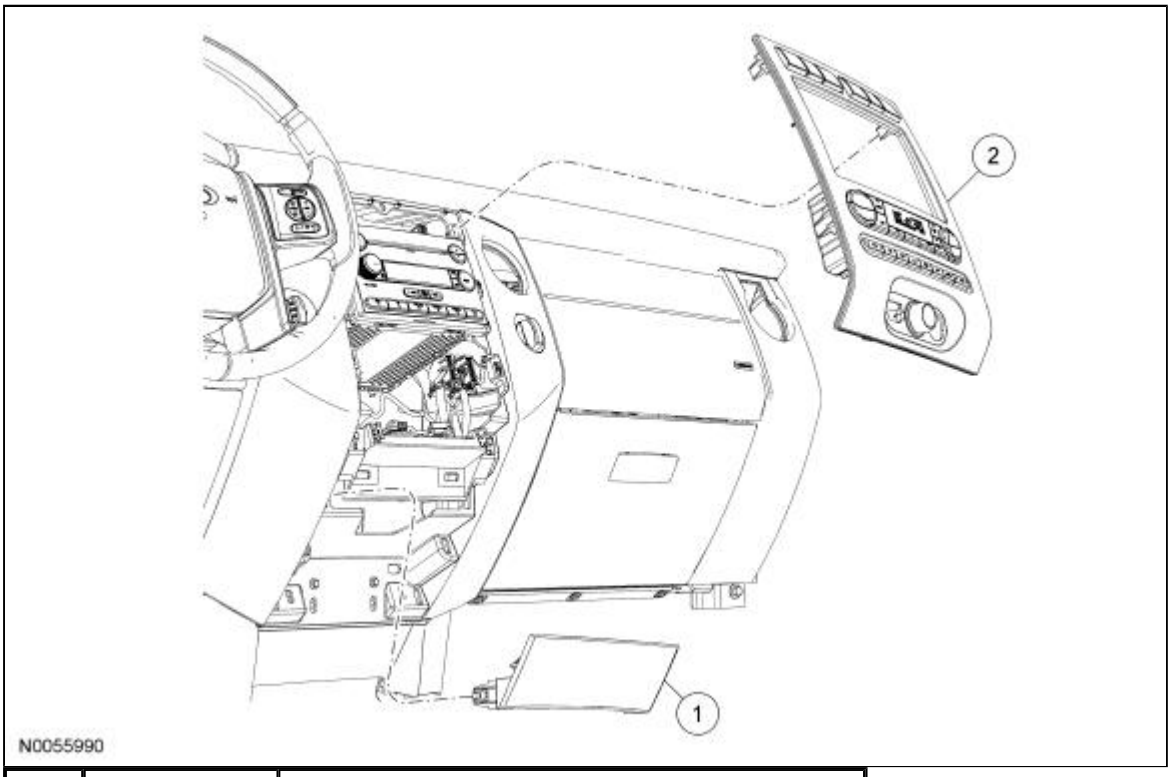
8. Remove the 2 upper screws from the upper instrument cluster center finish panel.

9. Remove the upper instrument cluster center finish panel.
    - Disconnect the electrical connectors.

10. To install, reverse the removal procedure.
    - Transfer parts as needed.

Instrument Cluster Center Finish Panel — Expedition

Printable View (152 KB)



Item	Part Number	Description
1	—	Lower instrument cluster center finish panel
2	04302	Upper instrument cluster center finish panel

1. Remove the lower instrument cluster center finish panel.

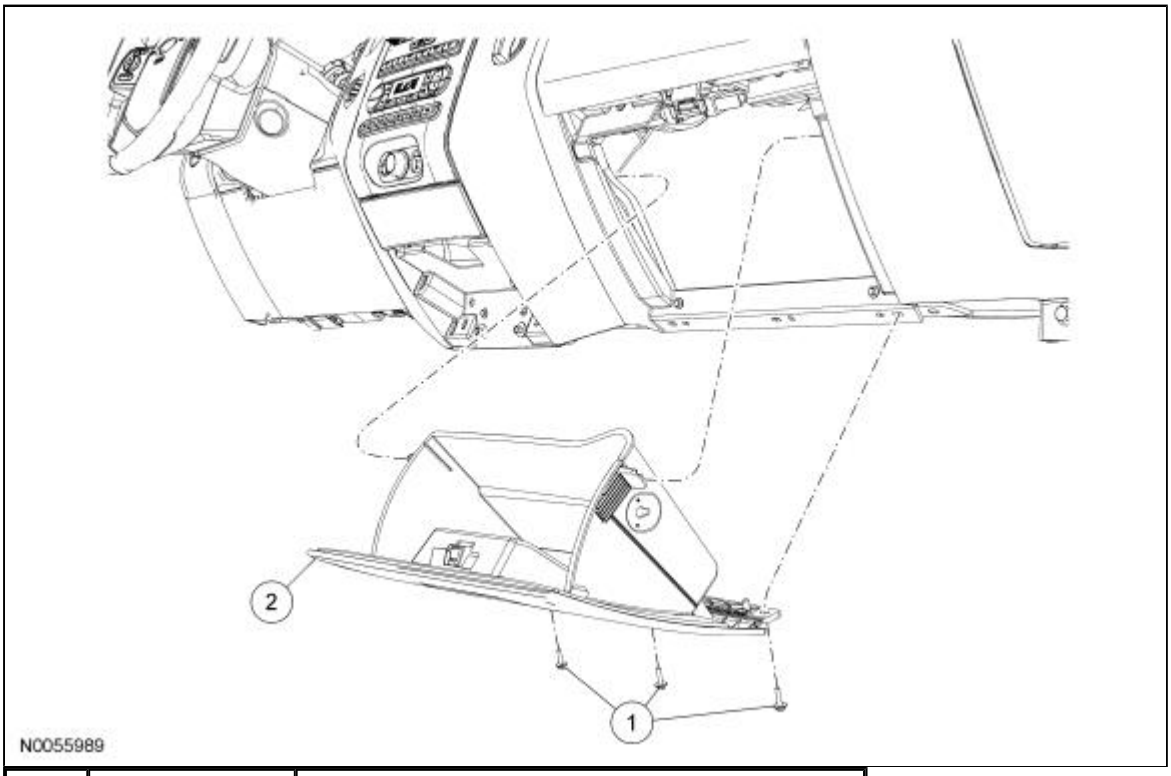
2. Remove the upper instrument cluster center finish panel.
   - Disconnect the electrical connectors.

3. To install, reverse the removal procedure.
   - Transfer parts as needed.

Glove Compartment

Printable View (196 KB)

NOTE: Expedition shown, Navigator similar.

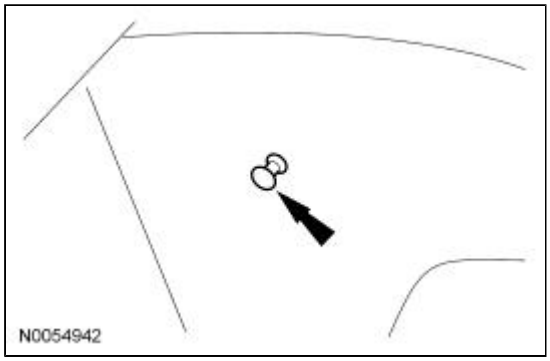


Item	Part Number	Description
1	W707628	Glove compartment screws (3 required)
2	06024	Glove compartment

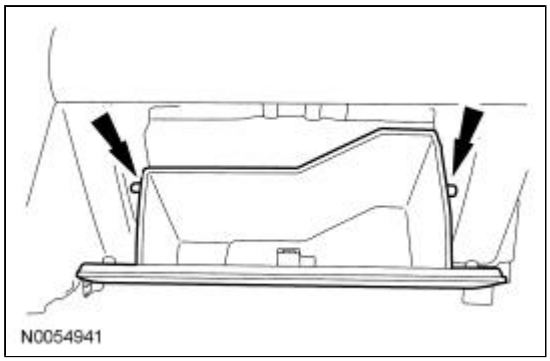
Removal and Installation

1. Open the glove compartment.
2. **CAUTION: Forcing the glove compartment past the stops will damage the dampener.**

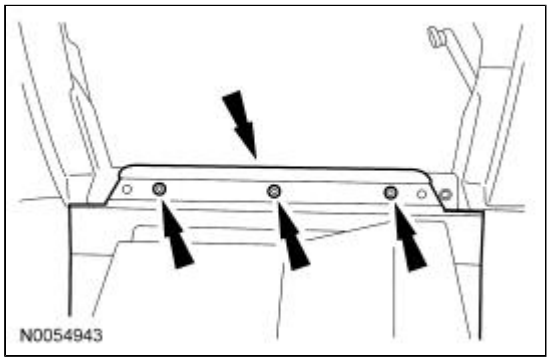
   If equipped, disconnect the dampener.



3. Release the stops.



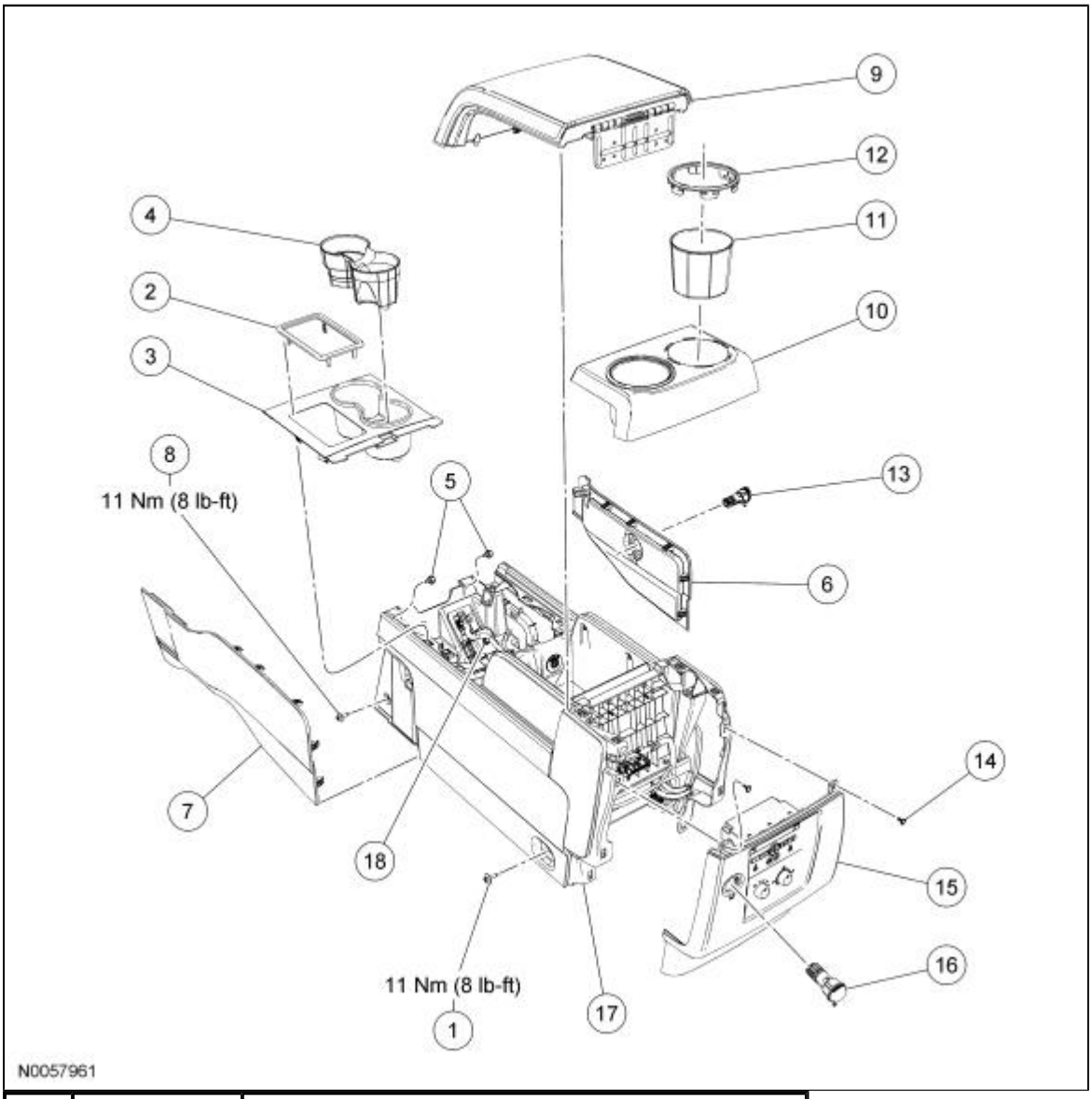
4. Remove the 3 glove compartment screws and the glove compartment.



5. To install, reverse the removal procedure.

Console — Front, Floor, Navigator

Printable View (418 KB)

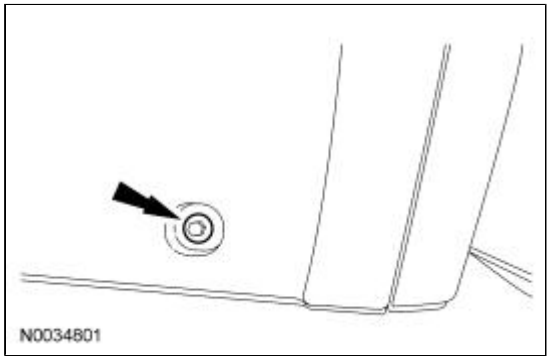


Item	Part Number	Description
1	W710806	Front floor console rear bolt (2 required)
2	—	Shifter trim ring
3	045A76	Front floor console finish panel
4	—	Front cup holder insert
5	W710879	Front floor console front screws (2 required)
6	04608A	Front floor console side cover RH
7	04608B	Front floor console side cover LH
8	W710806	Front floor console front bolt (2 required)
9	06024	Front floor console storage compartment door
10	—	Rear cup holder

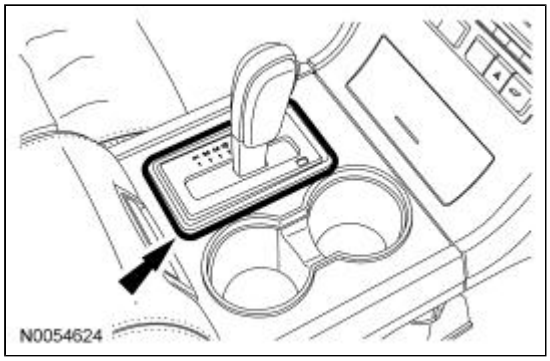
11	—	Rear cup holder insert
12	—	Rear cup holder trim ring
13	19N236	Front floor console front auxiliary power point
14	W710806	Front floor console rear panel screw (2 required)
15	045E24	Front floor console rear panel
16	19N236	Front floor console rear auxiliary power point
17	045A36	Front floor console
18	14B079	Bulkhead electrical connector

Removal and Installation

1. Place the shift lever in NEUTRAL and apply the parking brake.
2. Position the front seat forward.
3. Remove the 2 front floor console rear bolts.
   - To install, tighten to 11 Nm (8 lb-ft).



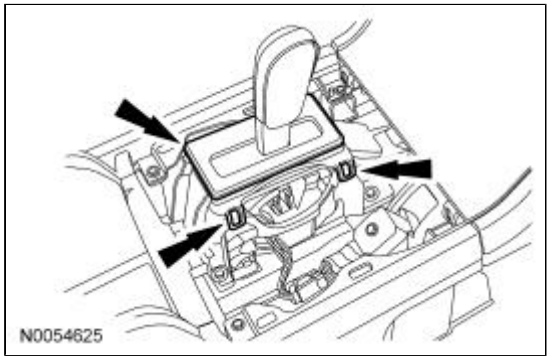
4. Position the front seats rearward.
5. Disconnect the battery. For additional information, refer to Section 414-01 .
6. Remove the shifter trim ring.



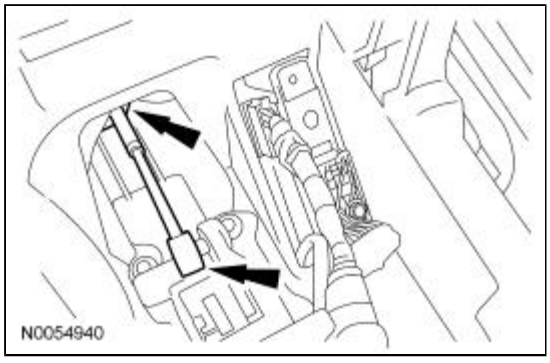
7. Remove the front floor console finish panel.
   - Pull upward on the rear of the finish panel to release the retainers.
8. **NOTE:** RH retainers shown, LH similar.

   Position the shifter lever indicator bezel aside.

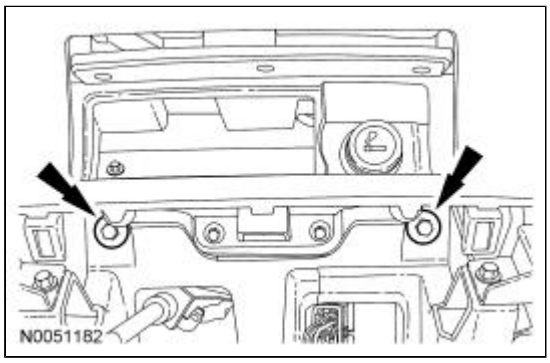
- Release the 4 retainers.



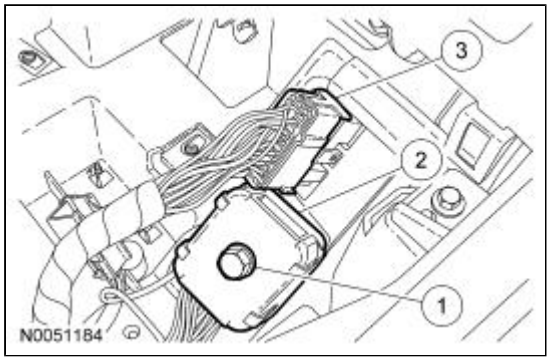
9. Disconnect the shift cable.



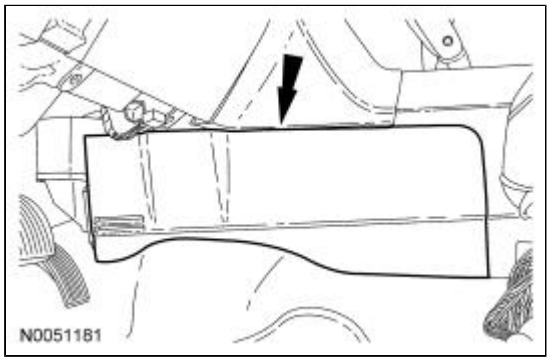
10. Remove the front floor console front screws.
    - To install, tighten to 7 Nm (62 lb-in).



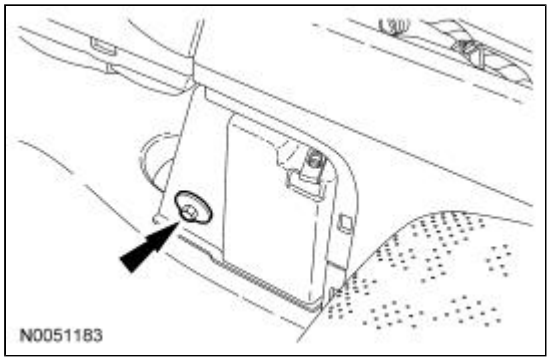
11. Disconnect the front floor console electrical connectors.
    1. Loosen the bulkhead electrical connector bolt.
        - To install, tighten to 3 Nm (27 lb-in).
    2. Disconnect the bulkhead electrical connector.
    3. Disconnect the electrical connector.



12. Remove the LH and RH front floor console side finish panels.
    - If equipped, disconnect the electrical connector.



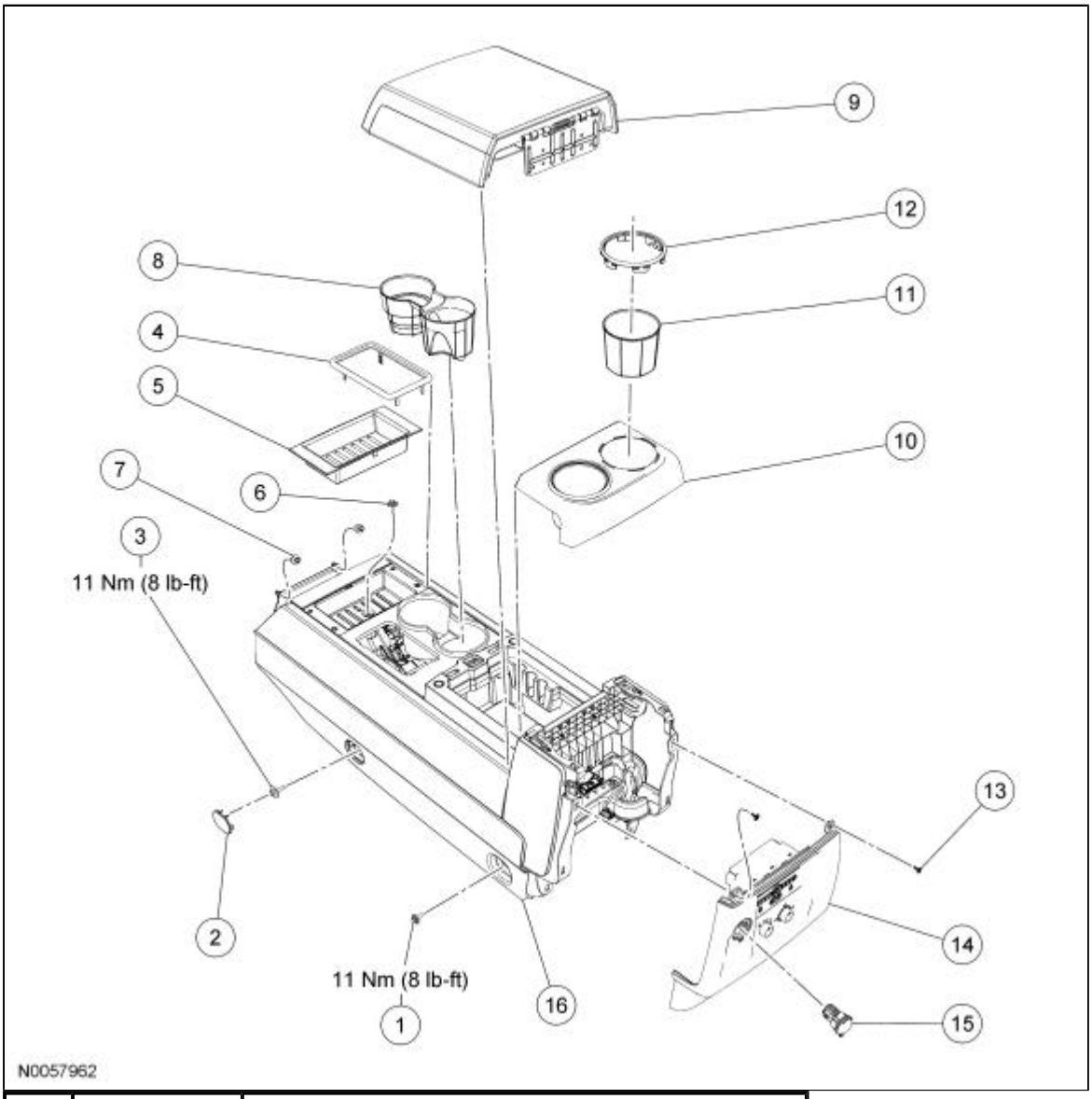
13. Remove the LH and RH front floor console front bolts and the floor console.
    - To install, tighten to 11 Nm (8 lb-ft).



14. To install, reverse the removal procedure.

Console — Front, Floor, Expedition

Printable View (423 KB)



Item	Part Number	Description
1	W710806	Front floor console rear bolt (2 required)
2	—	Front floor console bolt cover
3	W710806	Front floor console front bolt (2 required)
4	—	Shifter trim ring
5	—	Front floor console tray mat
6	W707607	Front floor console screw
7	W710879	Front floor console front screw (2 required)
8	—	Front cup holder insert
9	06024	Front floor console storage compartment door
10	—	Rear cup holder

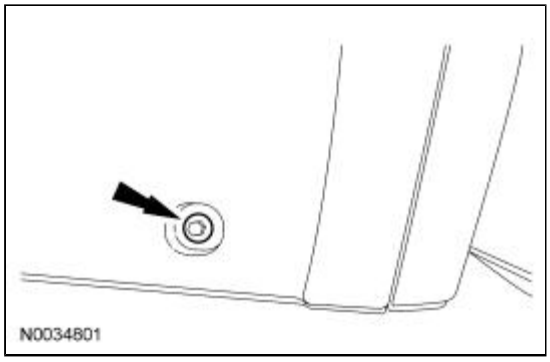
11	—	Rear cup holder insert
12	—	Rear cup holder trim ring
13	W7008401	Front floor console rear panel screw (2 required)
14	045E24	Front floor console rear panel
15	19N236	Front floor console rear auxiliary power point
16	045A36	Front floor console

Removal and Installation

1. Place the gear shift lever in NEUTRAL and apply the parking brake.

2. Position the front seat forward.

3. Remove the 2 front floor console rear bolts.
   - To install, tighten to 11 Nm (8 lb-ft).

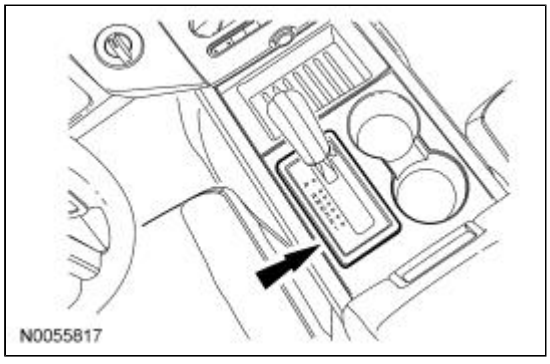


4. Position the front seats rearward.

5. Remove the 2 front floor console front bolts.
   - Remove the 2 bolt covers.
   - Remove the 2 bolts.
     - To install, tighten to 11 Nm (8 lb-ft).

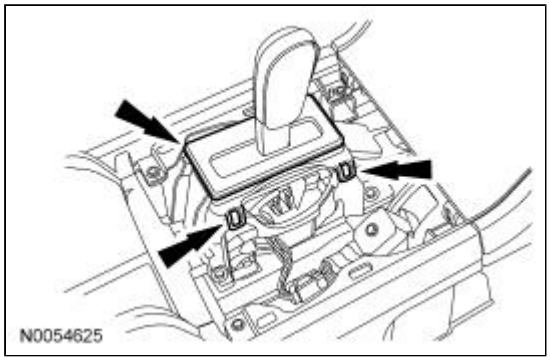
6. Disconnect the battery. For additional information, refer to Section 414-01 .

7. Remove the shifter trim ring.

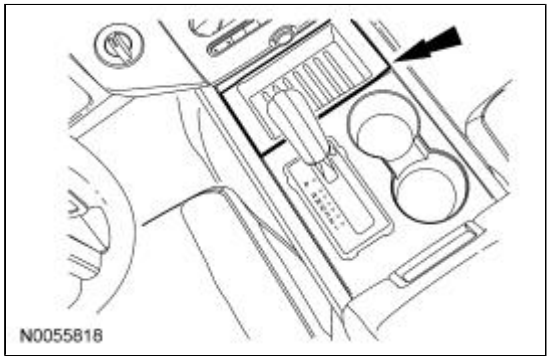


8. **NOTE:** Navigator shown, Expedition similar.

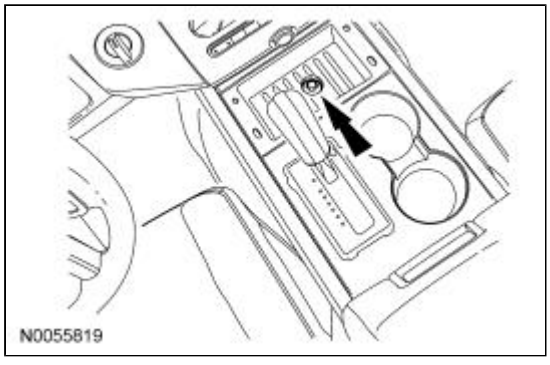
   Position the gear shift lever indicator bezel aside.
   - Release the 4 retainers and position aside.



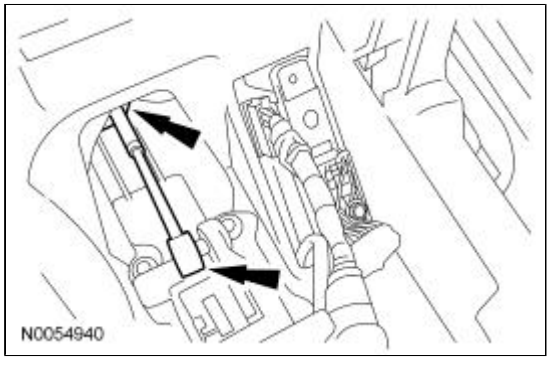
9. Remove the front floor console tray mat.



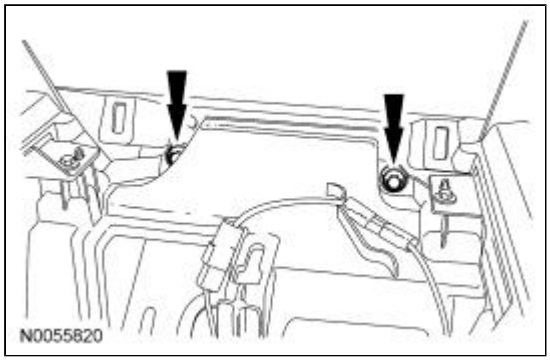
10. Remove the front floor console screw.



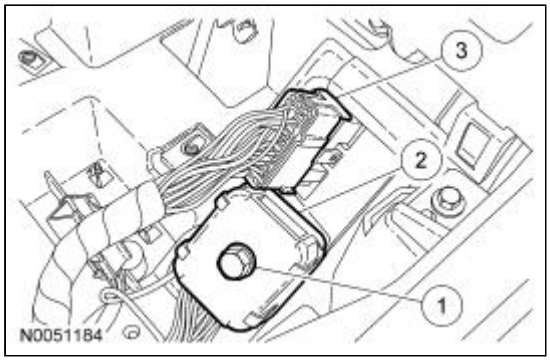
11. Disconnect the shifter cable.



12. Remove the floor console front screws.
    - To install, tighten to 7 Nm (62 lb-in).



13. Disconnect the front floor console electrical connectors.
    1. Loosen the bulkhead electrical connector bolt.
        - To install, tighten to 3 Nm (27 lb-in).
    2. Disconnect the bulkhead electrical connector.
    3. Disconnect the electrical connector.

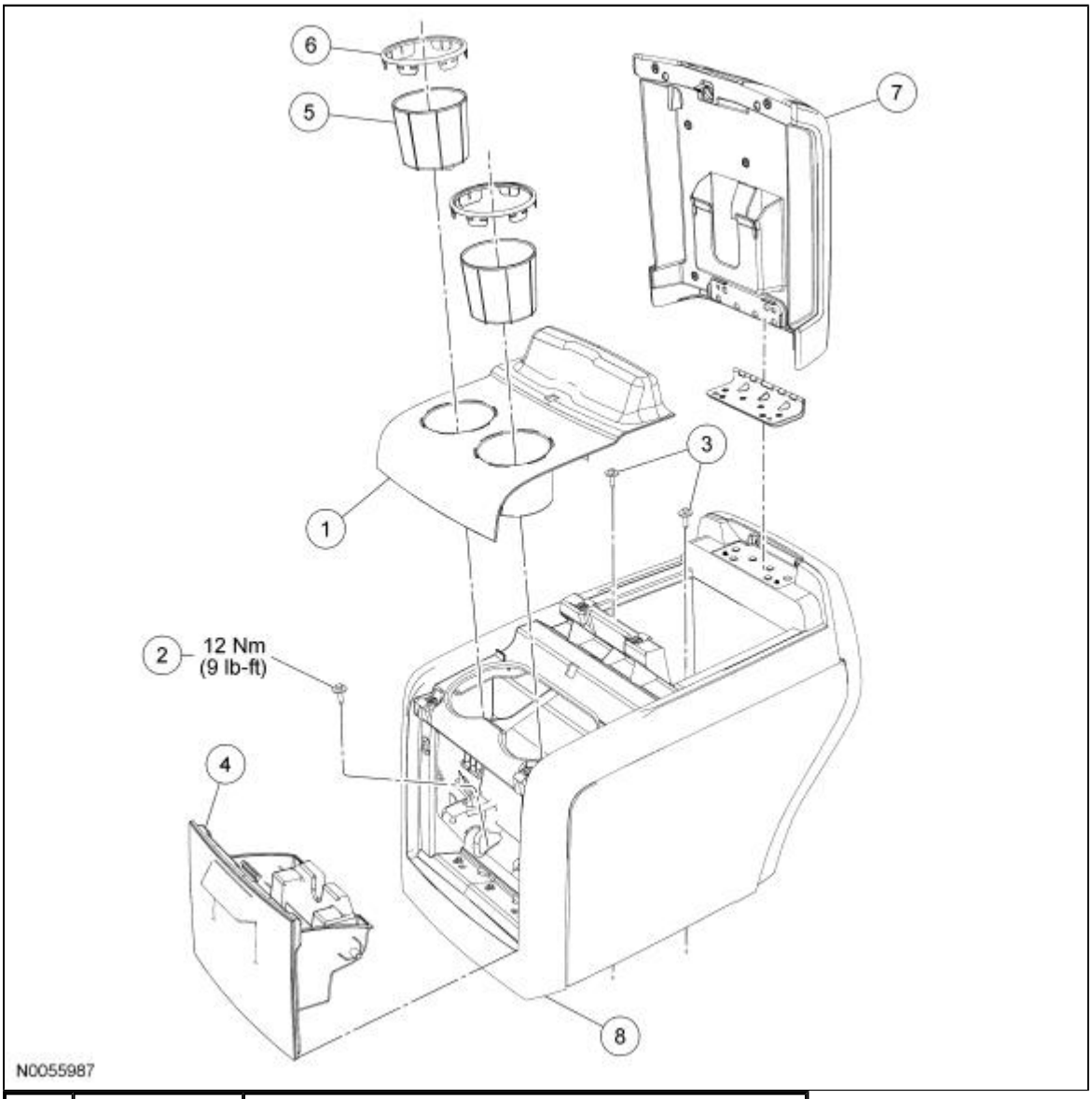


14. Remove the front floor console.

15. To install, reverse the removal procedure.

Console — Rear, Floor

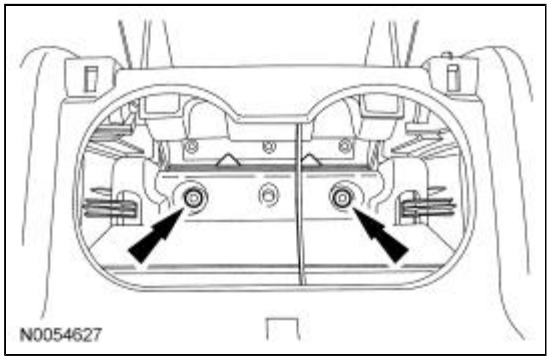
Printable View (209 KB)



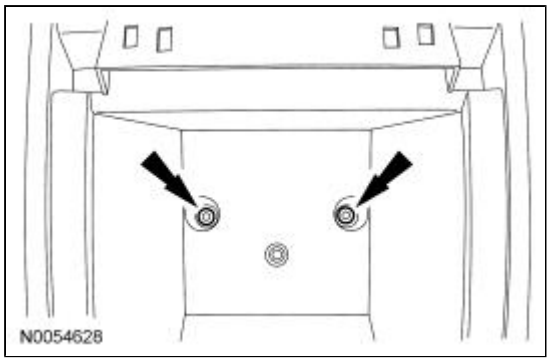
Item	Part Number	Description
1	04567	Rear floor console cup holder
2	W706599	Rear floor console front bolt (2 required)
3	W706599	Rear floor console rear bolts (2 required)
4	115A00	Rear floor console storage bin
5	13562	Rear floor console cup holder insert (2 required)
6	—	Rear floor console cup holder trim ring
7	06024	Rear floor console storage compartment door
8	045A36	Rear floor console

Removal and Installation

1. Remove the 2 rear floor console front bolts.
    - Open the rear floor console storage bin.
    - Remove the rear floor console cup holder.
    - Remove the rear floor console front bolts.
        - To install, tighten to 12 Nm (9 lb-ft).



2. Remove the 2 rear floor console rear bolts.
    - Open the rear floor console storage compartment door.
    - Remove the rear floor console rear bolts.
    - Remove the rear floor console.



3. To install, reverse the removal procedure.

Printable View (65 KB)

Lock Repair/Replacement Specifications

Part Number	Lock Repair Package Name
F85Z-11582-AA	Ignition Cylinder Kit
F85Z-1521990-BA	Door Lock Cylinder Kit

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch bolts	9	—	80
Door striker bolts	22	—	16
Exterior door handle nuts	9	—	80
Hood latch bolts	35	26	—
Hood striker bolts	10	—	89
License plate housing nuts	5	—	44
Liftgate latch bolts	12	9	—
Liftgate release handle nuts (Expedition)	6	—	53
Liftgate release handle nuts (Navigator)	9	—	80
Liftgate striker bolts	25	18	—
Liftgate window latch bolts	8	—	71
Liftgate window latch striker	6	—	53

Handles, Locks, Latches and Entry Systems

Printable View (109 KB)

The hood latch system contains a latch attached to the upper radiator support (header panel) and a hood latch striker attached to the hood. The latch is controlled by the hood latch release handle and cable.

The front and rear door entry system contains a latch that is attached to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The doors can be locked/unlocked by the remote keyless entry (RKE) transmitter, the keyless entry keypad, the door lock control switches or the door lock cylinder (LH front door).

The rear doors have a child safety lock feature, which is a manual override to prevent the door from being opened from the inside door handle. The child safety lock is integral to the rear door latch and is located on the inside of the rear door frame.

Liftgate

The liftgate system contains a latch located on the bottom of the inside frame of the liftgate, which is electronically controlled by the smart junction box (SJB) and (if equipped) the power liftgate module. When the SJB detects the liftgate release handle is pulled, the SJB actuates the liftgate latch. The liftgate release operates only when the doors have been unlocked electronically. The SJB will not release the liftgate if the vehicle speed is greater than 5 km/h (3 mph).

The liftgate window latch is mounted on the upper center portion of the liftgate frame and includes the ajar switch and the latch actuator. The liftgate window latch release is controlled by the SJB. When the SJB detects the release switch is pressed, a request from the RKE transmitter or the correct code from the keyless entry keypad, the SJB actuates the liftgate glass latch release. The liftgate window glass release operates only when the doors have been unlocked electronically.

Power Lock/Unlock

The power lock/unlock feature requests all of the vehicle doors locked or unlocked upon a customer request from either interior door lock switch in the vehicle. The power door locking system functions independently of ignition status or vehicle speed.

Auto-Locking

The auto-locking feature locks all doors when all doors, including the liftgate, are closed, the brake pedal was pressed with the ignition switch in the ON position, and a vehicle speed of 20 km/h (12 mph) or higher is achieved. This feature relocks the doors (if any doors are open) after the brake pedal is pressed, once all doors are read as closed, and the vehicle speed exceeds 20 km/h (12 mph). The auto-locking feature can be enabled/disabled through module configuration, the scan tool, the keyless entry keypad, the instrument panel message center (if equipped), or the ignition switch and the door lock control switch.

Smart Unlock

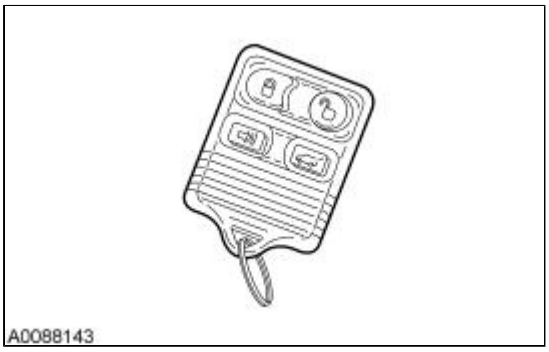
The smart unlock feature prevents the driver door from locking with the key in the ignition lock cylinder. When the SJB receives a LOCK command from a door lock control switch with the key in the ignition lock cylinder and the driver door open, the SJB commands the driver door to UNLOCK.

Remote Keyless Entry (RKE) Transmitter

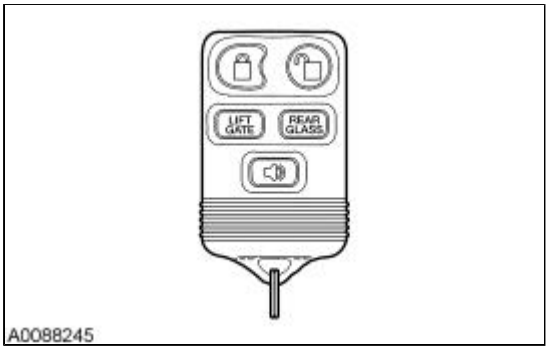
The door locks, release latches, and interior lighting are controlled by the SJB. For additional information

of the interior lighting system, refer to Section 417-02 .

Without Power Liftgate



With Power Liftgate



The RKE transmitter initiates the following electronic system functions:

- Unlocks the driver door (single press of the unlock button)
- Unlocks all doors (second press of the unlock button within 3 seconds)
- Locks all doors
- Releases the liftgate window glass
- Activates/deactivates the panic alarm
- Issues a command to open the power liftgate (if equipped)
- Issues a command to turn on the interior lamps (when unlocking) and off (when locking), provided the defeat switch on the dimmer switch is not active
- Sounds the horn and flashes the turn signals once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sounds the horn and flashes the turn signals twice when LOCK is pressed twice within 3 seconds, and any door is open

The RKE transmitter has a minimum operating range of 10 m (33 ft).

Up to 4 RKE transmitters can be programmed.

The RKE transmitters can be programmed using a scan tool or by using the remote keyless entry transmitter programming procedure. For additional information, refer to Remote Keyless Entry Transmitter Programming in this section.

Remote Keyless Entry (RKE) Transmitter Lock/Unlock Control — Unlock

The remote control feature provides lock/unlock functions independently of ignition status, vehicle speed, or transmission position. The remote control feature provides a 2-step process for unlocking the doors. Upon receipt of the first request for unlocking the doors, the remote control feature requests the

SJB to unlock the driver door only. If another unlock request is received within 3 seconds of the first, the remote control feature requests that all doors be unlocked.

Remote Keyless Entry (RKE) Transmitter Lock/Unlock Control — Lock

The remote control feature requests that all the doors be locked when the LOCK button is pressed. On any press of the lock button with all doors closed, the remote control feature requests 1 flash of the parking lamps. If any door is ajar, no flash occurs, indicating it locked all the doors but 1 or more doors are ajar. As soon as the last door is closed, 1 flash of the parking lamps occurs. If 2 presses of the lock button are received within 3 seconds, the horn chirps once, and the parking lamps flash twice to indicate that all the doors are closed and locked. If any door is ajar when the second lock request is received within 3 seconds of the first, the remote control feature requests the horn chirp twice without flashing the parking lamps to indicate it locked all the doors, but 1 or more doors are ajar. When the key is in the RUN or START position, no parking lamp flashes or horn chirp confirmations occur.

Panic Alarm

The panic alarm feature controls activation of the panic alarm, providing audible and visual alarms that are evident from the exterior of the vehicle. The panic alarm feature requests that the parking lamps and horn are flashed until deactivation. The flashing of the outputs occurs at the same time. Activation of the panic alarm is accomplished by pressing the PANIC button on a RKE transmitter whenever the key is in the OFF or ACC position. At all other times this feature is disabled. Deactivation of an active PANIC alarm is accomplished by:

- a second press of the RKE transmitter PANIC button.
- the ignition switch transitions out of the OFF or ACC position.
- a period of 2 minutes and 45 seconds has elapsed since the initial activation.

Keyless Entry Keypad

The keyless entry keypad, located on the exterior of the driver door, provides a method for the customer to access the vehicle without a key or RKE transmitter. The keyless entry keypad feature:

- Locks all doors
- Unlocks only the driver door
- Unlocks all doors
- Programs/erases the customer keypad code
- Enables/disables auto-locking
- Enables/disables auto-unlocking
- Releases the liftgate glass

The keyless entry keypad feature operates independently of ignition status, vehicle speed, or transmission position. When a keypad button is pressed, the keypad buttons illuminate to provide better visibility. If 7/8 and 9/0 are pressed or 5 seconds have elapsed since the last button press, the illumination is turned off.

Each vehicle equipped with a keyless entry keypad is programmed with a 5-digit entry code. This code is provided to the customer on a wallet card in the Owner's Literature package. In addition, this code is available through a scan tool. When entering codes, each digit must be entered within 5 seconds of the previous button press.

Anti-Scan Feature

To provide added security, the keyless entry keypad is disabled for 1 minute after pressing the button 35 times without a valid entry code being entered. The keypad flashes during this 1-minute mode with all functionality disabled except for 7/8 and 9/0 still being allowed to lock the vehicle.

Anti-Scan is turned off after any of the following events:

- One minute of keyless entry keypad inactivity has elapsed
- The RKE transmitter UNLOCK button is pressed
- The key is turned to the ON position

Unlocking the Doors with the Keyless Entry Keypad System

To unlock the driver door, enter either the factory set code or the personal code (each digit must be pressed within 5 seconds of the prior digit). This illuminates the interior lamps.

To unlock all doors, enter either the factory set code or the personal code (driver door unlocks) and press the 3/4 button within 5 seconds.

To unlatch the liftgate glass, enter either the factory set code or the personal code (each digit must be pressed within 5 seconds of the prior digit) and press the 5/6 button within 5 seconds.

Locking the Doors with the Keyless Entry Keypad System

It is not necessary to enter the factory set or personal code prior to locking all doors. To lock all doors, press the 7/8 and 9/0 buttons at the same time.

Perimeter Lighting Feature

Vehicles equipped with perimeter lighting can have this feature activated or deactivated.

NOTE: On vehicles with autolamps, the perimeter lighting feature does not activate in daylight conditions.

The following items illuminate when the unlock button on the remote transmitter is pressed:

- Fog lamps (Navigator)
- Headlamps (Expedition)
- Parking, rear and license plate lamps

The lamps turn off:

- if the ignition switch is turned to the RUN position.
- when the lock control on the remote transmitter is pressed
- if the vehicle is locked using the keyless entry keypad
- after 25 seconds have elapsed since the perimeter lighting was activated

Deactivating/Activating Perimeter Lighting Feature

NOTE: The perimeter lighting feature may also be deactivated/activated using a scan tool.

NOTE: Make sure the ignition switch is in the OFF position and all doors are closed before beginning this procedure.

1. Turn the ignition switch from the OFF to the RUN position.

2. Press the unlock button on the door lock control switch 3 times.

3. Turn the ignition switch from the RUN to the OFF position.

4. Press the unlock button on the door lock control switch 3 times.

5. Turn the ignition switch to the RUN position. The horn chirps one time to indicate that

programming mode is entered.

6. **NOTE:** The horn chirps once if the perimeter lighting is disabled or a chirp followed by a honk if the perimeter lighting is enabled.

   Press the unlock button twice within 5 seconds.

7. **NOTE:** The horn chirps once to confirm the procedure is complete.

   Turn the ignition switch from the RUN to the OFF position.

Locks, Latches and Entry Systems

Printable View (415 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

Power Locks

The smart junction box (SJB) monitors the door lock control switches. When the SJB receives an unlock/lock command from either door lock control switch, the SJB energizes a relay (internal to the SJB) to supply the correct power and grounds for the door lock actuators.

Liftgate and Liftgate Glass Release

NOTE: The liftgate latch release is not connected mechanically to the liftgate release handle. The liftgate latch release operates electronically. Pulling on the handle with extra force will not aid in releasing the latch.

The liftgate release handle operates the liftgate latch electronically. When the handle is pulled, a switch is closed, indicating to the SJB to release the liftgate latch.

The SJB monitors the liftgate release switch and the liftgate glass release switch. The doors must be unlocked electronically in order for the SJB to release the liftgate latch or the liftgate glass latch. When this condition is met and the SJB receives a request from the liftgate release handle or the liftgate glass release switch, the SJB provides power to the corresponding latch release motor.

Keyless Entry Keypad

The SJB monitors the keyless entry keypad input. When the correct codes are entered into the SJB, the SJB carries out functions associated with code entered. Based on input from the keypad, the SJB:

- Locks all doors
- Unlocks the driver door
- Unlocks all doors
- Enters programming mode
- Enables/disables the autolock feature
- Enables/disables the auto-unlock feature
- Releases the liftgate glass latch

Remote Keyless Entry (RKE)

The SJB receives input from programmed RKE transmitters. Based on input from the RKE transmitter, the SJB:

- Locks all doors
- Unlocks the driver door
- Unlocks all doors
- Releases the liftgate glass latch
- Activates/deactivates the panic alarm
- If equipped, issues a command to the power liftgate module to open the power liftgate
- Turns the interior lamps on (when unlocking) and off (when locking), provided the defeat switch on the dimmer switch is not active
- Sounds the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sounds the horn twice when LOCK is pressed twice within 3 seconds, and any door is open

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Door/liftgate handles
• Latches
	• Smart junction box (SJB) fuse(s):
	  ▪ 5 (10A) (keypad)
	  ▪ 17 (20A) (door lock actuators)
	• Door lock actuators
	• Door lock control switches
	• Circuitry
	• Remote keyless entry (RKE) transmitter
	• Keyless entry keypad
	• SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and the power liftgate module.

9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart

DTC	Description	Action
B1624	Lamp Keypad Output Open Circuit	Go To Pinpoint Test H .
B2276	Less Than 2 Transmitters Programmed	Go To Pinpoint Test I .
B2425	Remote Keyless Entry Out of Synchronization	Go To Pinpoint Test J .
B2666	Liftgate Release Switch Circuit Failure	Go To Pinpoint Test F .
B2667	Liftglass Release Switch Circuit Failure	Go To Pinpoint Test E .
B273A	Liftgate Release Output Circuit Shorted to Ground	Go To Pinpoint Test F .
B273B	Liftgate Release Output Circuit Open or Shorted to Battery Voltage	Go To Pinpoint Test F .
B2A25	Trim Panel Lock Switch Failure	Go To Pinpoint Test C .
B2A26	Keypad Switch Circuit Failure	Go To Pinpoint Test G .
All other DTCs	—	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Circuitry • SJB	• REFER to Section

		418-00 .
• All door locks are inoperative	• Fuse • Circuitry • SJB	• Go To Pinpoint Test A .
• A single/more than one door lock is inoperative	• Circuitry • Door lock actuator • SJB	• Go To Pinpoint Test B .
• The door locks operate only one way	• Circuitry • SJB	• Go To Pinpoint Test C .
• All door locks are inoperative from one switch	• Circuitry • Door lock control switch	• Go To Pinpoint Test D .
• The liftgate glass latch release is inoperative/does not operate correctly	• Fuse • Circuitry • Liftgate glass release switch • Liftgate glass release motor (integral to the liftgate glass latch) • SJB	• Go To Pinpoint Test E .
• The liftgate latch release is inoperative/does not operate correctly	• Circuitry • Liftgate release switch (integral to the liftgate release handle) • Liftgate release motor (integral to the liftgate latch) • Power liftgate module • SJB	• Go To Pinpoint Test F .
• The doors do not lock/unlock using the keyless entry keypad	• Circuitry • Keyless entry keypad • SJB	• Go To Pinpoint Test G .
• The keyless entry keypad illumination is inoperative/does not operate correctly	• Circuitry • Keyless entry keypad • SJB	• Go To Pinpoint Test H .
• The doors do not lock/unlock using the remote keyless entry (RKE) transmitter	• RKE transmitter battery • RKE transmitter • RKE transmitter programming • SJB	• Go To Pinpoint Test I .
• The remote keyless entry (RKE) transmitter is out of synchronization	• RKE transmitter • RKE transmitter button pressed a substantial amount of times while outside the range of the vehicle • SJB	• Go To Pinpoint Test J .
• The panic feature is inoperative/does not operate correctly	• Horn system • Parking lamps system • RKE transmitter • SJB	• Go To Pinpoint Test K .
• The remote keyless entry (RKE) transmitter has poor range performance	• Environmental interference • RKE transmitter battery • RKE transmitter • SJB	• Go To Pinpoint Test L .

Pinpoint Tests

Pinpoint Test A: All Door Locks Are Inoperative

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) fuse 17 (20A) provides voltage for the power lock/unlock system. Ground for the power lock/unlock system is provided to the SJB through circuit GD138 (BK/WH). The SJB contains internal relays that are energized depending on input received.

When the SJB receives a lock request from the door lock control switch, the SJB provides power to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, power and ground are reversed on the previously listed circuits.

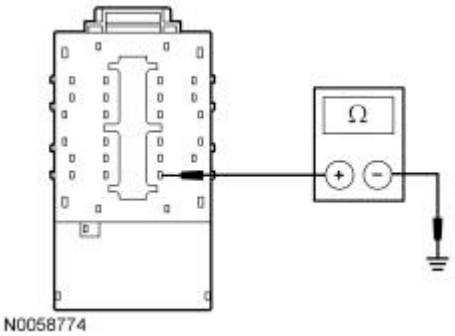
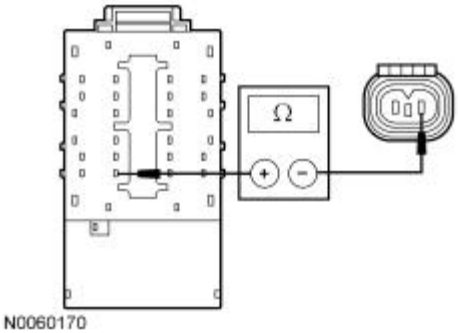
Possible Causes

- Fuse
- Circuit GD138 (BK/WH) open
- Circuit CPL11 (GY/BN) open
- SJB

PINPOINT TEST A: ALL DOOR LOCKS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
A1 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES	
• Press the lock and unlock button of both door lock control switches while observing the door lock operation. • **Are the door locks inoperative from both switches?**	**Yes** GO to A2 . **No** Go To Pinpoint Test D .
A2 VERIFY ALL DOOR LOCKS ARE INOPERATIVE	
• Press the lock and unlock buttons from the door lock control switch while observing the door locks. • **Are all the door locks inoperative from both switch positions (lock and unlock)?**	**Yes** VERIFY the SJB fuse 17 (20A) is OK. If OK, GO to A3 . **No** GO to Symptom Chart .
A3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: SJB C2280e. • Measure the resistance between the SJB C2280e-7, circuit GD138 (BK/WH), harness side and ground.	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0058774 • **Is the resistance less than 5 ohms?**	
A4 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
• Disconnect: LH Front Door Lock Actuator C525. • Measure the resistance between the SJB C2280e-6, circuit CPL11 (GY/BN), harness side and the LH front door lock actuator C525-1, circuit CPL11 (GY/BN), harness side.  N0060170 • **Is the resistance less than 5 ohms?**	
A5 CHECK FOR CORRECT SJB OPERATION	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
• Disconnect all the SJB connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	

Pinpoint Test B: A Single/More Than One Door Lock Is Inoperative

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

When the smart junction box (SJB) receives a lock request from the door lock control switch, the SJB provides power to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, power and ground are reversed on the previously listed circuits.

Possible Causes

- Circuit CPL11 (GY/BN) open

- Circuit CPL51 (BU/GN) open
- Circuit CPL52 (VT/GY) open
- Door lock actuator
- SJB

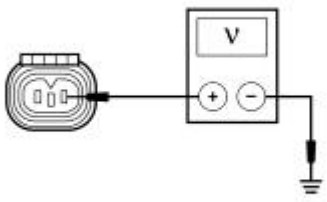
PINPOINT TEST B: A SINGLE/MORE THAN ONE DOOR LOCK IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>B1 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN</td><td rowspan="2">Yes
GO to B2 .

No
REPAIR the circuit. TEST the system for normal operation.</td></tr>
<tr><td>

Key in OFF position.
Disconnect: Inoperative Door Lock Actuator.
NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.
While pressing the door lock control switch in the LOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:

<table>
<tr><th>Inoperative Door Lock Actuator</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>LH front</td><td>C525-1</td><td>CPL11 (GY/BN)</td></tr>
<tr><td>RH front</td><td>C603-1</td><td>CPL11 (GY/BN)</td></tr>
<tr><td>LH rear</td><td>C704-1</td><td>CPL11 (GY/BN)</td></tr>
<tr><td>RH rear</td><td>C804-1</td><td>CPL11 (GY/BN)</td></tr>
</table>


N0058776

Is the voltage greater than 10 volts when the lock switch is pressed?

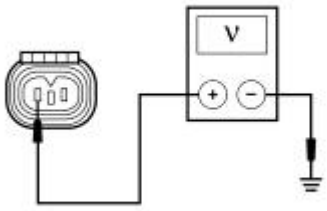
</td></tr>
<tr><td>B2 CHECK CIRCUIT CPL52 (VT/GY) OR CIRCUIT CPL51 (BU/GN) FOR VOLTAGE</td><td rowspan="2">Yes
INSTALL a new door lock actuator. REFER to Door Lock Actuator in this section. TEST the system</td></tr>
<tr><td>

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.
While pressing the door lock control switch in the UNLOCK position, measure the voltage between the inoperative door

</td></tr>
</table>

lock actuator, harness side and ground as follows:

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-2	CPL51 (BU/GN)
RH front	C603-2	CPL52 (VT/GY)
LH rear	C704-2	CPL52 (VT/GY)
RH rear	C804-2	CPL52 (VT/GY)



N0058777

- **Is the voltage greater than 10 volts when the unlock switch is pressed?**

for normal operation.

No
GO to B3 .

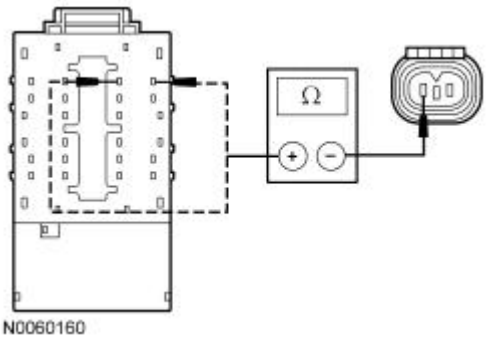
B3 CHECK CIRCUIT CPL51 (BU/GN) OR CIRCUIT CPL52 (VT/GY) FOR AN OPEN

- Disconnect: SJB C2280e.
- Measure the resistance between the inoperative door lock actuator, harness side and the SJB, harness side as follows:

Inoperative Door Lock Actuator Connector-Pin	SJB Connector-Pin	Circuit
LH front C525-2	C2280e-28	CPL51 (BU/GN)
RH front C603-2	C2280e-27	CPL52 (VT/GY)
LH rear C704-2	C2280e-27	CPL52 (VT/GY)
RH rear C804-2	C2280e-27	CPL52 (VT/GY)

Yes
GO to B4 .

No
REPAIR the circuit. TEST the system for normal operation.

 N0060160 • **Is the resistance less than 5 ohms?**	

B4 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Door Locks Operate Only One Way

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL27 (WH/BN) and CPL30 (BU/BN) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground.

The SJB contains internal relays that are energized depending on input received. When the SJB receives a lock or unlock request from the door lock control switch, the SJB energizes the appropriate relay(s) to lock or unlock the doors.

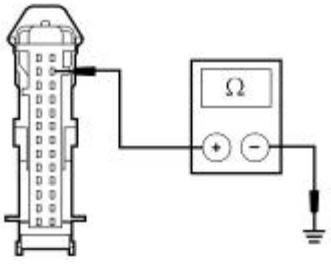
DTC B2A25 — is an on-demand DTC that sets when the SJB detects a short to ground from the lock or unlock request input circuits.

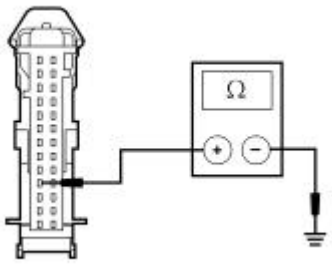
Possible Causes

- Circuit CPL27 (WH/BN) open or short to ground
- Circuit CPL30 (BU/BN) open or short to ground
- SJB

PINPOINT TEST C: THE DOOR LOCKS OPERATE ONLY ONE WAY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

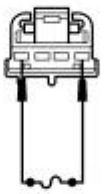
Test Step	Result / Action to Take
C1 CHECK THE RECORDED SJB DTCs FROM ON-DEMAND SELF-TEST • Check the recorded results from the SJB and power liftgate module self-test. • **Is DTC B2A25 present?**	**Yes** GO to C2 . **No** GO to C5 .
C2 CHECK THE LH DOOR LOCK CONTROL SWITCH • Disconnect: LH Door Lock Control Switch C505. • Repeat the SJB on-demand self-test. • **Is DTC B2A25 retrieved again?**	**Yes** GO to C3 . **No** INSTALL a new LH door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation.
C3 CHECK THE RH DOOR LOCK CONTROL SWITCH • Disconnect: RH Door Lock Control Switch C605. • Repeat the SJB on-demand self-test. • **Is DTC B2A25 retrieved again?**	**Yes** GO to C4 . **No** INSTALL a new RH door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation.
C4 CHECK THE LOCK INPUT CIRCUIT OR THE UNLOCK INPUT CIRCUIT FOR A SHORT TO GROUND • Key in OFF position. • Disconnect: SJB C2280d. • If the doors do not lock, measure the resistance between the SJB C2280d-17, circuit CPL27 (WH/BN), harness side and ground.  N0058779 • If the doors do not unlock, measure the resistance between the SJB C2280d-4, circuit CPL30 (BU/BN), harness side and ground.	**Yes** GO to C8 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.



N0058780

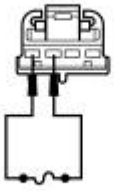
- **Is the resistance greater than 10,000 ohms?**

C5 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES	
• Key in OFF position. • Press the lock and unlock button of both door lock control switches while observing the door lock operation. • **Do the door locks operate only one way from both switches?**	**Yes** GO to C7 . **No** GO to C6 .
C6 CHECK CIRCUIT CPL27 (WH/BN) (LOCK INPUT) OR CIRCUIT CPL30 (BU/BN) (UNLOCK INPUT) FOR AN OPEN (SINGLE SWITCH INOPERATIVE)	
• Disconnect: Suspect Door Lock Control Switch. • Unlock the doors from the working door lock control switch. • Connect a fused (5A) jumper wire between the LH door lock switch C505-1, circuit CPL27 (WH/BN), harness side and the LH door lock switch C505-4, circuit GD143 (BK/VT), harness side; or between the RH door lock switch C605-1, circuit CPL27 (WH/BN), harness side and the RH door lock switch C605-4, circuit GD138 (BK/WH), harness side.	**Yes** INSTALL a new door lock control switch. REFER to Door Lock Control Switch . TEST the system for normal operation. **No** REPAIR the input circuit in question. TEST the system for normal operation.

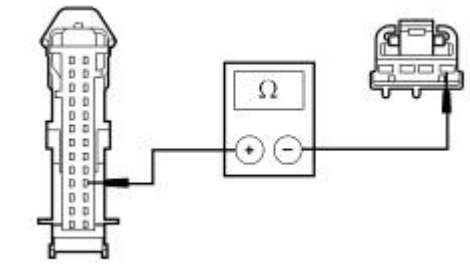
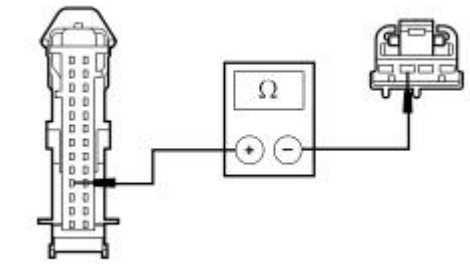


N0058784

- Remove the jumper wire.
- Connect a fused (5A) jumper wire between the LH door lock switch C505-3, circuit CPL30 (BU/BN), harness side and the LH door lock switch C505-4, circuit GD143 (BK/VT), harness side; or between the RH door lock switch C605-3, circuit CPL30 (BU/BN), harness side and the RH door lock switch C605-4, circuit GD138 (BK/WH), harness side.



N0058803

• **Do the doors lock and unlock with the jumper wire?**	
C7 CHECK CIRCUIT CPL27 (WH/BN) (LOCK INPUT) OR CIRCUIT CPL30 (BU/BN) (UNLOCK INPUT) FOR AN OPEN (BOTH SWITCHES INOPERATIVE)	
• Disconnect: LH Door Lock Control Switch C505. • Disconnect: SJB C2280d. • If the doors do not lock, measure the resistance between the SJB C2280d-17, circuit CPL27 (WH/BN), harness side and the LH door lock switch C505-1, circuit CPL27 (WH/BN), harness side.  N0058781 • If the doors do not unlock, measure the resistance between the SJB C2280d-4, circuit CPL30 (BU/BN), harness side and the LH door lock switch C505-3, circuit CPL30 (BU/BN), harness side.  N0058782 • **Is the resistance less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit in question. TEST the system for normal operation.
C8 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: All Door Locks Are Inoperative From One Switch

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

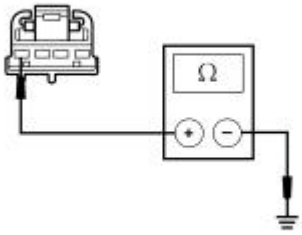
The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL27 (WH/BN) and CPL30 (BU/BN) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground. Ground for the LH door lock control switch is provided through circuit GD143 (BK/VT). Ground for the RH door lock control switch is provided through circuit GD138 (BK/WH).

Possible Causes

- Circuit GD138 (BK/WH) open
- Circuit GD143 (BK/VT) open
- Door lock control switch

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE FROM ONE SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK CIRCUIT GD143 (BK/VT) (LH DOOR LOCK SWITCH) OR GD138 (BK/WH) (RH DOOR LOCK SWITCH) FOR AN OPEN	
• Disconnect: Inoperative Door Lock Control Switch. • Measure the resistance between the LH door lock control switch C505-4, circuit GD143 (BK/VT), harness side and ground; or between the RH door lock control switch C605-4, circuit GD138 (BK/WH), harness side and ground.  N0058783 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new door lock control switch. REFER to Door Lock Control Switch . TEST the system for normal operation. **No** REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test E: The Liftgate Glass Latch Release Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) does not release the liftgate glass unless the doors have been unlocked electronically or the request is initiated from a remote keyless entry (RKE) transmitter.

The SJB sends a voltage signal to the liftgate glass release switch through circuit CPL60 (BN/YE). When the switch is pressed, the signal is routed to ground through circuit GD150 (BK/WH). When the SJB detects a request from the liftgate glass release switch, the SJB provides voltage to the liftgate glass latch release motor (integral to the liftgate glass latch) through circuit CPL59 (BN/BU). Ground for the liftgate glass latch is provided through circuit GD150 (BK/WH).

DTC B2667 — is an on-demand DTC that sets when the SJB detects a short to ground from the liftgate glass release switch input circuit.

Possible Causes

- Circuit CPL60 (BN/YE) open or short to ground
- Circuit CPL59 (BN/BU) open or short to voltage
- Circuit GD150 (BK/WH) open
- Liftgate glass release switch
- Liftgate glass release motor (integral to the liftgate glass latch)
- SJB

PINPOINT TEST E: THE LIFTGATE GLASS LATCH RELEASE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>E1 CHECK THE DOOR LOCK OPERATION</td><td rowspan="2">Yes
GO to E2 .

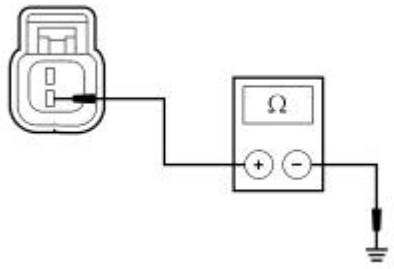
No
Go To Pinpoint Test A .</td></tr>
<tr><td>• Lock and unlock the doors using the door lock control switch.
• Do the door lock operate correctly?</td></tr>
<tr><td>E2 CHECK THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TESTS</td><td rowspan="2">Yes
GO to E3 .

No
GO to E5 .</td></tr>
<tr><td>• Check the recorded results from the SJB self-test.
• Is DTC B2667 present?</td></tr>
<tr><td>E3 CHECK THE LIFTGATE GLASS RELEASE SWITCH (SHORT TO GROUND)</td><td rowspan="2">Yes
GO to E4 .

No
INSTALL a new liftgate glass release switch.
CLEAR the DTCs.
REPEAT the self-test.</td></tr>
<tr><td>• Disconnect: Liftgate Glass Release Switch C4039.
• Clear the DTC and carry out the SJB on-demand self-test.
• Is DTC B2667 still present?</td></tr>
<tr><td>E4 CHECK CIRCUIT CPL60 (BN/YE) FOR A SHORT TO GROUND</td><td rowspan="2">Yes
GO to E14 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>• Key in OFF position.
• Disconnect: SJB C2280d.
• Measure the resistance between the liftgate glass release switch, harness side and ground as follows:
<table><tr><th>Vehicle</th><th>Glass Release Switch Connector-Pin</th><th>Circuit</th></tr><tr><td>Expedition</td><td>C4039-2</td><td>1760 (WH/VT)</td></tr><tr><td></td><td></td><td></td></tr></table></td></tr>
</table>

Navigator	C4039-2	CPL60 (BN/YE)



N0058785

- **Is the resistance greater than 10,000 ohms?**

E5 MONITOR THE LIFTGATE GLASS RELEASE SWITCH PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Liftgate Glass Release Switch PID.
- Monitor the SJB liftgate release switch PID while pressing the liftgate glass release switch.
- **Does the PID indicate the liftgate release switch is active?**

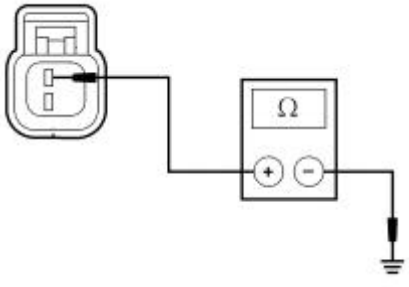
Yes
GO to E9 .

No
GO to E6 .

E6 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (SWITCH)

- Key in OFF position.
- Disconnect: Liftgate Glass Release Switch C4039.
- Measure the resistance between the liftgate glass release switch, harness side and ground as follows:

Vehicle	Glass Release Switch Connector-Pin	Circuit
Expedition	C4039-1	57 (BK)
Navigator	C4039-1	CPL60 (BN/YE)



N0009143

- **Is the resistance less than 5 ohms?**

Yes
GO to E7 .

No
REPAIR the circuit. TEST the system for normal operation.

E7 CHECK THE LIFTGATE GLASS RELEASE SWITCH

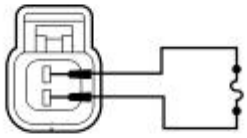
- Unlock the doors with the door lock control switch.
- Connect a fused (5A) jumper wire between the liftgate glass release switch pins, harness side as follows:

Vehicle	Glass Release Switch Connector-Pin/ Circuit	Glass Release Switch Connector-Pin/ Circuit

Yes
INSTALL a new liftgate glass release switch. TEST the system for normal operation.

No

Expedition	C4039-2 1760 (WH/VT)	C4039-1 57 (BK)
Navigator	C4039-2 1760 (WH/VT)	C4039-1 GD150 (BK/WH)



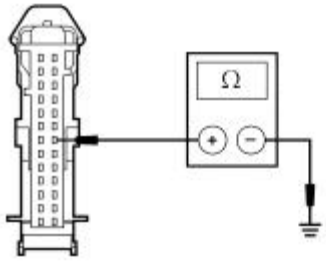
N0058786

- **Does the liftgate glass latch release?**

LEAVE the jumper wire connected. GO to E8 .

E8 CHECK CIRCUIT CPL60 (BN/YE) FOR AN OPEN

- Disconnect: SJB C2280d.
- Measure the resistance between the SJB C2280d-20, circuit CPL60 (BN/YE), harness side and ground.



N0058787

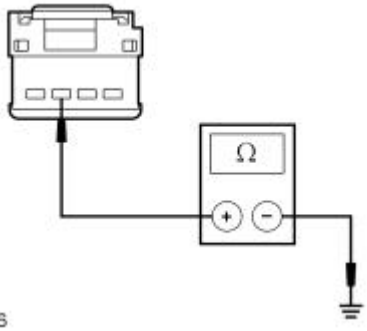
- **Is the resistance less than 5 ohms?**

Yes
GO to E14 .

No
REPAIR the circuit. TEST the system for normal operation.

E9 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (LATCH)

- Key in OFF position.
- Disconnect: Liftgate Glass Latch C4040.
- Measure the resistance between the liftgate glass latch C4040-3, circuit GD150 (BK/WH), harness side and ground.



N0009146

- **Is the resistance less than 5 ohms?**

Yes
GO to E10 .

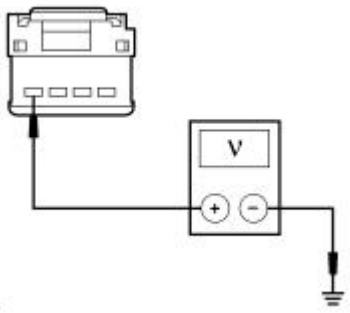
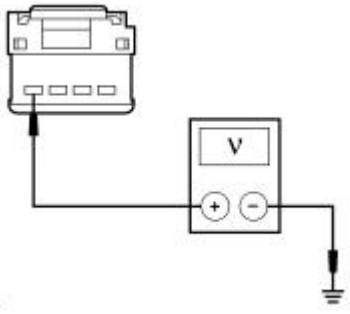
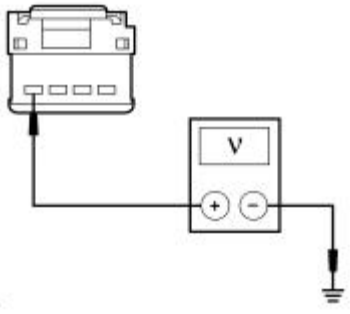
No
REPAIR the circuit. TEST the system for normal operation.

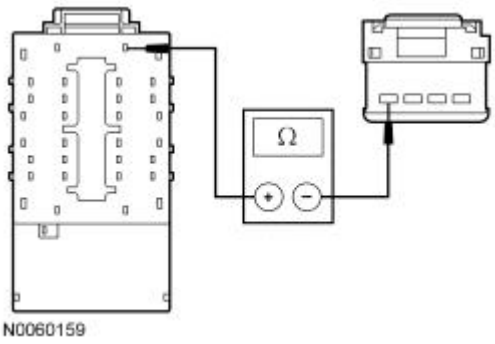
E10 CHECK FOR A SHORT TO VOLTAGE TO THE LIFTGATE GLASS LATCH

- Key in ON position.
- Measure the voltage between the liftgate glass latch C4040-4, circuit CPL59 (BN/BU), harness side and ground.

Yes
GO to E11 .

No

 N0058788 • **Is any voltage present?**	GO to E12 .
E11 CHECK CIRCUIT CPL59 (BN/BU) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280e. • Key in ON position. • Measure the voltage between the liftgate glass latch C4040-4, circuit CPL59 (BN/BU), harness side and ground.  N0058788 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E14 .
E12 CHECK FOR VOLTAGE TO THE LIFTGATE GLASS LATCH	
• Key in OFF position. • Unlock the doors with the door lock control switch. • **NOTE:** The SJB only supplies voltage to the liftgate glass latch momentarily. It is important to monitor the meter while pressing the liftgate glass release switch. • While pressing the liftgate glass release switch, measure the voltage between the liftgate glass latch C4040-4, circuit CPL59 (BN/BU), harness side and ground.  N0058788 • **Is the voltage greater than 10 volts when the switch is pressed?**	**Yes** INSTALL a new liftgate window latch. REFER to Liftgate Latch — Window in this section. TEST the system for normal operation. **No** GO to E13 .
E13 CHECK CIRCUIT CPL59 (BN/BU) FOR AN OPEN	
• Disconnect: SJB C2280e. • Measure the resistance between the SJB C2280e-31, circuit CPL59 (BN/BU), harness side and the liftgate glass latch C4040-4, circuit CPL59 (BN/BU), harness side.	**Yes** GO to E14 . **No**

 • **Is the resistance less than 5 ohms?**	REPAIR the circuit. TEST the system for normal operation.

E14 CHECK FOR CORRECT SJB OPERATION
• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Liftgate Latch Release Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) does not release the liftgate unless the doors have been unlocked electronically or the request is initiated from a remote keyless entry (RKE) transmitter.

The SJB sends a voltage signal to the liftgate release switch (part of the liftgate release handle) through circuit CPL45 (BN). When the switch is activated (the handle is pulled), the signal is routed to ground through circuit GD150 (BK/WH). When the SJB detects a request from the liftgate release switch, the SJB provides voltage through circuit CPL10 (BN/BU) to the liftgate latch release motor (integral to the liftgate latch) (vehicles with a manual liftgate) or the power liftgate module (vehicles equipped with a power liftgate). For vehicles with a manual liftgate, ground for the liftgate latch is provided through circuit GD150 (BK/WH).

DTC B2666 — is an on-demand DTC that sets when the SJB detects a short to ground from the liftgate release switch input circuit.

DTC B273A — is an on-demand DTC that sets when the SJB detects a short to ground from the liftgate latch release output circuit.

DTC B273B — is an on-demand DTC that sets when the SJB detects an open or short to voltage from the liftgate latch release output circuit.

Possible Causes

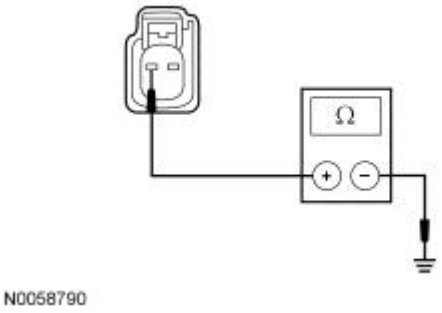
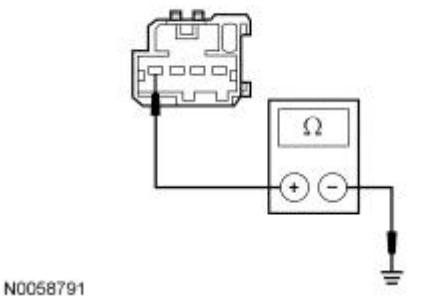
- Circuit CPL45 (BN) open or short to ground
- Circuit CPL10 (GN/WH) open, short to ground or voltage
- Circuit GD150 (BK/WH) open

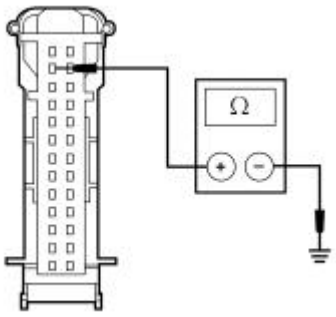
- Liftgate release switch (integral to the liftgate release handle)
- Liftgate release motor (integral to the liftgate latch)
- Power liftgate module
- SJB

PINPOINT TEST F: THE LIFTGATE LATCH RELEASE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
F1 CHECK THE RECORDED SJB AND POWER LIFTGATE MODULE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check the recorded results from the SJB and power liftgate module self-test. • **Are any DTCs present?**	**Yes** For any power liftgate module DTC, REFER to Section 501-03 . For DTC B2666, GO to F2 . For DTC B273A, GO to F4 . For DTC B273B, GO to F6 (manual liftgate) or GO to F7 (power liftgate). For all other DTCs, REFER to the Smart Junction Box (SJB) Diagnostic Trouble Code (DTC) Chart in this section. **No** GO to F11 .
F2 CHECK THE LIFTGATE RELEASE SWITCH (SHORT TO GROUND)	
• Disconnect: Liftgate Release Switch C4340. • Clear the DTC and carry out the SJB on-demand self test. • **Is DTC B2666 still present?**	**Yes** GO to F3 . **No** INSTALL a new liftgate release switch. REFER to Liftgate Release Handle in this section. CLEAR the DTCs. REPEAT the self-test.
F3 CHECK CIRCUIT CPL45 (BN) FOR A SHORT TO GROUND	
• Key in OFF position.	**Yes**

• Disconnect: SJB C2280d. • Measure the resistance between the liftgate release switch C4340-2, circuit CPL45 (BN), harness side and ground.  N0058790 • **Is the resistance greater than 10,000 ohms?**	GO to F15 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F4 CHECK THE LIFTGATE LATCH (MANUAL LIFTGATE) OR THE POWER LIFTGATE MODULE (SHORT TO GROUND)	
• Key in OFF position. • Disconnect: Liftgate Latch C457 or Power Liftgate Module C4174b. • Key in ON position. • **NOTE:** It may be normal for DTC B273A to be present when carrying out this step and should be ignored. • Clear the DTC and carry out the SJB on-demand self test. • **Is DTC B273B present?**	**Yes** For a manual liftgate, INSTALL a new liftgate latch. REFER to Liftgate Latch in this section. CLEAR the DTCs. REPEAT the self-test. For a power liftgate, GO to F14 . **No** GO to F5 .
F5 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO GROUND	
• For vehicles with a manual liftgate, measure the resistance between the liftgate latch C457-1, circuit CPL10 (GN/WH), harness side and ground.  N0058791 • For vehicles with a power liftgate, measure the resistance between the power liftgate module C4174b-12, circuit CPL10 (GN/WH), harness side and ground.	**Yes** GO to F15 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

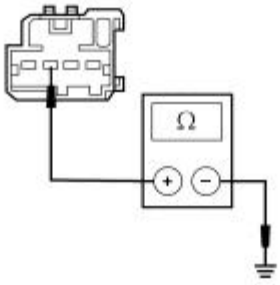


N0058792

- **Is the resistance greater than 10,000 ohms?**

F6 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (LATCH)

- Key in OFF position.
- Disconnect: Liftgate Latch C457.
- Measure the resistance between the liftgate latch C457-2, circuit GD150 (BK/WH), harness side and ground.



N0058793

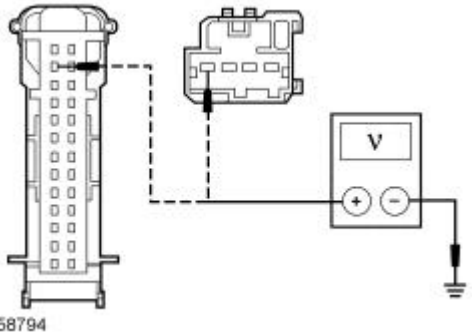
- **Is the resistance less than 5 ohms?**

Yes
GO to F7 .

No
REPAIR the circuit.
CLEAR the DTCs.
REPEAT the self-test.

F7 CHECK FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Power Liftgate Module C4174b (if equipped).
- Key in ON position.
- Measure the voltage between the liftgate latch C457-1, circuit CPL10 (GN/WH), harness side and ground; or between the power liftgate module C4174b-12, circuit CPL10 (GN/WH), harness side and ground.



N0058794

- **Is the voltage greater than 10 volts?**

Yes
GO to F8 .

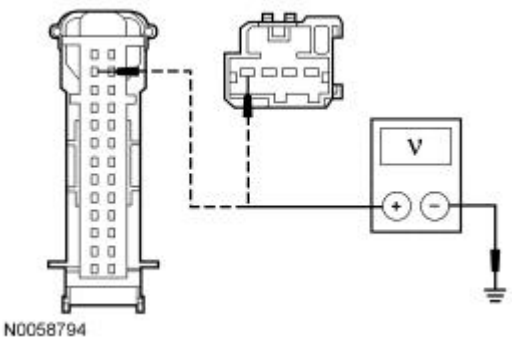
No
GO to F9 .

F8 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e.
- Key in ON position.
- Measure the voltage between the liftgate latch C457-1, circuit CPL10 (GN/WH), harness side and ground; or between the power liftgate module C4174b-12, circuit CPL10 (GN/WH), harness side and ground.

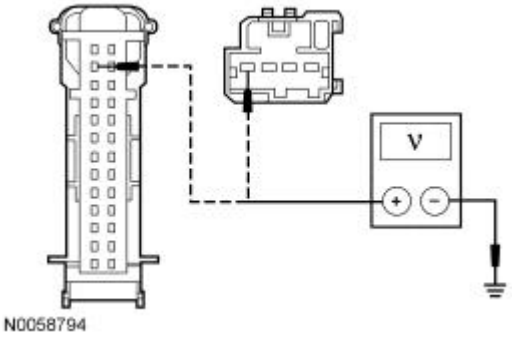
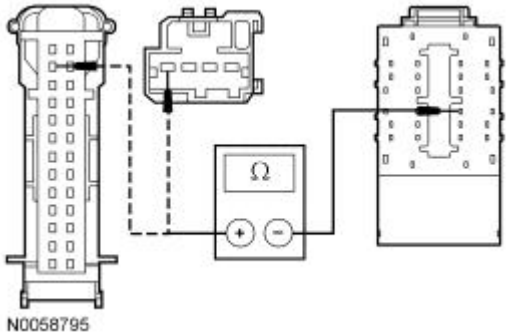
Yes
REPAIR the circuit.
TEST the system for normal operation.

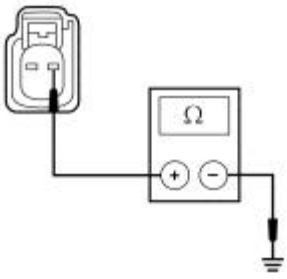
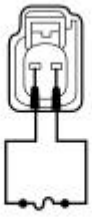
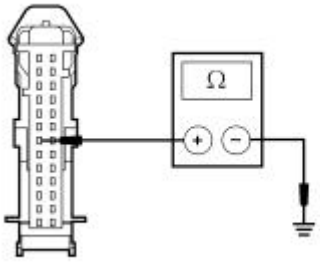
No
GO to F15 .



N0058794

- **Is any voltage present?**

F9 CHECK FOR SJB OUTPUT	
• Key in OFF position. • Unlock the doors with the door lock control switch. • **NOTE:** The SJB only supplies voltage for the liftgate latch release momentarily. It is important to monitor the meter while activating the liftgate release switch. • While activating the liftgate release switch (pull the liftgate release handle), measure the voltage between the liftgate latch C457-1, circuit CPL10 (GN/WH), harness side and ground; or between the power liftgate module C4174b-12, circuit CPL10 (GN/WH), harness side and ground.  N0058794 • **Is the voltage greater than 10 volts when the switch is activated?**	**Yes** For a manual liftgate, INSTALL a new liftgate latch. REFER to Liftgate Latch in this section. CLEAR the DTCs. REPEAT the self-test. For a power liftgate, GO to F14 . **No** GO to F10 .
F10 CHECK CIRCUIT CPL10 (GN/WH) FOR AN OPEN	
• Disconnect: SJB C2280e. • Measure the resistance between the liftgate latch C457-1, circuit CPL10 (GN/WH), harness side and the SJB C2280e-15, circuit CPL10 (GN/WH), harness side; or between the power liftgate module C4174b-12, circuit CPL10 (GN/WH), harness side and the SJB C2280e-15, circuit CPL10 (GN/WH), harness side.  N0058795 • **Is the resistance less than 5 ohms?**	**Yes** GO to F15 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F11 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN (SWITCH)	
• Key in OFF position. • Disconnect: Liftgate Release Switch C4340.	**Yes** GO to F12 .

• Measure the resistance between the liftgate release switch C4040-1, circuit GD150 (BK/WH), harness side and ground.  N0058796 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. TEST the system for normal operation.
F12 CHECK THE LIFTGATE RELEASE SWITCH	
• Unlock the doors with the door lock control switch. • Connect a fused (5A) jumper wire between the liftgate release switch C4040-2, circuit CPL45 (BN), harness side and the liftgate release switch C4040-1, circuit GD150 (BK/WH), harness side.  N0058797 • **Does the liftgate latch release?**	**Yes** INSTALL a new liftgate release handle. REFER to Liftgate Release Handle in this section. TEST the system for normal operation. **No** LEAVE the jumper wire connected. GO to F13.
F13 CHECK CIRCUIT CPL45 (BN) FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-7, circuit CPL45 (BN), harness side and ground.  N0060161 • **Is the resistance less than 5 ohms?**	**Yes** GO to F15. **No** REPAIR the circuit. TEST the system for normal operation.
F14 CHECK FOR CORRECT POWER LIFTGATE MODULE OPERATION	

• Disconnect all the power liftgate module connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the power liftgate module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new power liftgate module. REFER to Section 501-03. CLEAR the DTCs. REPEAT the self-test.
	
	No

	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
F15 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Doors Do Not Lock/Unlock Using The Keyless Entry Keypad

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the keyless entry keypad through circuits CPK29 (GY/BU), CPK30 (VT/GN), and CPK31 (YE/GN). When a button is pressed on the keypad, one or more of the voltage signals is routed to ground through circuit GD133 (BK). Based on the input received, the SJB is able to determine which number on the keypad is pressed.

DTC B2A26 — is an on-demand DTC that sets when the SJB detects a short to ground from any of the keypad input circuits.

Possible Causes

- Circuit CPK29 (GY/BU) open or short to ground
- Circuit CPK30 (VT/GN) open or short to ground
- Circuit CPK31 (YE/GN) open or short to ground
- Circuit GD133 (BK) open
- Keyless entry keypad
- SJB

PINPOINT TEST G: THE DOORS DO NOT LOCK/UNLOCK USING THE KEYLESS ENTRY KEYPAD

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>G1 CHECK DOOR LOCK CONTROL SWITCH OPERATION</td><td></td></tr>
<tr><td>• Key in OFF position.
• Press the lock and unlock button on the door lock control switch.
• Do the door locks operate correctly from the door lock control switch?</td><td>Yes
GO to G2 .

No
GO to Symptom Chart .</td></tr>
<tr><td>G2 CHECK THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST</td><td></td></tr>
<tr><td>• Check the recorded results from the SJB self-test.
• Is DTC B2A26 present?</td><td>Yes
GO to G3 .

No
GO to G5 .</td></tr>
<tr><td>G3 CHECK THE KEYLESS ENTRY KEYPAD FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>• Disconnect: Keyless Entry Keypad C500.
• Key in ON position.
• Repeat the SJB on-demand self-test.
• Is DTC B2A26 still present?</td><td>Yes
GO to G4 .

No
INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>G4 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: SJB C2280d.
• Measure the resistance between the SJB, harness side and ground as follows:

<table><tr><th>SJB Connector-Pin</th><th>Circuit</th></tr><tr><td>C2280d-5</td><td>CPK29 (GY/BU)</td></tr><tr><td>C2280d-18</td><td>CPK30 (VT/GN)</td></tr><tr><td>C2280d-6</td><td>CPK31 (YE/GN)</td></tr></table>
• Are the resistances greater than 10,000 ohms?</td><td>Yes
GO to G8 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>G5 CHECK THE KEYPAD INPUTS FOR AN OPEN</td><td></td></tr>
<tr><td>• Key in OFF position.
• Disconnect: SJB C2280d.
• Measure the resistance between the SJB, harness side and ground while pressing the keypad buttons as follows:

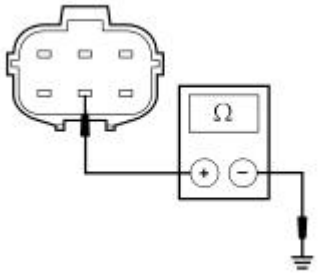
<table><tr><th>Keypad Button</th><th>SJB Connector-Pin</th><th>Circuit</th></tr><tr><td>1/2</td><td>C2280d-5</td><td>CPK29 (GY/BU)</td></tr><tr><td>7/8</td><td>C2280d-18</td><td>CPK30 (VT/GN)</td></tr><tr><td>9/0</td><td>C2280d-6</td><td>CPK31 (YE/GN)</td></tr></table>
• Are the resistances less than 5 ohms when the</td><td>Yes
GO to G8 .

No
GO to G6 .</td></tr>
</table>

<table>
<tr><td>corresponding button is pressed?</td><td></td></tr>
<tr><td>G6 CHECK CIRCUIT GD133 (BK) FOR AN OPEN</td><td rowspan="2">Yes
GO to G7 .

No
REPAIR the circuit. TEST the system for normal operation.</td></tr>
<tr><td>

Disconnect: Keyless Entry Keypad C500.
Measure the resistance between the keyless entry keypad C500-5, circuit GD133 (BK), harness side and ground.



N0058804

Is the resistance less than 5 ohms?

</td></tr>
<tr><td>G7 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR AN OPEN</td><td rowspan="2">Yes
INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. TEST the system for normal operation.

No
REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>

Measure the resistance between the SJB, harness side and the keyless entry keypad, harness side as follows:

<table>
<tr><th>SJB Connector-Pin</th><th>Keyless Entry Keypad Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C2280d-5</td><td>C500-1</td><td>CPK29 (GY/BU)</td></tr>
<tr><td>C2280d-18</td><td>C500-3</td><td>CPK30 (VT/GN)</td></tr>
<tr><td>C2280d-6</td><td>C500-6</td><td>CPK31 (YE/GN)</td></tr>
</table>

Are the resistances less than 5 ohms?

</td></tr>
<tr><td>G8 CHECK FOR CORRECT SJB OPERATION</td><td rowspan="2">Yes
INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>

Disconnect all the SJB connectors.
Check for:

corrosion
damaged pins
pushed-out pins

Connect all the SJB connectors and make sure they seat correctly.
Operate the system and verify the concern is still present.
Is the concern still present?

</td></tr>
</table>

Pinpoint Test H: The Keyless Entry Keypad Illumination Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects a keyless entry button pressed, the SJB provides voltage to

the keyless entry keypad through circuit CPK28 (WH). Ground for the keyless entry keypad is provided through circuit GD143 (BK/VT).

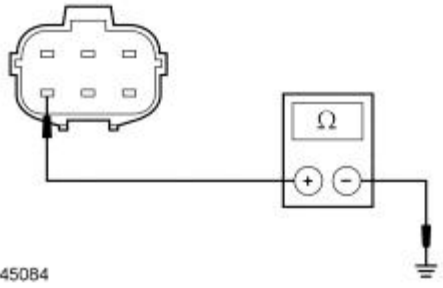
DTC B1624 — is an on-demand DTC that sets when the SJB detects the keyless entry keypad illumination output circuit is open or short to voltage.

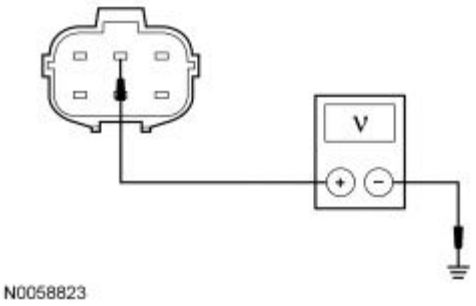
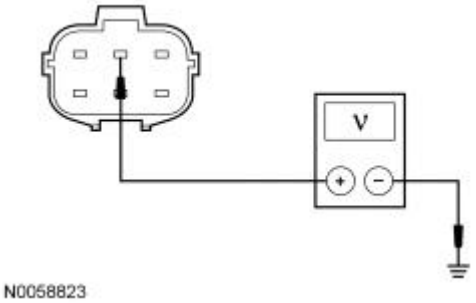
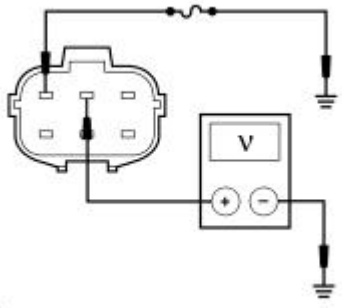
Possible Causes

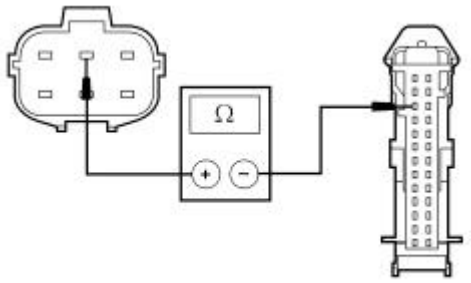
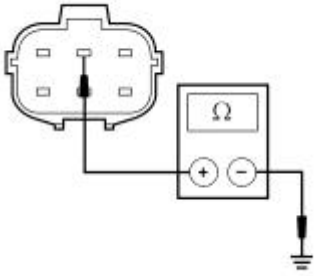
- Circuit CPK28 (WH) open, short to ground or voltage
- Circuit GD143 (BK/VT) open
- Keyless entry keypad
- SJB

PINPOINT TEST H: THE KEYLESS ENTRY KEYPAD ILLUMINATION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK THE KEYLESS ENTRY KEYPAD OPERATION	
• Enter the security code to unlock the driver door. • **Does the driver door unlock using the keyless entry keypad?**	**Yes** GO to H2 . **No** Go To Pinpoint Test G .
H2 CHECK THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B1624 present?**	**Yes** GO to H3 . **No** GO to H6 .
H3 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Disconnect: Keyless Entry Keypad C500. • Measure the resistance between the keyless entry keypad C500-4, circuit GD143 (BK/VT), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to H4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
H4 CHECK FOR CONSTANT VOLTAGE	
• Key in ON position.	**Yes**

• Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (WH), harness side and ground.  N0058823 • **Is any voltage present?**	GO to H5 . **No** GO to H6 .
H5 CHECK CIRCUIT CPK28 (WH) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Disconnect: SJB C2280d. • Key in ON position. • Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (WH), harness side and ground.  N0058823 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to H9 .
H6 CHECK FOR SJB OUTPUT	
• Key in OFF position. • Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (WH), harness side and ground while connecting a fused (5A) jumper wire between the keyless entry keypad C500-1, circuit CPK29 (GY/BU), harness side and ground.  N0058805 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. CLEAR the DTCs. REPEAT the self-test. **No** If DTC B1624 was present, REMOVE the jumper wire. GO to H7 . If DTC B1624 was not present, REMOVE the jumper wire. GO to H8 .
H7 CHECK CIRCUIT CPK29 (WH) FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the keyless entry keypad C500-2, circuit CPK29 (WH), harness side and the SJB C2280d-11, circuit CPK29 (WH), harness side.	**Yes** GO to H9 . **No** REPAIR the circuit. CLEAR the DTCs.

 N0058806 • **Is the resistance less than 5 ohms?**	REPEAT the self-test.
H8 CHECK CIRCUIT CPK29 (WH) FOR A SHORT TO GROUND	
• Disconnect: SJB . • Measure the resistance between the keyless entry keypad C500-2, circuit CPK29 (WH), harness side and ground.  N0058807 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
H9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ▪ corrosion ▪ damaged pins ▪ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Doors Do Not Lock/Unlock Using The Remote Keyless Entry (RKE) Transmitter

Normal Operation

Remote locking and unlocking of the doors is accomplished by the smart junction box (SJB) receiving a command message from the RKE transmitter. The SJB energizes the appropriate relays to lock or unlock the doors

DTC B2276 — is a continuous DTC that sets when the SJB detects that there are no or only one RKE transmitter programmed.

Possible Causes

- RKE transmitter battery
- RKE transmitter
- RKE transmitter programming
- SJB

PINPOINT TEST I: THE DOORS DO NOT LOCK/UNLOCK USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

Test Step	Result / Action to Take
I1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• **NOTE:** Make sure the RKE transmitters are ones provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle. • Check that the correct RKE transmitters are used with the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to I2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.
I2 CHECK THE OPERATION OF THE RKE TRANSMITTER WITH THE KEY IN THE OFF POSITION	
• Key in OFF position. • Check the operation of the RKE transmitter. • **Does the system operate correctly now?**	**Yes** The system is operating as designed. INFORM the customer of the correct vehicle operation. **No** GO to I3 .
I3 CHECK THE POWER DOOR LOCK SYSTEM FOR CORRECT OPERATION	
• Verify the door lock/unlock operation by using the door lock control switch. • **Do all the doors lock and unlock correctly?**	**Yes** GO to I4 . **No** GO to Symptom Chart .
I4 CHECK FOR THE COMPLETE FUNCTIONALITY OF THE RKE TRANSMITTER (S)	
• Check all the RKE transmitter buttons for correct operation. • **Does the panic button operate correctly?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM all RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation. **No**

	GO to I5 .
I5 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED	
• Enter the following diagnostic mode on the diagnostic tool: SJB Function Test. • Monitor the RKE transmitter identification code (TIC) through the scan tool menus. • **NOTE:** The vehicle must be electronically unlocked prior to using any scan tools (through the door lock control switch). • Verify the RKE transmitter signal is being received. Using a scan tool, press a button on the RKE transmitter while observing the SJB TIC PID. • **Does the TIC show up on the scan tool screen when a button is pressed?**	**Yes** GO to I6 . **No** GO to I7 .
I6 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED	
• Enter the following diagnostic mode on the diagnostic tool: SJB Function Test. • Monitor the RKE transmitter TIC PID through the scan tool menus. • Verify the RKE transmitters are programmed to the vehicle. • **Does the TIC displayed under RKE transmitter match any of the TICs stored in memory?**	**Yes** GO to I8 . **No** PROGRAM all of the RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
I7 CHECK THE RKE TRANSMITTER BATTERY	
• Using a thin coin, open the RKE transmitter. • Do not clean off any grease from the battery terminals on the back surface of the circuit board. • Verify the correct battery is used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** GO to I9 . **No** INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the RKE transmitters (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.
I8 CHECK IF THE RKE TRANSMITTER IS OUT OF SYNCHRONIZATION WITH THE SJB	
• Check the recorded results from the SJB self-test. • **Is continuous DTC B2425 present?**	**Yes** Go To Pinpoint Test J . **No** GO to I9 .
I9 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD RKE TRANSMITTER	
• Enter the following diagnostic mode on the diagnostic tool: SJB Function Test. • Monitor the RKE transmitter TIC/DATA through the scan tool menus. • Use the customer's second RKE transmitter (or a known good RKE transmitter that is programmed and correct for the vehicle), verify the RKE transmitter signal is being received by the SJB.	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM all RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation.

• **Does the TIC show up on the scan tool when a button is pressed on the RKE transmitter?**	**No** GO to I10 .
I10 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Remote Keyless Entry (RKE) Transmitter Is Out Of Synchronization

Normal Operation

The remote keyless entry (RKE) transmitters and the smart junction box (SJB) use a rolling code to prevent the codes from being "captured" by a code grabber. The system advances the counter in the RKE transmitter and in the SJB every time an RKE transmitter button is pressed. All RKE transmitters must be present to begin diagnosis of the RKE system.

DTC B2425 — is a continuous DTC that sets when the SJB detects the rolling counter received from an RKE transmitter is 1,024 times greater than the rolling counter stored in the module.

Possible Causes

- RKE transmitter
- RKE transmitter button pressed a substantial amount of times while outside the range of the vehicle
- SJB

PINPOINT TEST J: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER IS OUT OF SYNCHRONIZATION

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

Test Step	Result / Action to Take
J1 RESYNCHRONIZE THE INOPERATIVE RKE TRANSMITTER	
• Key in OFF position. • Press any button on the inoperative RKE transmitter 4 times consecutively within 30 seconds. • **Does the RKE transmitter operate correctly now?**	**Yes** The transmitter is now synchronized. CLEAR the DTCs. REPEAT the self-test. **No** GO to J2 .
J2 CHECK FOR A SECOND RKE TRANSMITTER	
• Check for another RKE transmitter that operates with the vehicle. • **Is there another RKE transmitter that operates with the vehicle?**	**Yes** GO to J3 . **No** GO to J4 .

J3 RESYNCHRONIZE THE INOPERATIVE RKE TRANSMITTER USING THE SECOND RKE TRANSMITTER	
• Key in OFF position. • Press any button on the operational RKE transmitter. • Within 30 seconds, press a button on the inoperative RKE transmitter. • Check the inoperative RKE transmitter for correct operation. • **Does the inoperative RKE transmitter operate now?**	**Yes** The transmitter is now synchronized. CLEAR the DTCs. REPEAT the self-test. **No** GO to J4 .
J4 PROGRAM THE INOPERATIVE RKE TRANSMITTER OR ALL THE RKE TRANSMITTERS	
• Program the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. Refer to Remote Keyless Entry Transmitter Programming in this section. • **Does the inoperative RKE transmitter(s) operate now?**	**Yes** The transmitter(s) is now synchronized. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** Go To Pinpoint Test I .

Pinpoint Test K: The Panic Feature Is Inoperative/Does Not Operate Correctly

Normal Operation

When the remote keyless entry (RKE) transmitter PANIC button is pressed, the smart junction box (SJB) activates the horn and the parking lamps.

Possible Causes

- Parking lamps system
- Horn system
- RKE transmitter
- SJB

PINPOINT TEST K: THE PANIC FEATURE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
K1 VERIFY THE HORN OPERATION	
• Operate the horn through the steering wheel switch. • **Does the horn operate correctly?**	**Yes** GO to K2 . **No** REFER to Section 413-06 .
K2 VERIFY THE PARKING LAMP OPERATION	

• Place the headlamp switch in the PARKING LAMPS ON position. • **Do the parking lamps operate correctly?**	**Yes** GO to K3 . **No** REFER to Section 417-01 .
K3 CHECK THE RKE TRANSMITTER OPERATION	
• Unlock and lock the doors using the RKE transmitter. • **Do the doors lock and unlock correctly?**	**Yes** GO to K4 . **No** Go To Pinpoint Test I .
K4 CHECK THE RKE TRANSMITTER SIGNAL TO THE VEHICLE SECURITY MODULE	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: SJB Transmitter Panic Button PID. • Monitor the SJB transmitter panic button PID while pressing the panic button on the transmitter. • **Does the PID agree with the button press?**	**Yes** GO to K5 . **No** REPLACE the inoperative RKE transmitter. PROGRAM all RKE transmitter(s). REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation.
K5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Remote Keyless Entry (RKE) Transmitter Has Poor Range Performance

Normal Operation

The RKE transmitter has a minimum operating range of 10 m (33 ft). The smart junction box (SJB) has an internal antenna to receive the RKE transmitter signal. When the SJB receives a command from a programmed transmitter, the SJB processes the command to provide the appropriate output.

Possible Causes

- Environmental interference
- RKE transmitter
- RKE transmitter battery
- SJB

PINPOINT TEST L: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER HAS POOR RANGE PERFORMANCE

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems must be disconnected before diagnosing any RKE concerns.

Test Step	Result / Action to Take
L1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• **NOTE:** Make sure the RKE transmitters are ones provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system, that may have been installed on the vehicle. • Check that the correct RKE transmitters are used with the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to L2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.
L2 CHECK ALL RKE TRANSMITTERS FOR POOR RANGE PERFORMANCE	
• **NOTE:** The 3 m (10 ft) measurement of range is not the standard but is a guideline that clearly indicates a vehicle is experiencing poor range performance. • Check all RKE transmitters for poor range performance (less than 3 m [10 ft]). • **Do all RKE transmitters experience poor range?**	**Yes** GO to L4 . **No** GO to L3 .
L3 CHECK THE RKE TRANSMITTER BATTERY	
• Using a thin coin, open the RKE transmitter. • Do not clean off any grease from the battery terminals on the back surface of the circuit board. • Verify the correct battery is used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** REPLACE the inoperative RKE transmitter and PROGRAM all RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation. **No** INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the RKE transmitters (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.
L4 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND THE VEHICLE	
• Make sure the poor performance is consistent in nature and is not from one approaching angle. • RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle is within 0.5 miles (0.8 km) of high-power devices or radio/TV	**Yes** GO to L5 . **No** The system is operating correctly at this time. The range may have been affected by environmental interference.

towers, the operating distance of the transmitters may be reduced. • **Is the poor range performance consistent around the vehicle?**	
L5 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors.
• Check for:
  ▪ corrosion
  ▪ damaged pins
  ▪ pushed-out pins
• Connect all the SJB connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Remote Keyless Entry Transmitter Programming

Printable View (79 KB)

NOTE: All remote keyless entry (RKE) transmitters must be programmed at the same time.

NOTE: Programming (or reprogramming) of the RKE transmitters can be accomplished using a scan tool or by carrying out the following steps.

NOTE: Do not apply the brake pedal during this sequencing, as doing so ends the sequence and the transmitters will not be programmed.

1. Electronically unlock the door locks using the door lock control switch.

2. Turn the ignition switch from the OFF to the RUN position 8 times in rapid succession (within 10 seconds), with the eighth turn ending in RUN. If the module successfully enters program mode, it locks and then unlocks all the doors.

3. **NOTE:** If no action is taken within 20 seconds after a transmitter has been programmed, the programming sequence ends (the doors lock and unlock to confirm that programming is complete).

   Within 20 seconds, press any button on the RKE transmitter to be programmed. The doors lock and then unlock to confirm that each RKE transmitter is programmed. Repeat this step for each RKE transmitter.

4. Exiting the programming mode is accomplished if one of the following occurs:
   - The key transitions to the OFF position.
   - 20 seconds have passed since entering programming mode or since the last RKE transmitter was programmed.
   - The maximum number (4) of RKE transmitters have been programmed.

5. Check the operation of the transmitter. If the door locks do not respond for the programmed RKE transmitter(s), wait several seconds and press the button again. If the door locks still fail to respond, refer to Locks, Latches and Entry Systems in this section. (Make sure that no more than the maximum number of RKE transmitters are attempted to be programmed.)

Keyless Entry Keypad Code Programming

Printable View (78 KB)

NOTE: Up to 3 codes can be programmed. Once there are 3 programmed codes, any attempt to program additional codes will be unsuccessful.

1. Enter the permanent factory keyless entry keypad code.
2. **NOTE:** The locks should lock and unlock to indicate programming mode has been entered.

   Press the 1/2 button within 5 seconds to activate the programming mode. Holding the 1/2 button for more than 2 seconds after activation erases the stored customer codes.
3. Within 5 seconds, enter the new 5-digit keypad code. The doors lock and unlock to confirm the new code is programmed. If the locks do not lock and unlock, the new code programming has not been successful and the procedure must be started from the beginning.

Remote Memory Activation

Printable View (62 KB)

1. Move the seat, rear view mirrors, and adjustable pedals to the desired position.
2. Press the memory set switch SET button.
3. Within 5 seconds, press any button on the remote transmitter (except the PANIC button), and then press the appropriate memory set switch button.
4. Repeat Steps 1-3 for each remote transmitter to be programmed.

Remote Memory Deactivation

Printable View (62 KB)

1. Press the memory set switch SET button.
2. Within 5 seconds, press any button on the remote transmitter that is to be deactivated (except the PANIC button), and then press the memory set switch SET button.
3. Repeat Steps 1 and 2 for each remote transmitter to be deactivated from the memory setting.

Autolock and Horn Chirp Programming

Printable View (82 KB)

Programming the Autolock Feature Using the Door Lock Control Switch

NOTE: This feature can also be enabled or disabled using the message center switch functions, if equipped.

NOTE: The autolock feature can be enabled or disabled independently of the auto-unlock feature.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition switch from the OFF to the RUN position.
2. Press the unlock button on the door lock control 3 times.
3. Turn the ignition switch from the RUN to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition switch to the RUN position. The horn chirps one time to indicate that programming mode is entered.
6. **NOTE:** The lock and unlock buttons must be pressed within 5 seconds of each other.

   Within 30 seconds of entering the programming mode, press the unlock button on the door lock control switch then the lock button to enable/disable the autolock feature. The horn chirps once if the autolocks are disabled or a chirp followed by a honk if the autolocks are enabled.
7. Programming ends when the ignition switch state changes or times out after 2 minutes.

Programming the Auto-Unlock Feature Using the Door Lock Control Switch

NOTE: This feature can also be enabled or disabled using the message center switch functions, if equipped.

NOTE: The auto-unlock feature can be enabled or disabled independently of the autolock feature.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition switch from the OFF to the RUN position.
2. Press the unlock button on the door unlock control 3 times.
3. Turn the ignition switch from the RUN to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition switch to the RUN position. The horn chirps one time to indicate that programming mode is entered.

6. **NOTE:** The lock and unlock buttons must be pressed within 5 seconds of each other.

   Within 30 seconds of entering the programming mode, press the lock button on the door lock control switch then the unlock button to enable/disable the auto-unlock feature. The horn chirps once if the autolocks are disabled or a chirp followed by a honk if the autolocks are enabled.

7. Programming ends when the ignition switch state changes or times out after 2 minutes.

Programming the Perimeter Lighting Feature Using the Door Lock Control Switch

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition switch from the OFF to the RUN position.

2. Press the unlock button on the door unlock control 3 times.

3. Turn the ignition switch from the RUN to the OFF position.

4. Press the unlock button on the door unlock control switch 3 times.

5. Turn the ignition switch to the RUN position. The horn chirps one time to indicate that programming mode is entered.

6. **NOTE:** The lock and unlock buttons must be pressed within 5 seconds of each other.

   Within 30 seconds of entering the programming mode, press the lock button on the door lock control switch then the unlock button to enable/disable the perimeter lighting feature. The horn chirps once if the perimeter lighting is disabled or a chirp followed by a honk if the perimeter lighting is enabled.

7. Programming ends when the ignition switch state changes or times out after 2 minutes.

Programming the Autolock Feature Using the Keyless Entry Keypad

NOTE: The autolock feature can be enabled or disabled independently of the auto-unlock feature.

NOTE: The following steps must be carried out within 30 seconds or the procedure needs to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Enter the factory set 5 digit entry code.

2. Press and hold the 3/4 button.

3. While holding the 3/4 button, press and release the 7/8 button.

4. Release the 3/4 button. The horn chirps once if the autolocks are disabled, or chirps once followed by a honk if the autolocks are enabled.

Programming the Auto-Unlock Feature Using the Keyless Entry Keypad

NOTE: The auto-unlock feature can be enabled or disabled independently of the autolock feature.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Enter the factory set 5 digit entry code.

2. Press and hold the 3/4 button.

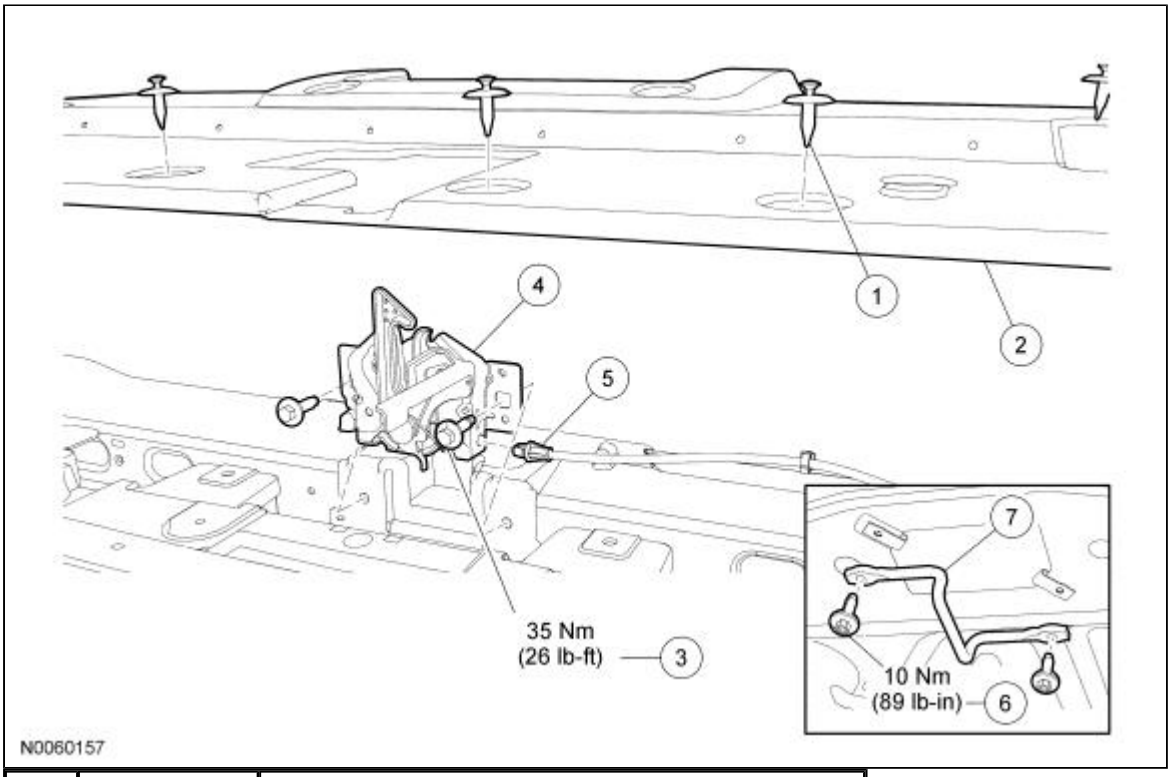
3. While holding the 3/4 button, press and release the 7/8 button twice.

4. Release the 3/4 button. The horn chirps once if auto-unlock is disabled, or chirps once followed by a honk if auto-unlock is enabled.

Hood Latch

Printable View (171 KB)

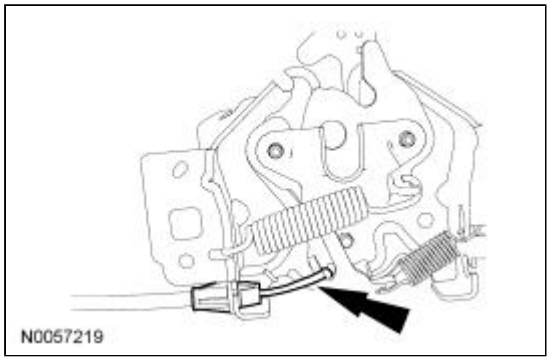
NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	N804837	Upper radiator sight shield pin-type (10 required)
2	19E525	Upper radiator sight shield
3	W711848	Hood latch bolts (2 required)
4	16700	Hood latch
5	—	Hood latch cable (part of 16916)
6	N807014	Hood striker bolts (2 required)
7	16K689	Hood striker

Removal and Installation

1. Remove the 10 pin-type retainers and the upper radiator sight shield.
2. Remove the 2 bolts and the hood latch.
   - To install, tighten to 35 Nm (26 lb-ft).
3. Release the hood latch cable from the hood latch.

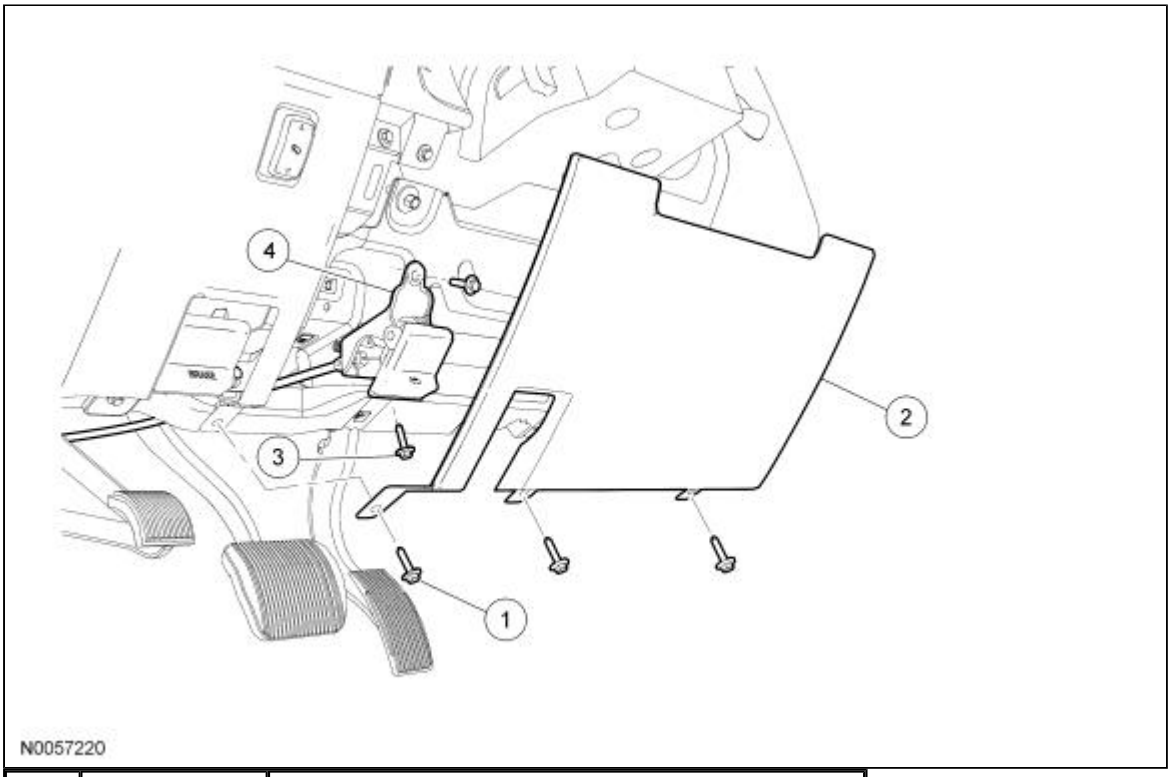


4. To install, reverse the removal procedure.
    - Verify the hood latch engages the striker in the latched position (secondary).
    - Verify the hood latch engages the striker in the fully latched position (primary).
    - Adjust the hood latch as necessary.

Hood Latch Release Handle

Printable View (189 KB)

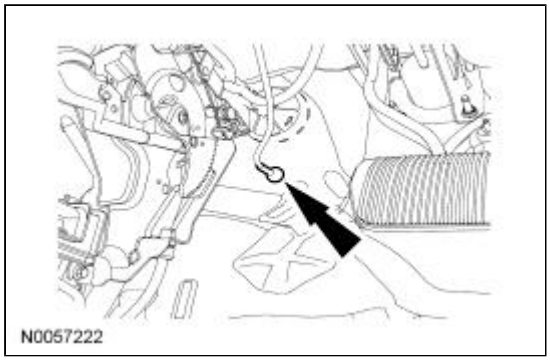
NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	W707628	Steering column cover screws (3 required)
2	7804459	Steering column cover
3	W707628	Hood latch release handle screws (2 required)
4	16916	Hood latch release handle

Removal and Installation

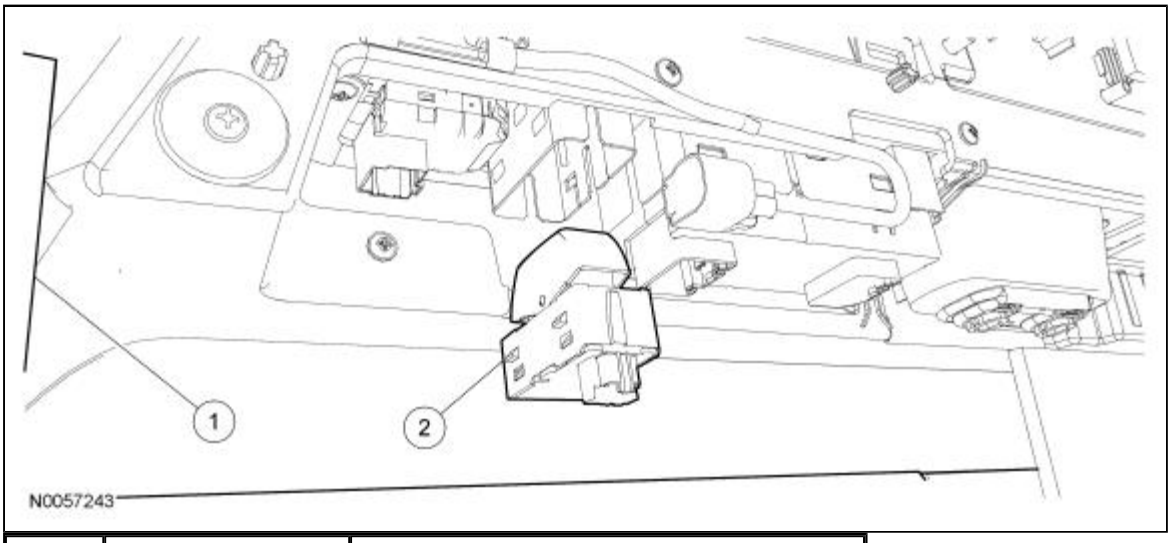
1. Remove the hood latch. For additional information, refer to Hood Latch in this section.
   - Note the routing of the hood release cable.
2. Remove the 3 screws and the steering column cover.
3. Remove the 2 screws and the hood latch release handle.
4. Release the cable guides and pull the cable through the cowl panel.



5. To install, reverse the removal procedure.

Door Lock Control Switch

Printable View (134 KB)



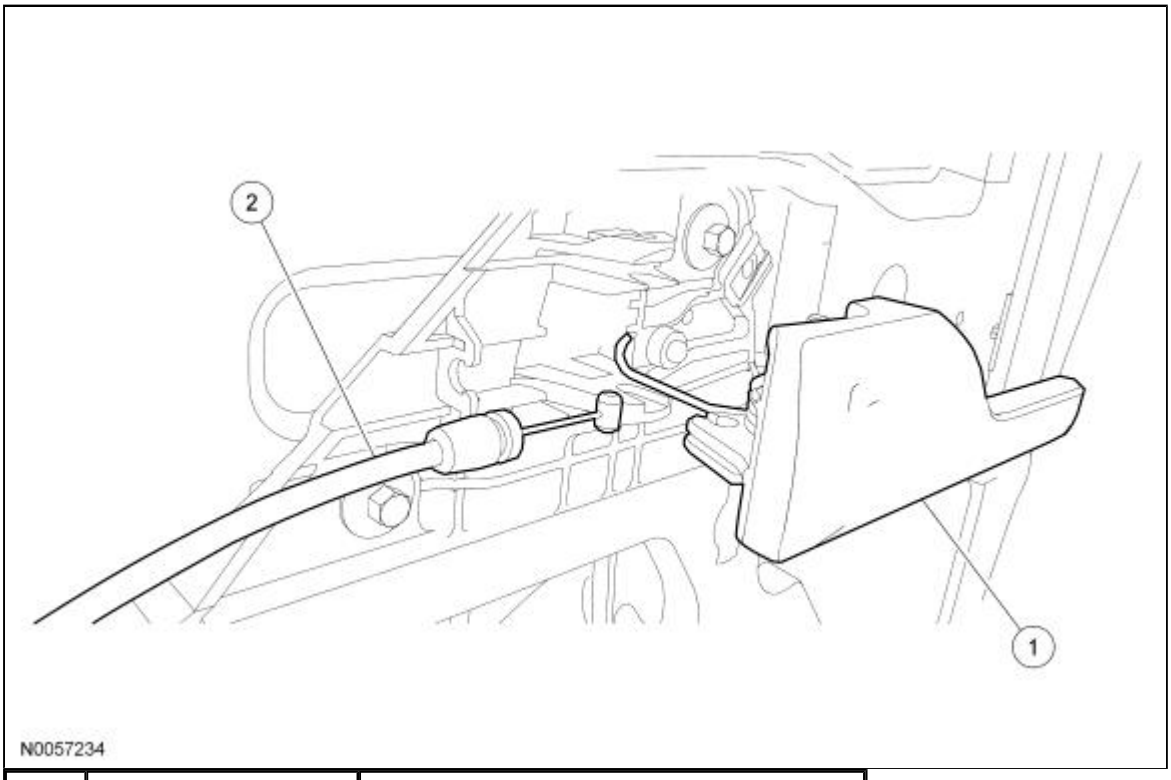
Item	Part Number	Description
1	23943/23942	Front door trim panel (LH/RH)
2	14A028	Door lock control switch

Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Release the tabs and remove the door lock control switch.
3. To install, reverse the removal procedure.

Interior Door Handle

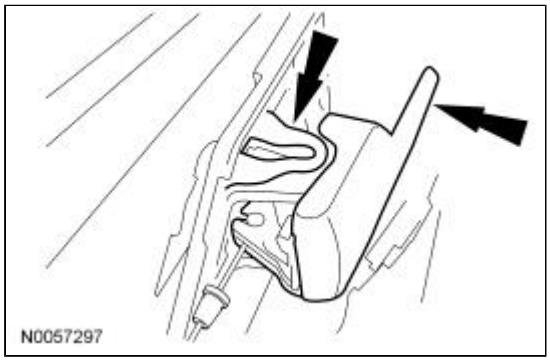
Printable View (163 KB)



Item	Part Number	Description
1	7821819/ 7821818	Interior door handle (LH/RH)
2	78221A00	Exterior door handle actuating cable

Removal and Installation

1. Remove the front or rear door trim panel. For additional information, refer to Section 501-05 .
2. Release the door handle retaining clip and position the interior door handle aside.



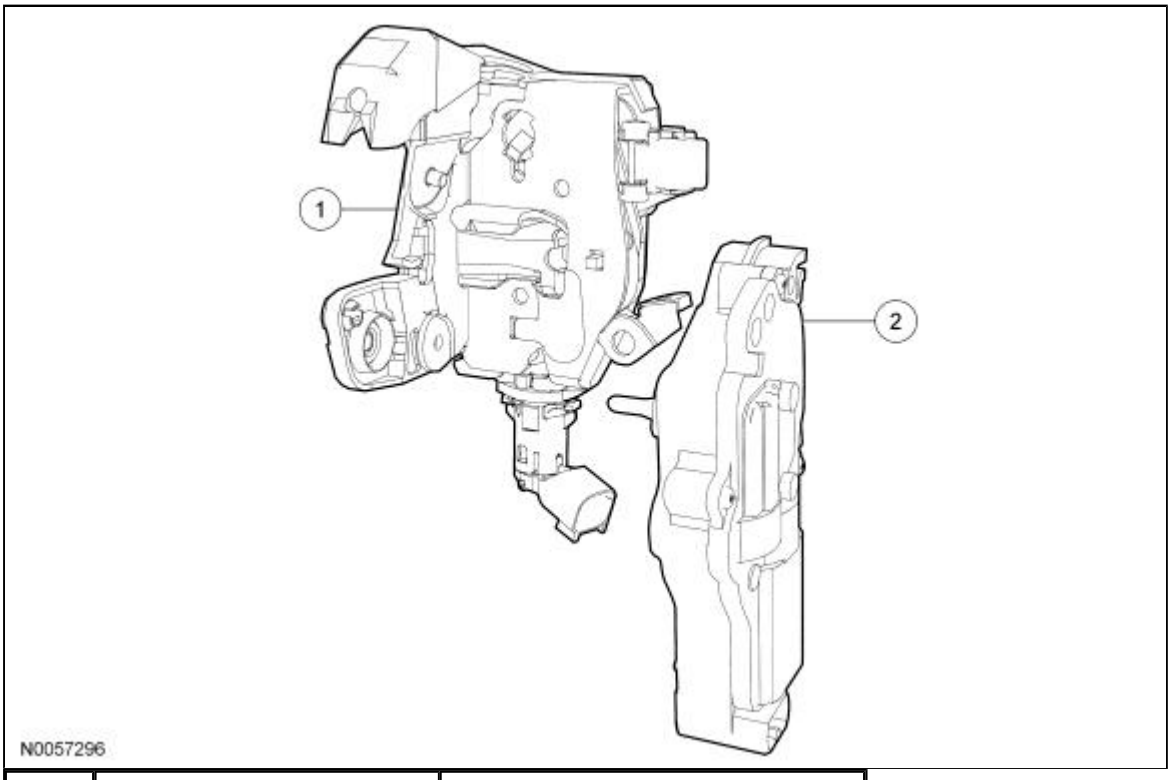
3. Release the interior door handle actuating cable from the interior door handle.
4. **NOTE:** Make sure the interior door handle spring is realigned before installation of the door

handle. Check for normal operation.

To install, reverse the removal procedure.

Door Lock Actuator

Printable View (119 KB)



Item	Part Number	Description
1	—	Door latch
2	25218A43/ 25218A42	Door lock actuator (LH/RH)

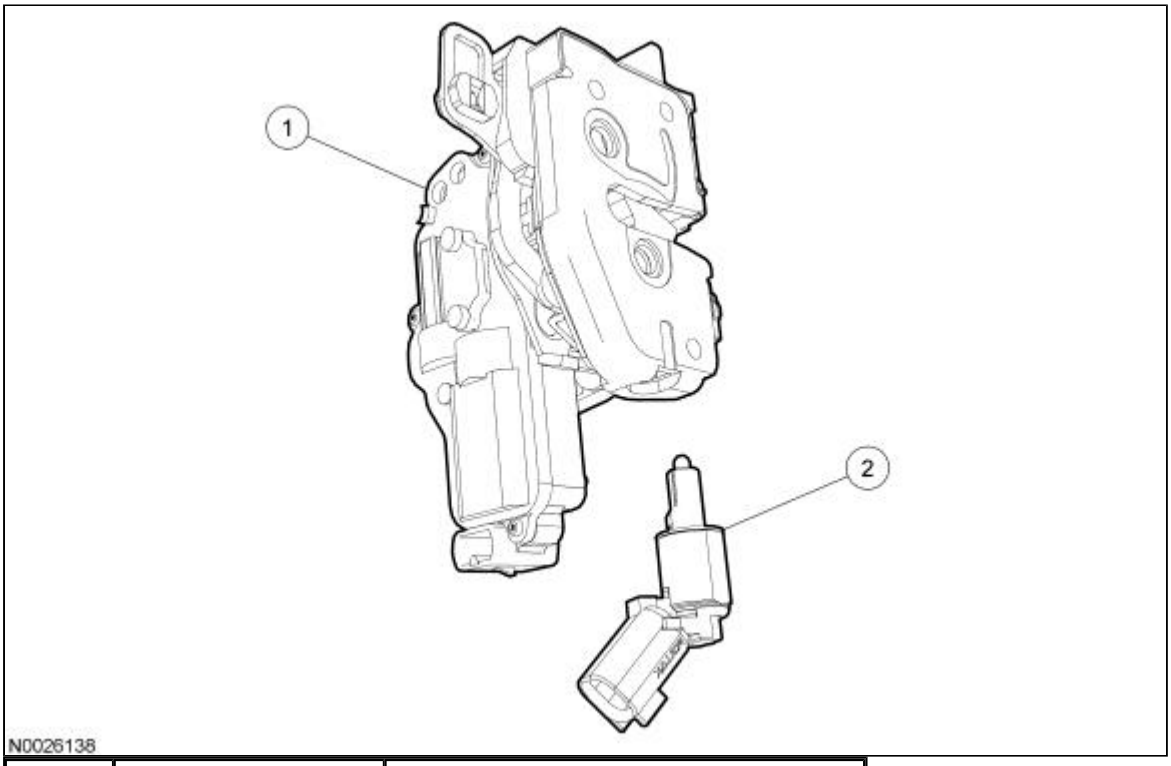
Removal and Installation

1. Remove the door latch. For additional information, refer to Front Door Latch or Rear Door Latch in this section.
2. Release the locking tab and remove the door lock actuator.
3. To install, reverse the removal procedure.

Door Ajar Switch

Printable View (129 KB)

NOTE: LH front door latch shown, others similar.



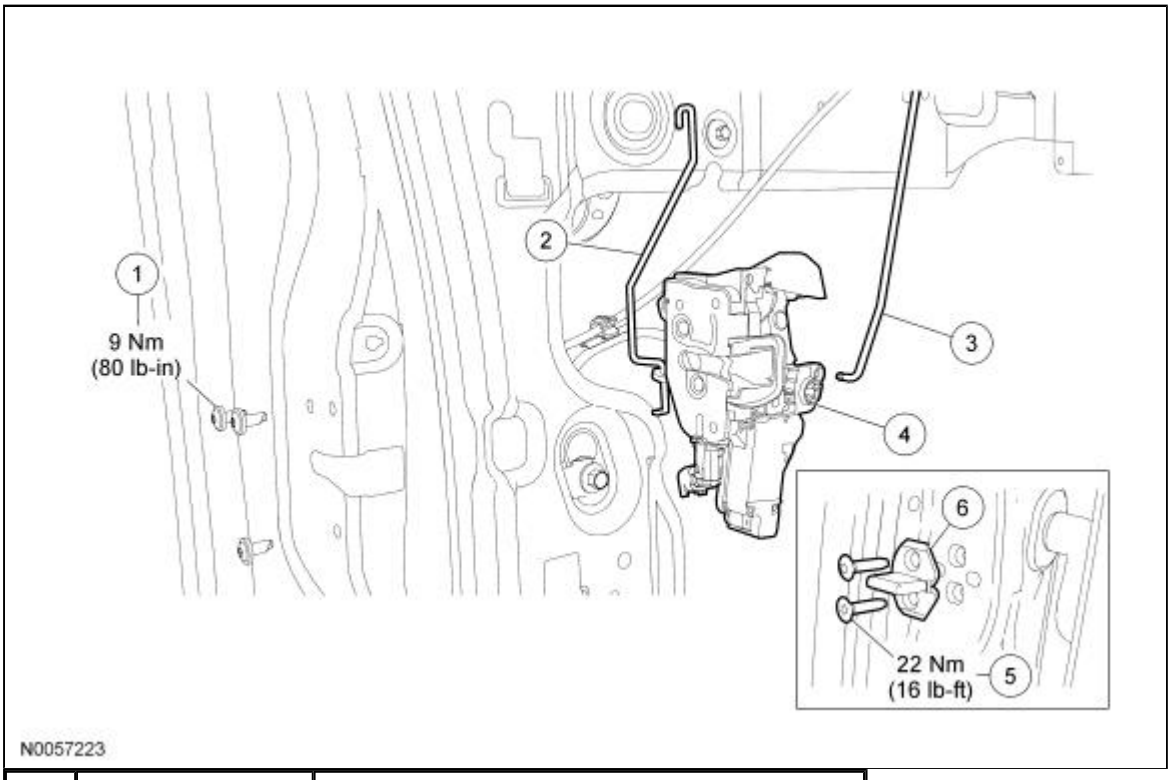
Item	Part Number	Description
1	—	Door latch
2	13713/14018	Door ajar switch (LH/RH)

Removal and Installation

1. Remove the door latch. For additional information, refer to Front Door Latch or Rear Door Latch in this section.
2. Release the locking tab and remove the door ajar switch.
3. To install, reverse the removal procedure.

Front Door Latch

Printable View (261 KB)



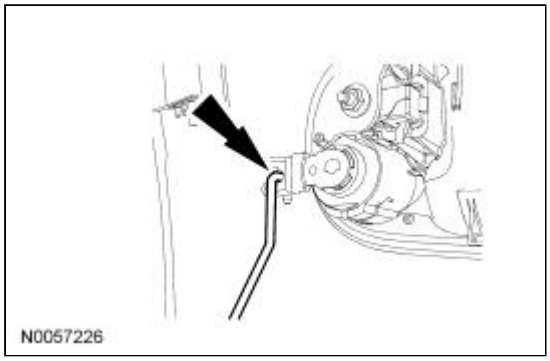
Item	Part Number	Description
1	N811471	Front door latch bolts (3 required)
2	7822135	Door lock cylinder actuating lock rod
3	7821853/ 7821852	Front door manual actuating lock rod (LH/RH)
4	1621813/ 1621812	Front door latch (LH/RH)
5	N807169	Front door striker bolts (2 required)
6	5422008	Front door striker

Removal and Installation

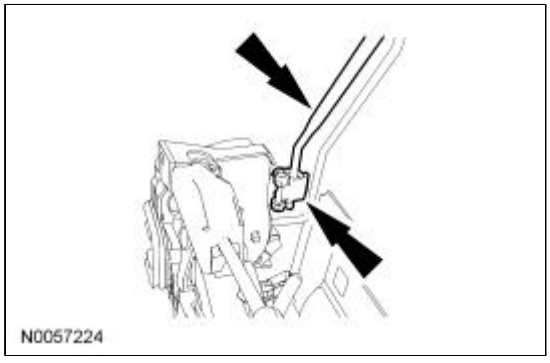
NOTE: The door glass must be completely raised.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
   - Position the water shield aside.

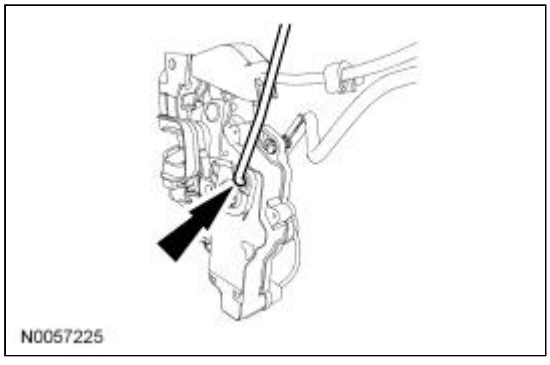
2. For the LH door, disconnect the door lock cylinder actuating lock rod from the lock cylinder.



3. Open the clip and disconnect the exterior door handle actuating rod.

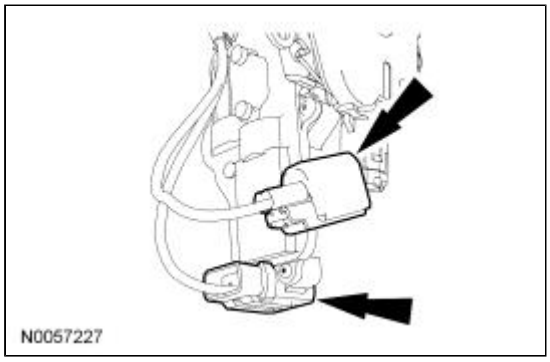


4. Disconnect the manual actuating lock rod from the door latch.

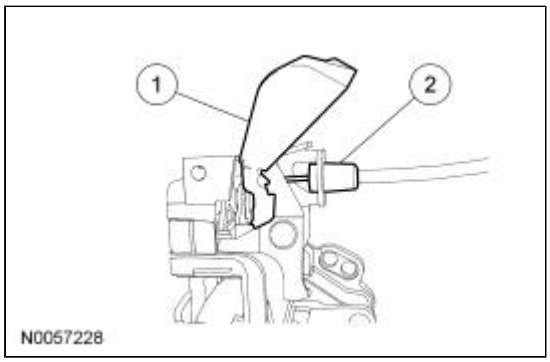


5. Remove and discard the 3 bolts and position the front door latch aside.
    - To install, tighten to 9 Nm (80 lb-in).

6. Disconnect the electrical connectors.
    - Separate the door harness from the door latch.



7. Release the interior door handle actuating cable and remove the front door latch.
    1. Position the cable cover aside.
    2. Release the conduit and the interior door handle actuating cable.

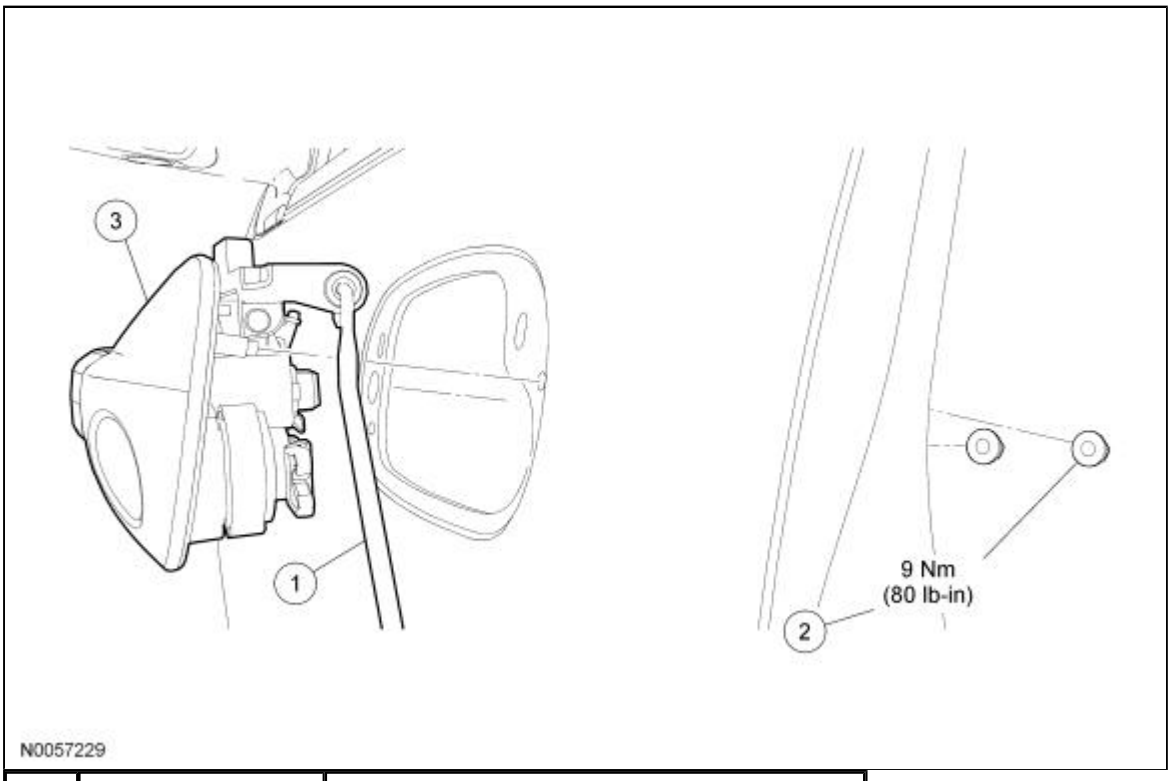


8. **NOTE:** Make sure the exterior door handle and the door handle actuating rod are in a relaxed position and that the exterior door handle rod is all the way up before closing the clip.

    To install, reverse the removal procedure.

Exterior Front Door Handle

Printable View (167 KB)



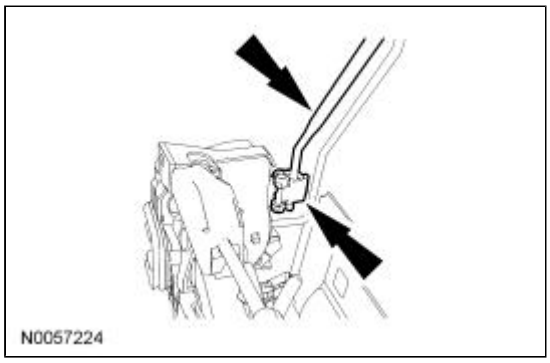
Item	Part Number	Description
1	7822153/ 7822152	Exterior door handle actuating rod (LH/RH)
2	—	Exterior door handle nuts (2 required)
3	7822405/ 7822404	Exterior door handle (LH/RH)

Removal and Installation

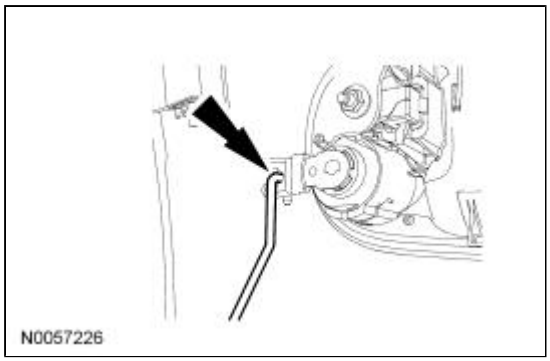
NOTE: The front door window glass must be completely raised.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
   - Position the water shield aside.

2. Open the clip and disconnect the exterior door handle actuating rod.



3. If equipped, disconnect the door lock cylinder actuating rod from the lock cylinder.



4. **NOTE:** Push the exterior door handle out from the bottom surface of the handle.

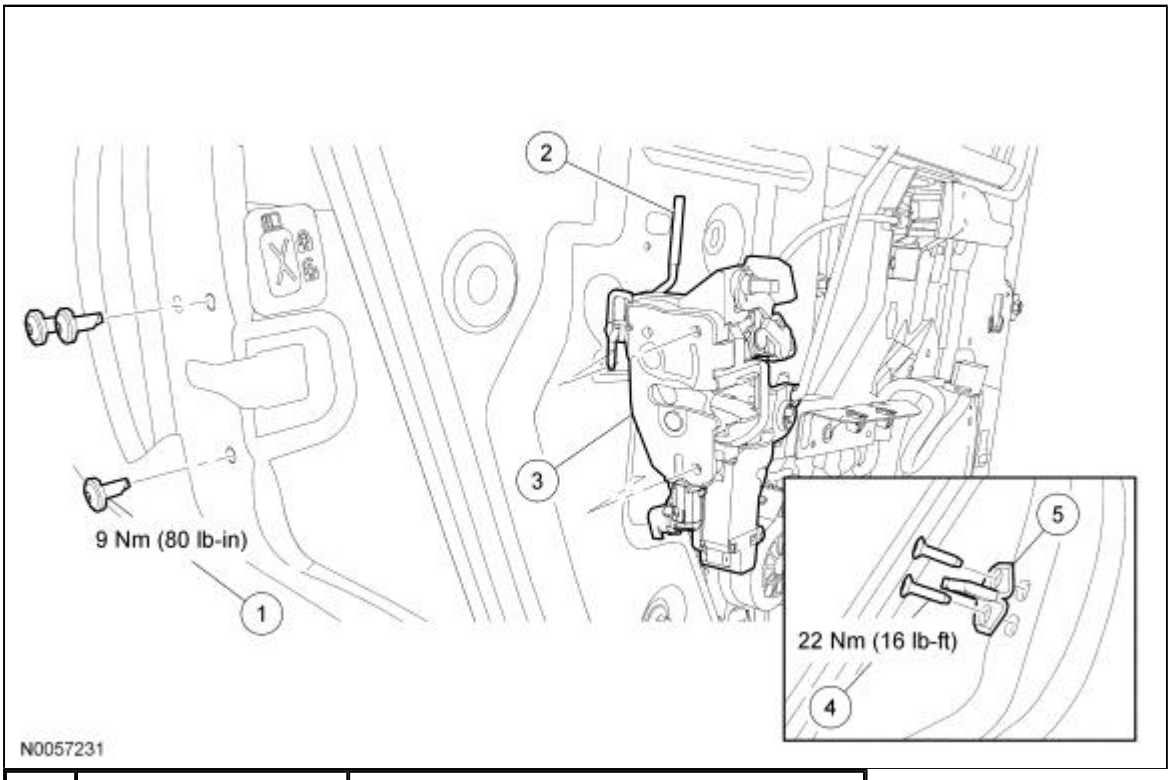
   Remove the 2 nuts and the exterior front door handle.
   - To install, tighten to 9 Nm (80 lb-in).

5. **NOTE:** Make sure the exterior door handle and the door handle actuating rod are in a relaxed position and that the exterior door handle rod is all the way up before closing the clip.

   To install, reverse the removal procedure.

Rear Door Latch

Printable View (249 KB)



Item	Part Number	Description
1	N811471	Rear door latch bolts (3 required)
2	7826597/ 7826596	Exterior door handle actuating rod (LH/RH)
3	78264A01/ 78264A00	Rear door latch (LH/RH)
4	N807169	Rear door striker bolts (2 required)
5	5422008	Rear door striker

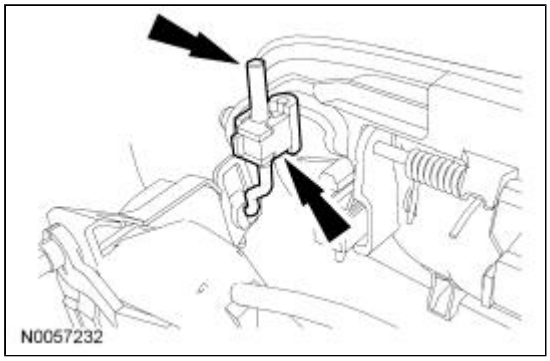
Removal and Installation

NOTE: The rear door window glass must be completely raised.

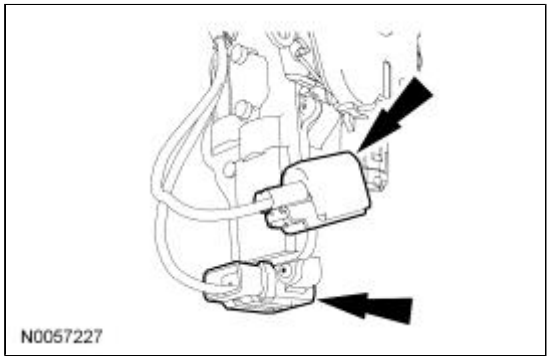
1. Remove rear door trim panel. For additional information, refer to Section 501-05 .
   - Position the water shield aside.

2. Remove and discard the 3 bolts and position the rear door latch aside.
   - To install, tighten to 9 Nm (80 lb-in).

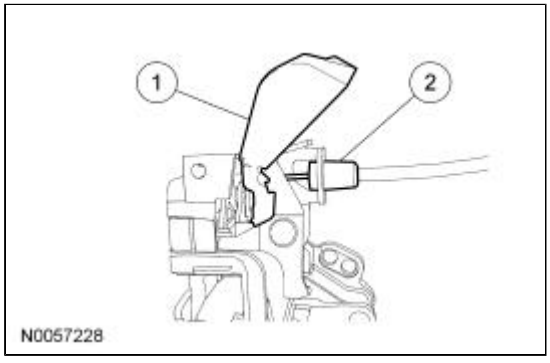
3. Open the clip and disconnect the exterior door handle actuating rod.



4. Disconnect the electrical connectors.



5. Release the interior door handle actuating cable and remove the rear door latch.
    1. Position the cable cover aside.
    2. Release the conduit and the interior door handle actuating cable.

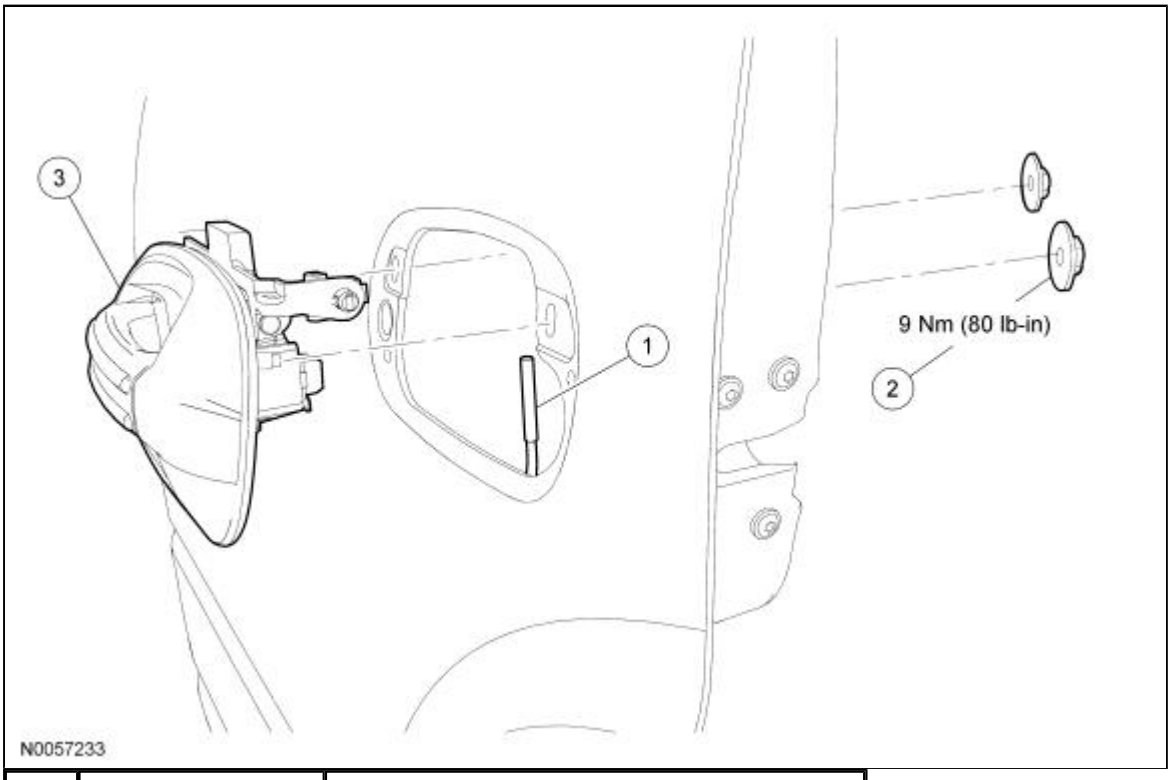


6. **NOTE:** Make sure the exterior door handle and the door handle actuating rod are in a relaxed position and that the exterior door handle rod is all the way up before closing the clip.

    To install, reverse the removal procedure.

Exterior Rear Door Handle

Printable View (157 KB)



Item	Part Number	Description
1	7826597/ 7826596	Exterior door handle actuating rod (LH/RH)
2	—	Exterior door handle nuts (2 required)
3	7826605/ 7826604	Exterior door handle (LH/RH)

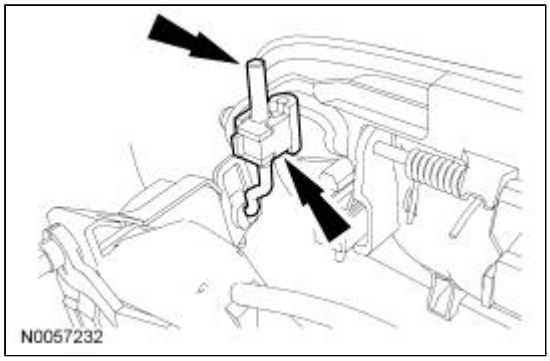
Removal and Installation

NOTE: The door glass must be completely raised.

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
   - Position the water shield aside.

2. Remove and discard the 3 bolts and position the rear door latch aside.
   - To install, tighten to 9 Nm (80 lb-in).

3. Open the clip and disconnect the exterior door handle actuating rod.



4. Remove the 2 nuts and the exterior rear door handle.
    - To install, tighten to 9 Nm (80 lb-in).

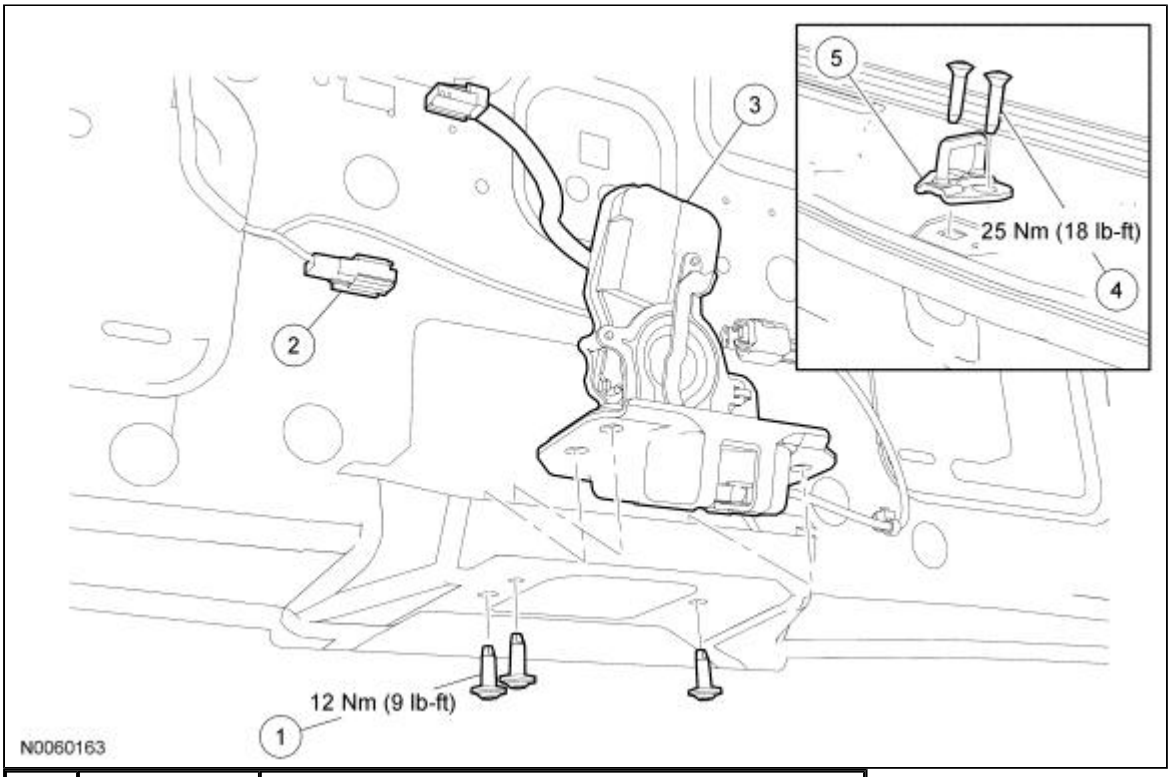
5. **NOTE:** Make sure the exterior door handle and the door handle actuating rod are in a relaxed position and that the exterior door handle rod is all the way up before closing the clip.

   To install, reverse the removal procedure.

Liftgate Latch

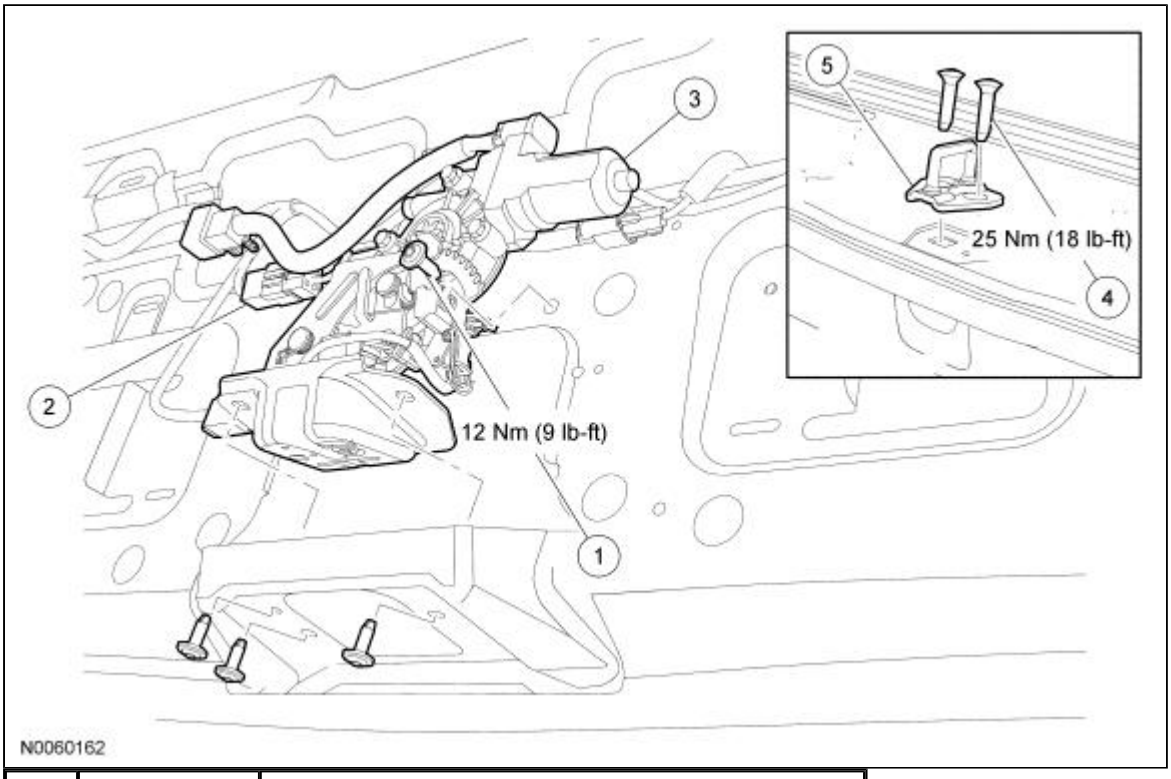
Printable View (266 KB)

Manual Liftgate



Item	Part Number	Description
1	N807675	Liftgate latch bolts (3 required)
2	—	Liftgate latch electrical connector (part of 14086)
3	7843150	Liftgate latch
4	N807169	Liftgate striker bolts (2 required)
5	784235	Liftgate striker

Power Liftgate



Item	Part Number	Description
1	N807675	Liftgate latch bolts (4 required)
2	—	Liftgate latch electrical connector (part of 14086)
3	7843150	Liftgate latch
4	N807169	Liftgate striker bolts (2 required)
5	784235	Liftgate striker

Removal and Installation

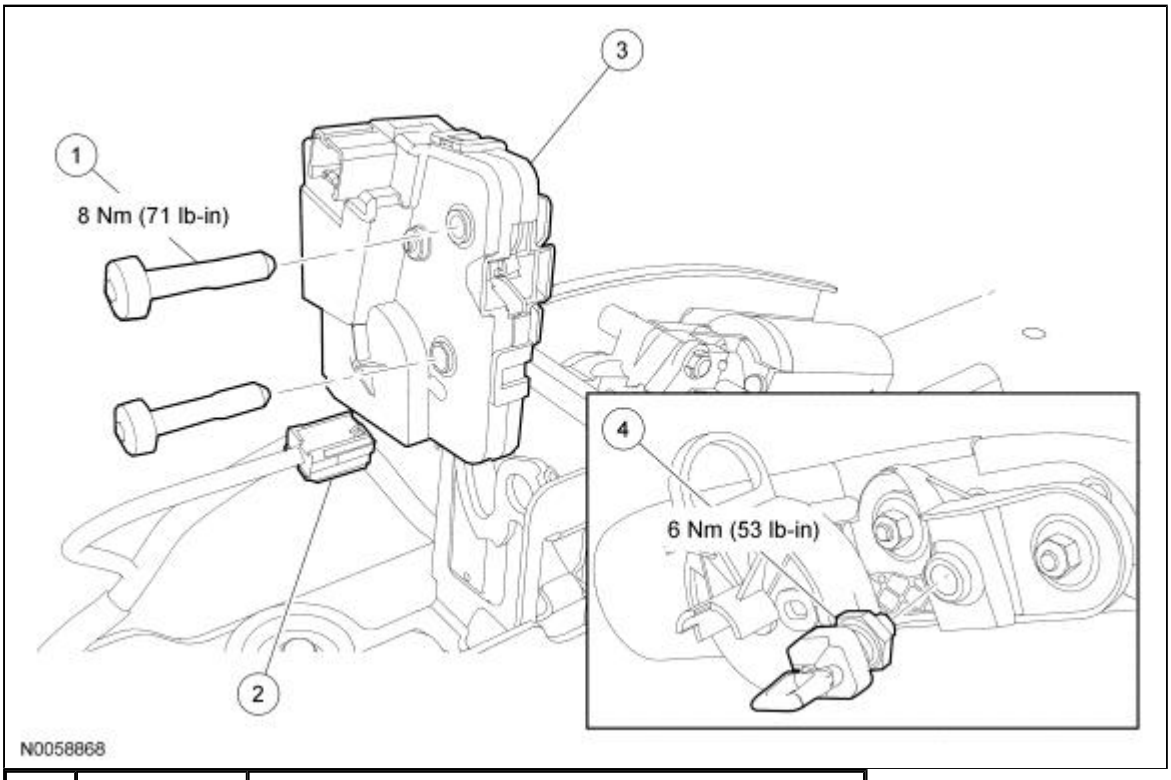
1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
   - Position the water shield aside.

2. Remove and discard the 3 bolts (4 bolts if equipped with a power liftgate) and the liftgate latch.
   - Disconnect the electrical connector.
   - To install, tighten to 12 Nm (9 lb-ft).

3. To install, reverse the removal procedure.

Liftgate Latch — Window

Printable View (152 KB)



Item	Part Number	Description
1	—	Liftgate glass latch screws (2 required)
2	—	Liftgate glass latch electrical connector (part of 14086)
3	17C424	Liftgate glass latch
4	—	Liftgate glass striker

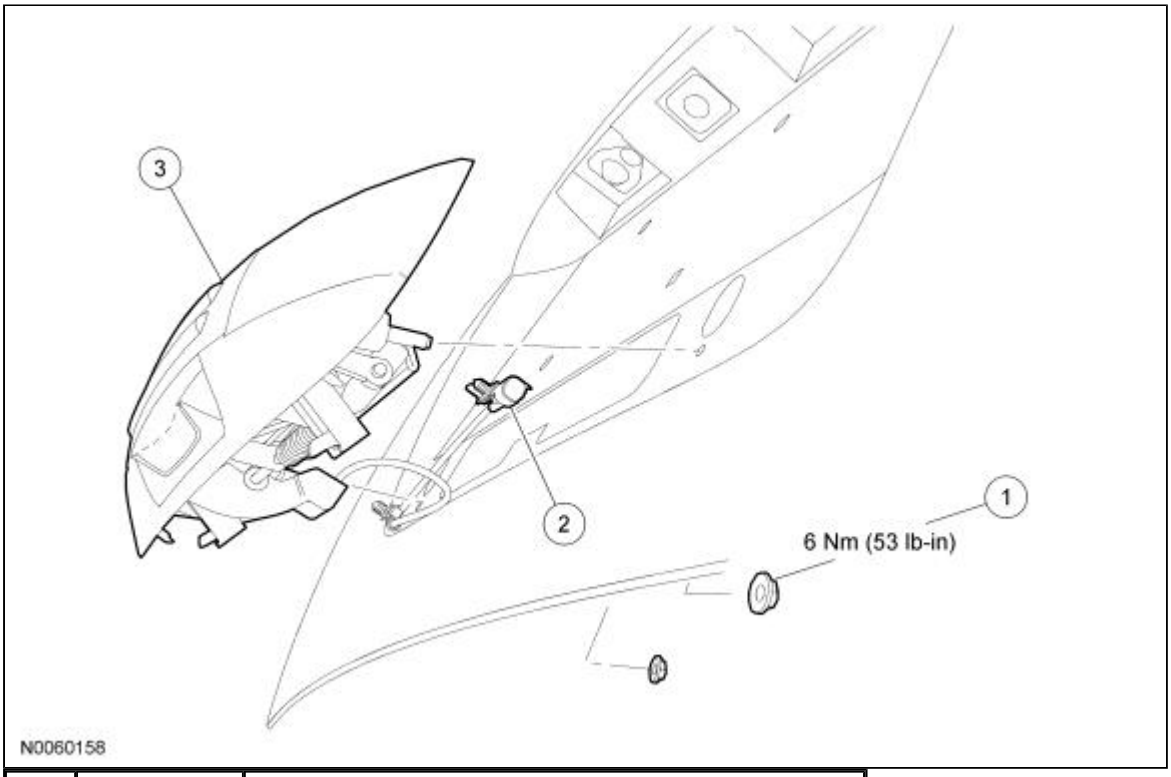
Removal and Installation

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
2. Remove the 2 screws and the liftgate window latch.
   - Disconnect the electrical connector.
   - To install, tighten to 8 Nm (71 lb-in).
3. To install, reverse the removal procedure.

Liftgate Release Handle

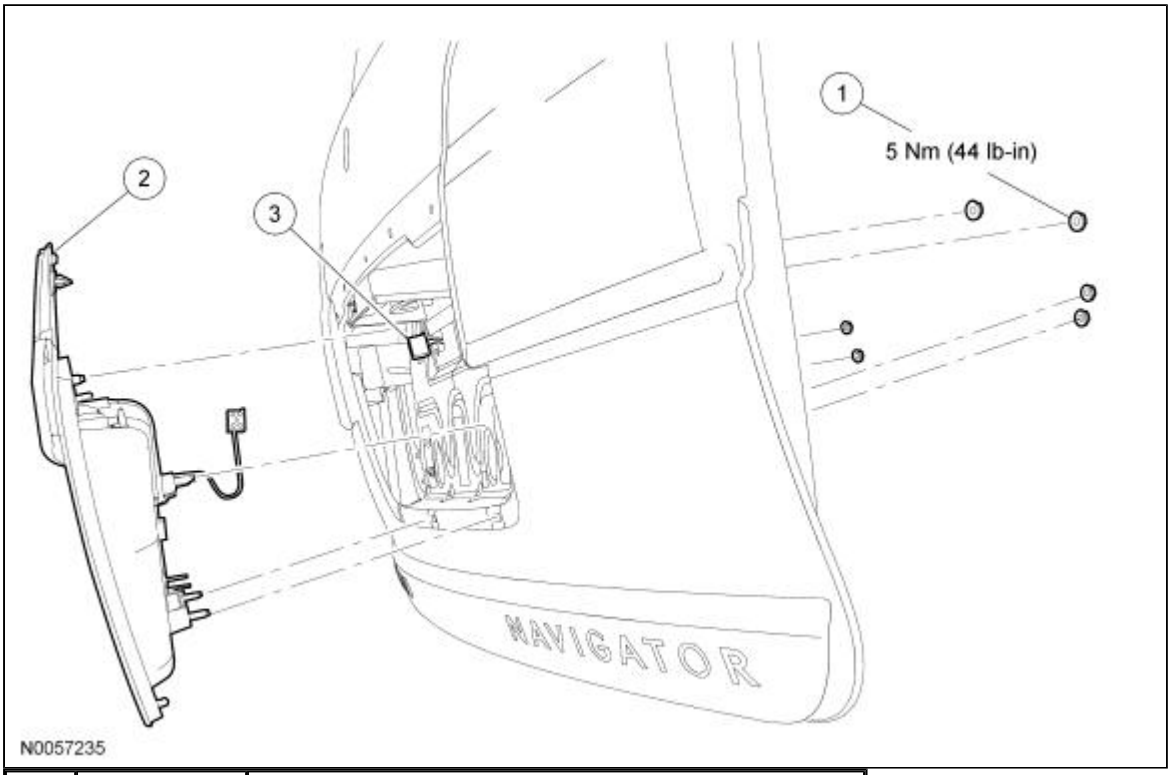
Printable View (276 KB)

Expedition

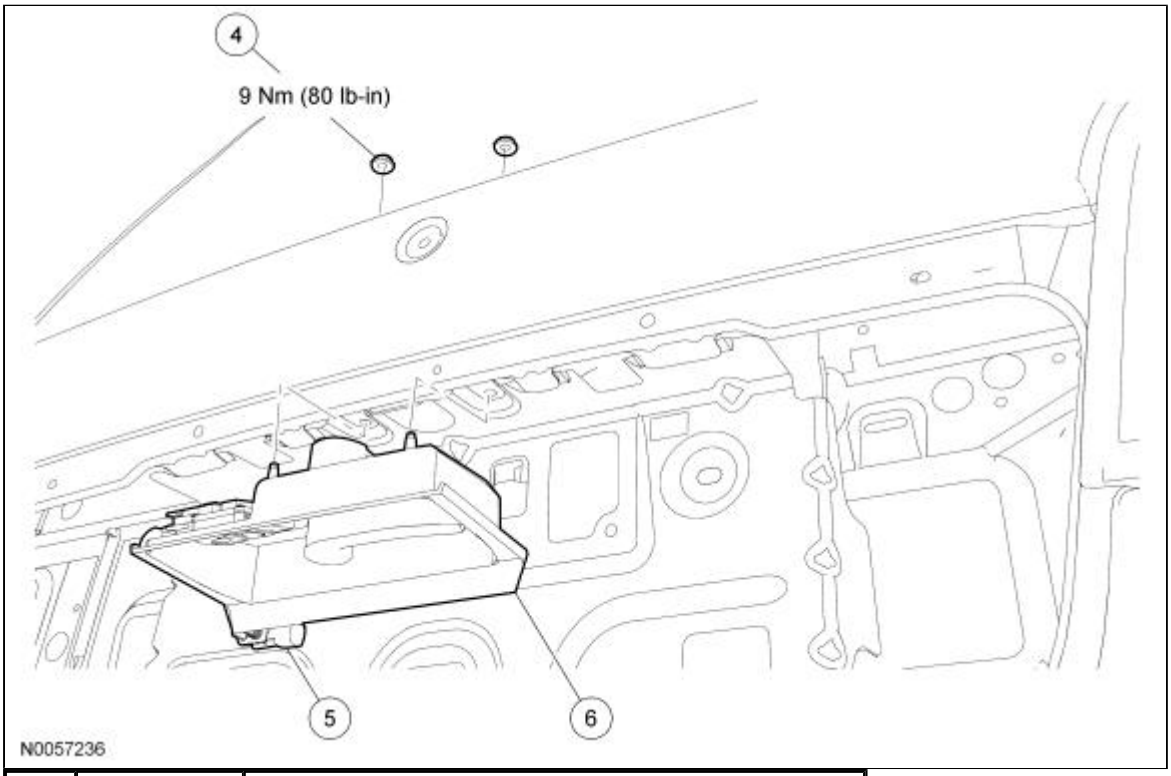


Item	Part Number	Description
1	—	Liftgate release handle nuts (2 required)
2	—	Liftgate release handle electrical connector (part of 78666C02)
3	78666C02	Liftgate release handle

Navigator



Item	Part Number	Description
1	N621906	License plate housing nuts (6 required)
2	78404C42	License plate housing
3	17C424	License plate housing electrical connector (part of 14086)



	Part	

Item	Number	Description
4	—	Liftgate release handle nuts (2 required)
5	—	Liftgate release handle electrical connector (part of 78666C02)
6	78666C02	Liftgate release handle

Removal and Installation

All vehicles

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
    - Position the water shield aside.

Expedition

2. Remove the 2 nuts and the liftgate release handle.
    - Disconnect the electrical connector.
    - To install, tighten to 6 Nm (53 lb-in).

Navigator

3. Remove the 6 nuts and the license plate housing.
    - Disconnect the electrical connector.
    - To install, tighten to 5 Nm (44 lb-in).

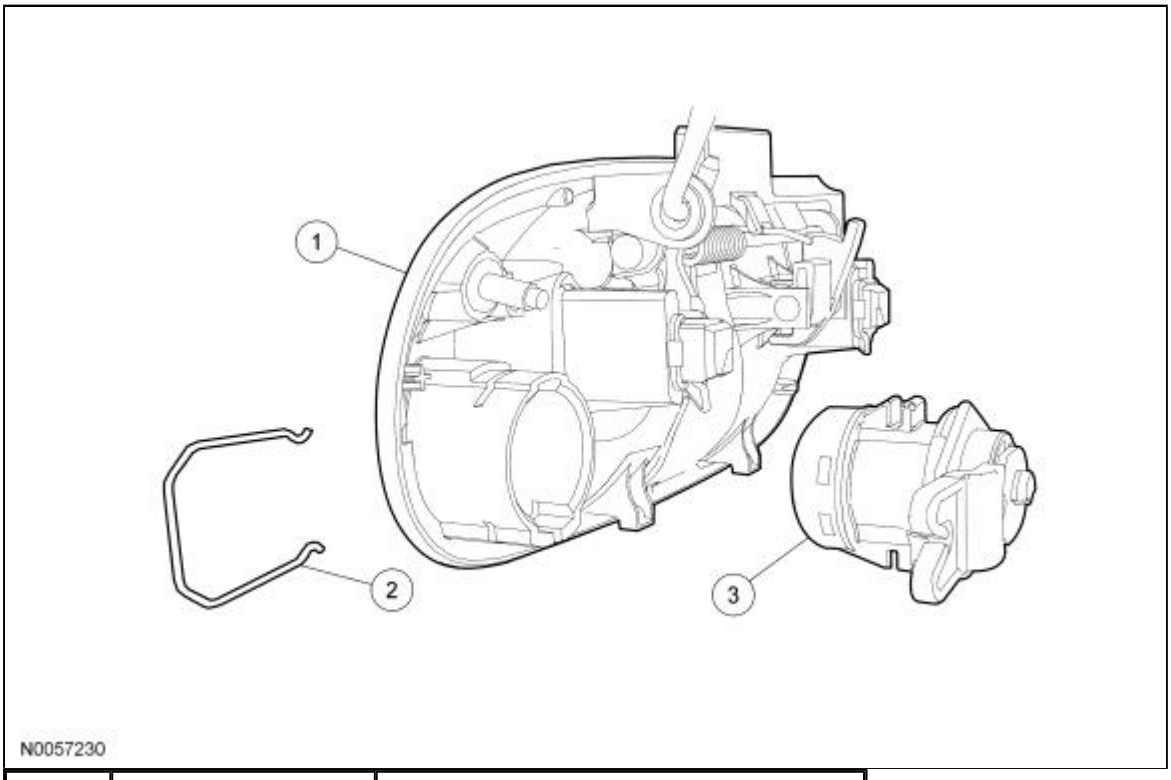
4. Remove the 2 nuts and the liftgate release handle.
    - Disconnect the electrical connector.
    - To install, tighten to 9 Nm (80 lb-in).

All vehicles

5. To install, reverse the removal procedure.

Door Lock Cylinder

Printable View (140 KB)



Item	Part Number	Description
1	7822405	Exterior door handle
2	7822404	Door lock cylinder retainer
3	7821991	Door lock cylinder

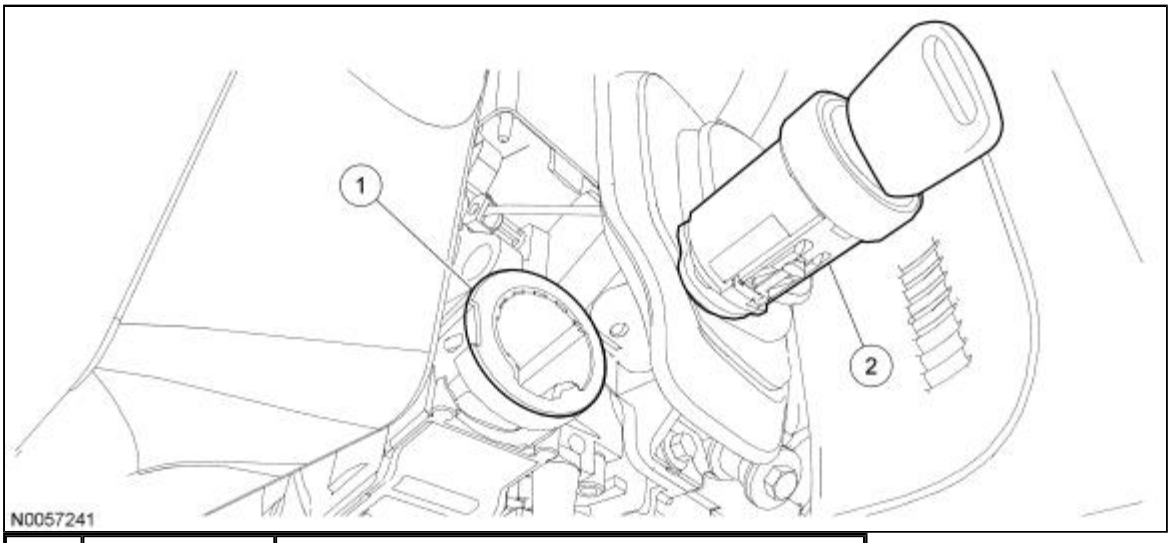
Removal and Installation

NOTE: Individual lock cylinders are repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current code of the vehicle.

1. Remove the exterior front door handle. For additional information, refer to Exterior Front Door Handle in this section.
2. Remove the retainer and the front door lock cylinder.
3. To install, reverse the removal procedure.

Ignition Lock Cylinder — Functional

Printable View (190 KB)



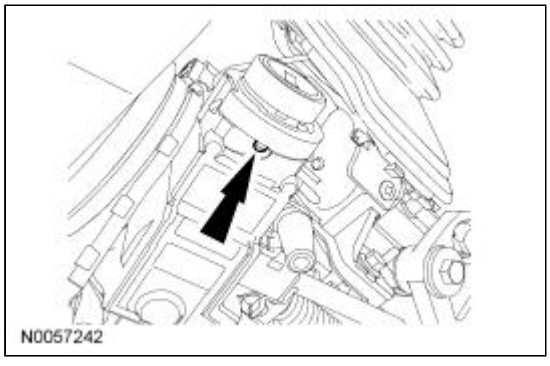
Item	Part Number	Description
1	—	Ignition lock cylinder housing (part of 3L529)
2	7822050	Ignition lock cylinder

Removal and Installation

1. Remove the passive anti-theft system (PATS) transceiver. For additional information, refer to Section 419-01 .

2. **NOTE:** The ignition lock cylinder must be in the RUN position.

   Using a suitable tool, press the release pin and remove the ignition lock cylinder.



3. To install, reverse the removal procedure.
   - Verify the ignition lock cylinder operation.

Ignition Lock Cylinder — Non Functional

Printable View (63 KB)

Removal

1. Remove the passive anti-theft system (PATS) transceiver. For additional information, refer to Section 419-01 .

2. Remove the ignition lock cylinder.
   - Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.
   - Use a 3/8-inch diameter drill to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.
   - Remove and discard the ignition lock cylinder and drill shavings from the steering column.

3. Remove the bearing retainer.

4. Remove the steering column lock housing bearing and steering column lock gear.

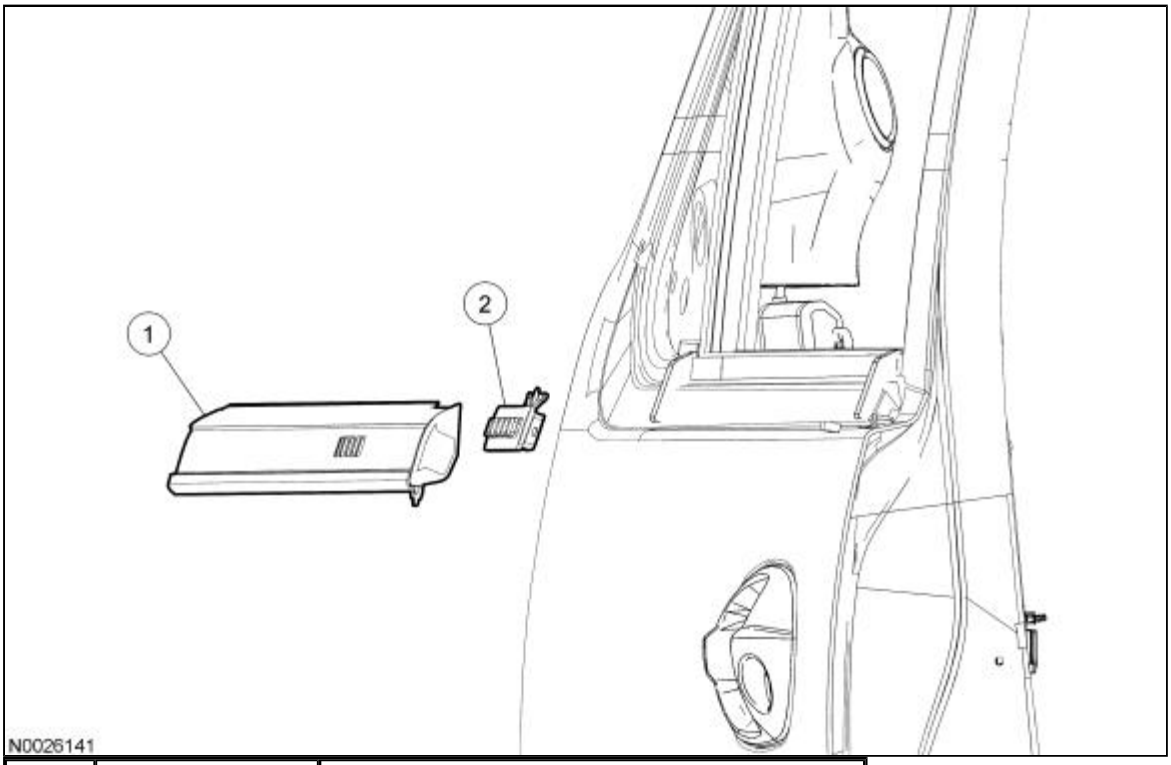
Installation

1. Thoroughly clean all drill shavings from the steering column and inspect it for damage.

2. Install a new ignition lock cylinder.
   - Verify the ignition lock cylinder operation.

Keyless Entry Keypad

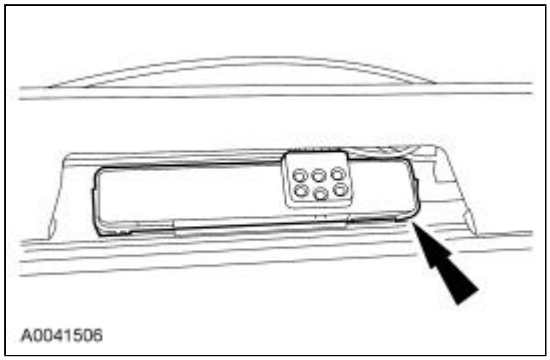
Printable View (141 KB)



Item	Part Number	Description
1	7821453	Front door outer glass weatherstrip
2	14A626	Keyless entry keypad

Removal and Installation

1. Remove the exterior mirror. For additional information, refer to Section 501-09 .
2. Remove the front door outer glass weatherstrip.
   - Disconnect the electrical connector.
3. Release the tabs and remove the keyless entry keypad.
   - Disconnect the keypad harness retaining clips from the weatherstrip.



4. To install, reverse the removal procedure.

Printable View (81 KB)

General Specifications

Item	Specification
RH windshield wiper blade park measurement	50-70 mm (2.0-2.9 in)
LH windshield wiper blade park measurement	50-70 mm (2.0-2.9 in)
Rear window wiper blade park measurement	60-80 mm (2.4-3.2 in)
Fluid Specification	
Premium Windshield Washer Concentrate (US) ZC-32-A, ZC-32-B, ZC-32-C (US)	WSB-M8B16-A2
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Liftgate window glass latch bolts	8	—	71
Rear window glass handle nut	18	13	—
Rear window striker and wiper pivot shaft assembly nuts	6	—	53
Rear window wiper motor bolts	11	8	—
Rear window wiper pivot arm nut	15	11	—
Windshield wiper motor crank bolt	18	13	—
Windshield wiper motor bolts	15	11	—
Windshield wiper mounting arm and pivot shaft bolts	8	—	71
Windshield wiper pivot arm nuts	35	26	—
Windshield washer reservoir screws	5	—	44

Wipers and Washers

Printable View (63 KB)

The wiper and washer system consists of the following components:

- Front windshield wiper motor
- Windshield wiper blades
- Windshield wiper pivot arms
- Windshield wiper mounting arm and pivot shaft
- Rear window wiper blade
- Rear window wiper motor
- Rear window wiper striker and wiper pivot shaft assembly
- Rear window wiper pivot arm
- Windshield washer fluid reservoir
- Windshield washer fluid pump
- Windshield wiper/washer switch (part of multi-function switch)

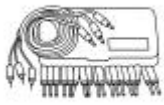
Windshield Wiper/Washer Switch

The windshield wiper/washer switch is an integral component of the steering column multi-function switch. Refer to Section 211-05 .

Wipers and Washers

Printable View (415 KB)

Special Tool(s)

ST1137-A	73III Digital Multimeter or equivalent 105-R0051
 ST1138-A	Flex Probe Kit 105-R025B or equivalent
ST1453-A	SABRE Premium Battery and Electrical System Tester 010-00736 or equivalent

Principles of Operation

The wiper motors receive inputs from the following:

- Multi-function switch
- Powertrain control module (PCM)
- Ignition switch
- Smart junction box (SJB)

The following components are integrated in the wiper motors:

- Windshield wiper motor module
- High/low speed relay
- Run/park relay
- Washer pump relay
- Park sense (Hall-effect sensor)

High Speed Windshield Wipers

High speed is activated when the windshield wiper/washer switch supplies a specific ground input to the windshield wiper motor module. The module then grounds the internal park/run relay and the internal HI/LO speed relay. Voltage is then sent to the high speed side of the wiper motor, which activates the high-speed mode. High speed mode is exited by selecting a different state on the switch. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the park position and the Hall-effect sensor senses the motor magnet. The output to the run/park relay deactivates the relay and disconnects the voltage to the motor.

Low Speed Windshield Wipers

Low speed is activated when the windshield wiper/washer supplies ground inputs to the windshield wiper motor module. The module then supplies ground for the run/park relay, which activates the relay, sending voltage to the low speed side of the motor, activating the low speed mode. Low speed mode is exited by selecting a different state on the switch. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the PARK position, and the Hall-effect sensor senses the motor magnet. The output to the run/park relay deactivates the relay and disconnects the voltage to the motor.

Intermittent Speed Windshield Wipers

The intermittent wiper speed is activated with grounds controlled by the multi-function switch inputs to the windshield wiper motor module. The windshield wiper motor module then activates the windshield wiper run/park relay coil and switches voltage through the windshield wiper high/low relay. The high/low relay remains deactivated, supplying the voltage to the wiper motor low speed input, and activates the windshield wiper motor. When the windshield wiper motor module receives the grounded input, the motor continues to operate until the Hall effect senses magnet, which turns OFF the run/park sense output to the windshield wiper run/park software, deactivating the relay and disconnecting voltage to the wiper motor. The windshield wipers remain parked until the windshield wiper motor module completes a time-out and then repeats the intermittent windshield wiper cycle.

Speed-Dependent Windshield Wipers

The windshield wiper motor module responds to the windshield wiper control commands by interpreting inputs from the PCM system. The speed-dependent wipers will compensate for the extra moisture that accumulates on the windshield at higher speeds, except when the multi-function switch is in the INT 1 position. At higher speeds, the speed-dependent feature shortens the delay between wipes when using the variable interval wipers. Delays will automatically adjust at speeds between 16 and 105 km/h (10 and 65 mph).

Intermittent Rear Window Wiper System

The rear window wiper intermittent speed is activated when the rear window wiper motor module receives ground controlled by the multi-function switch inputs to the rear window wiper motor module. The rear window wiper motor module then activates the rear window wiper relay (internal). This activates the rear window wiper motor by providing voltage from the smart junction box (SJB). Once the rear window wiper motor is activated, its internal run/park switch connects voltage to the motor, keeping it operating. When the rear window wiper motor returns to the PARK position, the run/park switch disconnects voltage internally from the wiper motor input. The rear window wiper remains parked until the rear window wiper motor module completes a time-out and then repeats the cycle.

Washer System

The windshield washer and the rear window washer are activated by the internal wiper motor modules when it receives a ground from the multi-function switch between the washer inputs. Depending on the correct ground, the internal wiper motor modules activate either the windshield washer or rear window washer relays (internal) by grounding the respective relay coil. When either module is activated, it connects voltage to the washer pump while the deactivated module provides ground to the washer pump. In this manner, voltage polarity is reversible to achieve directional change of the washer pump and washer fluid.

Software Safe Mode

The windshield wiper motor defaults to software safe mode when the run/park sensor does not sense the Hall-effect magnet inside the wiper motor. This can be caused by an obstruction of the windshield wipers, a binding linkage or loss of the Hall sensor signal. The motor continues to operate in a High/Low speed condition, and when turned off, the wipers immediately park on the windshield. If necessary, the wipers can be turned on and off until they return to the PARK position.

Inspection and Verification

1. Verify the customer concern by operating the system.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Windshield washer hoses
• Wiper linkage
• Multi-function switch
	• Smart junction box (SJB) fuses:
	  ▪ 19 (25A)
	  ▪ 43 (5A)
	  ▪ 45 (5A)
	  ▪ 49 (30A)
	• Circuitry
	• Windshield wiper motor
	• Rear wiper motor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If cause is not visually evident, verify the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The wipers are inoperative — windshield	• Fuse • Multi-function switch • Circuitry • Windshield wiper motor • Ignition switch	• Go To Pinpoint Test A .
• The wipers are inoperative — rear window	• Fuse • Multi-function switch • Circuitry • Rear window wiper motor • Ignition switch	• Go To Pinpoint Test B .
• The wipers stay on continuously — windshield	• Windshield wiper motor • Multi-function switch • Circuitry	• Go To Pinpoint Test C .
• The wipers stay on continuously — rear window	• Rear window wiper motor • Multi-function switch • Circuitry	• Go To Pinpoint Test D .
• The high/low wiper	• Multi-function	• Go To Pinpoint Test E .

speeds do not operate correctly — windshield	switch • Circuitry • Windshield wiper motor	
• The intermittent wiper speed does not operate correctly — windshield	• Multi-function switch • Circuitry • Windshield wiper motor	• Go To Pinpoint Test F .
• The intermittent wiper speed does not operate correctly — rear window	• Multi-function switch • Circuitry • Rear window wiper motor	• Go To Pinpoint Test G .
• The wash and wipe function is inoperative — windshield	• Windshield wiper motor	• If the washer pump is inoperative, Go To Pinpoint Test I . • If the washer pump is operative, INSTALL a new windshield wiper motor. TEST the system for normal operation.
• The wash and wipe function is inoperative — rear window	• Multi-function switch • Circuitry • Rear window wiper motor	• Go To Pinpoint Test H .
• The washer pump is inoperative	• Circuitry • Washer pump • Multi-function switch • Windshield wiper motor • Rear window wiper motor	• Go To Pinpoint Test I .
• The speed dependent interval mode does not operate correctly	• Windshield wiper motor • Circuitry • Powertrain control module (PCM)	• Go To Pinpoint Test J .
• The wipers will not park at the correct position	• Pivot arm adjustment • Linkage • Windshield wiper motor • Rear window wiper motor	• REFER to Wiper Blade and Pivot Arm Adjustment — Windshield or Wiper Blade and Pivot Arm Adjustment — Rear in this section.

Pinpoint Tests

Pinpoint Test A: The Wipers are Inoperative — Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

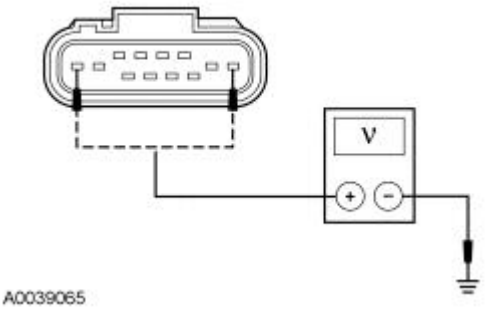
Normal Operation

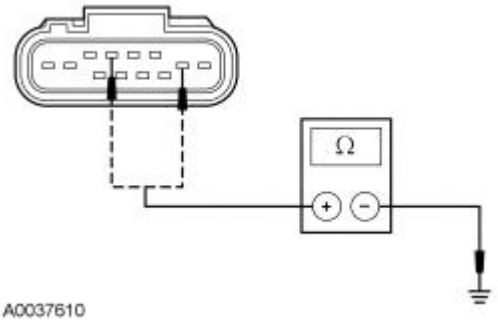
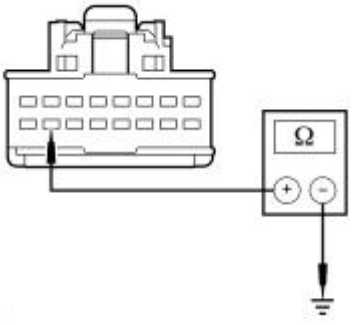
During normal operation, the windshield wiper motor receives voltage at all times through smart junction box (SJB) fuse 49 (30A), circuit SBB49 (RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 45 (5A), circuit CBP45 (YE). Ground is provided to the windshield wiper motor through circuit GD133 (BK) and circuit GD120 (BK/GN). The run/park and high/low relays are contained in the wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Fuse(s)
- Multi-function switch
- Open in circuit CBP45 (YE), GD138 (BK/GN), SBB49 (RD), GD120 (BK/GN) or GD133 (BK)
- Ignition switch
- Windshield wiper motor

PINPOINT TEST A: THE WIPERS ARE INOPERATIVE — WINDSHIELD

Test Step	Result / Action to Take
A1 CHECK CIRCUITS SBB49 (RD) AND CBP45 (YE) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Key in ON position. • Measure the voltage between windshield wiper C125-5, circuit SBB49 (RD), harness side and ground; and between windshield wiper motor C125-8, circuit CBP45 (YE), harness side and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY the SJB fuse 45 (5A) and fuse 49 (30A) are OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.
A2 CHECK CIRCUITS GD120 (BK/GN) AND GD133 (BK) FOR OPENS	
• Key in OFF position. • Measure the resistance between windshield wiper C125-6, circuit GD120 (BK/GN), harness side and ground; and between windshield wiper motor C125-3, circuit GD133 (BK), harness side and ground.	**Yes** GO to A3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

 A0037610 • **Are the resistances less than 5 ohms?**	
A3 CHECK THE MULTI-FUNCTION SWITCH • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to A4 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 .
A4 CHECK CIRCUIT GD138 (BK/WH) FOR OPEN • Measure the resistance between C202-15, circuit GD138 (BK/WH), harness side and ground.  N0052860 • **Is the resistance less than 5 ohms?**	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK FOR CORRECT WIPER MOTOR OPERATION • Disconnect all wiper motor connectors. • Check for: ▪ corrosion. ▪ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** GO to A6 . **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.
A6 CHECK THE WINDSHIELD WIPER MOTOR • Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Did the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Windshield in this section. TEST the system

	for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Wiper Motor — Windshield in this section.

Pinpoint Test B: The Wipers are Inoperative — Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

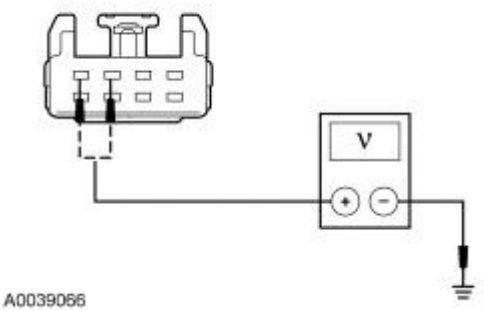
Normal Operation

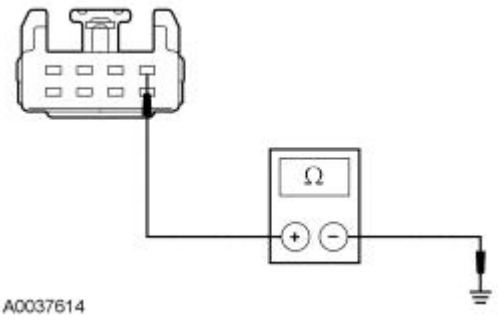
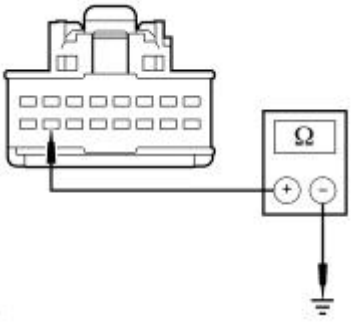
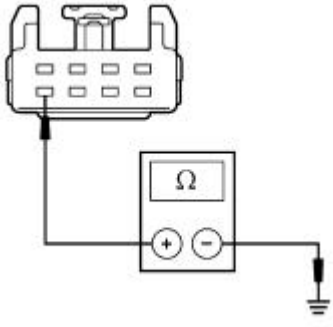
During normal operation, the rear wiper motor receives voltage at all times through smart junction box (SJB) fuse 19 (25A), circuit SBP19 (BU/RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 43 (5A), circuit CBP43 (GY). Ground is provided to the windshield wiper motor through circuit GD150 (BK/WH). The run/park relay is contained in the rear wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Fuse(s)
- Multi-function switch
- Open in circuit CBP43 (GY), SBP19 (BU/RD), CPL80 (WH/GN), GD138 (BK/WH) or GD150 (BK/WH)
- Ignition switch
- Rear window wiper motor

PINPOINT TEST B: THE WIPERS ARE INOPERATIVE — REAR WINDOW

Test Step	Result / Action to Take
B1 CHECK CIRCUITS CBP43 (GY) AND SBP19 (BU/RD) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Rear Wiper Motor C476. • Key in ON position. • Measure the voltage between rear wiper motor C476-3, circuit CBP43 (GY), harness side and ground; and between rear wiper motor C476-4, circuit SBP19 (BU/RD), harness side and ground.  A0039066 • **Are the voltages greater than 10 volts?**	**Yes** GO to B2 . **No** VERIFY SJB fuse 43 (5A) and fuse 19 (25A) are OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.
B2 CHECK CIRCUIT GD150 (BK/WH) FOR OPEN	

• Key in OFF position. • Measure the resistance between rear wiper C476-1, circuit GD150 (BK/WH), harness side and ground.  A0037614 • **Is the resistance less than 5 ohms?**	**Yes** GO to B3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
B3 CHECK THE MULTI-FUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to B4 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 .
B4 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Measure the resistance between C202-15, circuit GD138 (BK/WH), harness side and ground.  N0052860 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. TEST the system for normal operation.
B5 CHECK CIRCUIT CPL80 (WH/GN) FOR AN OPEN	
• The liftgate glass must be closed. • Measure the resistance between C476-8, circuit CPL80 (WH/GN), harness side and ground.  A0051365 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B6 . **No** REPAIR the circuit. TEST the system for normal operation.
B6 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to B7 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

B7 CHECK THE REAR WINDOW WIPER MOTOR	
• Carry out the rear widow wiper motor component test as described in this section. • **Did the rear window wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Rear in this section. TEST the system for normal operation. **No** INSTALL a new rear window wiper motor. REFER to Wiper Motor — Rear Window in this section.

Pinpoint Test C: The Wipers Stay on Continuously — Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

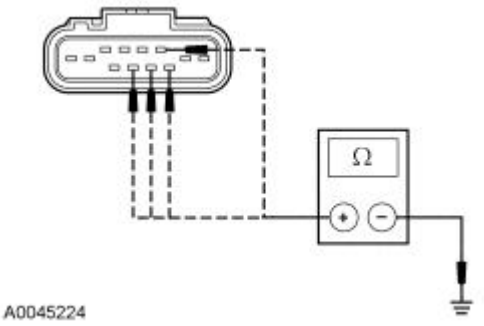
During normal operation, the windshield wiper motor receives voltage at all times through smart junction box (SJB) fuse 49 (30A), circuit SBB49 (RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 45 (5A), circuit CBP45 (YE). Ground is provided to the windshield wiper motor through circuit GD133 (BK) and circuit GD120 (BK/GN). The run/park and high/low relays are contained in the wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Multi-function switch
- Short to ground in circuit CRW19 (BU/OG), CRW18 (VT/WH), CRW08 (VT/OG) or CRW17 (GN/VT)
- Windshield wiper motor

PINPOINT TEST C: THE WIPERS STAY ON CONTINUOUSLY — WINDSHIELD

Test Step	Result / Action to Take
C1 CHECK THE MULTI-FUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test.	**Yes** GO to C2 . **No**

Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	INSTALL a new multi-function switch. REFER to Section 211-05 .
C2 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH), CRW08 (VT/OG) OR CRW17 (GN/VT) FOR SHORTS	
• Disconnect: Windshield Wiper Motor C125. • Using the following table, measure the resistance between windshield wiper motor C125 harness side and ground: **Windshield Wiper Motor C125** / **Ground** Pin 10, circuit CRW19 (BU/OG) / Ground Pin 11, circuit CRW18 (VT/WH) / Ground Pin 1, circuit CRW08 (VT/OG) / Ground Pin 9, circuit CRW17 (GN/VT) / Ground  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
C3 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to C4 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

C4 CHECK THE WINDSHIELD WIPER MOTOR	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Did the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Windshield in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Wiper Motor —

	Windshield in this section.

Pinpoint Test D: The Wipers Stay on Continuously — Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washer for schematic and connector information.

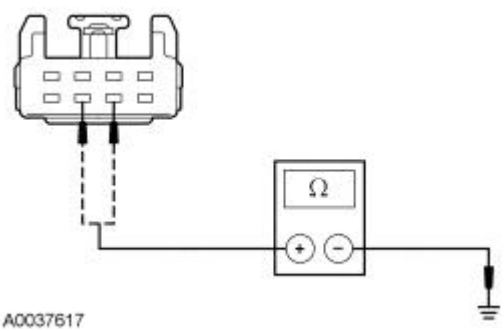
Normal Operation

During normal operation, the rear wiper motor receives voltage at all times through smart junction box (SJB) fuse 19 (25A), circuit SBP19 (BU/RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 43 (5A), circuit CBP43 (GY). Ground is provided to the windshield wiper motor through circuit GD150 (BK/WH). The run/park relay is contained in the rear wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Multi-function switch
- Short to ground in circuit CRW20 (GY/YE) or CRW21 (YE/VT)
- Rear window wiper motor

PINPOINT TEST D: THE WIPERS STAY ON CONTINUOUSLY — REAR WINDOW

Test Step	Result / Action to Take
D1 CHECK THE MULTI-FUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to D2 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 .
D2 CHECK CIRCUITS CRW20 (GY/YE) AND CRW21 (YE/VT) FOR SHORTS	
• Disconnect: Rear Window Wiper Motor C476. • Measure the resistance between rear window wiper motor C476-6, circuit CRW20 (GY/YE), harness side and ground; and between rear wiper motor C476-7, circuit CRW21 (YE/VT), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
D3 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to D4 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

D4 CHECK THE REAR WINDOW WIPER MOTOR	
• Carry out the rear window wiper motor component test as described in this section. • **Did the rear window wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Rear in this section. TEST the system for normal operation. **No** INSTALL a new rear window wiper motor. REFER to Wiper Motor — Rear Window in this section.

Pinpoint Test E: The High/Low Wiper Speeds Do Not Operate Correctly — Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

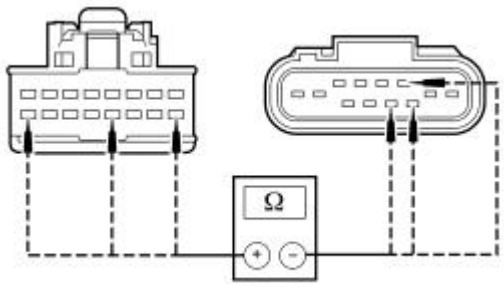
During normal operation, the windshield wiper motor receives voltage at all times through smart junction box (SJB) fuse 49 (30A), circuit SBB49 (RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 45 (5A), circuit CBP45 (YE). Ground is provided to the windshield wiper motor through circuit GD133 (BK) and circuit GD120 (BK/GN). The run/park and high/low relays are contained in the wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

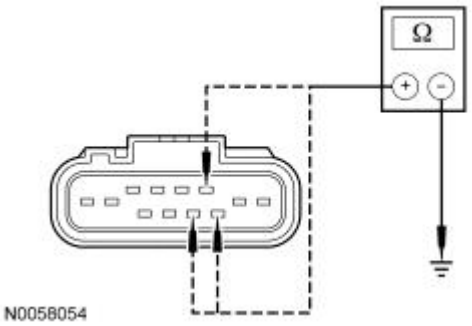
Possible Causes

- Multi-function switch
- Open or short to ground in circuit CRW19 (BU/OG), CRW08 (VT/OG) or CRW 17 (GN/VT)
- Windshield wiper motor

PINPOINT TEST E: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY — WINDSHIELD

Test Step	Result / Action to Take
E1 CHECK THE MULTI-FUNCTION SWITCH	
• Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test.	**Yes** GO to E2 . **No**

Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	INSTALL a new multi-function switch. REFER to Section 211-05 . TEST the system for normal operation.
E2 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) AND CRW17 (GN/VT) FOR OPENS • Disconnect: Windshield Wiper Motor C125. • Using the following table, measure the resistance between multi-function switch C202 harness side and the windshield wiper motor C125 harness side: **Multi-function Switch C202** / **Windshield Wiper Motor C125** Pin 16, circuit CRW19 (BU/OG) / Pin 10, circuit CRW19 (BU/OG) Pin 9, circuit CRW08 (VT/OG) / Pin 1, circuit CRW08 (VT/OG) Pin 12, circuit CRW17 (GN/VT) / Pin 9, circuit CRW17 (GN/VT)  N0052863 • **Is the resistance less than 5 ohms?**	**Yes** GO to E3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
E3 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) OR CRW17 (GN/VT) FOR SHORTS • Using the following table, measure the resistance between windshield wiper motor C125 harness side and ground: **Windshield Wiper Motor C125** / **Ground** Pin 10, circuit CRW19 (BU/OG) / Ground Pin 1, circuit CRW08 (VT/OG) / Ground Pin 9, circuit CRW17 (GN/VT) / Ground	**Yes** GO to E4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

 • **Is the resistance greater than 10,000 ohms?**	
E4 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to E5 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

E5 CHECK THE WINDSHIELD WIPER MOTOR	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Did the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Windshield in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Wiper Motor — Windshield in this section.

Pinpoint Test F: The Intermittent Wiper Speed Does Not Operate Correctly — Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

During normal operation, the windshield wiper motor receives voltage at all times through smart junction box (SJB) fuse 49 (30A), circuit SBB49 (RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 45 (5A), circuit CBP45 (YE). Ground is provided to the windshield wiper motor through circuit GD133 (BK) and circuit GD120 (BK/GN). The run/park and high/low relays are contained in the wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Multi-function switch
- Open or short to ground in circuit CRW18 (VT/WH), CRW17 (GN/VT) or CRW19 (BU/OG)
- Windshield wiper motor

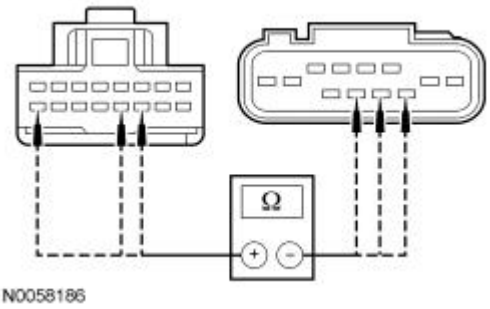
PINPOINT TEST F: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY — WINDSHIELD

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 CHECK THE MULTI-FUNCTION SWITCH
• Key in OFF position.
• Disconnect: Multi-function Switch C202.
• Carry out the multi-function switch component test.

Refer to Wiring Diagrams Cell 149 for schematic and connector information.

• Did the multi-function switch pass the component test?</td><td>Yes
GO to F2 .

No
INSTALL a new multi-function switch. REFER to Section 211-05 . TEST the system for normal operation.</td></tr>
<tr><td>F2 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH) AND CRW17 (GN/VT) FOR OPENS
• Disconnect: Windshield Wiper Motor C125.
• Using the following table, measure the resistance between multi-function switch C202 harness side and windshield wiper motor C125 harness side:

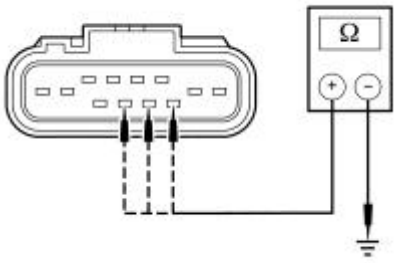
<table><tr><th>Multi-function Switch C202a</th><th>Windshield Wiper Motor C125</th></tr><tr><td>Pin 16, circuit CRW19 (BU/OG)</td><td>Pin 10, circuit CRW19 (BU/OG)</td></tr><tr><td>Pin 12, circuit CRW17 (GN/VT)</td><td>Pin 9, circuit CRW17 (GN/VT)</td></tr><tr><td>Pin 11, circuit CRW18 (VT/WH)</td><td>Pin 11, circuit CRW18 (VT/WH)</td></tr></table>
 

• Is the resistance less than 5 ohms?</td><td>Yes
GO to F3 .

No
REPAIR the circuit(s) in question. TEST the system for normal operation.</td></tr>
<tr><td>F3 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH) OR CRW17 (GN/VT) FOR SHORTS
• Using the following table, measure the resistance between windshield wiper motor C125 harness side and ground:

<table><tr><th>Windshield Wiper Motor C125</th><th>Ground</th></tr><tr><td>Pin 10, circuit CRW19 (BU/OG)</td><td>Ground</td></tr><tr><td>Pin 11, circuit CRW18 (VT/WH)</td><td>Ground</td></tr><tr><td>Pin 9, circuit CRW17 (GN/VT)</td><td>Ground</td></tr></table></td><td>Yes
GO to F4 .

No
REPAIR the circuit(s) in question. TEST the system for normal operation.</td></tr>
</table>

 N0058187 • **Is the resistance greater than 10,000 ohms?**	
F4 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to F5 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

F5 CHECK THE WINDSHIELD WIPER MOTOR	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Did the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Windshield in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Wiper Motor — Windshield in this section.

Pinpoint Test G: The Intermittent Wiper Speed Does Not Operate Correctly — Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

During normal operation, the rear wiper motor receives voltage at all times through smart junction box (SJB) fuse 19 (25A), circuit SBP19 (BU/RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 43 (5A), circuit CBP43 (GY). Ground is provided to the windshield wiper motor through circuit GD150 (BK/WH). The run/park relay is contained in the rear wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch.

Possible Causes

- Multi-function switch
- Rear window wiper motor

PINPOINT TEST G: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY — REAR WINDOW

Test Step	Result / Action to Take
G1 VERIFY REAR WASHER PUMP OPERATION • Key in ON position. • Activate the rear washer pump. • **Does the rear washer pump activate?**	**Yes** GO to G2 . **No** Go To Pinpoint Test I .
G2 CHECK THE MULTI-FUNCTION SWITCH • Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to G3 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 .

G3 CHECK FOR CORRECT WIPER MOTOR OPERATION
• Disconnect all wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to G4 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

G4 CHECK THE REAR WINDOW WIPER MOTOR • Carry out the rear widow wiper motor component test as described in this section. • **Did the rear window wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Rear in this section. TEST the system for normal operation. **No** INSTALL a new rear window wiper motor. REFER to Wiper Motor — Rear Window in this section.

Pinpoint Test H: The Wash and Wipe Function is Inoperative — Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

During normal operation, the rear wiper motor receives voltage at all times through smart junction box (SJB) fuse 19 (25A), circuit SBP19 (BU/RD). The windshield wiper motor also receives power with the ignition switch in RUN or ACC positions through SJB fuse 43 (5A), circuit CBP43 (GY). Ground is provided to the windshield wiper motor through circuit GD150 (BK/WH). The run/park relay is contained in the rear wiper motor electronics. Mode of operation is dependent on the signal(s) received from the multi-function switch. When the correct input is received from the multi-function switch, the rear wiper motor provides power to the washer pump through circuit CRW12 (GY/OG). Ground is provided to the washer pump through circuit CRW14 (BU/WH) and the windshield wiper motor.

Possible Causes

- Multi-function switch
- Open in circuit
- Rear window wiper motor

PINPOINT TEST H: THE WASH AND WIPE FUNCTION IS INOPERATIVE — REAR WINDOW

Test Step	Result / Action to Take
H1 CHECK THE WASHER PUMP • Operate the rear window washer system. • **Does the washer pump operate?**	**Yes** GO to H2 . **No** Go To Pinpoint Test I
H2 CHECK THE MULTI-FUNCTION SWITCH • Key in OFF position. • Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to H3 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 .

H3 CHECK FOR CORRECT WIPER MOTOR OPERATION
• Disconnect all wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to H4 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

H4 CHECK THE REAR WINDOW	

WIPER MOTOR	
• Carry out the rear widow wiper motor component test as described in this section. • **Did the rear window wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Rear in this section. TEST the system for normal operation. **No** INSTALL a new rear window wiper motor. REFER to Wiper Motor — Rear Window in this section.

Pinpoint Test I: The Washer Pump is Inoperative

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

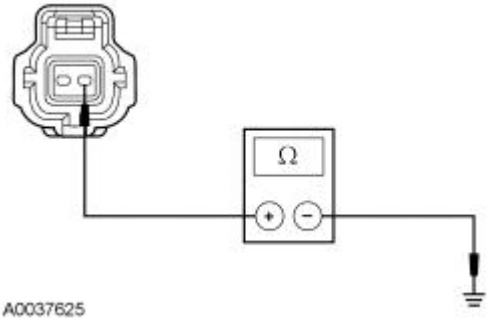
Normal Operation

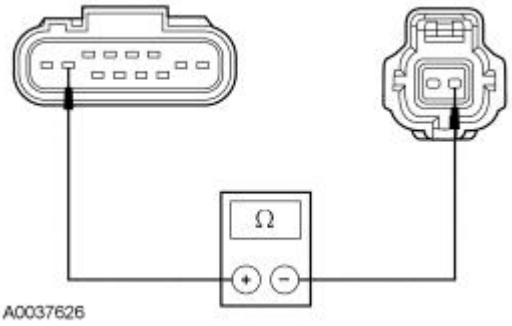
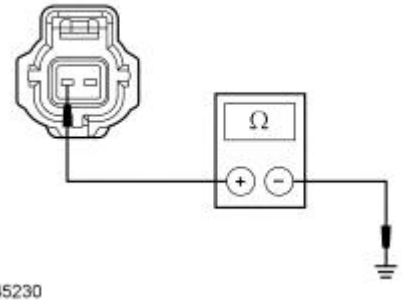
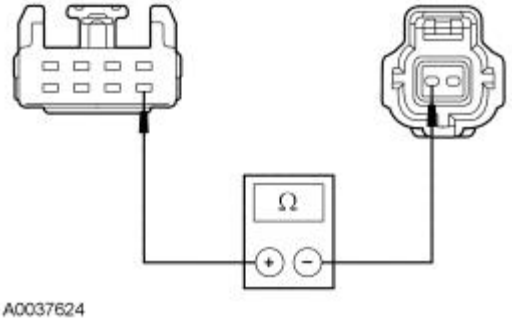
During normal operation, when the front wiper wash is selected, the windshield wiper motor provides power to the washer pump through circuit CRW14 (BU/WH) and ground is provided to the washer pump through circuit CRW12 (GY/OG) and the rear wiper motor. If rear wiper wash is selected, the rear wiper motor provides power to the washer pump through circuit CRW12 (GY/OG) and ground is provided to the washer pump through circuit CRW14 (BU/WH) and the windshield wiper motor.

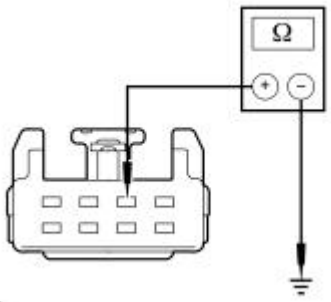
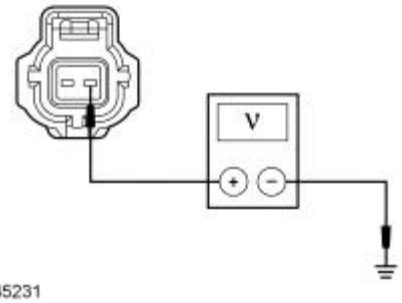
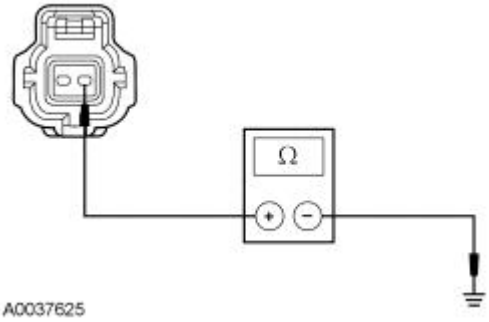
Possible Causes

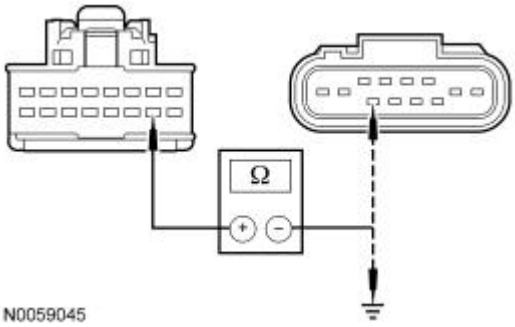
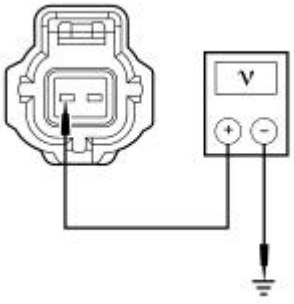
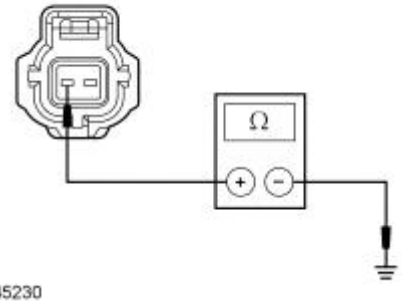
- Multi-function switch
- Open in circuit CRW14 (BU/WH), CRW12 (GY/OG), CRW07 (GY/BN), CRW20 (GY/YE), SBB49 (RD) or GD149 (BK/GY)
- Short to ground in circuit CRW14 (BU/WH), CRW12 (GY/OG), CRW07 (GY/BN) or CRW20 (GY/YE)
- Washer pump
- Windshield wiper motor
- Rear wiper motor

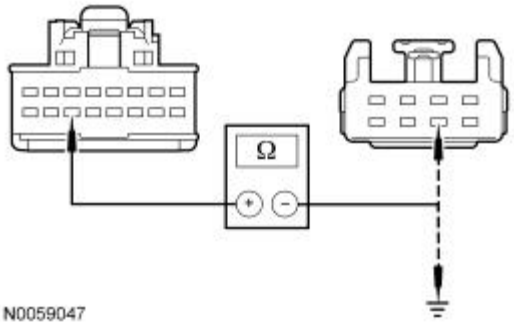
PINPOINT TEST I: THE WASHER PUMP IS INOPERATIVE

Test Step	Result / Action to Take
I1 CHECK CIRCUIT CRW14 (BU/WH) FOR GROUND	
• Disconnect: Washer Pump Motor C1357. • Key in ON position. • Measure the resistance between washer pump C1357-2, circuit CRW14 (BU/WH) harness side and ground.  	**Yes** GO to I3 . **No** GO to I2 .

• **Is the resistance less than 5 ohms?**	
I2 CHECK CIRCUIT CRW14 (BU/WH) FOR AN OPEN	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between windshield wiper motor C125-7, circuit CRW14 (BU/WH), harness side and washer pump C1357-2, circuit CRW14 (BU/WH) harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to I14 . **No** REPAIR the circuit. TEST the system for normal operation.
I3 CHECK CIRCUIT CRW12 (GY/OG) FOR GROUND	
• Measure the resistance between washer pump C1357-1, circuit CRW12 (GY/OG) harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to I6 . **No** GO to I4 .
I4 CHECK CIRCUIT CRW12 (GY/OG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Rear Window Wiper Motor C476. • Measure the resistance between rear window wiper motor C476-5, circuit CRW12 (GY/OG), harness side and washer pump C1357-1, circuit CRW12 (GY/OG) harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to I5 . **No** REPAIR the circuit. TEST the system for normal operation.
I5 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Measure the resistance between rear window wiper motor C476-2, circuit GD149 (BK/GY), harness side and ground.	**Yes** GO to I15 . **No**

 N0059043 • **Is the resistance less than 5 ohms?**	REPAIR the circuit. TEST the system for normal operation.
I6 CHECK CIRCUIT CRW14 (BU/WH) FOR VOLTAGE	
• Key in ON position. • Measure the voltage between washer pump C1357-2, circuit CRW14 (BU/WH) harness side and ground while depressing the multi-function switch to the WASH position.  A0045231 • **Is the voltage greater than 10 volts?**	**Yes** GO to I10 . **No** GO to I7 .
I7 CHECK CIRCUIT CRW14 (BU/WH) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between washer pump C1357-2, circuit CRW14 (BU/WH) harness side and ground.  A0037625 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I8 . **No** REPAIR the circuit. TEST the system for normal operation.
I8 CHECK THE MULTI-FUNCTION SWITCH	
• Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**Yes** GO to I9 . **No** INSTALL a new multi-function switch. REFER to Section 211-05 . TEST the system for normal operation.

I9 CHECK CIRCUIT CRW07 (GY/BN) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between windshield wiper motor C125-12, circuit CRW07 (GY/BN) harness side and multi-function switch C202-10, circuit CRW07 (GY/BN) harness side; and between multi-function switch C202-10, circuit CRW07 (GY/BN) harness side and ground.  N0059045 • **Is the resistance less than 5 ohms between multi-function switch and wiper motor; and greater than 10,000 ohms between multi-function switch and ground?**	**Yes** GO to I14 . **No** REPAIR the circuit. TEST the system for normal operation.
I10 CHECK CIRCUIT CRW12 (GY/OG) FOR VOLTAGE	
• Measure the voltage between washer pump C1357-1, circuit CRW12 (GY/OG) harness side and ground while depressing the multi-function switch to the REAR WASH position.  N0059046 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new washer pump. TEST the system for normal operation. **No** GO to I11 .
I11 CHECK CIRCUIT CRW12 (GY/OG) FOR A SHORT TO GROUND	
• Key in OFF position. • Disconnect: Rear Window Wiper Motor C476. • Measure the resistance between washer pump C1357-1, circuit CRW12 (GY/OG) harness side and ground.  A0045230 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I12 . **No** REPAIR the circuit. TEST the system for normal operation.
I12 CHECK THE MULTI-FUNCTION SWITCH	
• Disconnect: Multi-function Switch C202. • Carry out the multi-function switch component test.	**Yes** GO to I13 .

Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the multi-function switch pass the component test?**	**No** INSTALL a new multi-function switch. REFER to Section 211-05 . TEST the system for normal operation.
I13 CHECK CIRCUIT CRW20 (GY/YE) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between rear window wiper motor C476-6, circuit CRW20 (GY/YE) harness side and multi-function switch C202-14, circuit CRW20 (GY/YE) harness side; and between multi-function switch C202-14, circuit CRW20 (GY/YE) harness side and ground.  • **Is the resistance less than 5 ohms between multi-function switch and wiper motor; and greater than 10,000 ohms between multi-function switch and ground?**	**Yes** GO to I15 . **No** REPAIR the circuit. TEST the system for normal operation.
I14 CHECK THE WINDSHIELD WIPER MOTOR	

• Disconnect the wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new windshield wiper motor. REFER to Wiper Motor — Windshield in this section. TEST the system for normal operation.
	
	No
	REPAIR the circuit. TEST the system for normal operation.

I15 CHECK THE REAR WINDOW WIPER MOTOR	

• Disconnect the wiper motor connectors.
• Check for:
  ▪ liftgate glass open.
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new rear window wiper motor. REFER to Wiper Motor — Rear Window in this section. TEST the system for normal operation.
	
	No
	REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test J: The Speed Dependent Interval Mode Does Not Operate Correctly

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

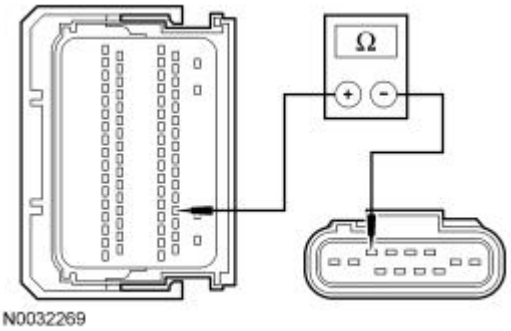
Normal Operation

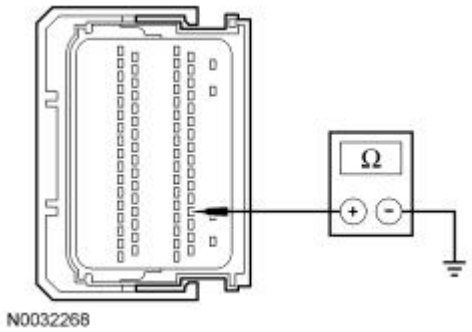
During normal operation, the windshield wiper motor receives vehicle speed information from the PCM system through circuit VE822 (YE/BU). The speed dependent wipers function in all INT modes except INT 1.

Possible Causes

- Open or short to ground in circuit VE822 (YE/BU)
- Windshield wiper motor
- Powertrain control module (PCM)

PINPOINT TEST J: THE WINDSHIELD WIPER SPEED DEPENDENT INTERVAL MODE DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
J1 CHECK THE PCM — MONITOR THE VSS • Monitor the VSS while driving the vehicle from 0 to 88.5 kph (55 mph). • **Does the VSS agree with the PCM PIDs?**	**Yes** GO to J2 . **No** REFER to Section 206-09 .
J2 CHECK CIRCUIT VE822 (YE/BU) FOR AN OPEN • Disconnect: PCM C175b. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between PCM C175b-63, circuit VE822 (YE/BU), harness side and windshield wiper motor C125-4, circuit VE822 (YE/BU), harness side.  N0032269 • **Is the resistance less than 5 ohms?**	**Yes** GO to J3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J3 CHECK CIRCUIT VE822 (YE/BU) FOR A SHORT TO GROUND • Measure the resistance between PCM C175b-63, circuit VE822 (YE/BU), harness side and ground.	**Yes** GO to J4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0032268 • **Is the resistance greater than 10,000 ohms?**	

J4 CHECK FOR CORRECT WIPER MOTOR OPERATION
• Disconnect all wiper motor connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to J5 .
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

J5 CHECK THE WINDSHIELD WIPER MOTOR • Key in OFF position. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Did the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. Concern may have been caused by binding or incorrect pivot arm adjustment. REFER to Wiper Blade and Pivot Arm Adjustment — Windshield in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Wiper Motor — Windshield in this section.

Component Test — Wiper Motor — Windshield

CAUTION: Do not handle the windshield wiper motor abusively when diagnosing the wiper operations. Failure to follow this caution may result in damage to the motor magnets and will make the windshield wiper motor inoperative. Rough handling of new windshield wiper motors may also damage the motor magnets.

NOTE: Windshield wiper motor component test is carried out to determine if windshield wiper motor and module are functional and not in default mode. Refer to Principles of Operation in this section.

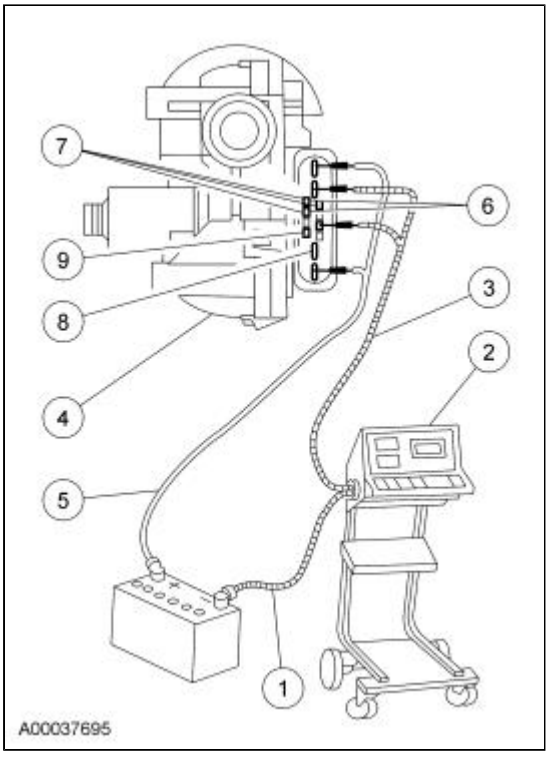
NOTE: Battery voltage must remain within 10 to 15 VDC to carry out test and keep windshield wiper motor from entering its software safe mode.

NOTE: When connecting the power and ground test leads to the windshield wiper motor terminals, care must be taken to not short terminals between power and ground, as well as making sure the logic ground, pin 3, is always securely connected to prevent permanent windshield wiper motor module damage.

If the windshield wiper motor does not pass any of the following tests, install a new windshield wiper

motor. Refer to Wiper Motor — Windshield in this section.

Use SABRE Premium Battery and Electrical System Tester 010-00736 or equivalent to test the windshield wiper motor.



To test the windshield wiper motor, remove the windshield wiper mounting arm and pivot shaft from the windshield wiper motor. Refer to Wiper Blade and Pivot Arm Adjustment — Windshield in this section.

Disconnect the wiper motor. Connect the (1) green lead from the (2) SABRE to the battery negative (-) post. Connect the red lead (3) from the SABRE to the wiper motor (4) component side connector ground and logic ground pins 6 and 3 (3). Connect battery positive cable (5) to windshield wiper motor (4) component side connector battery and logic positive pins 5 and 8 (5).

Low Speed

Test the LOW speed mode by connecting a separate set of test leads from battery ground (-) post to windshield wiper motor (4) component side pins 9 and 10 (6). When these pins are grounded, the windshield wiper motor operation should now be in low speed mode.

High Speed

Test the HIGH speed mode by connecting a separate set of test leads from battery ground (-) post to windshield wiper motor (4) component side pins 1, 9 and 10 (7). When these pins are grounded, the windshield wiper motor operation should now be in high speed mode.

Washer Pump Relay (Integral)

Test the windshield wiper motor internal washer relay function by measuring the voltage between windshield wiper motor (4) component side pin 7 (8) and ground while grounding the windshield wiper motor (4) component side pin 12 (9). When wash command input pin 12 is grounded, measured voltage should read 10 volts or greater.

Component Test — Wiper Motor — Rear Window

CAUTION: Do not handle the rear window wiper motor abusively when diagnosing the wiper operations. Failure to follow this caution may result in damage to the motor magnets and will make the rear window wiper motor inoperative. Rough handling of new rear window wiper motors may also damage the motor magnets.

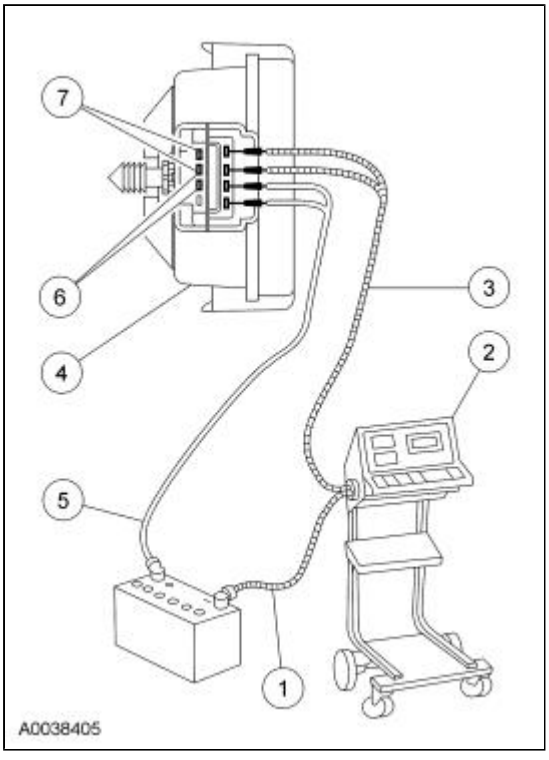
NOTE: The rear window wiper motor component test is carried out to determine if wiper motor and module are functional.

NOTE: Battery voltage must remain within 10 to 15 VDC to carry out test and keep wiper motor from entering its software safe mode.

NOTE: When connecting the power and ground test leads to the rear wiper motor terminals, care must be taken to not short terminals between power and ground, as well as making sure the logic ground, pin 3, is always securely connected to prevent permanent rear window wiper motor module damage.

If the rear window wiper motor does not pass any of the following tests, install a new rear window wiper motor. Refer to Wiper Motor — Rear Window in this section.

Use the SABRE Premium Battery and Electrical System Tester 010-00736 or equivalent to test the rear window wiper motor.



Disconnect the rear window wiper motor. Connect the (1) green lead from the (2) SABRE to the battery negative (-) post. Connect the red lead (3) from the SABRE to the wiper motor (4) component side connector ground pins 1 an 2 (3). Connect battery positive cable (5) to wiper motor (4) component side connector battery and logic positive pins 3 and 4 (5).

On Mode

Test the ON mode by connecting a separate set of test leads from battery ground (-) post to windshield wiper motor (4) component side pins 6 and 7 (6). When these pins are grounded, the rear window wiper motor operation should now be in ON mode.

Washer Pump Relay (Integral)

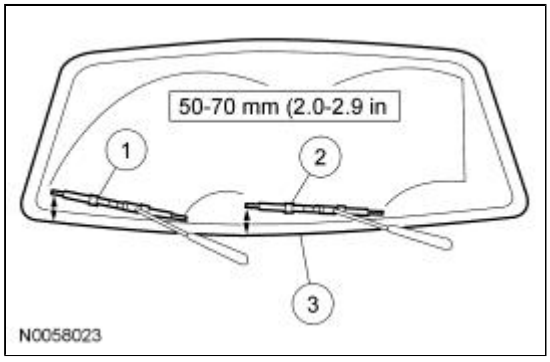
Test the rear window wiper motor internal washer relay function by measuring the voltage between wiper motor (4) component side pin 5 (7) and ground. When wash command input pin 6 (7) is grounded, measured voltage should read 10 volts or greater.

Wiper Blade and Pivot Arm Adjustment — Windshield

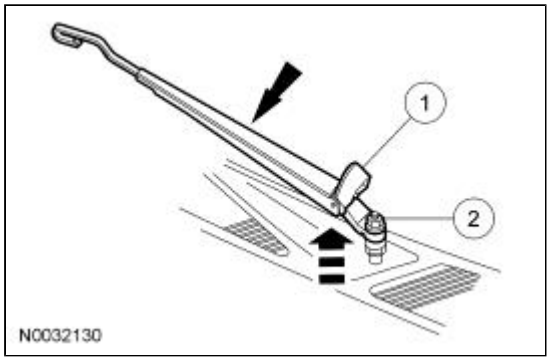
Printable View (105 KB)

1. Cycle and park the windshield wipers.

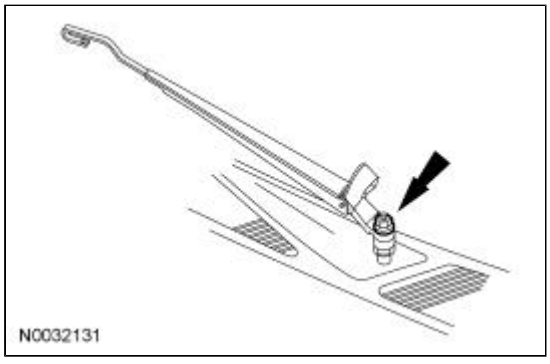
2. Verify the distance between the outer tip of the (1) RH windshield wiper blade and the (3) bottom of the windshield glass and between the outer tip of the (2) LH windshield wiper blade and the (3) bottom of the windshield glass are within specifications.



3. If the distance is not within specification, remove the windshield wiper pivot arm and reposition to specification.
    1. Lift the pivot arm nut cover.
    2. Remove the nut.



4. Tighten the windshield wiper pivot arm nuts to 35 Nm (26 lb-ft).

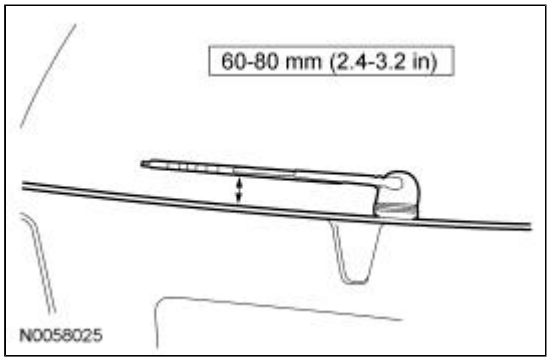


Wiper Blade and Pivot Arm Adjustment — Rear

Printable View (112 KB)

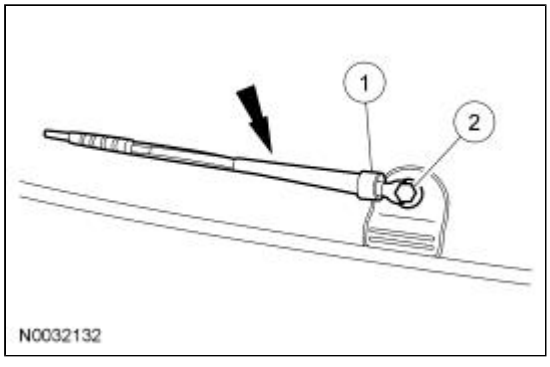
1. Cycle and park the rear window wiper pivot arm and blade.

2. Check the rear window wiper park measurement. If not within specification, the rear window wiper pivot arm will need to be removed.



3. **CAUTION: Use a shop towel or similar device to protect the vehicle finish when carrying out the procedure.**

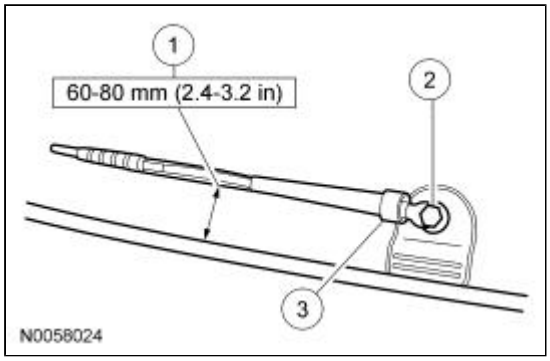
   Remove the rear window wiper pivot arm.
   1. Lift the pivot arm nut cover.
   2. Remove the nut.



4. **NOTE:** This step makes sure that the wiper motor is in the PARK position.

   Turn the rear window wiper switch ON and allow the motor to operate for at least one cycle. Turn the rear window wiper switch to OFF.

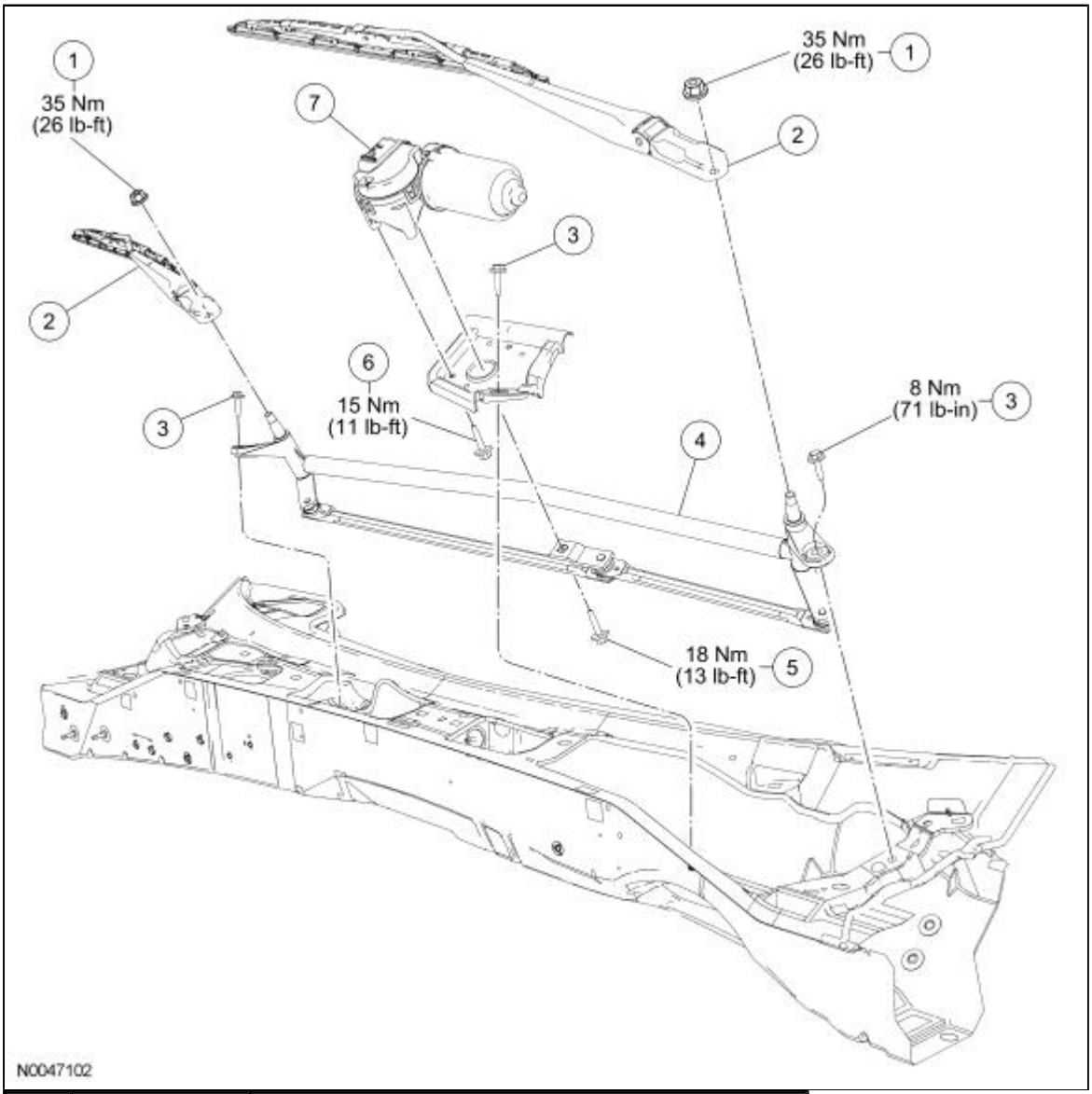
5. Install the rear window wiper pivot arm onto the rear window wiper motor shaft.
   1. Position the wiper pivot arm within specification.
   2. Tighten the nut to 35 Nm (26 lb-ft).
   3. Install the cover.


1
60-80 mm (2.4-3.2 in)
2
3
N0058024

Wiper and Washer System — Exploded View

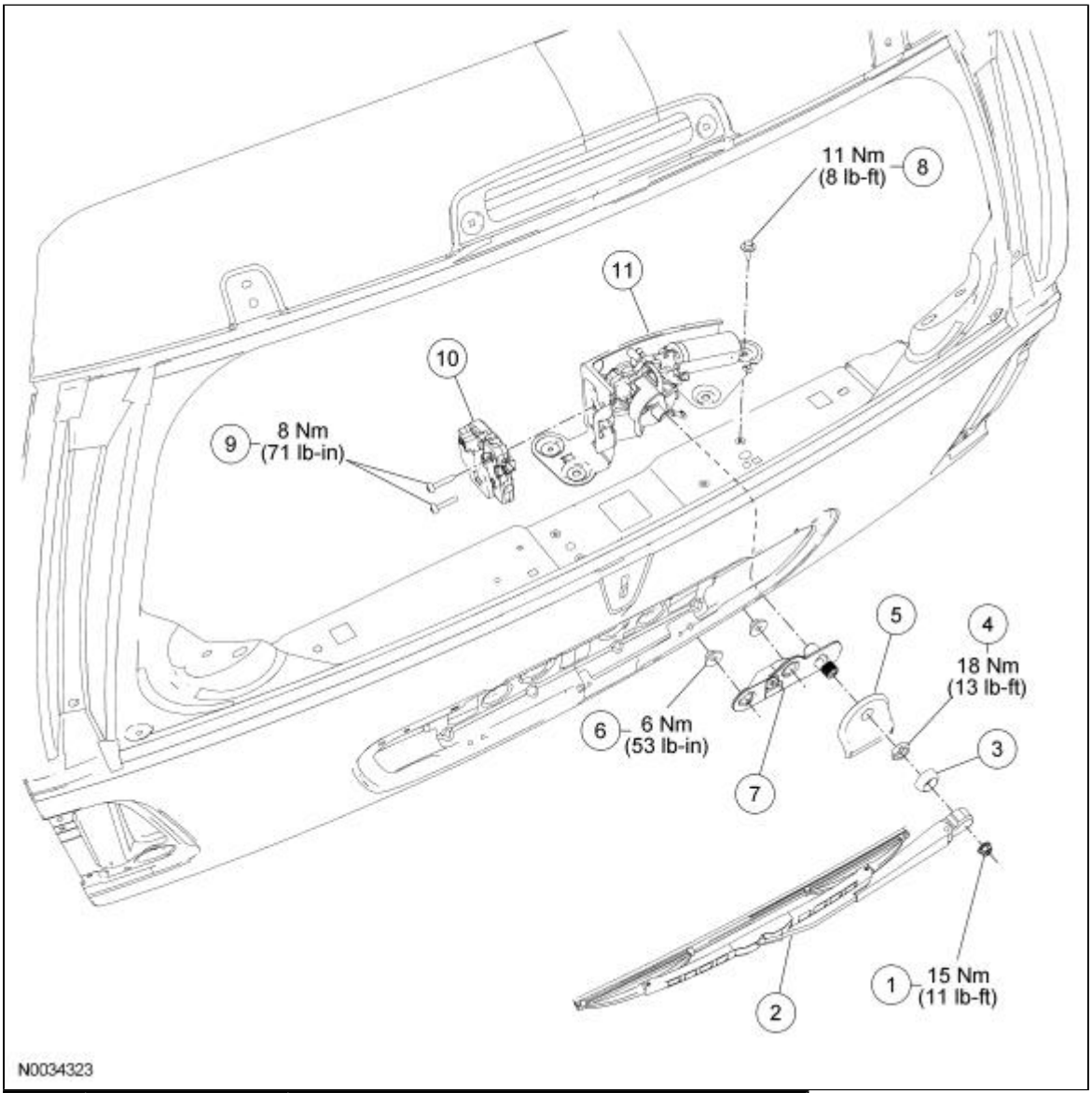
Printable View (336 KB)

Wiper and Washer System — Front



Item	Part Number	Description
1	W707014-S441	Wiper pivot arm nut
2	17526	Wiper pivot arm (LH and RH)
3	N807391	Wiper pivot arm linkage bolt (3 required)
4	17508A	Wiper pivot arm linkage assembly (includes wiper motor)
5	—	Wiper motor crank bolt
6	—	Wiper motor attachment bolt (3 required)
7	17508B	Wiper motor

Wiper and Washer System — Rear



Item	Part Number	Description
1	W708312	Wiper pivot arm nut
2	17526	Wiper pivot arm assembly
3	17C526A	Dust boot cover
4	W710357	Handle retaining nut
5	44009	Rear window glass handle
6	—	Striker latch nut (2 required)
7	17C426	Striker latch assembly
8	—	Wiper motor bracket bolt (4 required)
9	421A00	Latch assembly bolt (2 required)
10	40860	Latch assembly
11	17508	Wiper motor assembly

1. For additional information, refer to the procedures in this section.

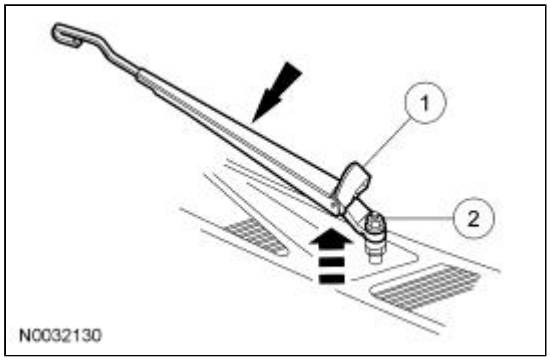
Wiper Pivot Arm — Front

Printable View (94 KB)

Removal and Installation

NOTE: The windshield wiper pivot arms must be in the highest position to remove them.

1. Turn the ignition switch to the ON position.
2. Turn the windshield wiper on.
3. Stop the windshield wiper pivot arms at the highest position by turning the ignition switch OFF.
4. Remove the windshield wiper pivot arm.
    1. Lift the pivot arm nut cover.
    2. Remove the nut.
        - To install, tighten to 35 Nm (26 lb-ft).



5. To install, reverse the removal procedure.
    - Adjust the windshield wiper pivot arms. For additional information, refer to Wiper Blade and Pivot Arm Adjustment — Windshield in this section.

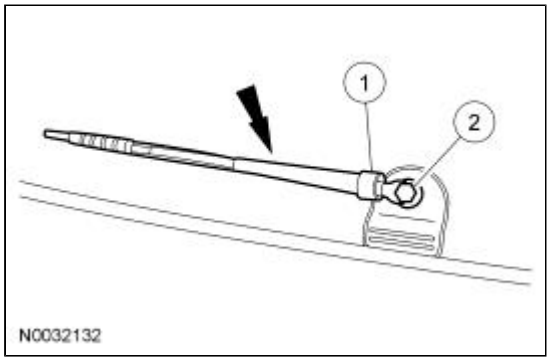
Wiper Pivot Arm — Rear

Printable View (103 KB)

Removal

1. **CAUTION: Use a shop towel or similar device to protect the vehicle finish when carrying out the procedure.**

   Remove the rear window wiper pivot arm.
   1. Lift the pivot arm nut cover.
   2. Remove the nut.

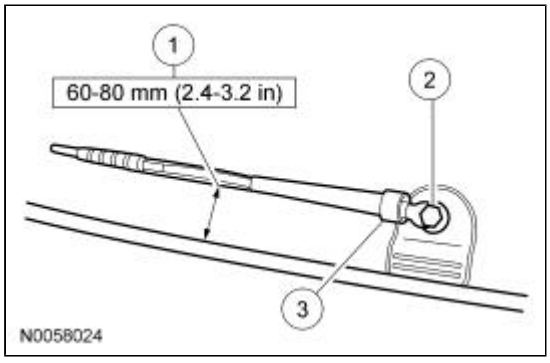


Installation

1. **NOTE:** This step makes sure that the wiper motor is in the PARK position.

   Turn the rear window wiper switch ON and allow the motor to operate for at least one cycle. Turn the rear window wiper switch to OFF.

2. Install the rear window wiper pivot arm onto the rear window wiper motor shaft.
   1. Position the wiper pivot arm within specification.
   2. Tighten the nut to 15 Nm (11 lb-ft).
   3. Install the cover.

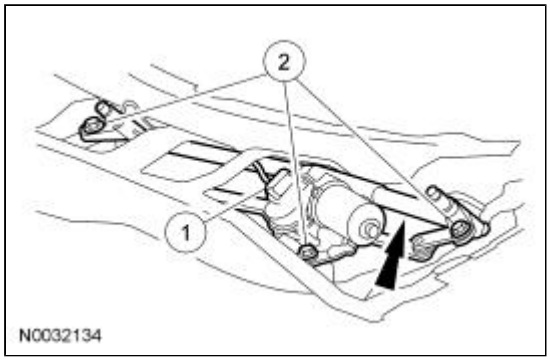


Wiper Mounting Arm and Pivot Shaft — Windshield

Printable View (84 KB)

Removal and Installation

1. Remove the cowl grille panel. For additional information, refer to Section 501-02 .
2. Disconnect and position the hood light harness aside.
3. Remove the hood struts.
   - Using a suitable tool support the hood.
4. Remove the mounting arm and pivot shaft assembly.
   1. Disconnect the electrical connector and position the wiring harness aside.
   2. Remove the bolts.
   - To install, tighten to 8 Nm (71 lb-in).



5. To install, reverse the removal procedure.

Wiper Mounting Arm and Pivot Shaft — Rear

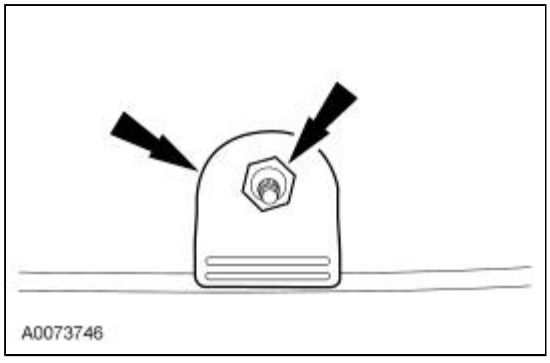
Printable View (82 KB)

Removal and Installation

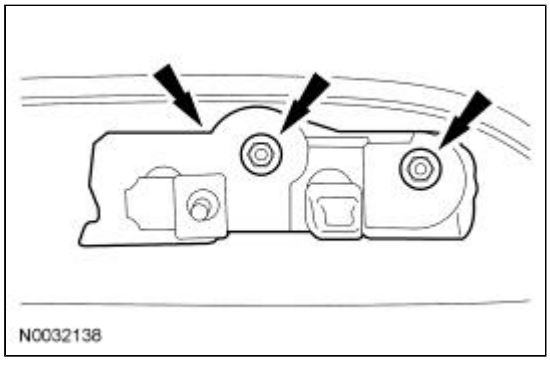
1. Remove the rear wiper pivot arm. For additional information, refer to Wiper Pivot Arm — Rear in this section.

2. Remove the dust boot cover.

3. Remove the nut and the rear window glass handle.
   - To install, tighten to 18 Nm (13 lb-ft).



4. Remove the nuts and the rear window wiper striker and wiper pivot shaft assembly.
   - To install, tighten to 6 Nm (53 lb-in).



5. To install reverse the removal procedure.

Striker and Wiper Pivot Shaft Assembly — Rear

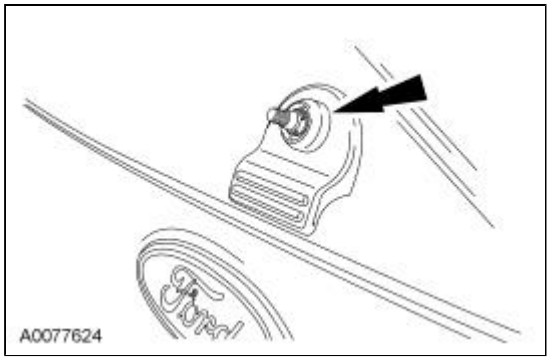
Printable View (271 KB)

Material

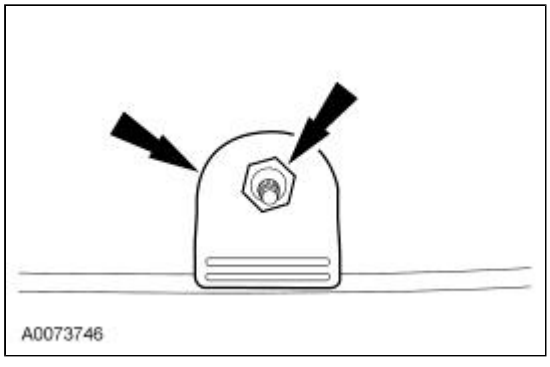
Item	Specification
Rear Window Wiper Motor Alignment Tool	2L1Z-14A163-AB

Removal

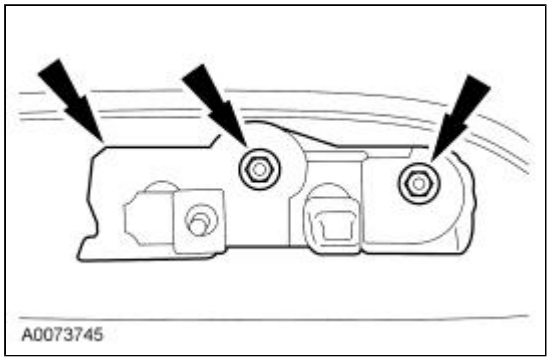
1. Remove the rear wiper pivot arm. For additional information, refer to Wiper Pivot Arm — Rear in this section.
2. Remove the dust boot cover.



3. Remove the nut and the rear window glass handle.



4. Remove the nuts and the rear window striker and wiper pivot shaft assembly.

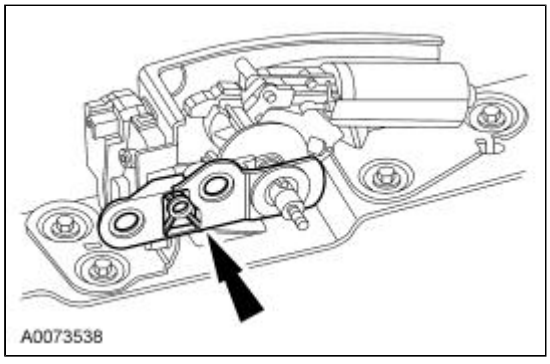


Installation

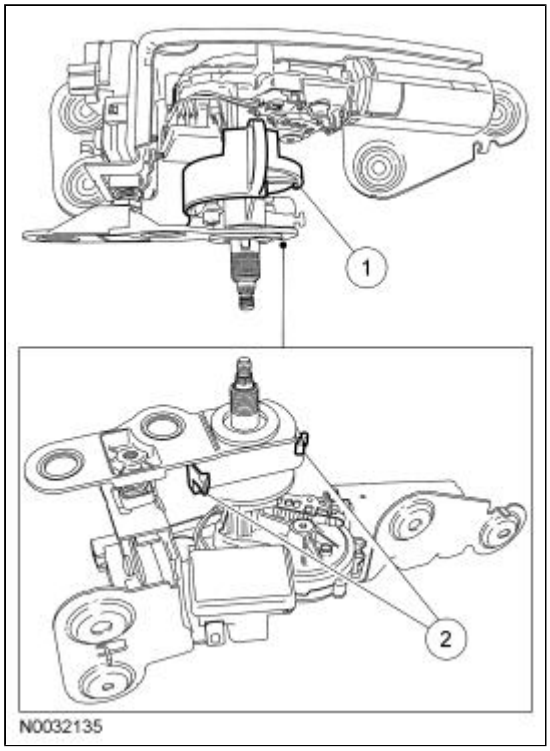
1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .

2. **NOTE:** An audible click should be heard as the striker engages the latch.

   Push the rear window wiper striker and pivot shaft assembly into the wiper motor. The pivot shaft pin should be aligned with the hole in the motor disc.

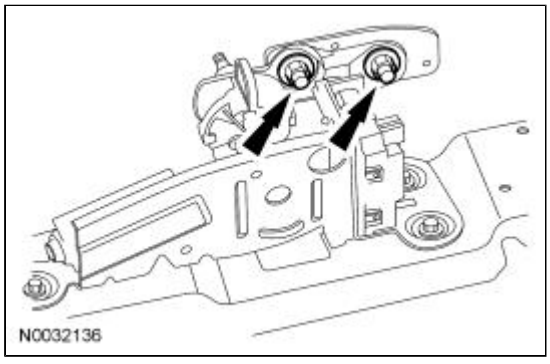


3. Install the rear window wiper motor alignment tool. If installing a new rear wiper motor, one is provided with the motor assembly.
   1. Make sure the alignment tool fits over the motor disc and striker assembly.
   2. Make sure the alignment tool clips are securely engaged.

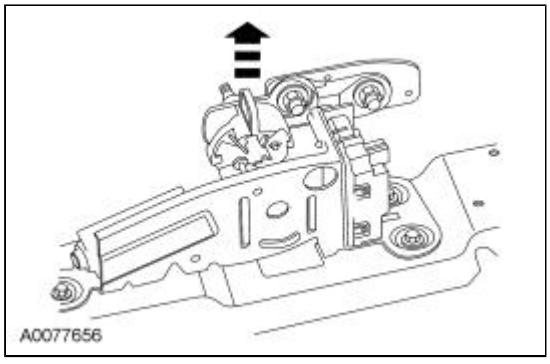


4. Carefully close the liftgate glass.

5. Open the liftgate. Install the rear window wiper striker and wiper pivot arm mounting assembly nuts. Tighten to 6 Nm (53 lb-in).

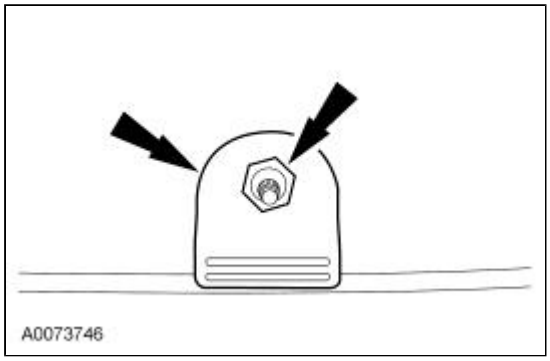


6. Remove the rear window wiper motor alignment tool.

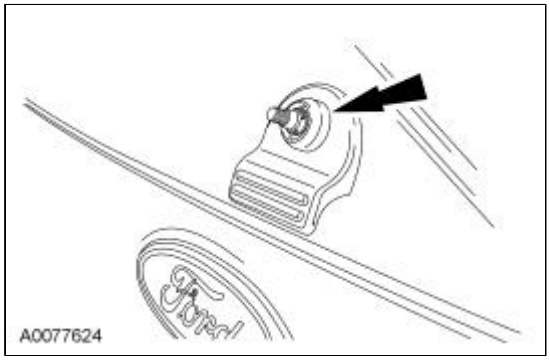


7. Close the liftgate.

8. Install the rear window wiper pivot shaft nut and handle. Tighten to 18 Nm (13 lb-ft).



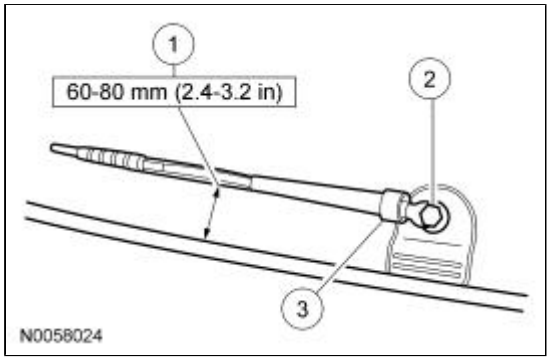
9. Install the dust boot cover.



10. **NOTE:** This step makes sure that the wiper motor is in the PARK position.

    Turn the rear window wiper switch ON and allow the motor to operate for at least one cycle. Turn the rear window wiper switch to OFF.

11. Install the rear wiper pivot arm onto the rear window wiper motor shaft.
    1. Position the wiper pivot arm onto the rear window wiper motor shaft.
    2. Tighten the nut to 15 Nm (11 lb-ft).
    3. Install the cover.



12. Open the liftgate.

13. Install the liftgate trim panel. For additional information, refer to Section 501-05 .

14. Test the liftgate and liftgate glass for normal operation.

Wiper Motor — Windshield

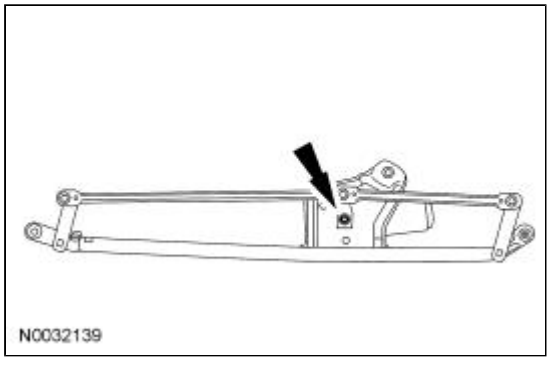
Printable View (96 KB)

Removal and Installation

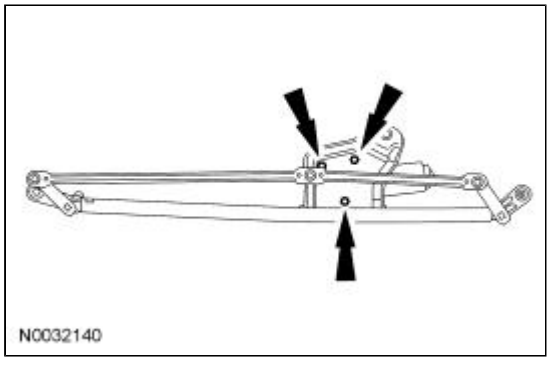
1. Remove the mounting arm and pivot shaft. For additional information, refer to Wiper Mounting Arm and Pivot Shaft — Windshield in this section.

2. **NOTE:** Mark the position of the windshield wiper motor crank before it is disconnected.

   Disconnect the windshield wiper motor crank.
   - Remove the bolt.
   - To install, tighten to 18 Nm (13 lb-ft).



3. Remove the bolts and the windshield wiper motor.
   - To install, tighten to 15 Nm (11 lb-ft).



4. **NOTE:** The windshield wiper motor crank must be set to the same location for the windshield wiper mounting arm and pivot shaft to be installed properly. Refer to Component test in this section.

   To install reverse the removal procedure.

Wiper Motor — Rear Window

Printable View (363 KB)

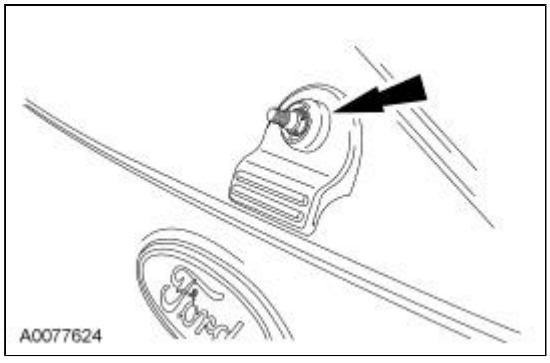
Material

Item	Specification
Rear Window Wiper Motor Alignment Tool	2L1Z-14A163-AB

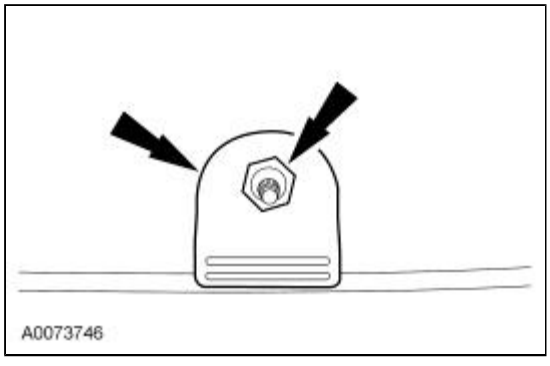
Removal

1. Remove the rear wiper pivot arm. For additional information, refer to Wiper Pivot Arm — Rear in this section.

2. Remove the dust boot cover.

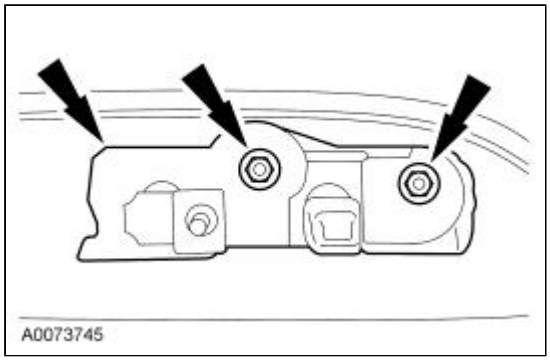


3. Remove the rear window wiper pivot shaft nut and handle.
   - To install, tighten to 18 Nm (13 lb-ft).



4. Open the liftgate glass.

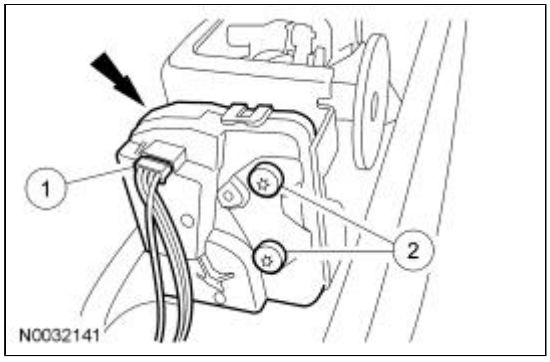
5. Remove the nuts and the rear window striker and wiper pivot shaft assembly.
   - To install, tighten to 6 Nm (53 lb-in).



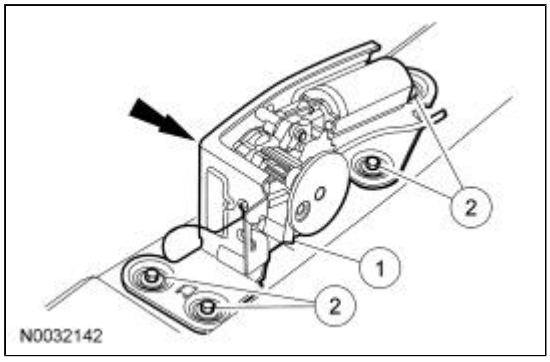
6. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .

7. Close the liftgate.

8. If installing a new rear wiper motor, remove the liftgate window glass latch.
    1. Disconnect the electrical connector.
    2. Remove the bolts.
        - To install, tighten to 8 Nm (71 lb-in).

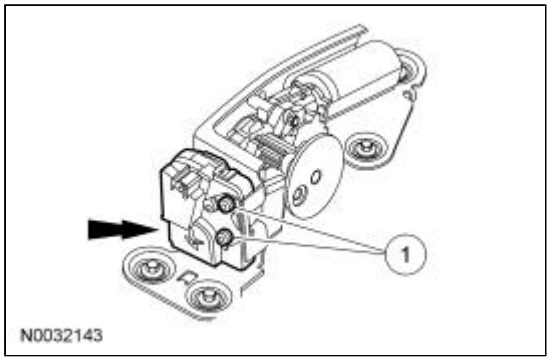


9. Remove the rear window wiper motor.
    1. Disconnect the electrical connector.
    2. Remove the bolts.
        - To install, tighten to 11 Nm (8 lb-ft).



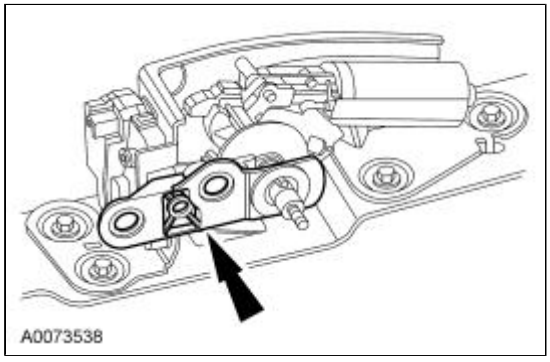
Installation

1. If installing a new rear wiper motor, install the liftgate window glass latch.
    1. Tighten bolts to 8 Nm (71 lb-in).

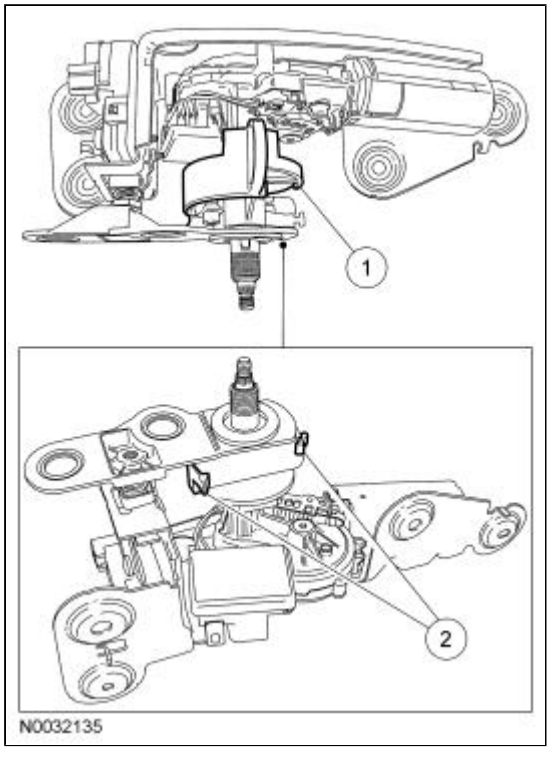


2. **NOTE:** An audible click should be heard as the striker engages the latch.

   Push the rear window wiper striker and pivot shaft assembly into the wiper motor. The pivot shaft pin should be aligned with the hole in the motor disc.

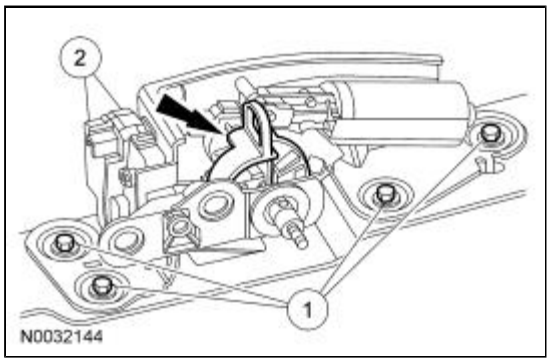


3. Install the rear window wiper motor alignment tool. If installing a new rear wiper motor, one is provided with the motor assembly.
   1. Make sure the alignment tool fits over the motor disc and striker assembly.
   2. Make sure the alignment tool clips are securely engaged.



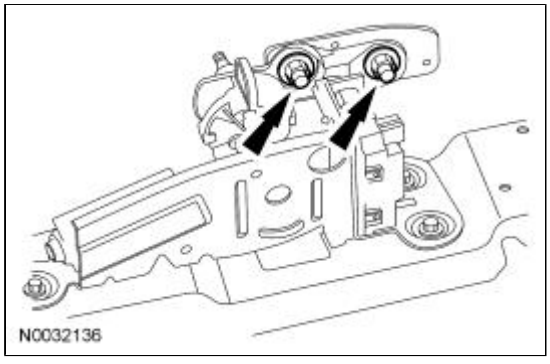
4. Install the rear wiper motor.

1. Tighten the bolts to 11 Nm (8 lb-ft).
2. Connect the electrical connectors.



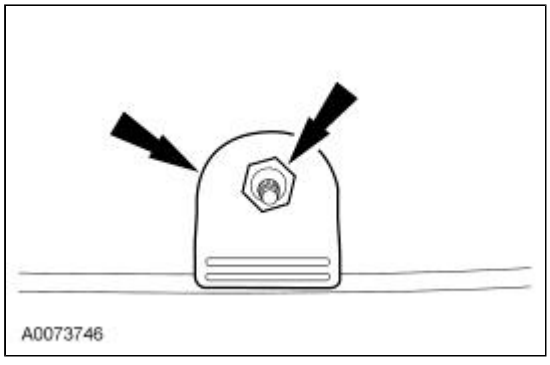
5. Carefully close the liftgate glass.

6. Open the liftgate. Install the rear window wiper striker and wiper pivot arm mounting assembly nuts.
   - Tighten to 6 Nm (53 lb-in).

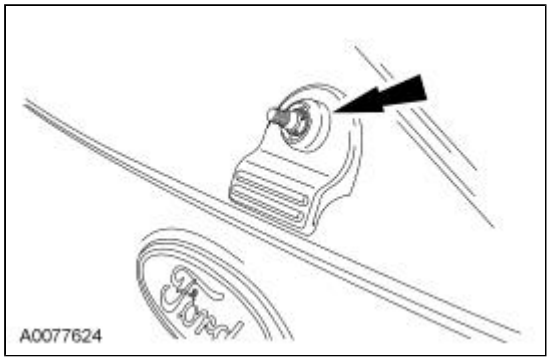


7. Close the liftgate.

8. Install the rear window wiper pivot shaft nut and handle.
   - Tighten to 18 Nm (13 lb-ft).



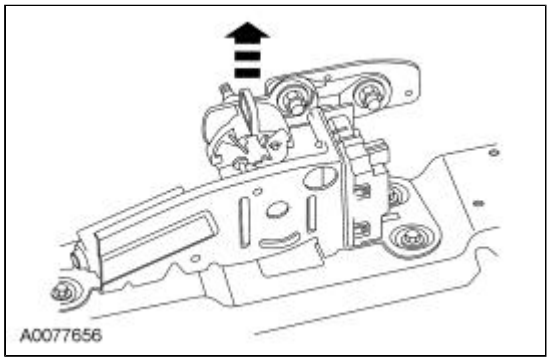
9. Install the dust boot cover.



10. Install the rear wiper pivot arm. For additional information, refer to Wiper Pivot Arm — Rear in this section.

11. Open the liftgate.

12. Remove the rear window wiper motor aligning tool.



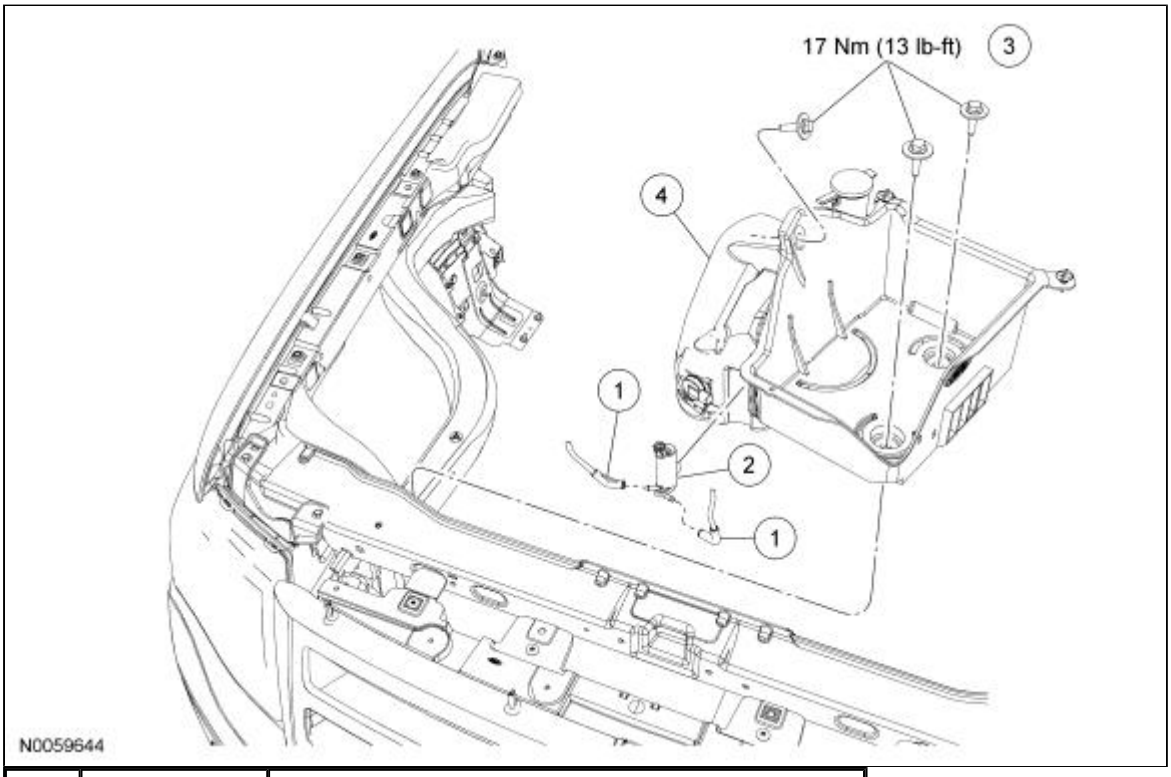
13. Open the liftgate glass.

14. Install the liftgate trim panel. Refer to Section 501-05 .

15. Test the liftgate and liftgate glass for normal operation.

Wiper and Washer System — Exploded View, Washer Pump and Reservoir

Printable View (176 KB)



Item	Part Number	Description
1	—	Windshield washer reservoir hoses
2	—	Windshield washer pump
3	W701835	Windshield washer reservoir bolts (3 required)
4	—	Windshield washer reservoir

1. For additional information, refer to the procedures in this section.

Washer Pump

Printable View (80 KB)

Removal and Installation

WARNING: Windshield washer solution contains methanol, which is poisonous. Observe all cautions and warnings indicated on the label of the container. Failure to follow these instructions could result in personal injury.

CAUTION: When servicing the windshield washer pump be careful not to damage the windshield washer pump seal.

CAUTION: Do not operate the windshield washer pump before filling the windshield washer reservoir. Failure to do so could result in premature pump failure.

1. Remove the RH headlamp assembly. For additional information, refer to Section 417-01 .
2. Position aside the shield as necessary to gain access to the washer pump.
3. Disconnect the windshield washer reservoir hoses.
4. Disconnect the windshield washer pump electrical connector.
5. Remove the windshield washer pump.
6. To install, reverse the removal procedure.

Washer Reservoir

Printable View (234 KB)

Removal and Installation

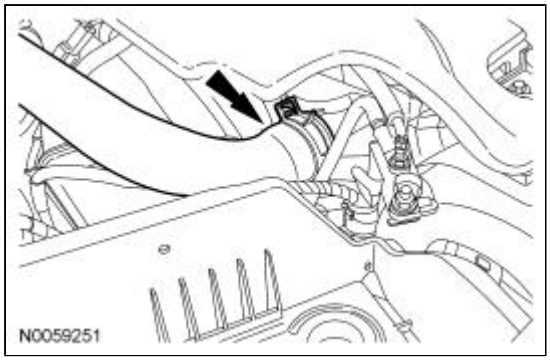
WARNING: Windshield washer solution contains methanol, which is poisonous. Observe all cautions and warnings indicated on the label of the container. Failure to follow these instructions could result in personal injury.

CAUTION: When servicing the windshield washer pump, be careful not to damage the windshield washer pump seal.

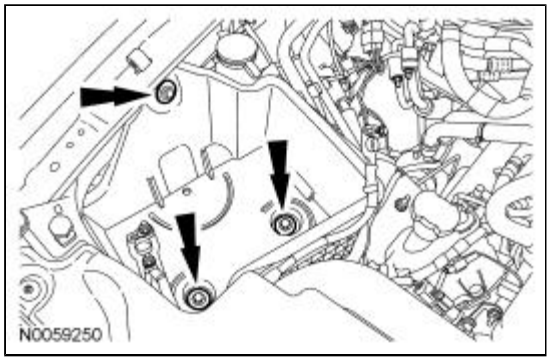
CAUTION: Do not operate the windshield pump before filling the windshield washer reservoir. Failure to do so could result in premature pump failure.

NOTE: The washer reservoir is integrated with the battery tray and cannot be serviced separately.

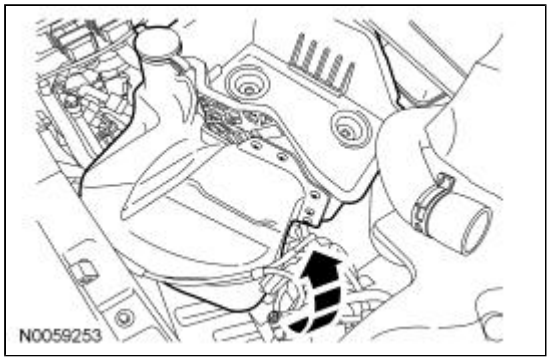
1. Remove the vehicle battery. For additional information, refer to Section 414-01 .
2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Disconnect the upper radiator hose at the radiator inlet, and position aside.



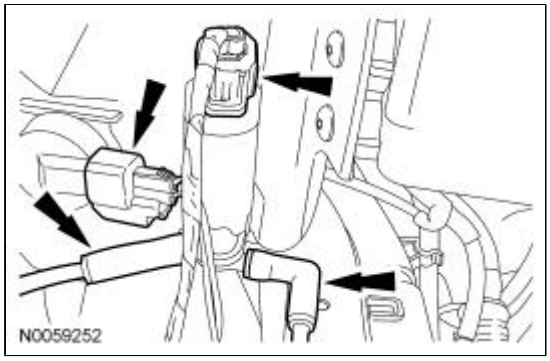
4. Remove the 3 battery tray bolts.
   - To install, tighten to 17 Nm (13 lb-ft).



5. Carefully position the washer reservoir assembly to gain access to the electrical connectors and washer hoses.



6. Disconnect the windshield washer solvent level electrical connector, washer pump electrical connectors and washer hoses.



7. **NOTE:** If necessary, drain the windshield washer reservoir after removal.

   Remove the washer reservoir assembly.

8. Transfer components as necessary.

9. To install, reverse the removal procedure.
   - Refer to Section 303-03 for coolant filling and bleeding procedures.

Printable View (78 KB)

General Specifications

Item	Specification
Roof Opening Panel Alignment	
Height adjustment (front)	-1.5-0 mm (-0.059-0 in)
Height adjustment (rear)	0-1.5 mm (0-0.059 in)

Torque Specifications

Description	Nm	lb-in
Roof opening panel frame bolts	10	89
Roof opening panel glass screws	4	35
Roof opening panel motor screws	4	35
Roof opening panel water trough screws	1	9
Roof opening panel air deflector screws	1	9

Roof Opening Panel

Printable View (63 KB)

The roof opening panel system consists of:

- roof opening panel motor/module.
- roof opening panel.
- overhead console.
- roof opening panel frame.
- roof opening panel frame drain hose.
- roof opening panel water trough.
- roof opening panel shield.
- roof opening panel air deflector.
- roof opening panel lifter assembly.
- roof opening panel rear trough guides.

The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel. The roof opening panel motor and module are installed new as an assembly. The roof opening panel is an electronically operated glass panel that can be opened or closed by the roof opening panel switch. Actuating the switch in either a forward or rearward motion supplies a ground to the roof opening panel motor/module. The soft-stop function is controlled by the roof opening panel motor/module. The roof opening panel has 3 modes of operation, manual mode, express open and tilt. The express open feature is activated when the switch is pressed momentarily. The tilt feature is activated when the tilt switch is depressed. These functions are controlled by the roof opening panel motor/module.

The roof opening panel has a comfort STOP position, which is 70 mm (2.75 in) from the full OPEN position, and is controlled by the roof opening panel motor/module. The comfort STOP position reduces wind rumbling noise that may occur when the vehicle is operated with the roof opening panel in the full OPEN position.

When the roof opening panel is opened in either express open or manual mode, it will stop at the comfort stop position first. In manual mode, the roof opening panel can be opened to full open from comfort stop by releasing the switch, then pressing and holding it until the roof opening panel is in the full OPEN position. In express open mode, the roof opening panel can be opened to full open from comfort stop by momentarily pressing the switch.

The roof opening panel can be closed by pressing the switch and holding it until the roof opening panel is in the desired position.

A new roof opening panel motor will only open and must be initialized. The roof opening panel motor initialization procedure must be done when repairs are carried out on any part of the roof opening panel system, including: any time the roof opening panel motor has been removed from the roof opening panel assembly, a new roof opening panel motor has been installed or when a new roof opening panel assembly has been installed.

Roof Opening Panel

Printable View (138 KB)

Special Tool(s)

ST1137-A	73III Automotive Meter or equivalent 105-R0057

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Roof opening panel • Roof opening panel frame • Roof opening panel drain hoses • Roof opening panel lifter assemblies • Roof opening panel water trough • Roof opening panel rear trough guides • Roof opening panel air deflector assembly • Roof opening panel seal • Roof opening panel shield	• Smart junction box (SJB) circuit breaker 47 (30A) • Circuitry • Accessory delay relay • Roof opening panel switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to Symptom Chart.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The roof opening panel has excessive wind noise	• Roof opening panel adjustment • Roof opening panel seal	• Go To Pinpoint Test A .
• The roof opening panel leaks	• Roof opening panel adjustment	• Go To Pinpoint

	• Roof opening panel seal • Roof opening panel water trough and rear trough guides • Drain tube attachment points • Roof opening panel drain hose • Front rail sealant • Roof opening panel	Test B .
• The roof opening panel rattles	• Roof opening panel • Roof opening panel tracks • Roof opening panel air deflector assembly • Roof opening panel water trough • Roof opening panel rear trough guides • Roof opening panel lifter assemblies • Headliner • Motor pad • Rear side brackets	• Go To Pinpoint Test C .
• The roof opening panel is noisy during operation	• Roof opening panel • Roof opening panel tracks • Roof opening panel lifter assemblies • Roof opening panel adjustment • Roof opening panel motor/module assembly	• Go To Pinpoint Test D .
• The roof opening panel does not open or close	• Roof opening panel adjustment • Circuit breaker • Circuitry • Roof opening panel switch • Roof opening panel motor/module assembly • Roof opening panel water trough • Roof opening panel rear trough guides • Roof opening panel lifter assemblies	• Go To Pinpoint Test E .
• The express open is inoperative	• Circuitry • Roof opening panel switch • Roof opening panel motor assembly	• Go To Pinpoint Test F .
• The roof opening panel will not stop in the vent position	• Circuitry • Roof opening panel switch • Roof opening panel motor assembly	• Go To Pinpoint Test F .
• The roof opening panel does not open or close — one direction only	• Circuitry • Roof opening panel switch • Roof opening panel motor assembly	• Go To Pinpoint Test E .

Pinpoint Tests

Pinpoint Test A: The Roof Opening Panel Has Excessive Wind Noise

Normal Operation

During normal operation, when the roof opening panel glass is completely closed, it is flush with the roof panel and correctly sealed.

Possible Causes

- Roof opening panel glass adjustment
- Roof opening panel glass seal(s)

PINPOINT TEST A: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

Test Step	Result / Action to Take
A1 VERIFY ROOF OPENING PANEL NOISE	
• Road test the vehicle with the roof opening panel in the CLOSED and OPEN position. • **Is the wind noise present only in the open position?**	**Yes** GO to A4 . **No** GO to A2 .
A2 CHECK THE ROOF OPENING PANEL ADJUSTMENT	
• Check the roof opening panel adjustment. • **Is the adjustment OK?**	**Yes** GO to A3 . **No** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section.
A3 CHECK THE ROOF OPENING PANEL WEATHERSTRIP	
NOTE: Make sure the weatherstrip is secured to the glass, not cut, cracked, pinched, loose or obstructed in CLOSED, VENT and OPEN position. • Check the roof opening panel weatherstrip. • **Is the roof opening panel weatherstrip OK?**	**Yes** If still in question, compare to like unit. **No** INSTALL a new roof opening panel weatherstrip. REFER to Roof Opening Panel Weatherstrip in this section.
A4 CHECK THE AIR DEFLECTOR	
• Make sure the air deflector is securely attached and check for torn and unsecured tethers. • **Is the air deflector OK?**	**Yes** GO to A5 . **No** INSTALL new air deflector assembly. REFER to Air Deflector in this section.
A5 CHECK THE AIR DEFLECTOR FOR VIBRATION	
• Road test the vehicle and check	**Yes**

for air deflector vibration. • **Did the air deflector vibrate?**	MODIFY the curvature of the air deflector by slightly bending it upward or downward at its center. The top center edge of the air deflector should be approximately 6-8 mm (0.23-0.31 in) above the roof line at the center of the vehicle. TEST the system for normal operation. **No** PARTIALLY close the roof opening panel until the noise is eliminated. If the noise is eliminated, inform the customer that changing glass location will eliminate the wind noise. If the wind noise is not eliminated, INSTALL a new air deflector. REFER to Air Deflector in this section.

Pinpoint Test B: The Roof Opening Panel Leaks

Normal Operation

During normal operation, when the roof opening panel glass is completely closed, it is flush with the roof panel and correctly sealed. The drain channel collects water and drains it through the front drain hose(s) located in the A-pillar and the rear drain hose(s) located in the C-pillar.

Possible Causes

- Roof opening panel glass adjustment
- Roof opening panel drain hoses
- Roof opening panel glass seal(s)
- Sealant joints at frame (rail and track assembly) joints

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

Test Step	Result / Action to Take
B1 VERIFY CUSTOMER OPERATION OF THE ROOF OPENING PANEL WHEN PARKED	
• Make sure the customer is parking with the roof opening panel in the CLOSED position. • **Is the customer parking with the roof opening panel in the CLOSED position?**	**Yes** GO to B2. **No** INSTRUCT the customer to refer to the owner's manual for correct operation of the roof opening panel.
B2 CHECK THE ADJUSTMENT OF THE ROOF OPENING PANEL	
• Make sure the roof opening panel glass is centered and flush with the roof line. • **Is the roof opening panel adjusted correctly?**	**Yes** GO to B3. **No** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section. TEST the system for normal operation.
B3 CHECK THE WEATHERSTRIP CONDITION	
NOTE: The seal has a bonded joint located on	**Yes**

the passenger side or rear edge. This is not a defect. • Make sure the roof opening panel seal is not cracked, torn or loose. • Check the roof opening panel seal. • **Is the roof opening panel seal in good condition and free from damage?**	GO to B4 . **No** INSTALL a new roof opening panel seal. TEST the system for normal operation.
B4 CHECK THE WATER TROUGH CONDITION	
• Check the water trough and guides for damage and/or incorrect attachment and function. • **Is the water trough OK?**	**Yes** GO to B5 . **No** REPAIR the water trough or INSTALL a new component as necessary. TEST the system for normal operation.
B5 CHECK THE DRAIN HOSES	
NOTE: Drain hoses can be viewed with a flashlight by removing the headliner lace around the inside opening and gently pulling down on the headliner. (On some vehicles, Velcro-style attachments have been installed in place of the trim lace.) • Make sure the drain hoses are all connected and not cracked, slit, pinched or obstructed. • **Are all the drain hoses present and attached correctly?**	**Yes** GO to B6 . **No** REPAIR or INSTALL a new drain hose(s). TEST the system for normal operation.
B6 CHECK THE DRAIN HOSES FOR CORRECT FLOW	
NOTE: Drain hoses must flow downhill and cannot be pinched or restricted by headliner or any other trim components. • With the panel in the OPEN position, slowly pour water into the water trough area and make sure that the same amount of water exits the vehicle at the bottom of the A- and C-pillars. • Check the drain hoses for obstructions by blowing compressed air through the drain spouts in the water trough area, then retest the water. • **Are the drain hoses operating correctly?**	**Yes** INSPECT other areas of the vehicle that may cause water to enter the roof area, such as, the windshield or luggage rack if equipped. If no concerns are found, GO to B7 . **No** Lower the headliner and INSPECT the drain hoses for correct routing. REPAIR or INSTALL a new drain hose(s). TEST the system for normal operation.
B7 CHECK THE CONDITION OF THE ROOF OPENING PANEL FRAME	
• Check the roof opening panel frame for damage that may cause the roof opening panel seal to seat incorrectly. • **Is the roof opening panel frame OK?**	**Yes** INSTALL a new roof opening panel. REFER to Roof Opening Panel in this section. TEST the system for normal operation. **No** REPAIR the roof opening panel frame as necessary. TEST the system for normal operation.

Pinpoint Test C: The Roof Opening Panel Rattles

Normal Operation

During normal operation, when the roof opening panel is completely closed, it is flush with the roof panel. All components should be secured correctly.

Possible Causes

- Roof opening panel glass adjustment
- Roof opening panel lifter assemblies
- Roof opening panel tracks
- Roof opening drain channels (water trough) and guides
- Roof opening panel shield (sunshade)
- Roof opening panel air deflector
- Roof opening panel assembly

PINPOINT TEST C: THE ROOF OPENING PANEL RATTLES

Test Step	Result / Action to Take
C1 CHECK THE ROOF OPENING PANEL GLASS SCREWS FOR TIGHTNESS	
• Manually push up and fore/aft. • **Are the roof opening panel glass screws loose?**	**Yes** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section. TEST the system for normal operation. **No** GO to C2.
C2 CHECK THE ROOF OPENING PANEL TRACKS	
• Open the roof opening panel. • Check the roof opening panel tracks for obstructions and damage. • **Are the roof opening panel tracks OK?**	**Yes** GO to C3. **No** REMOVE all the roof opening panel track obstructions and REPAIR the roof opening panel tracks. TEST the system for normal operation.
C3 CHECK THE ROOF OPENING PANEL WATER TROUGH AND REAR TROUGH GUIDES	
• Check the roof opening panel water trough and rear trough guides for any loose obstructions. • **Are the roof opening panel water trough and rear trough guides installed securely and free from obstructions?**	**Yes** GO to C4. **No** REMOVE all obstructions from the roof opening panel water trough and INSTALL securely. SECURE the rear trough guides or INSTALL new roof opening panel rear trough guides if damaged. REFER to Roof Opening Panel Rear Trough Guide in this section. TEST the system for normal operation.
C4 CHECK THE ROOF OPENING PANEL SHIELD (SUNSHADE)	
• Check the roof opening panel shield (sunshade) for correct installation with all 4 tabs in the track channels. • **Is the roof opening panel**	**Yes** GO to C5. **No** INSTALL the roof opening panel shield correctly. TEST

shield installed correctly?	the system for normal operation.
C5 CHECK THE ROOF OPENING PANEL AIR DEFLECTOR ASSEMBLY	
• Check the roof opening panel air deflector assembly for obstructions, damage and incorrect attachments. • **Is the roof opening panel air deflector assembly OK?**	**Yes** GO to C6 . **No** REMOVE all obstructions and REPAIR or INSTALL a new roof opening panel air deflector assembly. REFER to Air Deflector in this section. TEST the system for normal operation.
C6 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES	
• Verify the roof opening panel lifter assemblies are free from obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to C7 . **No** REMOVE all obstructions from the roof opening panel lifter assemblies and REPAIR any damage. If the lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
C7 CHECK THE ROOF OPENING PANEL FRAME ATTACHMENTS	
• Check for correct torque and installation of the roof opening panel frame. • **Is the roof opening panel correctly installed and tightened to specification?**	**Yes** GO to C8 . **No** TIGHTEN or REINSTALL the roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
C8 CHECK THE ROOF OPENING PANEL FRAME TO HEADLINER FOR RATTLES	
• Check the roof opening panel frame to headliner for any interference condition that would induce a rattle. • **Is there a condition that will cause rattles?**	**Yes** INSTALL a suitable sound damper material to correct the condition. If the rattle still persists, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation. **No** INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.

Pinpoint Test D: The Roof Opening Panel Is Noisy During Operation

Normal Operation

During normal operation, the roof opening panel operates smoothly while opening and closing.

Possible Causes

- Roof opening panel glass adjustment
- Roof opening panel tracks

- Roof opening panel shield (sunshade)
- Roof opening panel motor

PINPOINT TEST D: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

Test Step	Result / Action to Take
D1 CHECK THE ROOF OPENING PANEL FOR OBSTRUCTIONS OR DAMAGE • Check the roof opening panel for any obstructions and damage. • **Are there any obstructions and/or damage?**	**Yes** REMOVE all obstructions. REPAIR any damage or INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation. **No** GO to D2.
D2 CHECK THE ROOF OPENING PANEL OPERATION • Check the roof opening panel during operation. • **Is the roof opening panel loose or incorrectly adjusted?**	**Yes** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section. TEST the system for normal operation. **No** GO to D3.
D3 CHECK THE ROOF OPENING PANEL TRACKS • Open the roof. • Check the roof opening panel tracks for obstructions and damage. • **Are the roof opening panel tracks OK?**	**Yes** GO to D4. **No** REMOVE all obstructions and REPAIR any damage. TEST the system for normal operation.
D4 CHECK THE ROOF OPENING PANEL SHIELD (SUNSHADE) • Check the roof opening panel shield for correct movement. • **Is the roof opening panel shield moving correctly?**	**Yes** GO to D5. **No** REMOVE and REINSTALL the roof opening panel shield. REFER to Roof Opening Panel Shield in this section. TEST the system for normal operation.
D5 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES • Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening**	**Yes** GO to D6. **No** REMOVE all obstructions and REPAIR any damage. If lifter

panel lifter assemblies OK?	assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
D6 CHECK THE ROOF OPENING PANEL MOTOR	
• Remove the roof opening panel motor/module and leave the electrical connector connected. • Operate the roof opening panel to the full OPEN and CLOSED position. • **Does the motor make excessive noise?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. TEST the system for normal operation. **No** REINSTALL the roof opening panel motor/module. TEST the system for normal operation. If the roof opening panel is still noisy, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. If the roof opening panel is no longer noisy, the system is operating correctly. The concern may have been caused by an incorrectly installed roof opening panel motor.

Pinpoint Test E: The Roof Opening Panel Does Not Open Or Close

Refer to Wiring Diagrams Cell 101 , Roof Opening Panel for schematic and connector information.

Normal Operation

During normal operation, the roof opening panel integrated motor/module assembly receives voltage on circuit CBP47 (GN/BU) when the ignition switch is in the ACC or ON position. The roof opening panel module is grounded through circuit GD143 (BK/VT). The roof opening panel integrated motor/module assembly provides a ground through circuit CPR37 (YE/GY) (switch common) to the roof opening panel switch. The roof opening panel switch applies the switch common (ground) to the roof opening panel motor/module assembly through circuits CPR31 (VT/BN), CPR39 (VT/WH) and CPR40 (YE/OG) when the switch is actuated. Pressing the tilt switch applies switch common (ground) to the roof opening panel integrated motor/module through circuit CPR31 (VT/BN). Pressing the close switch applies switch common (ground) to the roof opening panel integrated motor/module through circuit CPR40 (YE/OG). Pressing the open switch applies switch common (ground) to the roof opening panel integrated motor/module through CPR39 (VT/WH). Pressing the auto open switch applies switch common (ground) to the roof opening panel integrated motor/module through circuits CPR39 (VT/WH) and CPR31 (VT/BN).

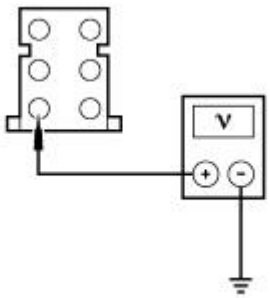
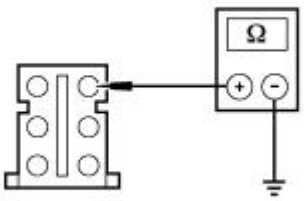
Possible Causes

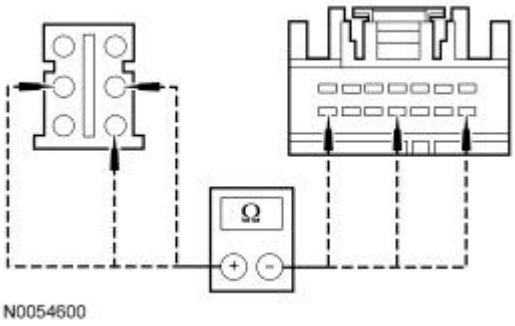
- Circuit breaker
- Open in circuit CBP47 (GN/BU), GD143 (BK/VT), CPR37 (YE/GY), CPR39 (VT/WH) or CPR40 (YE/OG)
- Roof opening panel switch
- Roof opening panel motor

PINPOINT TEST E: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

Test Step	Result / Action to Take
E1 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES FOR OBSTRUCTIONS OR DAMAGE	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to E2 . **No**

	REMOVE all obstructions and REPAIR any damage. If lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
E2 CHECK THE ROOF OPENING PANEL WATER TROUGH AND REAR TROUGH GUIDES	
• Check the water roof opening panel water trough and rear trough guides for any loose obstructions. • **Are the roof opening panel water trough and rear trough guides installed securely and free from obstructions?**	**Yes** GO to E3. **No** REMOVE all obstructions from the roof opening panel water trough and install securely. SECURE the rear trough guides or INSTALL new roof opening panel rear trough guides if damaged. REFER to Roof Opening Panel Rear Trough Guide in this section. TEST the system for normal operation.
E3 VERIFY THE ROOF OPENING PANEL ADJUSTMENT	
• Verify the roof opening panel is adjusted correctly. • **Is the roof opening panel adjusted correctly?**	**Yes** GO to E4. **No** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section. TEST the system for normal operation.
E4 CHECK THE ROOF OPENING PANEL MOTOR/MODULE FOR INITIALIZATION	
NOTE: The roof opening panel motor initialization procedure must be done when repairs are carried out on any part of the roof opening panel assembly, including whenever the roof opening panel motor/module has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section. • Carry out the Roof Opening Panel Motor Initialization procedure. Refer to Roof Opening Panel Motor Initialization in this section. • **If the concern still present?**	**Yes** GO to E5. **No** The system is operating correctly. The roof opening panel motor/module was uninitialized.
E5 CHECK THE POWER WINDOWS	
• Key in ON position. • Verify the power windows operate.	**Yes** GO to E6.

• **Do the power windows operate?**	**No** REFER to Section 501-11 to diagnose the accessory delay relay circuit.
E6 CHECK THE ROOF OPENING PANEL SWITCH	
• Carry out the roof opening panel switch component test. Refer to Wiring Diagrams Cell 149 for schematic and connector information. • **Did the roof opening panel switch pass the component test?**	**Yes** GO to E7 . **No** INSTALL a new roof opening panel switch. TEST the system for normal operation.
E7 CHECK CIRCUIT CBP47 (GN/BU) FOR VOLTAGE	
• Key in OFF position. • Disconnect: Roof Opening Panel Motor/Module C922. • Key in ON position. • Measure the voltage between roof opening panel motor/module C922-4, circuit CBP47 (GN/BU), harness side and ground.  A0083978 • **Is the voltage greater than 9 volts but less than 16 volts?**	**Yes** GO to E8 . **No** VERIFY the smart junction box (SJB) circuit breaker 47 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
E8 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Key in OFF position. • Measure the resistance between roof opening panel motor/module C922-3, circuit GD143 (BK/VT), harness side and ground.  A0084276 • **Is the resistance less than 5 ohms?**	**Yes** GO to E9 . **No** REPAIR the circuit. TEST the system for normal operation.
E9 CHECK CIRCUITS CPR37 (YE/GY), CPR39 (VT/WH) AND CPR40 (YE/OG) FOR AN OPEN	
• Disconnect: Roof Opening Panel Switch C930. • Measure the resistance between the roof opening panel motor/module C922-1, circuit CPR40 (YE/OG), harness side and roof opening panel switch C930-8, circuit CPR40 (YE/OG), harness side. Measure the resistance between roof opening	**Yes** GO to E10 . **No** REPAIR the circuit. TEST

panel motor/module C922-2, circuit CPR39 (VT/WH), harness side and roof opening panel switch C930-11, circuit CPR39 (VT/WH), harness side. Measure the resistance between roof opening panel motor/module C922-5, circuit CPR37 (YE/GY), harness side and roof opening panel switch C930-14, circuit CPR37 (YE/GY), harness side.  • **Are the resistances less than 5 ohms?**	the system for normal operation.

E10 CHECK FOR CORRECT ROOF OPENING PANEL MOTOR/MODULE OPERATION
• Disconnect the roof opening panel motor/module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all roof opening panel motor/module connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	CHECK the jumper harness between the vehicle harness and the roof opening panel for open or shorted circuits. If the jumper harness is not OK, INSTALL a new jumper harness between the vehicle harness to the roof opening panel motor/module. Otherwise, INSTALL a new roof opening panel module/motor. REFER to Roof Opening Panel Motor in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Express Open Is Inoperative

Refer to Wiring Diagrams Cell 101 , Roof Opening Panel for schematic and connector information.

Normal Operation

The roof opening panel integrated motor/module assembly provides a ground through circuit CPR37 (YE/GY) (switch common) to the roof opening panel switch. The roof opening panel switch supplies the switch common (ground) to the roof opening panel motor/module assembly through circuits CPR31 (VT/BN), CPR39 (VT/WH) and CPR40 (YE/OG) when the switch is actuated. Pressing the tilt switch

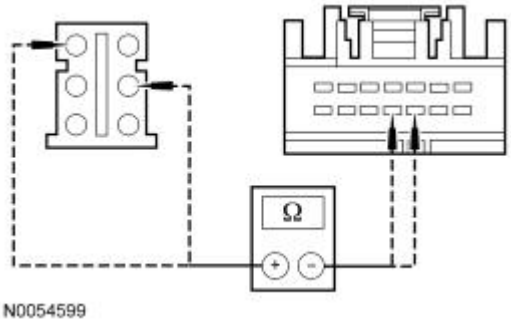
applies switch common (ground) to the roof opening panel integrated motor/module through circuit CPR31 (VT/BN). Pressing the close switch applies switch common (ground) to the roof opening panel integrated motor/module through circuit CPR40 (YE/OG). Pressing the open switch applies switch common (ground) to the roof opening panel integrated motor/module through CPR39 (VT/WH). Pressing the auto open switch applies switch common (ground) to the roof opening panel integrated motor/module through circuits CPR39 (VT/WH) and CPR31 (VT/BN).

Possible Causes

- Open in circuit CPR31 (VT/BN) or CPR39 (VT/WH)
- Roof opening panel switch
- Roof opening panel motor

PINPOINT TEST F: THE EXPRESS OPEN IS INOPERATIVE

Test Step	Result / Action to Take
F1 CHECK THE ROOF OPENING PANEL MOTOR/MODULE FOR INITIALIZATION	
NOTE: The roof opening panel motor initialization procedure must be done when repairs are carried out on any part of the roof opening panel assembly, including whenever the roof opening panel motor/module has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section. • Carry out the Roof Opening Panel Motor Initialization procedure. Refer to Roof Opening Panel Motor Initialization in this section. • **If the concern still present?**	**Yes** GO to F2 . **No** The system is operating correctly. The roof opening panel motor/module was uninitialized.
F2 CHECK THE ROOF OPENING PANEL SWITCH	
• Disconnect: Roof Opening Panel Switch C930. • Carry out the roof opening panel switch component test. Refer to Wiring Diagrams cell 149 for schematic and connector information. • **Did the roof opening panel switch pass the component test?**	**Yes** GO to F3 . **No** INSTALL a new roof opening panel switch. TEST the system for normal operation.
F3 CHECK CIRCUIT CPR31 (VT/BN) and CPR39 (VT/WH) FOR AN OPEN	
• Disconnect: Roof Opening Panel Motor/Module C922. • Measure the resistance between roof opening panel motor/module C922-2, circuit CPR39 (VT/WH), harness side and roof opening panel switch C930-11, circuit CPR39 (VT/WH), harness side; and between roof opening panel motor/module C922-6, circuit CPR31 (VT/BN), harness side and roof opening panel switch C930-10, circuit CPR31 (VT/BN), harness side.	**Yes** GO to F4 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0054599 • **Is the resistance less than 5 ohms for both measurements?**	

F4 CHECK FOR CORRECT ROOF OPENING PANEL MOTOR/MODULE OPERATION
• Disconnect the roof opening panel motor/module connectors.
• Check for:
  ▪ corrosion.
  ▪ pushed-out pins.
• Connect all roof opening panel motor/module connectors and make sure they seat correctly.
• Operate the system and verify that the concern is still present.
• **Is the concern still present?**
	Yes
	CHECK the jumper harness between the vehicle harness and the roof opening panel for open or shorted circuits. If the jumper harness is not OK, INSTALL a new jumper harness between the vehicle harness to the roof opening panel motor/module. Otherwise, INSTALL a new roof opening panel module/motor. REFER to Roof Opening Panel Motor in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Roof Opening Panel Motor Initialization

Printable View (80 KB)

CAUTION: Be sure there are no obstructions in the path of the roof opening panel glass before attempting to initialize the roof opening panel motor.

NOTE: A new roof opening panel motor will only open and must be initialized.

NOTE: The roof opening panel motor initialization procedure must be done when repairs are carried out on any part of the roof opening panel system, including: any time the roof opening panel motor has been removed from the roof opening panel assembly, a new roof opening panel motor has been installed or when a new roof opening panel assembly has been installed.

1. Turn the ignition to the RUN position. For an existing roof opening panel motor, proceed to Step 3.

2. **NOTE:** If the open switch is released before initialization movements are complete, turn the ignition key to the OFF position, then back to the RUN position and repeat this step.

   For a new roof opening panel motor/module:
   - Press the open switch until the roof opening panel moves past the full OPEN position and continue to hold for approximately 10 seconds. The roof opening panel will cycle slightly rearward and then slightly forward to the stored OPEN position. Release the switch at this point.
   - Press and hold the open switch. The roof opening panel glass will move to the full TILT position, then back to CLOSED (initialization movements). The initialization movements will start within approximately 3 seconds after the switch is pressed. When the initialization movements are complete, go to Step 4.

3. **NOTE:** All roof opening panel motor/module assemblies have an electronically controlled comfort STOP position, which is approximately 50 mm (2 in) from the full OPEN position. When the roof opening panel is opened, the open switch must be released when the comfort STOP position has been reached and then pressed again to fully open the roof opening panel.

   NOTE: If the open switch is released before initialization movements are complete, turn the ignition key to the OFF position, then back to the RUN position, and repeat this step.

   For an existing roof opening panel motor/module:
   - Press and hold the open switch until the roof opening panel glass moves to the full OPEN position.
   - Press and hold the open switch (for approximately 10 seconds) until the roof opening panel glass moves past full OPEN, then back to full OPEN. Quickly release the switch.
   - Press and hold the open switch. The roof opening panel glass will move to full TILT, then back to CLOSED (initialization movements). The initialization movements will start within approximately 3 seconds after the switch is pressed.

4. Release the open switch and test the system for normal operation by carrying out one-touch open to comfort STOP, full OPEN, close from full OPEN to full CLOSE and TILT operations.

Roof Opening Panel Alignment — Horizontal Adjustment

Printable View (80 KB)

NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel motor has been removed from the roof opening panel assembly, a new roof opening panel motor has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Position the roof opening panel in the CLOSED position.
2. Loosen the 2 roof opening panel glass screws on the driver side.
3. **CAUTION: Use care to avoid scratching the roof or damaging the roof opening panel seal.**

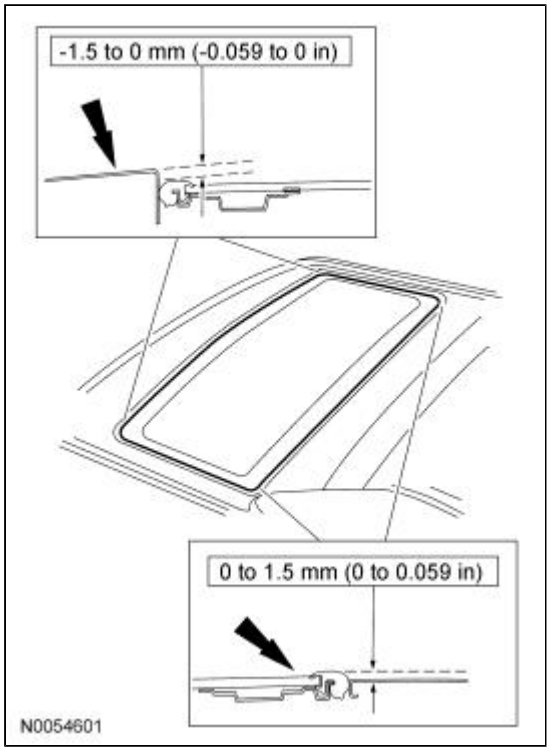
   Insert a plastic shim (or similar tool) with a thickness of approximately 3 mm between the rear of the roof opening panel seal and the roof opening panel.
4. Gently move the roof opening panel forward.
5. Tighten the roof opening panel glass screws to 4 Nm (35 lb-in).
6. Repeat for the passenger side.
7. Using a 0.5 mm (0.02 in) feeler or suitable gauge, inspect the seal contact around the entire roof opening panel glass.
8. Reinitialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel Alignment — Height Adjustment

Printable View (105 KB)

NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel motor has been removed from the roof opening panel assembly, a new roof opening panel motor has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

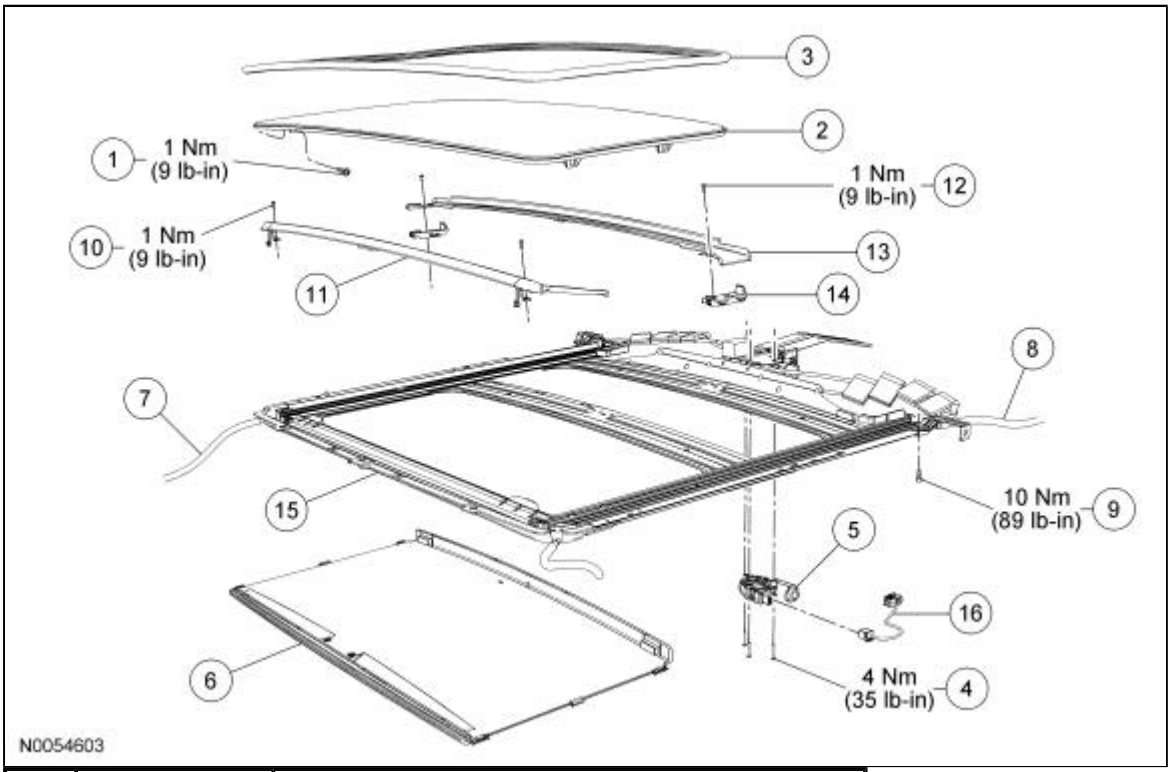
1. Position the roof opening panel in the CLOSED position.
2. Loosen the 4 roof opening panel glass screws.
3. Position the roof opening panel to the roof panel as specified.



4. Maintain the horizontal and vertical roof opening panel position, while adjusting and tighten the 4 roof opening panel screws to 4 Nm (35 lb-in).
5. Reinitialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel — Exploded View

Printable View (143 KB)



Item	Part Number	Description
1	502F24	Roof opening panel glass screw (4 required)
2	500A18	Roof opening panel glass
3	51884	Roof opening panel glass seal
4	15C682	Roof opening panel motor screw (3 required)
5	15790	Roof opening panel motor
6	519A02	Roof opening panel shield
7	502C52	Roof opening panel front drain hose (2 required)
8	502C53	Roof opening panel rear drain hose (2 required)
9	W711642-S424	Roof opening panel frame bolts (9 required)
10	502F36	Air deflector plastic tapping screw (2 required)
11	500A26	Air deflector
12	502F36	Trough assembly plastic tapping screw (2 required)
13	54022	Trough assembly
14	500A65	LH trough guide (RH trough guide part 78500A64)
15	502C22	Roof opening panel frame
16	15B673	Electrical harness

1. For additional information, refer to the procedures in this section.

Roof Opening Panel

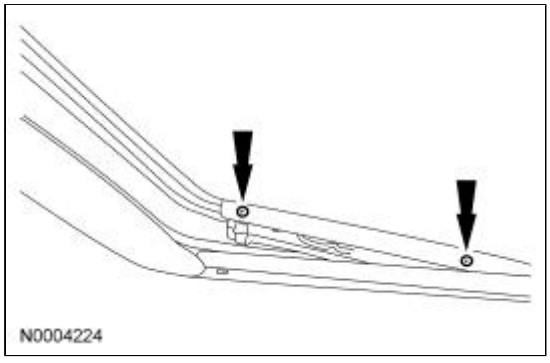
Printable View (97 KB)

Removal and Installation

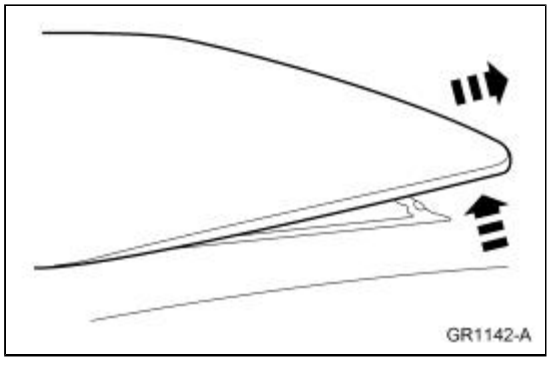
NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Position the roof opening panel in the VENT position.

2. Remove the 4 roof opening panel glass screws.
   - To install, tighten to 4 Nm (35 lb-in).



3. Remove the roof opening panel from the outside of the vehicle by lifting up and out.



4. To install, reverse the removal procedure.
   - Adjust the roof opening panel. For additional information, refer to Roof Opening Panel Alignment — Height Adjustment and Roof Opening Panel Alignment — Horizontal Adjustment in this section.

Roof Opening Panel Rear Trough Guide

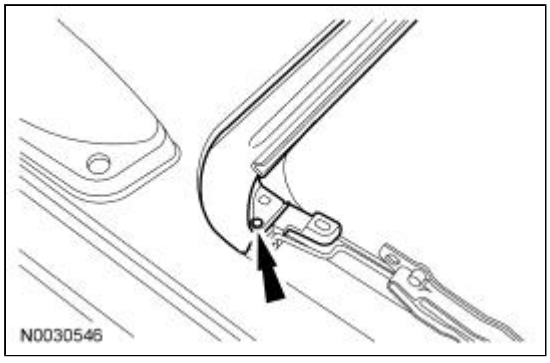
Printable View (185 KB)

Removal and Installation

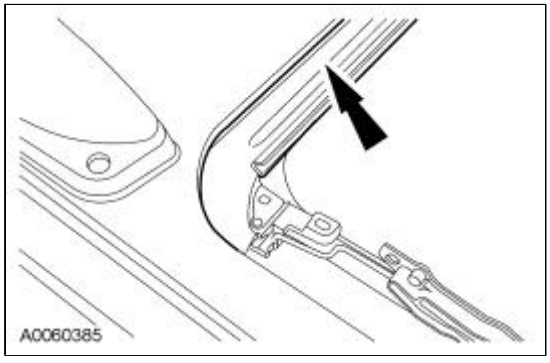
NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the roof opening panel. For additional information, refer to Roof Opening Panel in this section.

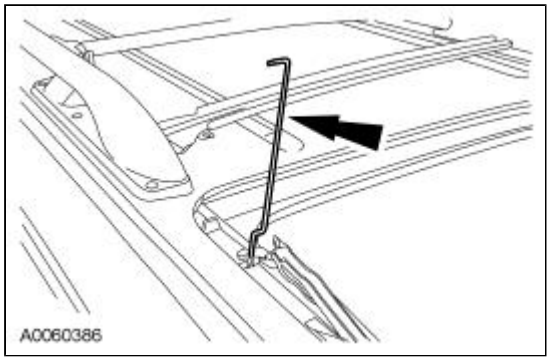
2. Remove the 2 trough guide retaining screws.
   - To install, tighten to 1 Nm (9 lb-in).



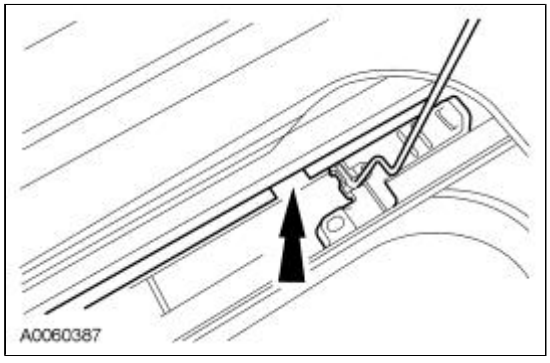
3. Remove the trough from the trough guide assembly.



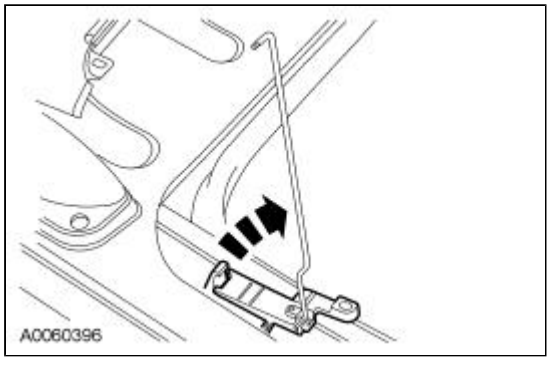
4. Disconnect the trough guide rods from the lifter arm assemblies.



5. Slide the trough guide back to the slot (approximately 15 mm [0.6 in]) cut in track.



6. Carefully twist trough guide through the slot in the track to remove.



7. Inspect the trough guide assembly for damage. If damage is found, inspect the track for broken pieces and remove them.

8. To install, reverse the removal procedure.

9. Adjust roof opening panel. For additional information, refer to Roof Opening Panel Alignment — Height Adjustment and Roof Opening Panel Alignment — Horizontal Adjustment in this section.

Roof Opening Panel Shield

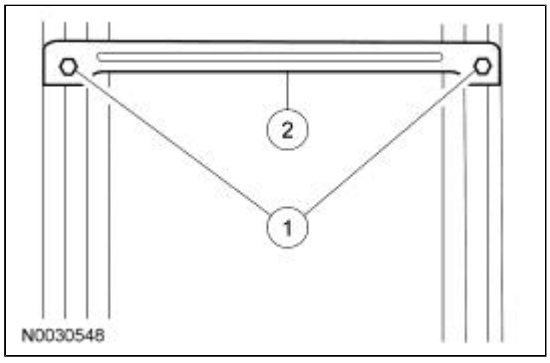
Printable View (105 KB)

Removal and Installation

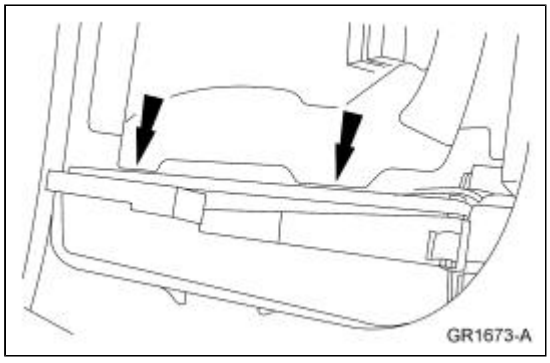
NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the roof opening panel glass. For additional information, refer to Roof Opening Panel in this section.

2. Remove the water trough.
   1. Remove the 2 screws.
      - To install, tighten to 1 Nm (9 lb-in).
   2. Remove the water trough.



3. Flex the opening shield to remove the guides from the tracks and remove the roof opening panel shield.



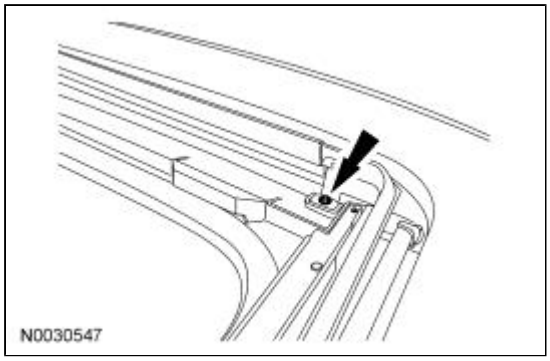
4. To install, reverse the removal procedure.

Air Deflector

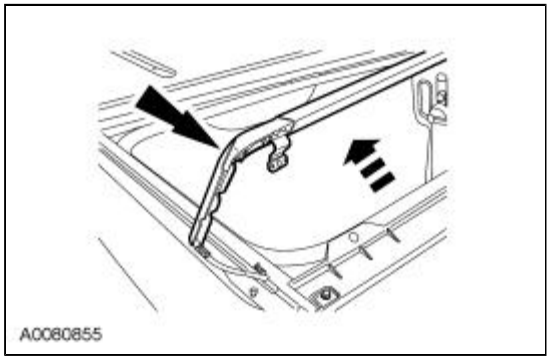
Printable View (138 KB)

1. Open the roof opening panel.
2. **NOTE:** RH side shown, LH similar.

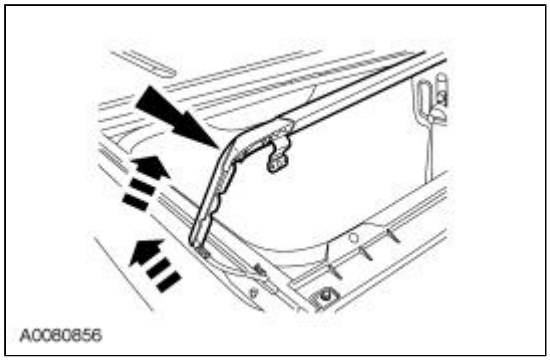
   Remove the 2 air deflector tether screws.
   - To install, tighten to 1 Nm (9 lb-in).



3. Raise the front of the air deflector.



4. Slide the air deflector toward the rear, then lift up to release it from the pivot shafts.



5. To install, reverse the removal procedure.

Roof Opening Panel Weatherstrip

Printable View (99 KB)

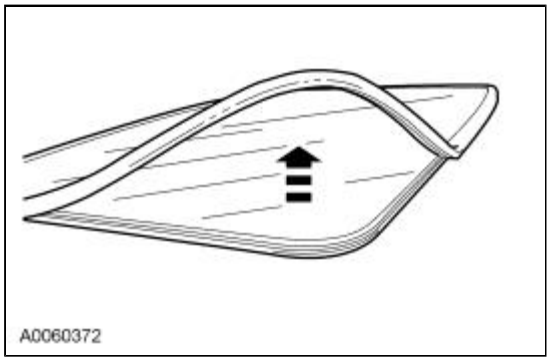
Removal

NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including: whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the roof opening panel. For additional information, refer to Roof Opening Panel in this section.

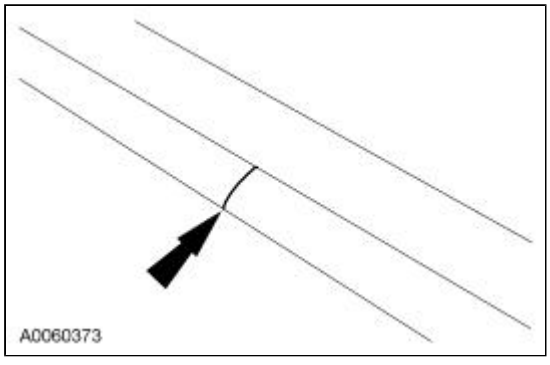
2. Place roof opening panel, topside up, on a worktable. Take care to support the glass assembly from below to prevent damaging the mounting tabs.

3. Remove the old roof opening panel weatherstrip by pulling up on the weatherstrip.



Installation

1. Place a new weatherstrip into position on the glass assembly, with the splice (seam) on the passenger side.



2. Starting with the corners, push the weatherstrip into position. Continue pushing the weatherstrip into position around the glass assembly until complete. Use a plastic or rubber hammer if necessary.

3. Install the roof opening panel. For additional information, refer to Roof Opening Panel in this section.

4. Adjust the roof panel. For additional information, refer to Roof Opening Panel Alignment — Height Adjustment and Roof Opening Panel Alignment — Horizontal Adjustment in this section.

Roof Opening Panel Motor

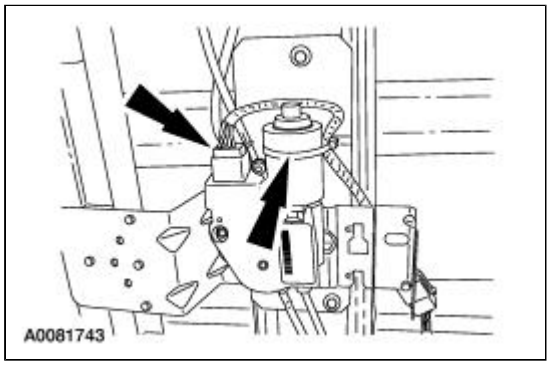
Printable View (118 KB)

Removal

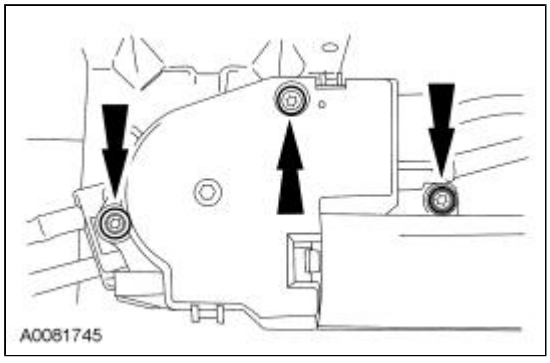
NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the headliner. For additional information, refer to Section 501-05 .

2. Disconnect the roof opening panel motor electrical connector and cut the tie strap.

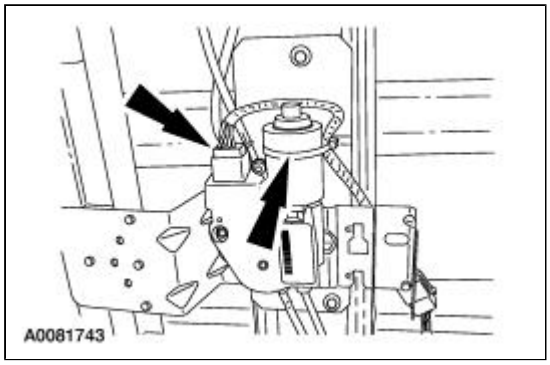


3. Remove the roof opening panel motor.
   - Remove the 3 screws.



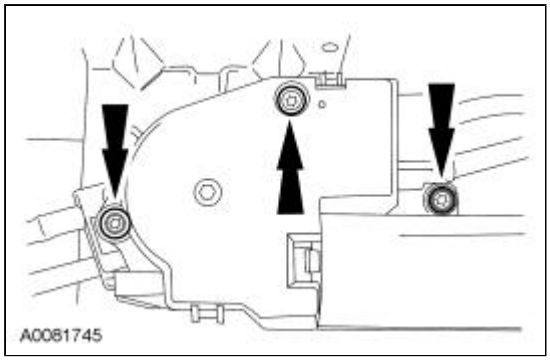
Installation

1. Connect the roof opening panel motor electrical connector. Install a new tie strap and trim off excess.



2. **NOTE:** When installing the roof opening panel motor/module, align the 3 attach holes before engaging the drive gear into the roof opening panel drive cable. Do not rotate the motor assembly after the drive gear is engaged with the roof opening panel drive cable. Otherwise, the cable can bind.

   Install the roof opening panel motor.
   - Align the attach holes, then install the 3 screws and tighten to 4 Nm (35 lb-in).



3. Connect the overhead console electrical connectors.

4. Initialize the roof opening panel motor/module. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

5. Disconnect the overhead console electrical connectors.

6. Install the headliner. For additional information, refer to Section 501-05 .

Roof Opening Panel Frame

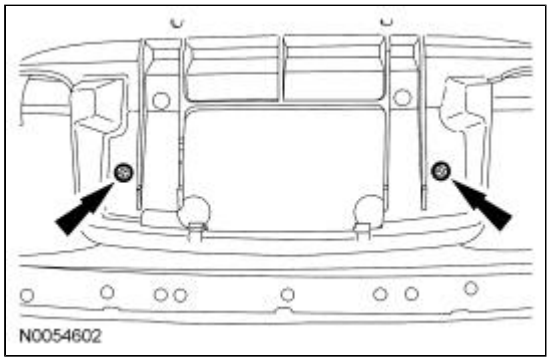
Printable View (138 KB)

Removal and Installation

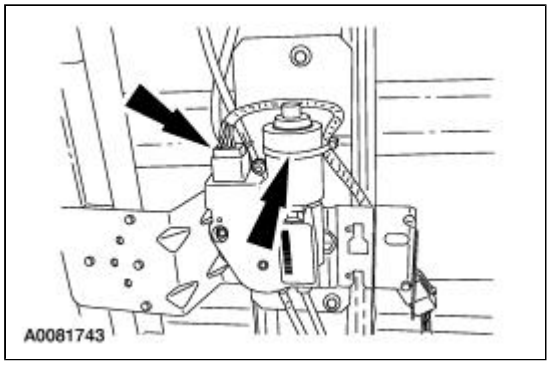
NOTE: The roof opening panel must be initialized when repairs are carried out on any part of the roof opening panel, including whenever the roof opening panel has been removed from the roof opening panel assembly, a new roof opening panel motor/module has been installed or when a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the headliner. For additional information, refer to Section 501-05 .

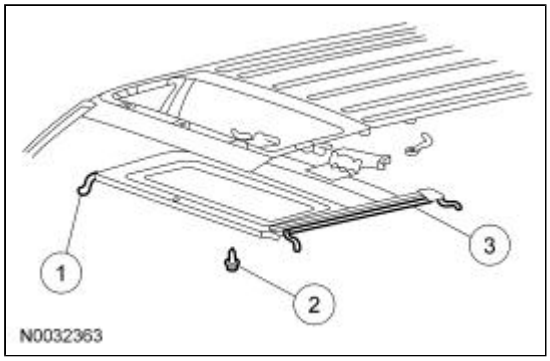
2. Remove the overhead console bracket.
   - Remove the screws.



3. Disconnect the electrical connector and cut the tie strap.



4. Remove the roof opening panel frame.
   1. Disconnect the 4 roof opening panel drain hoses.
   2. Remove the 11 bolts.
      - To install, tighten to 10 Nm (89 lb-in).
   3. Remove the roof opening panel frame.



5. To install, reverse the removal procedure. If a new roof opening panel frame is being installed, transfer the existing roof opening panel motor, air deflector, rear trough, roof opening panel glass and roof opening panel shield onto the new frame assembly.
    - Check for correct alignment of the roof opening panel. For additional information, refer to Roof Opening Panel Alignment — Horizontal Adjustment and Roof Opening Panel Alignment — Height Adjustment in this section.
    - Initialize the roof opening panel motor. Refer to Roof Opening Panel Motor Initialization in this section.

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Bumper cover-to-fender bolts	11	8	—
Front bumper nuts	90	66	—
Fender splash shield screws	3	—	27
Grille-to-radiator support bolts	4	—	35
Rear bumper cover nuts and bolts	8	—	71

Bumpers

Printable View (63 KB)

The bumper components consist of the following:

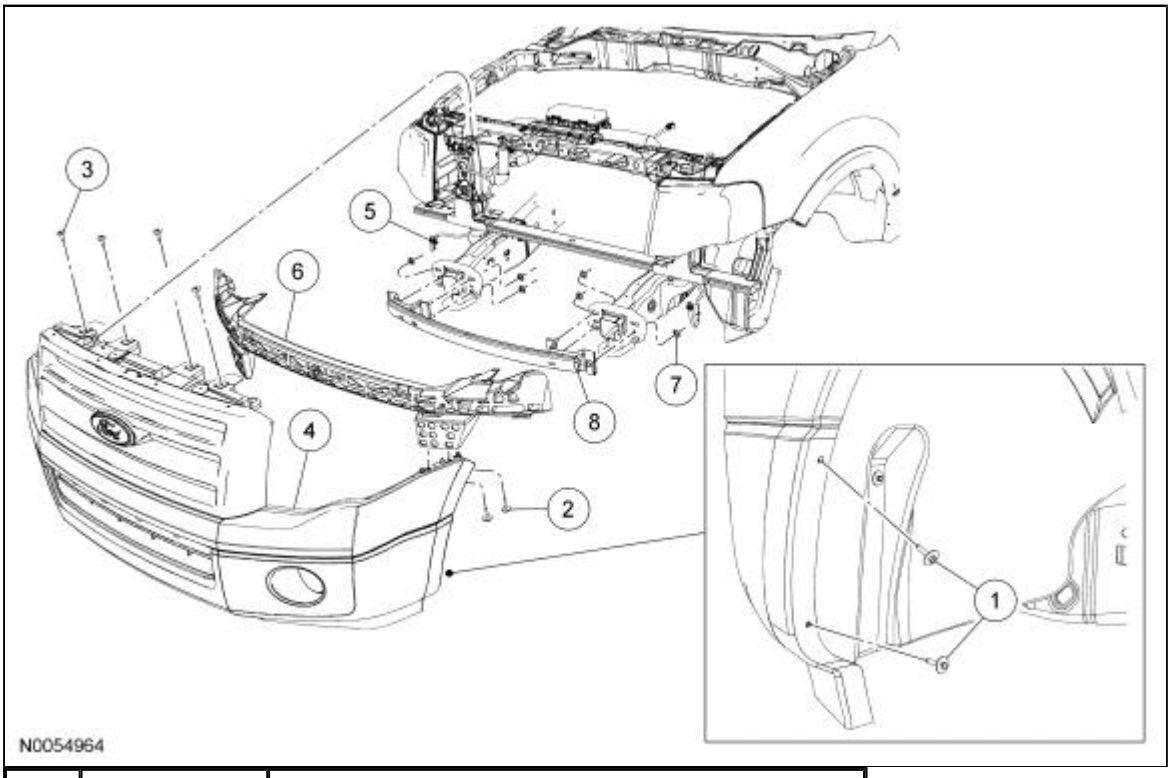
- Fog lamps (if equipped)
- Front bumper
- Front bumper cover
- Front bumper isolator
- Grille
- Rear bumper cover hitch cover
- Rear bumper cover
- Step pad

The trailer hitch is the rear bumper. For information on removal and installation, refer to Section 502-02 .

Bumper — Exploded View, Front

Printable View (195 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	W711401	Front fender splash shield screws (4 required)
2	W707522	Front bumper cover-to-fender bolt (4 required)
3	W712336	Grille-to-radiator support bolt (4 required)
4	17D597	Front bumper cover
5	15200	Fog lamp electrical connector
6	17C882	Isolator
7	W710807	Front bumper nut (6 required)
8	17757	Front bumper

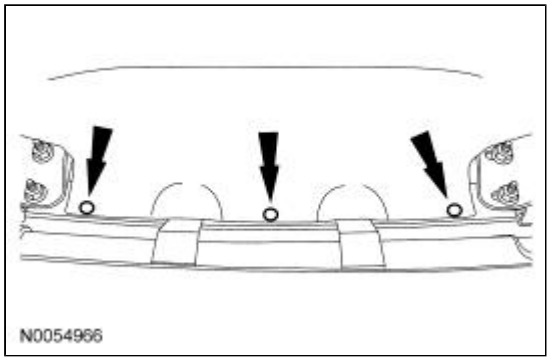
1. For additional information, refer to the procedures in this section.

Bumper Cover — Front

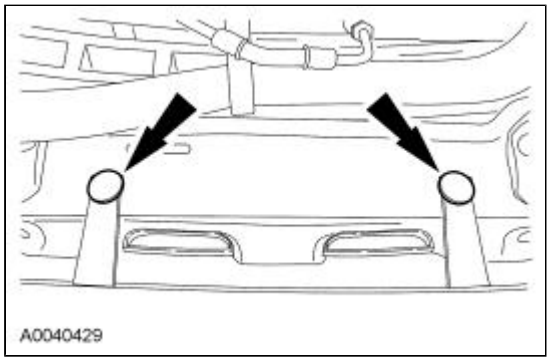
Printable View (170 KB)

Removal and Installation

1. Remove the 3 lower air deflector pin-type retainers.
   - Position the air deflector aside.



2. Remove the 2 front bumper cover lower pin-type retainers.

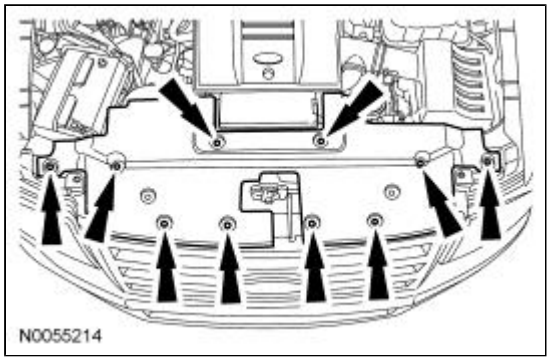


3. Remove the 4 LH and RH front fender splash shield screws.

4. Remove the 4 LH and RH front bumper cover-to-fender bolts.
   - To install, tighten to 11 Nm (8 lb-ft).

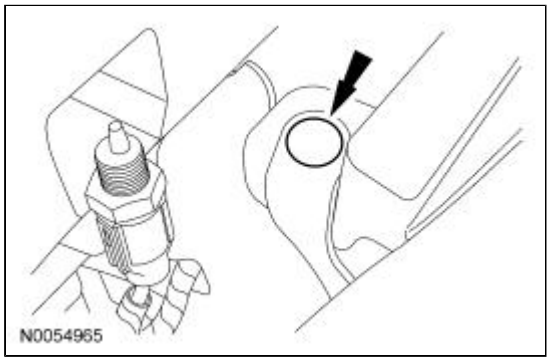
5. If equipped, disconnect the LH and RH fog lamp electrical connectors.

6. Remove the upper air deflector.
   - Remove the 10 pin-type retainers.



NOTE: Right side shown, left side similar.

7. Remove the 2 upper pin-type retainers for the lower air deflector.



8. Remove the 4 grille-to-radiator support bolts.
9. Remove the front bumper cover.
10. To install, reverse the removal procedure.

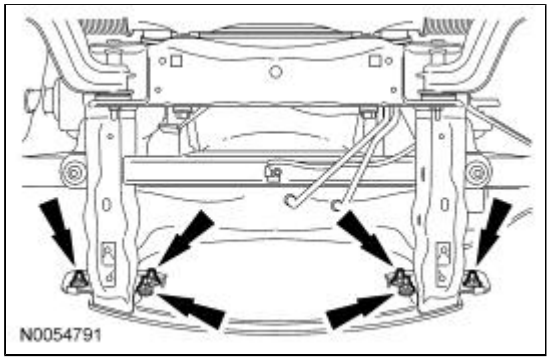
Bumper — Front

Printable View (92 KB)

Removal and Installation

1. Remove the front bumper cover. For additional information, refer to Bumper Cover — Front in this section.

2. Remove the front bumper.
   - Remove the 6 nuts.
   - To install, tighten to 90 Nm (66 lb-ft).

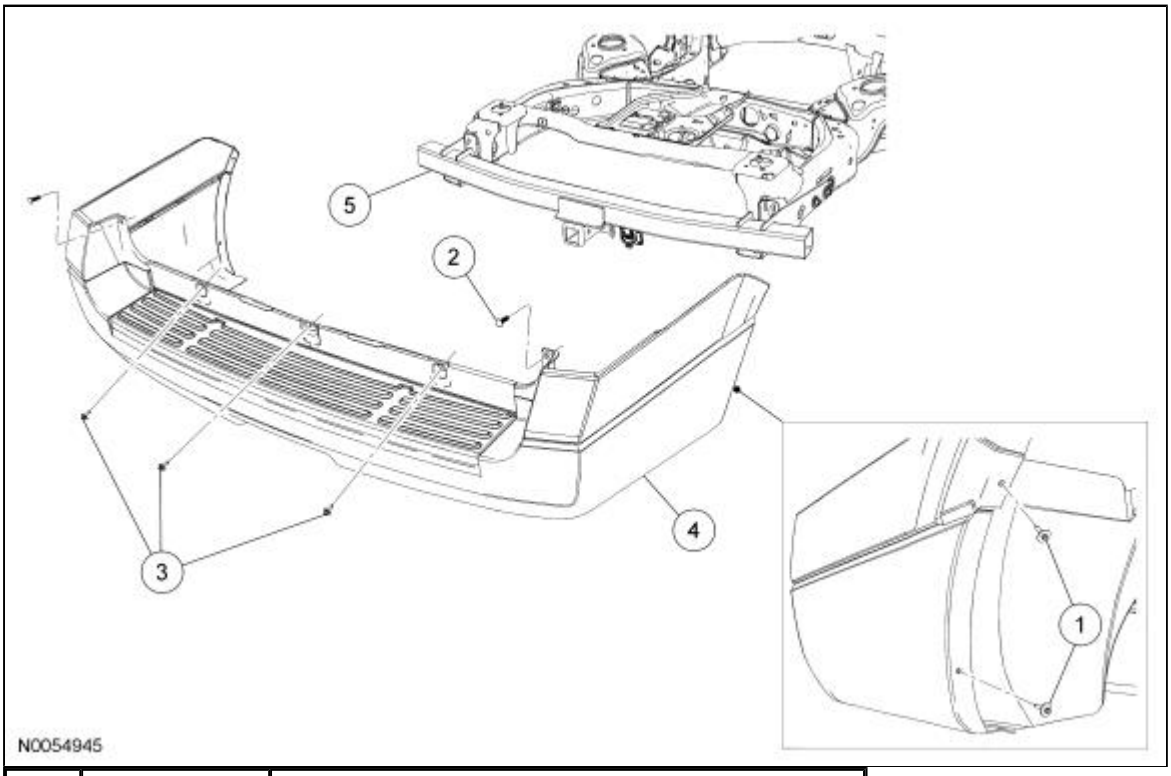


3. To install, reverse the removal procedure.

Bumper — Exploded View, Rear

Printable View (167 KB)

NOTE: Expedition shown, Navigator similar.



Item	Part Number	Description
1	W711401	Rear fender splash shield screws (4 required)
2	W708035	Pin-type retainer (2 required)
3	W705132	Rear bumper cover bolts (3 required)
4	17K835	Rear bumper cover
5	17775	Rear bumper

1. For additional information, refer to the procedures in this section.

Bumper Cover — Rear

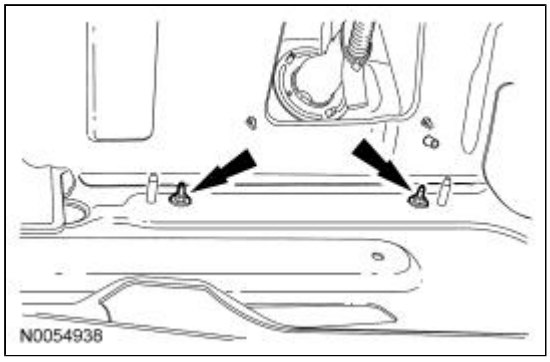
Printable View (158 KB)

Removal and Installation

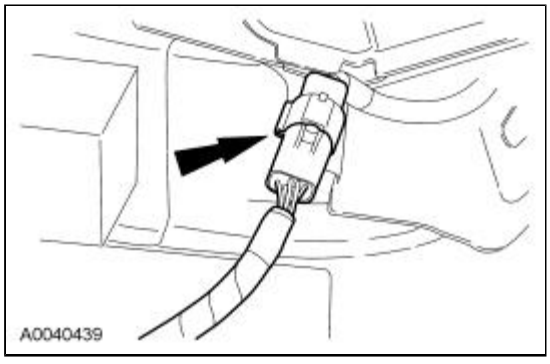
1. Remove the 4 LH and RH rear fender splash shield screws.

NOTE: Left side shown, right side similar.

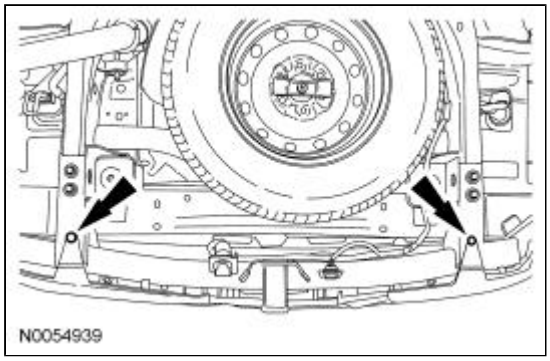
2. Remove the 4 LH and RH inner bumper cover nuts.



3. If equipped, disconnect the reverse parking aid electrical connector.



4. Remove the 2 rear bumper cover lower pin-type retainers.



5. Remove the rear bumper cover.
    - Remove the 2 rear bumper cover pin-type retainers and the 3 rear bumper cover bolts.

6. To install, reverse the removal procedure.

Printable View (63 KB)

Torque Specifications

Description	Nm	lb-ft
Front center safety belt buckle-to-floor bolt	40	30
Front center safety belt-to-seat frame bolt	55	41
Safety belt anchor-to-floor	40	30
Safety belt buckle and pretensioner nut	55	41
Safety belt D-ring bolt	40	30
Safety belt buckle-to-seat nut	55	41
Safety belt retractor bolt	40	30
Safety belt shoulder height adjuster bolt	40	30
Safety belt sling-to-roof bolt	40	30
Second row center safety belt anchor bolt-to-seat	55	41
Second row safety belt buckle-to-seat bolts	50	37
Third row center safety belt anchor bolt-to-seat	40	30
Third row child safety seat tether anchor bolt	28	21
Third row safety belt buckle-to-floor bolt	40	30
Third row safety belt buckle-to-seat bolts	40	30

Safety Belt System

Printable View (92 KB)

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

NOTE: If equipped, the second and third row rear center safety belt retractors may be equipped with a web stop button (small, thin, round button) located on the safety belt webbing. This button is only used for vehicle assembly and serves no other functional purpose. The button can possibly be retracted under the trim bezel making it difficult to pull the safety belt webbing out of the retractor. To service, remove this web stop button. Do not replace the safety belt retractor to eliminate this condition. Any resulting appearance concerns with the webbing can be worked out by hand.

All outboard safety belts, and second and third row center safety belts (if equipped) are continuous-loop, 3-point systems. The combination lap and shoulder belt (continuous-loop) uses a common slip tongue and retractor.

The shoulder harness retractor is designed to let the webbing move freely in and out at all times, except during vehicle hard braking, hard cornering or impact of 8 km/h (5 mph) or more, when it is automatically locked by a mechanically actuated inertia sensor.

When replacing safety belt buckles and/or retractor assemblies, use only the replacement parts specified in the Ford Customer Service Division Master Parts and Accessories Catalog.

Active Restraint System Components

The active restraint system consists of the following components in the locations described.

- Driver and front row outboard passenger safety belt buckle pretensioners, attached to the front seats.
- Front row outboard safety belt retractor, attached to the B-pillar sheet metal behind the trim panel.
- Front row center safety belt, with 60/40 bench seat, attached on top of the rear inboard 60 percent seat.
- Front row center safety belt buckle, with 60/40 bench seat, attached to the floor pan under the 60 percent seat.
- Front row safety belt shoulder height adjuster, attached to the B-pillar sheet metal behind the trim panel.
- Second row outboard safety belt retractor, attached to the quarter panel sheet metal behind the trim panel.
- Second row inboard safety belt retractor, with 20 percent seat, attached to the seat backrest frame.
- Second row inboard safety belt buckle, with 20 percent seat, attached to the side of the seat.
- Second row outboard safety belt buckle, attached to the side of the seat.
- Second row 40/20/40 seating, having child safety seat tether anchors welded to the seat cushion frame at all seating positions.
- Second row 40 percent bucket seats, having child safety seat tether anchors welded to the seat cushion frame at both seating positions.

- Second row 40/20/40 seating, having LATCH welded to the seat at all 3 seating positions.
- Second row 40 percent bucket seats, having LATCH welded to the seat cushion frame at both seating positions.
- Third row outboard safety belt retractor, attached to the D-pillar sheet metal behind the trim panel.
- Third row inboard safety belt retractor, attached to the 60 percent seat backrest frame.
- Third row RH safety belt buckle, attached to the side of the seat.
- Third row LH and center safety belt buckle assembly, attached to the floor pan under the 60 percent third row seat.
- Third row center child safety seat tether anchor, bolted to the 60 percent seat backrest frame.

Safety Belt Buckle and Pretensioner

All vehicles have a pretensioner system used with the front outboard safety belt buckles. This works in conjunction with the front air bag system mounted in the steering wheel and instrument panel.

The safety belt buckle and pretensioners are for the front outboard occupants, located on the inboard side of the seats. This allows the front safety belt buckle end to move with the front seat.

The safety belt buckle and pretensioner is a pyrotechnic device that removes excess webbing from the safety belt system. When the front air bag system is deployed, the pretensioner in the buckle deploys, causing the buckle to move downward, pulling excess webbing from the lap and shoulder safety belts.

If the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners, the driver and passenger seat belt system (including safety belt buckle and pretensioners, safety belt retractors and height adjusters) must be replaced.

If the ignition switch is turned to the ON or START position with the safety belt buckle pretensioner electrical connector(s) disconnected, the DTC and fault PIDs for an open circuit will be activated. For safety belt buckle pretensioner diagnostic information, refer to Section 501-20B .

For safety belt buckle pretensioner disposal information, refer to Section 501-20B .

Dual Locking Mode Retractors

WARNING: After any vehicle collision, the safety belt system at all outboard seating positions (except driver, which has no automatic locking retractor [ALR] feature) must be checked by a qualified technician to verify that the ALR feature for child seats is still functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when checked according to the procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: When replacing a dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.

All outboard continuous-loop, 3-point retractor systems, except the driver position, are equipped with the dual locking mode system.

The emergency locking retractor (ELR) mode will allow the occupant freedom of movement, locking tight only on hard braking, hard cornering or an impact of approximately 8 km/h (5 mph). The ELR mode helps to reduce the forward movement of the driver and passengers. The ELR mode is continuously in operation at all seating positions.

The automatic locking retractor (ALR) portion of this system does not allow the occupant freedom of movement. The ALR mode is used when locking a child seat in at a seating position or when a tight belt fit is desired. The ALR mode is automatically engaged when the webbing is fully extracted from the retractor and then allowed to retract. As the webbing is retracted back onto the spool, an audible clicking sound is made, indicating that the retractor is in ALR mode. The ALR mode is automatically disengaged when most of the webbing is retracted back onto the spool.

The automatic locking mode must be used when installing a child safety seat in the front or rear passenger seating positions where dual locking mode retractors are provided.

Energy Management Retractor

This vehicle has a safety belt system with an energy management feature at the front seating positions to help further reduce the risk of injury in the event of a head-on collision.

The energy management retractor feature is designed to pay out webbing in a controlled manner. This feature is designed to help reduce the belt force acting on the occupant's chest.

Safety Belt Extension Assembly

In certain cases, the safety belt may be too short, even when it is fully extended. About 20 cm (8 in) can be added to the belt length by using a safety belt extension. Safety belt extensions are available through any Ford or Lincoln Mercury dealer parts department at no cost. Safety belt extensions are only available with black webbing. There are 2 extension assemblies available, one for the front seating positions and one for the rear seating positions. They are not interchangeable. Only use extensions manufactured by the same supplier as the safety belt. Manufacturer identification is located at the end of the webbing on the label. Also, use the safety belt extension only if the safety belt is too short for you when fully extended. Do not use the extension to change the fit of the shoulder belt across the torso.

Attaching Safety Seats With Tether Straps

Some manufacturers make child safety seats that include a tether strap that goes over the back of the vehicle seat and attaches to an anchoring point. Other manufacturers offer the tether strap as an accessory. Contact the manufacturer of the child safety seat for information about ordering a tether strap.

Child safety seat tether anchors are manufactured into the vehicle. See the active restraint system component location at the beginning of this section or the owner's literature for locations.

For removal and installation of child safety seat tether anchors, refer to the appropriate procedure in this section or Section 501-10 for seat cushion frame replacement.

Lower Anchors and Tethers for Children (LATCH)

The lower anchors and tethers for children (LATCH) system is a standardized and uniform attachment system for installing child safety seats in passenger vehicles. LATCH-equipped child safety seats have 2 lower attachments that connect to the vehicle portion of the LATCH system.

The vehicle portion of the system consists of 2 attachment points (6 mm wires) welded to the rear seat cushion frame. The attachment points protrude from the bite line between the seat cushion and seat backrest.

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage.

If any of the attachment points (6 mm wires) are damaged, install a new seat cushion frame.

Warning System — Driver Safety Belt

The driver safety belt incorporates a safety belt warning indicator switch, warning indicator and chime. The warning indicator and chime are reminders to fasten the safety belt.

- If the driver safety belt is not buckled before the ignition key is turned to ON, the safety belt warning light illuminates for 1 to 2 minutes and the warning chime sounds for 4 to 8 seconds.
- If the driver side safety belt is buckled while the indicator light is illuminated and the warning chime is sounding, the safety belt warning light and warning chime turn OFF.
- If the safety belt is buckled before the key is turned to the ON position, the warning indicator will come on for 4 to 8 seconds with no chime.

Belt Minder

The Belt Minder feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders to the driver that the driver's safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster.

To activate or deactivate the Belt Minder feature, refer to Section 413-09 or the owner's literature.

If...	Then...
The driver's safety belt is not buckled approximately 5 seconds after the safety belt warning light has turned off...	The Belt Minder feature is activated — the safety belt warning light illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until safety belt is buckled.
The driver's safety belt is buckled while the safety belt indicator light is illuminated and the safety belt warning chime is sounding...	The Belt Minder feature will not activate.
The driver's safety belt is buckled before the ignition switch is turned to the ON position...	The Belt Minder feature will not activate.

Safety Belt System

Printable View (89 KB)

Inspection and Verification

1. Verify the customer's concern by operating the active restraint system to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
• Safety belt webbing integrity • Safety belt buckle and tongue assembly • Safety belt retractor	• Open fuse • Bare, broken or disconnected wire • Connector not tightly engaged • Safety belt warning indicator lamp burned out or broken

3. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. With the exception of removing a twist from the safety belt webbing, do not attempt to repair a component of the safety belt system; new components must be installed.
4. If the concern remains after the inspection, determine the symptom. GO to Symptom Chart .
5. To check the active restraint system for correct operation, carry out the appropriate Functional Test(s).

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• The safety belt warning indicator lamp does not operate, the safety belt warning chime is OK	• Burned-out bulb • Circuitry • Instrument cluster	• REFER to Section 413-01 .
• Neither the safety belt warning chime nor the safety belt warning indicator lamp operates	• Safety belt switch • Lighting control module • Restraint control module • Circuitry	• REFER to Section 501-20B .
• Excessive pressure on the	• Front safety	• CARRY OUT the

occupant during normal wear, the webbing cannot be extracted, excessive slack in webbing does not retract	belt retractor and tongue ● Rear safety belt retractor and tongue	component Functional Test in this section. INSTALL a new retractor if necessary.

Component Test

Carry out the appropriate Functional Test(s) as determined in Inspection and Verification.

Functional Test — Buckle and Tongue

The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).

1. Verify the following during the latching sequence:
    - Tongue insertion is not hindered by excessive effort.
    - A "click" is heard when the buckle latches the tongue.

2. Verify the system integrity by forcefully pulling on the belt webbing.

3. Unlatch the belt by fully depressing the buckle release button, and allowing the belt to release and retract.

4. Verify the following during the unlatching process:
    - Push-button depression does not require excessive effort.
    - Tongue can be removed easily from the buckle.
    - Repeat the above steps 3 times.

5. If the inspection reveals an obvious concern(s) that can be readily identified, install a new safety belt buckle or safety belt retractor assembly as required. Do not attempt to perform any repair on the buckle and tongue assembly. If a concern still exists with either component, a new safety belt buckle and safety belt and retractor assembly must also be installed.

Functional Test — Retractor

The safety belt and retractor assembly must be freely operational for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.

1. Extract and retract the safety belt between the full extension and stowed positions.

2. Verify the retractor operates without excessive effort or binding.

3. Install a new safety belt buckle retractor and tongue assembly if no obvious concerns are noticed and the complaint has been verified.

Functional Test — System Road Test Inspection

1. **NOTE:** If the RH or the rear safety belts are to be tested, a passenger must be used.

Fasten the safety belts and proceed to a safe area.

2. Attain a speed of 8 km/h (5 mph).

3. **WARNING: The driver and passenger must be prepared to brace themselves if the retractor does not lock.**

   Test the safety belts.
   1. Grasp the shoulder harness and prepare to lean forward.
   2. **WARNING: The maximum brake application should be on dry concrete or equivalent hard surface, NEVER on wet pavement or gravel.**

      WARNING: The driver and passenger must be prepared to brace themselves in the event the retractor does not lock.

      NOTE: Do not jerk on the safety belt webbing when carrying out this test. Lean forward slightly when the brake application is made.

      Make a maximum brake application without a skid.

4. The safety belts should lock up with minimum webbing extension.

5. If there is a lockup of both shoulder straps, the safety belt assemblies are functioning correctly. Should either or both retractors fail to lock up at the 8 km/h (5 mph) speed, repeat the test at a constant 24 km/h (15 mph) speed. (This test must be carried out with a RH front or rear passenger if the RH front or rear outboard safety belts are to be tested.)

6. **CAUTION: Before installing a new safety belt assembly, inspect the mounting area for damage and distortion. If the retractor of a new safety belt assembly has been bolted into a damaged or distorted mounting area, the retractor could be warped and may not function. If this is the case, remove the retractor, return the sheet metal to the original configuration and install another complete safety belt assembly.**

   If either or both retractors do not lock up at the 24 km/h (15 mph) test, return the vehicle for service of malfunctioning safety belts.

Functional Test — Automatic Locking Retractor

WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

1. Position the seat back into the full up position.

2. Position the height adjuster in the full down or up position.

3. Latch the seat belt buckle and tongue assembly.

4. Pull the shoulder belt out until the automatic locking retractor (ALR) feature is activated.

5. Release the shoulder belt and allow it to retract until it stops.

6. Pull on the shoulder belt to check that the belt has remained in the ALR mode. If the belt is not locked, install a new safety belt and retractor assembly.

7. Unlatch the safety belt tongue from the buckle and allow the safety belt to retract to its stowed position.

8. Pull the shoulder belt to verify the retractor assembly has converted automatically out of the ALR mode. If the shoulder belt remains locked in the stowed position, install a new safety belt and retractor assembly.

Safety Belt Procedure After a Collision

Printable View (79 KB)

1. **WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.**

   NOTE: Safety belt assemblies should be periodically inspected to make sure they have not become damaged and that they remain in correct operating condition, particularly if they have been subjected to severe stress.

   Before installing the new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be reworked back to its original shape and structural integrity.

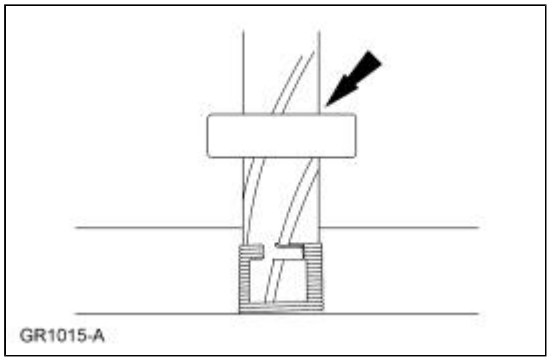
   Install the new safety belt(s) using the appropriate instructions. Carry out the Functional Test.

Safety Belt Shoulder Height Adjuster With Stripped Weld Nuts

Printable View (99 KB)

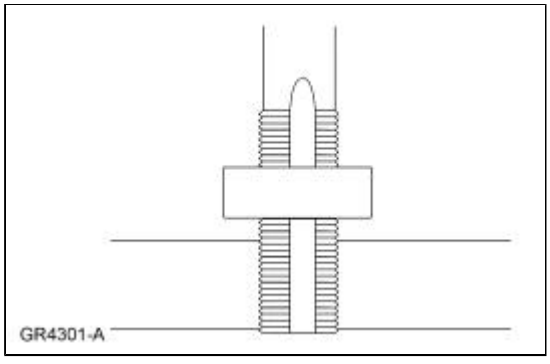
1. Remove the B-pillar trim panel. For additional information, refer to Section 501-05 .

2. Use the half-inch drill with integral stop to drill out the damaged threads in the upper pillar structure.

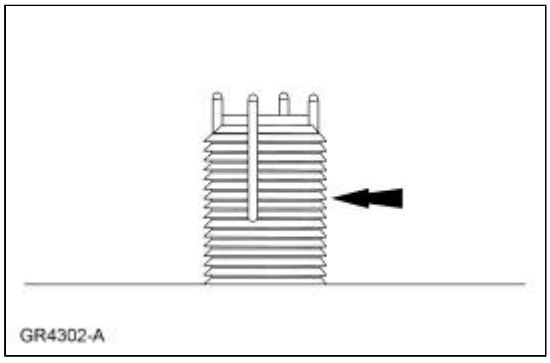


3. **NOTE:** After each rotation, back off tap slightly to remove new cuttings and be sure to blow out any chips before proceeding.

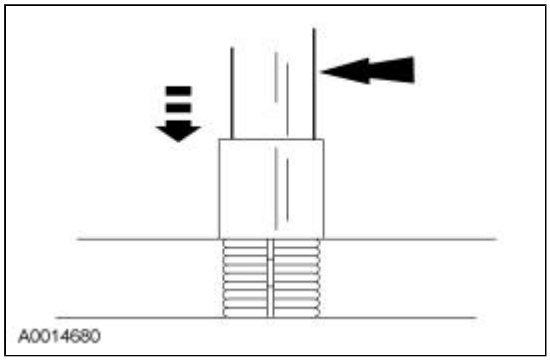
   Apply a suitable lubricant to the M14 x 1.5 tap with integral stop and tap new threads.



4. Use a threaded insert and screw it into the retapped hole until it is slightly below the surface.



5. Use a hammer to lightly tap the installation tool several times to seat the insert keys.

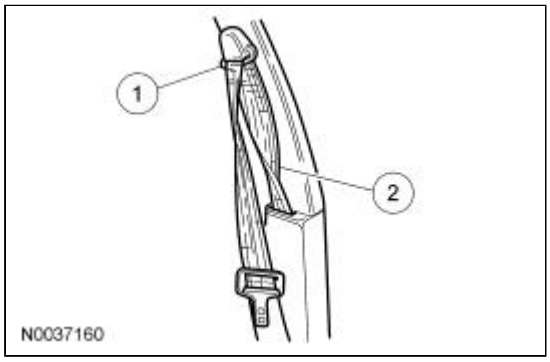


6. If the bolt(s) on the height adjuster is not stripped, reinstall the original safety belt shoulder height adjuster. If the bolt(s) is stripped, install a new safety belt shoulder height adjuster. For additional information, refer to the appropriate height adjuster procedure in this section.

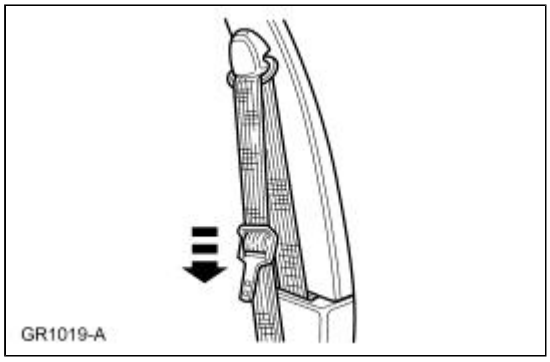
Safety Belt Twisted at the Safety Belt Guide — Outboard

Printable View (90 KB)

1. Straighten the twisted belt webbing.
    1. Grasp webbing at the safety belt guide.
    2. Feed twisted portion of webbing up through safety belt guide.



2. Pull straightened belt downward to check for correct operation.



Safety Belt Cleaning

Printable View (79 KB)

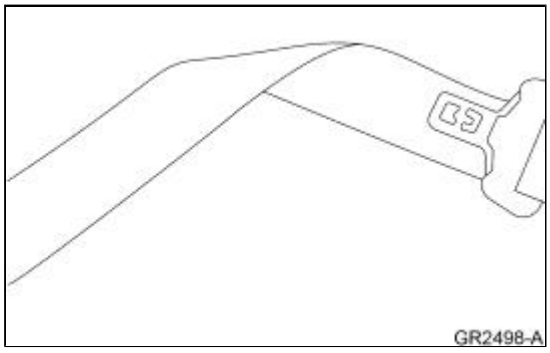
1. **WARNING: Do not bleach or re-dye the webbing, as the webbing may weaken.**

   Clean the safety belt webbing only with a mild soap solution recommended for cleaning upholstery or carpets. Follow the instructions provided with the soap.

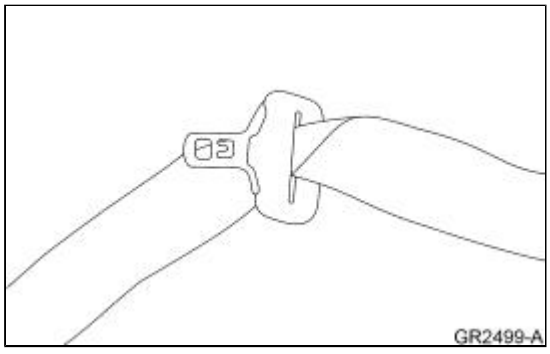
Safety Belt Tongue Rotated on Belt

Printable View (77 KB)

1. Fold the safety belt as indicated.

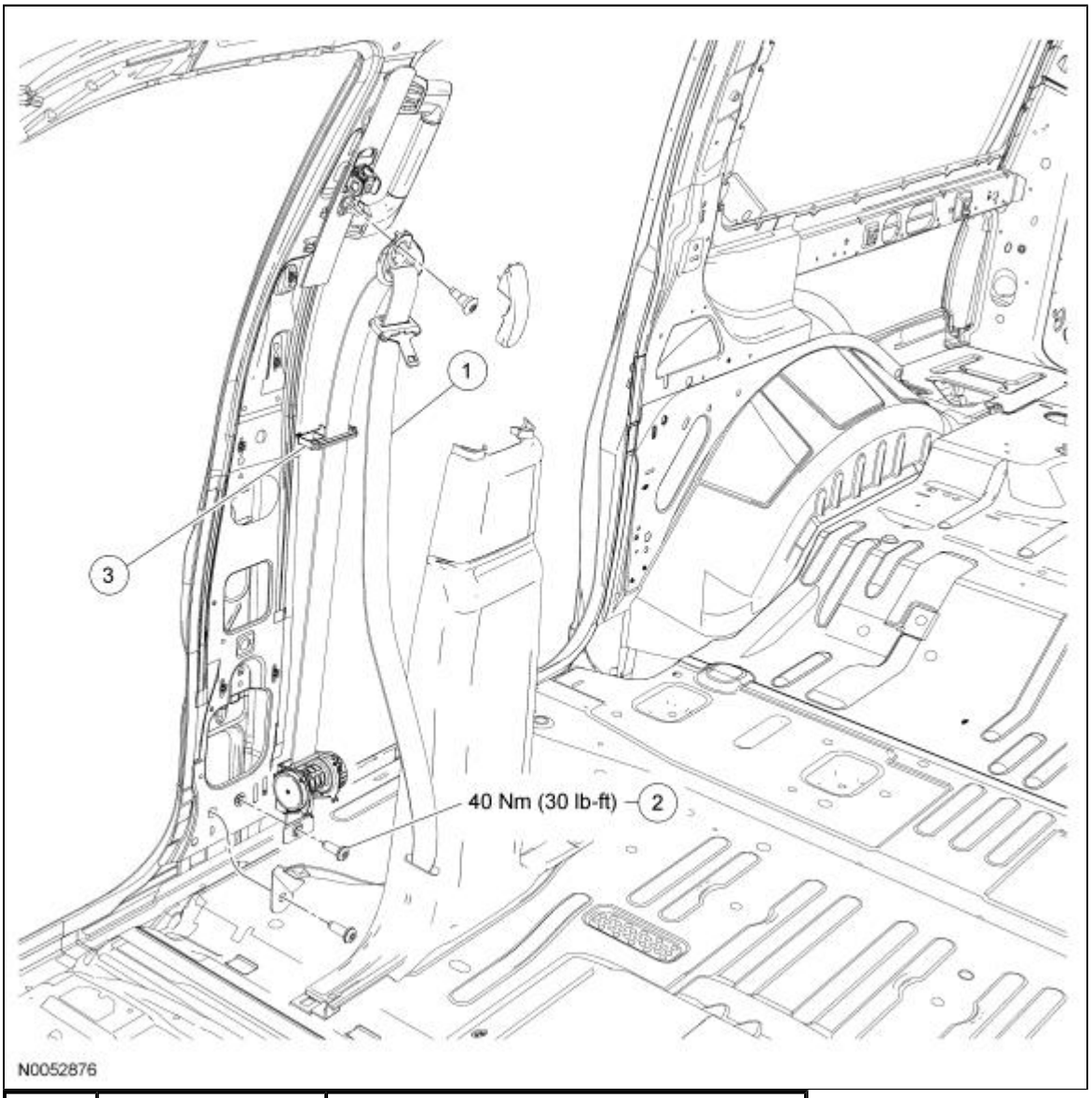


2. Pull the safety belt tongue over the fold in the safety belt.



Safety Belt Retractor — Front

Printable View (316 KB)



Item	Part Number	Description
1	611B08	Safety belt retractor assembly
2	—	Bolt, safety belt retractor
3	—	Safety belt guide

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: RH shown, LH similar.

1. **NOTE:** Inspect the D-ring cover for damage. If the cover is damaged or does not remain closed, install a new D-ring cover.

   Remove the upper and lower B-pillar trim panels. For additional information, refer to Section 501-05 .

2. Release the 2 pin-type retainers and safety belt guide.

3. Remove the bolt and safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

4. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

   NOTE: When installing the safety belt retractor, make sure to engage the anti-rotation tab to the sheet metal

   NOTE: Remove the shipping clip after safety belt retractor installation.

   To install, reverse the removal procedure.

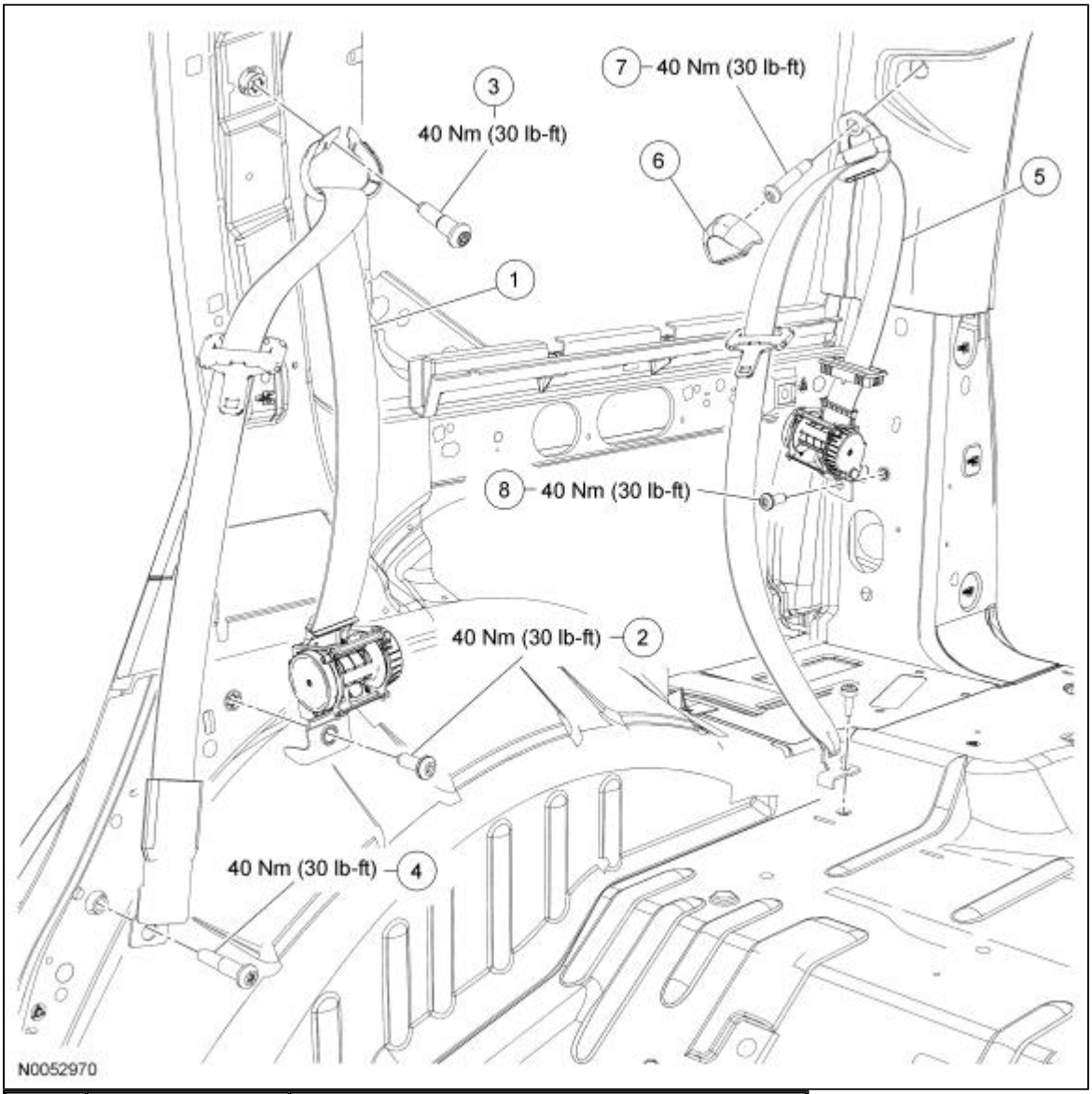
5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Retractor — Second Row and Third Row, Outboard

Printable
View (532 KB)

Expedition/Navigator

NOTE: RH shown, LH similar.

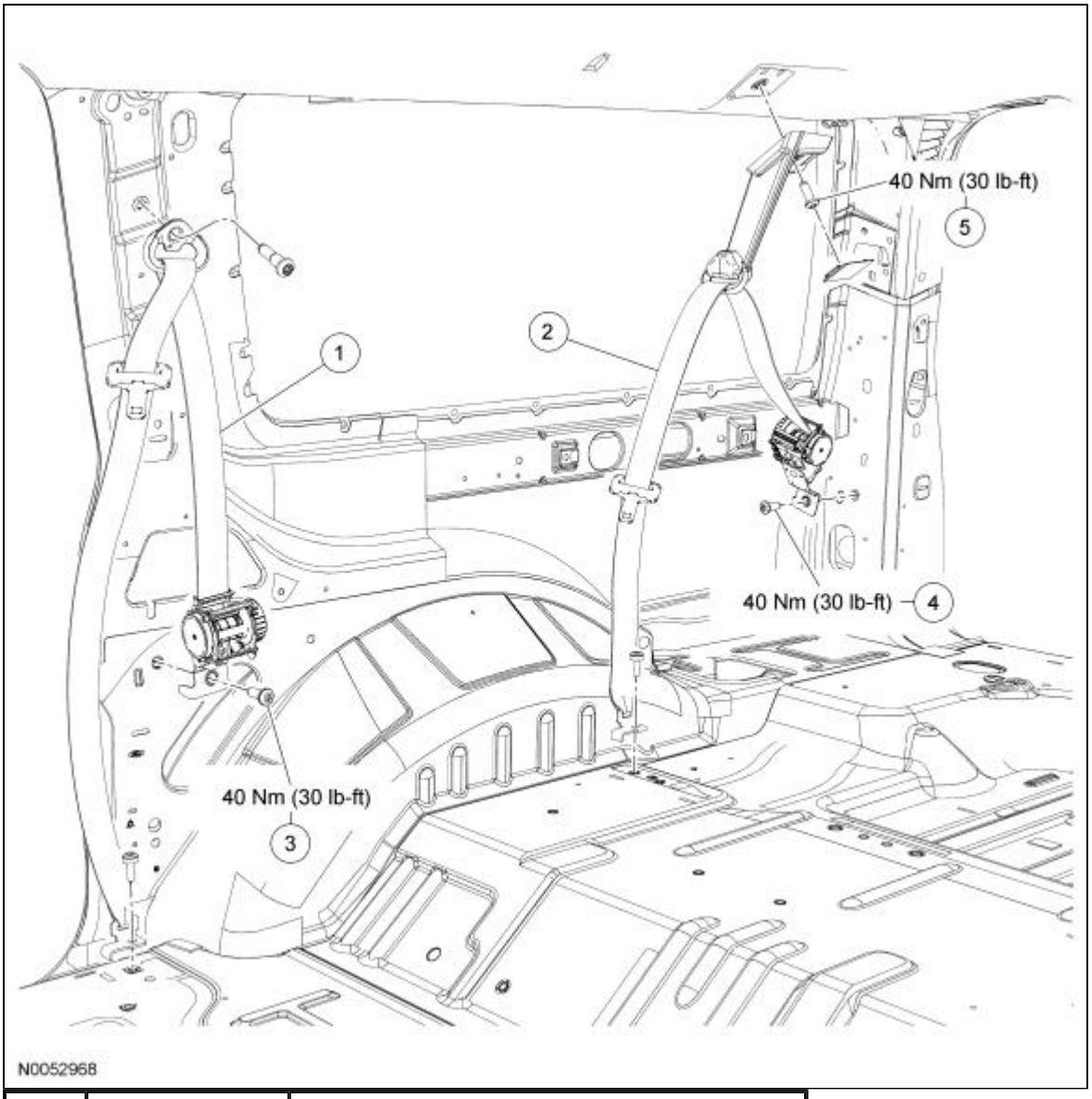


Item	Part Number	Description
1	611B68	Second row, safety belt retractor
2	N808774	Bolt, second row safety belt retractor
3	N808774	Bolt, second row D-ring
4	N808774	Bolt, second row safety belt anchor
5	611B68	Third row, safety belt retractor
6	—	D-ring cover, third row

7	—	Bolt, third row D-ring
8	N808774	Bolt, third row safety belt retractor

Expedition EL/Navigator L

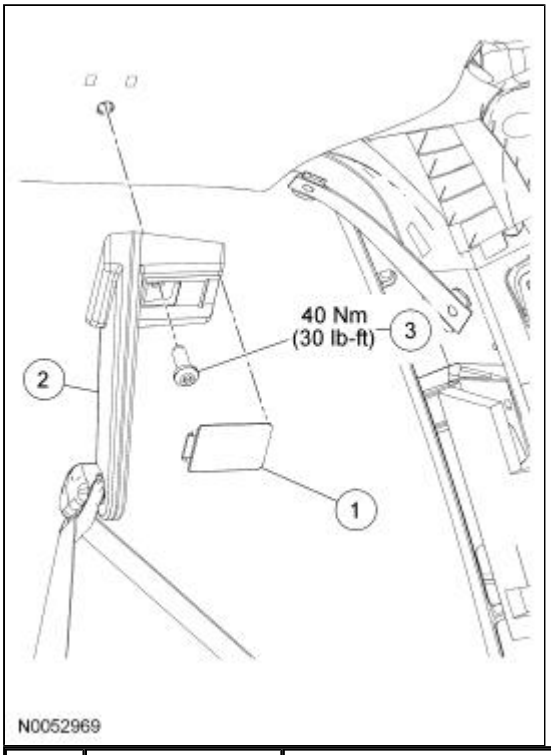
NOTE: RH shown, LH similar.



Item	Part Number	Description
1	611B68	Second row, safety belt retractor
2	611B68	Third row, safety belt retractor
3	N808774	Bolt, second row safety belt retractor
4	N808774	Bolt, third row safety belt retractor
5	N807750S	Bolt, third row safety belt sling

Safety Belt Retractor Sling, Expedition EL/Navigator L, 3rd Row

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	—	Cover, sling
2	N807750S	Bolt, third row safety belt sling
3	—	Third row safety belt sling (part of 611B68)

Removal and Installation

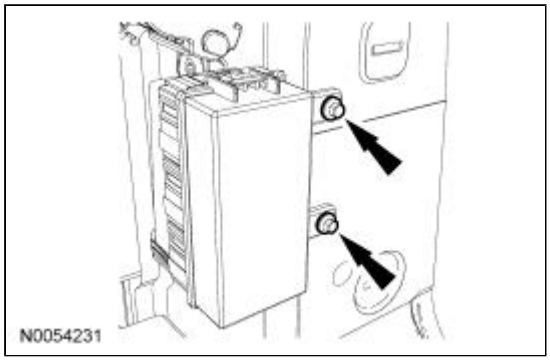
WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: RH shown, LH similar.

Both retractors

1. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .
2. For RH 3rd row safety belt retractor, remove the 2 screws and position aside the auxiliary relay box, if equipped.



Second row retractor (Expedition/Navigator)

3. Remove the safety belt anchor bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

4. **NOTE:** Inspect the D-ring cover for damage. If the cover is damaged or does not remain closed, install new D-ring cover and bolt.

   Open the D-ring cover and remove the D-ring bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

5. Remove the bolt and safety belt retractor.
    - To install, tighten to 40 Nm (30 lb-ft).

Second row retractor (Expedition EL/Navigator L)

6. **NOTE:** Inspect the D-ring cover for damage. If the cover is damaged or does not remain closed, install new D-ring cover and bolt.

   Open the D-ring cover and remove the D-ring bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

7. Remove the bolt and safety belt retractor.
    - To install, tighten to 40 Nm (30 lb-ft).

Third row retractor (Expedition/Navigator)

8. Open the D-ring cover and remove the D-ring bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

9. Remove the bolt and safety belt retractor.
    - To install, tighten to 40 Nm (30 lb-ft).

Third row retractor (Expedition EL/Navigator L)

10. Remove the sling cover and bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

11. Remove the bolt and safety belt retractor.
    - To install, tighten to 40 Nm (30 lb-ft).

Both retractors

12. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

NOTE: Before installing the third row safety belt anchor, make sure the floor slotted plastic insert is still present. If it is not, another insert must be installed.

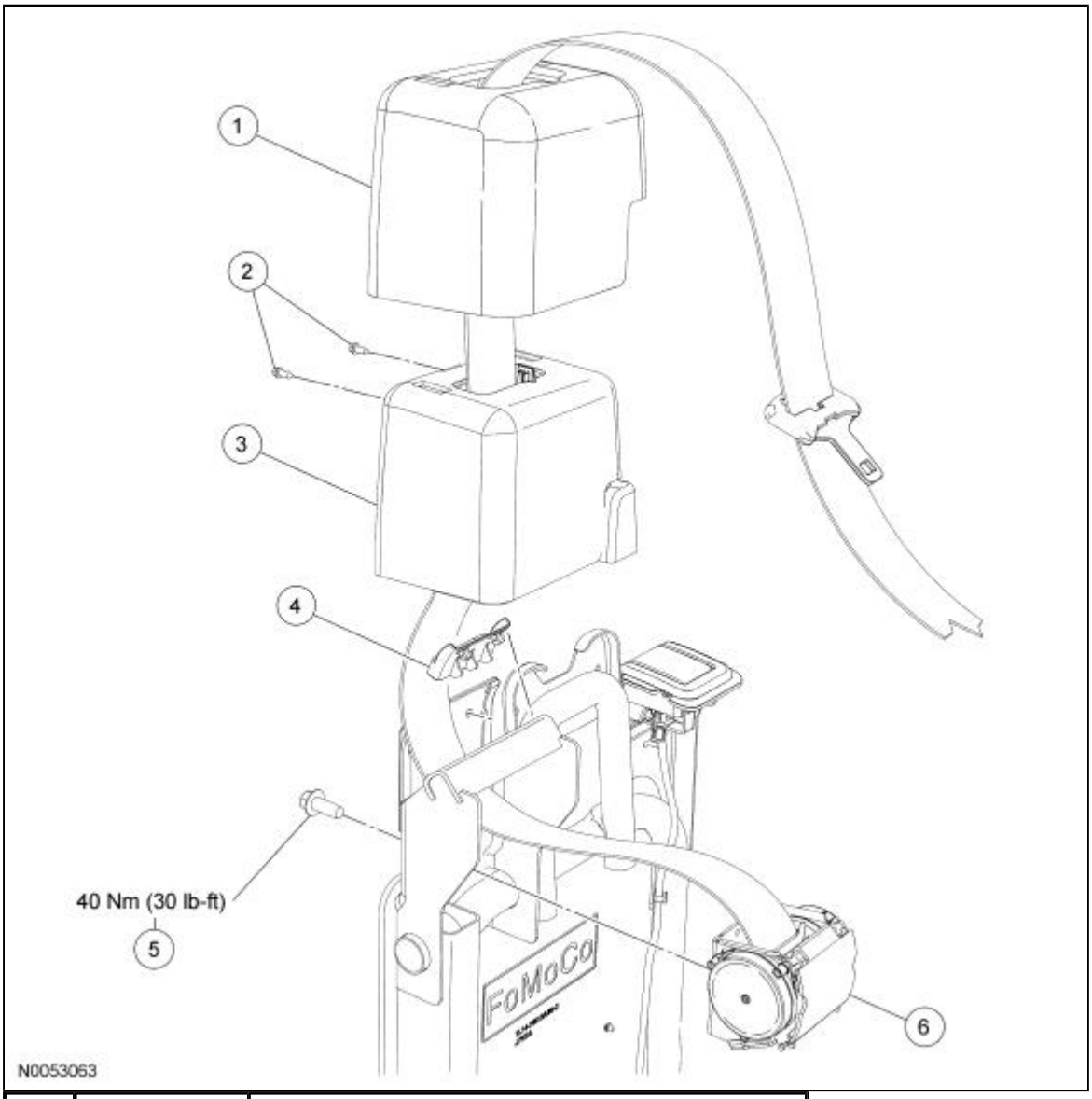
NOTE: When installing the safety belt retractor, make sure to engage the anti-rotation tab to the sheet metal.

To install, reverse the removal procedure.

13. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Retractor — Second Row, Center

Printable View (187 KB)



Item	Part Number	Description
1	611D52	Foam, safety belt retractor cover
2	W504042	Screws, safety belt retractor cover (2 required)
3	613C46	Safety belt retractor cover
4	—	Safety belt retractor guide (part of 611B64)
5	W505274	Bolt, safety belt retractor
6	611B64	Safety belt retractor

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether

attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: The retractor may be equipped with an additional web stop button (small, thin, round button, not to be confused with the larger web stop button) located on the safety belt webbing. This button is only used for vehicle assembly and serves no other functional purpose. The button can possibly be retracted under the trim bezel making it difficult to pull the safety belt webbing out of the retractor. To service, remove this web stop button. Do not install a new safety belt retractor to eliminate this condition. Any resulting appearance concerns with the webbing can be worked out by hand. For additional information, refer to Safety Belt System in this section.

1. Remove the second row 20 percent seat backrest trim cover. For additional information, refer to Section 501-10 .

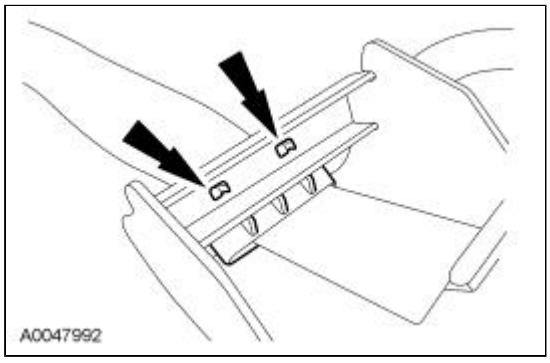
2. Remove the seat backrest foam pad.

3. Remove the safety belt retractor cover foam.

4. Remove the 2 screws from the seat belt retractor cover and remove the cover.

5. Remove the safety belt retractor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

6. Pinch and release the safety belt retractor guide from the seat backrest frame and remove the safety belt retractor.



7. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

   NOTE: When installing the safety belt retractor, make sure to engage the anti-rotation tab to the sheet metal.

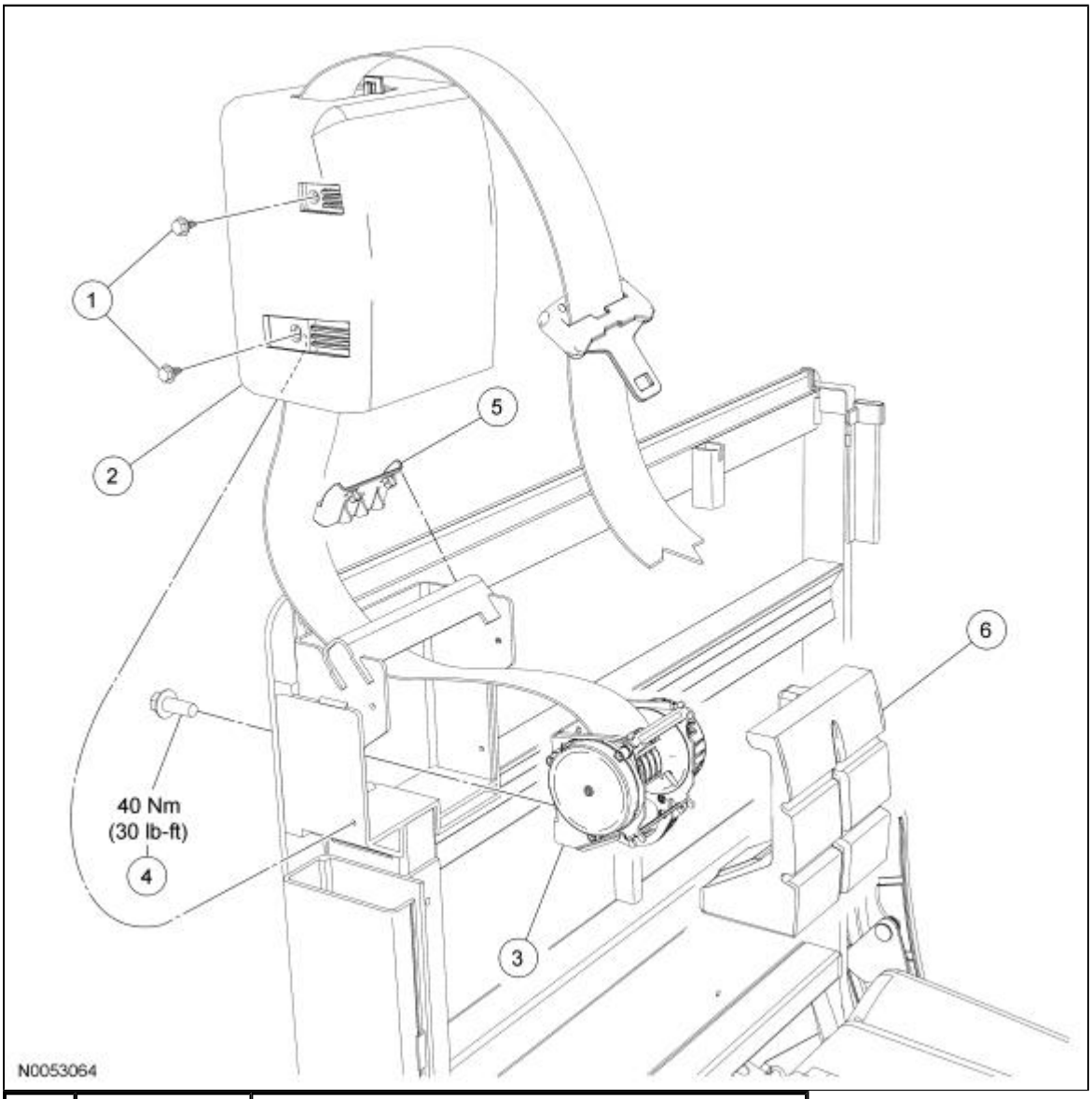
   NOTE: Remove the shipping clip after safety belt retractor installation.

   To install, reverse the removal procedure.

8. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Retractor — Third Row, Center

Printable View (217 KB)



Item	Part Number	Description
1	W708687	Screw, safety belt retractor cover (4 required)
2	613C46	Safety belt retractor cover
3	611B64	Safety belt retractor
4	—	Bolt, safety belt retractor (part of 611B64)
5	—	Safety belt retractor guide (part of 611B64)
6	—	Safety belt retractor insulator (part of 611B64)

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether

attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: The retractor may be equipped with an additional web stop button (small, thin, round button, not to be confused with the larger web stop button) located on the safety belt webbing. This button is only used for vehicle assembly and serves no other functional purpose. The button can possibly be retracted under the trim bezel making it difficult to pull the safety belt webbing out of the retractor. To service, remove this web stop button. Do not install a new safety belt retractor to eliminate this condition. Any resulting appearance concerns with the webbing can be worked out by hand.

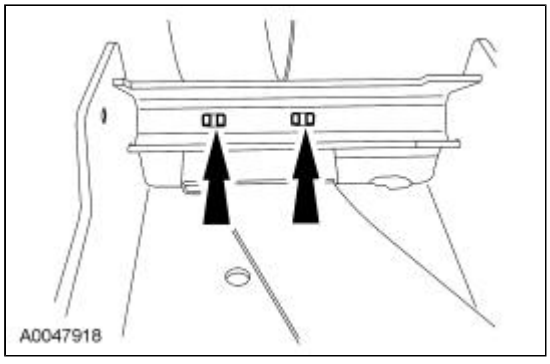
1. Remove the third row 60 percent seat backrest trim cover. For additional information, refer to Section 501-10 .

2. Remove the seat backrest foam pad.

3. Remove the 4 screws from the seat belt retractor cover (2 shown).

4. Remove the safety belt retractor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

5. Pinch to release the safety belt retractor guide and remove the safety belt retractor.



6. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

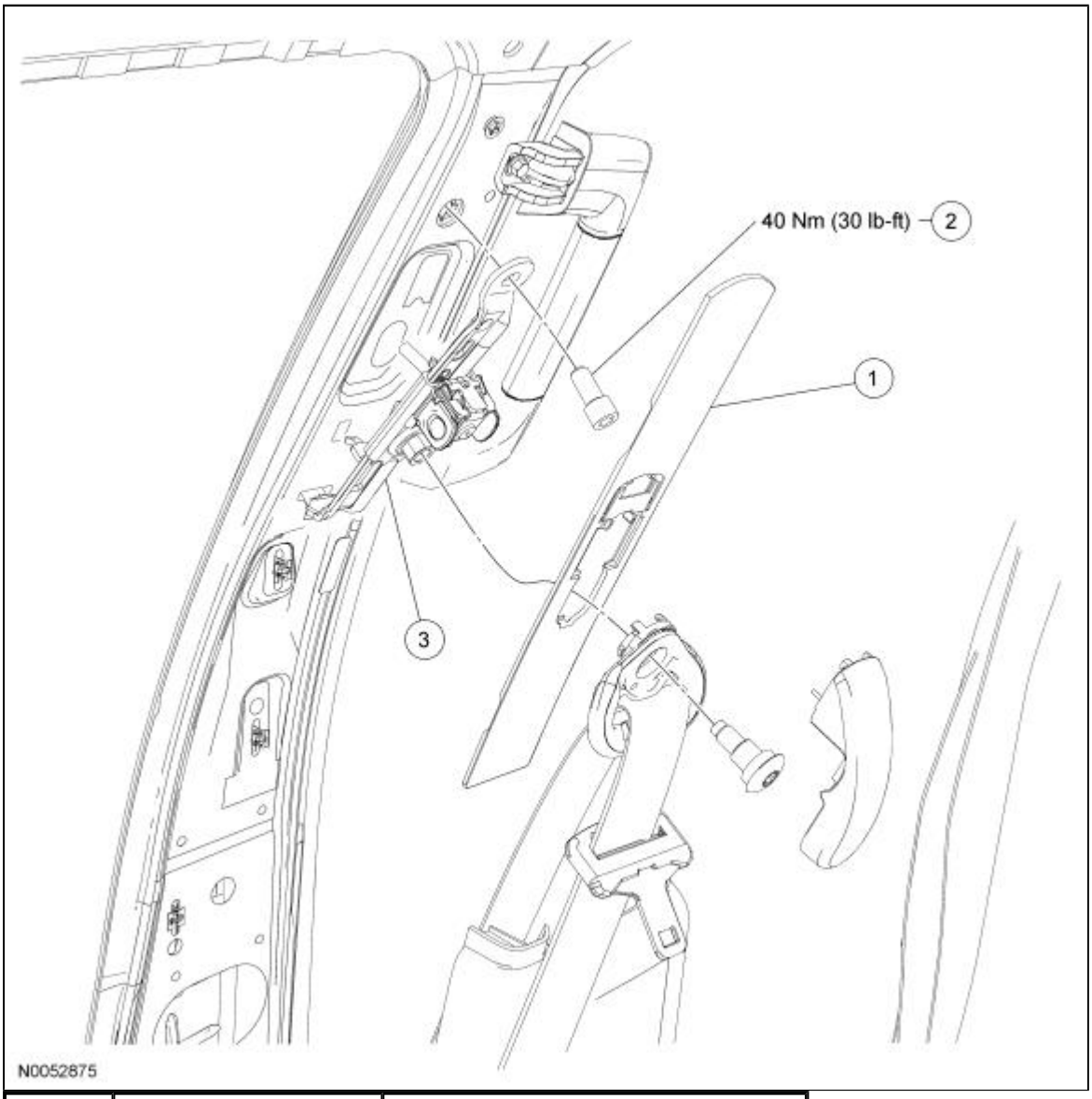
   NOTE: Remove the shipping clip after safety belt retractor installation.

   To install, reverse the removal procedure.

7. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Shoulder Height Adjuster

Printable View (242 KB)



Item	Part Number	Description
1	602B90	Cover, height adjuster
2	—	Bolt, height adjuster
3	602B82	Height adjuster

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensors [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The automatic locking retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child safety seat is functioning correctly, in addition to other checks for correct safety belt system function. A new belt and retractor assembly must be installed if the safety belt assembly's ALR feature, or any other safety belt function, is not operating correctly when inspected according to the functional inspection procedures in the workshop manual. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

NOTE: RH shown, LH similar.

1. **NOTE:** Inspect the D-ring cover for damage. If the cover is damaged or does not remain closed, install new D-ring cover and bolt.

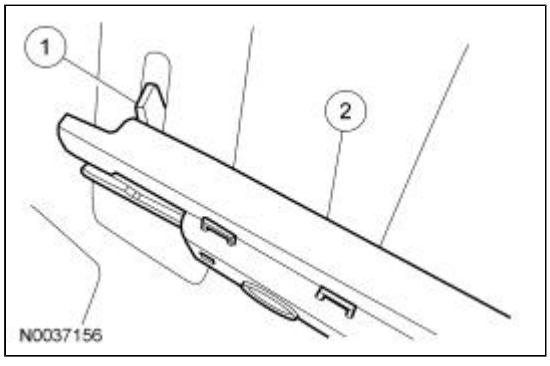
   Position the safety belt guide to the lowest position.

   Remove the upper B-pillar trim panel. For additional information, refer to Section 501-05 .

2. Access the bolt behind the safety belt shoulder height adjuster trim cover.

3. Remove the safety belt shoulder height adjuster bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

4. Remove the safety belt shoulder height adjuster.
   1. Rotate the safety belt shoulder height adjuster downward to release the lower tab.
   2. Remove the safety belt shoulder height adjuster.



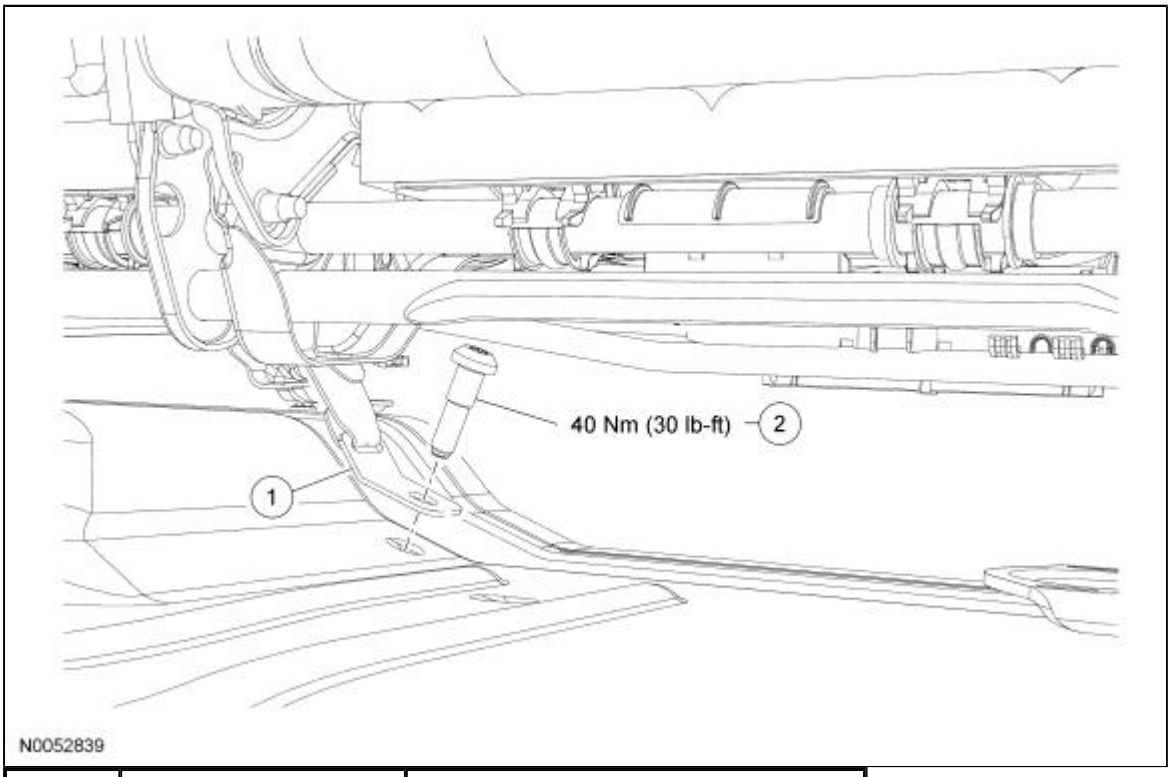
5. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

   To install, reverse the removal procedure.

6. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Buckle — Front, Center

Printable View (159 KB)



Item	Part Number	Description
1	611B60	Safety belt buckle
2	N811712	Bolt, safety belt buckle

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Move the seat to the most forward position.

2. Remove the bolt and route the safety belt buckle out of the seat.
   - To install, tighten to 40 Nm (30 lb-ft).

3. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

   NOTE: Make sure the safety belt buckle is accessible to the occupant after installation.

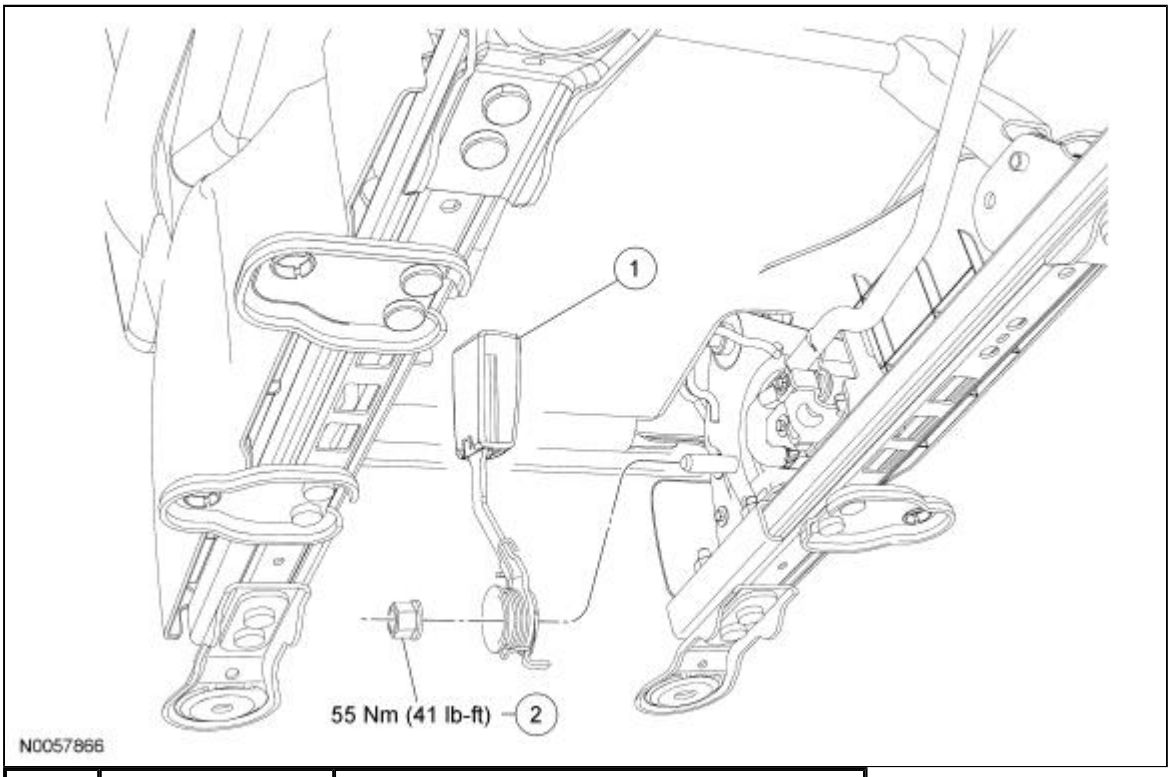
   To install, reverse the removal procedure.

4. Check the active restraint system for correct operation. For additional information, refer to Safety

Belt System in this section.

Safety Belt Buckle — Second Row, 20 Percent Seat

Printable View (200 KB)



Item	Part Number	Description
1	60044	Safety belt buckle assembly
2	N620483	Nut, safety belt buckle assembly

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Position the seat upright.

2. Remove the nut and safety belt buckle assembly from underneath the seat.
   - To install, tighten to 55 Nm (41 lb-ft).

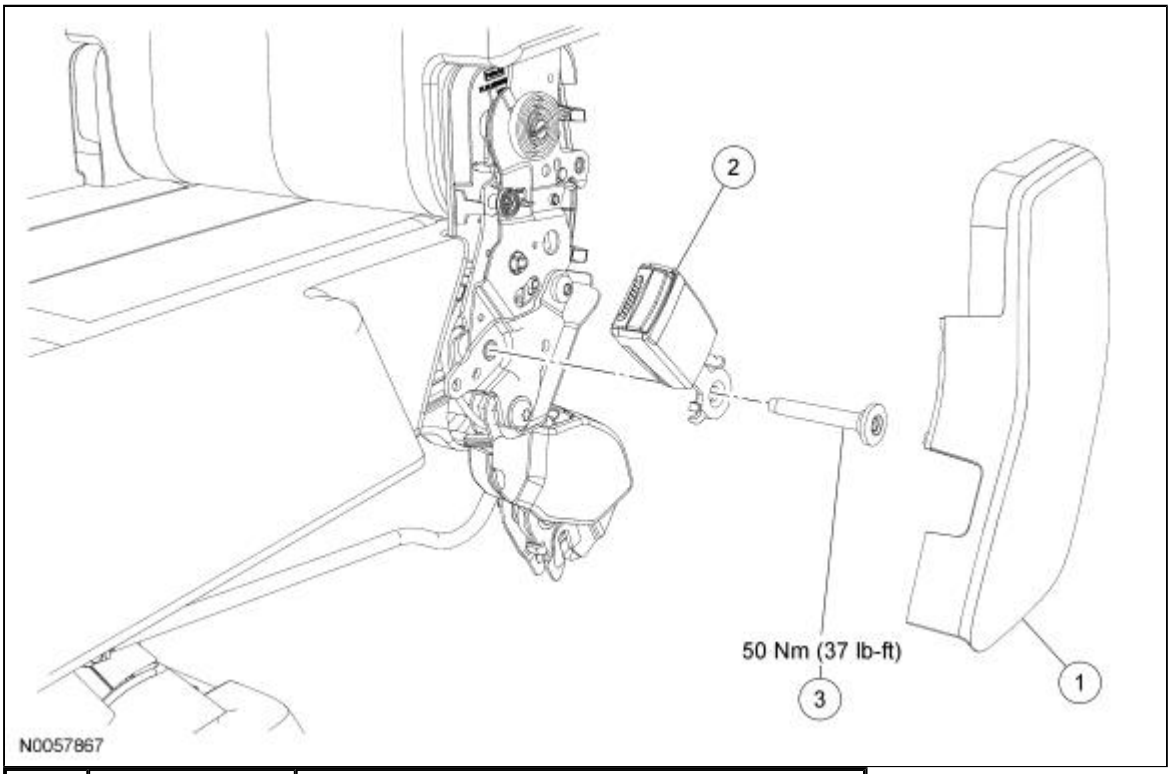
3. **NOTE:** When installing the safety belt buckle, make sure to engage the anti-rotation tab to the seat frame.

   To install, reverse the removal procedure.

4. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Buckle — Second Row, 40 Percent Seat

Printable View (160 KB)



Item	Part Number	Description
1	666L76	Side shield
2	613D98	Safety belt buckle
3	—	Bolt, safety belt buckle (part of 613D98)

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

NOTE: RH 40 percent seat shown, LH similar.

1. Pivot the 40 percent seat upward.

2. Remove the rearward screw (not shown) and seat side shield.
   - Release the pin-type retainer (not shown).

3. Remove the bolt and the safety belt buckle.
   - To install, tighten to 50 Nm (37 lb-ft).

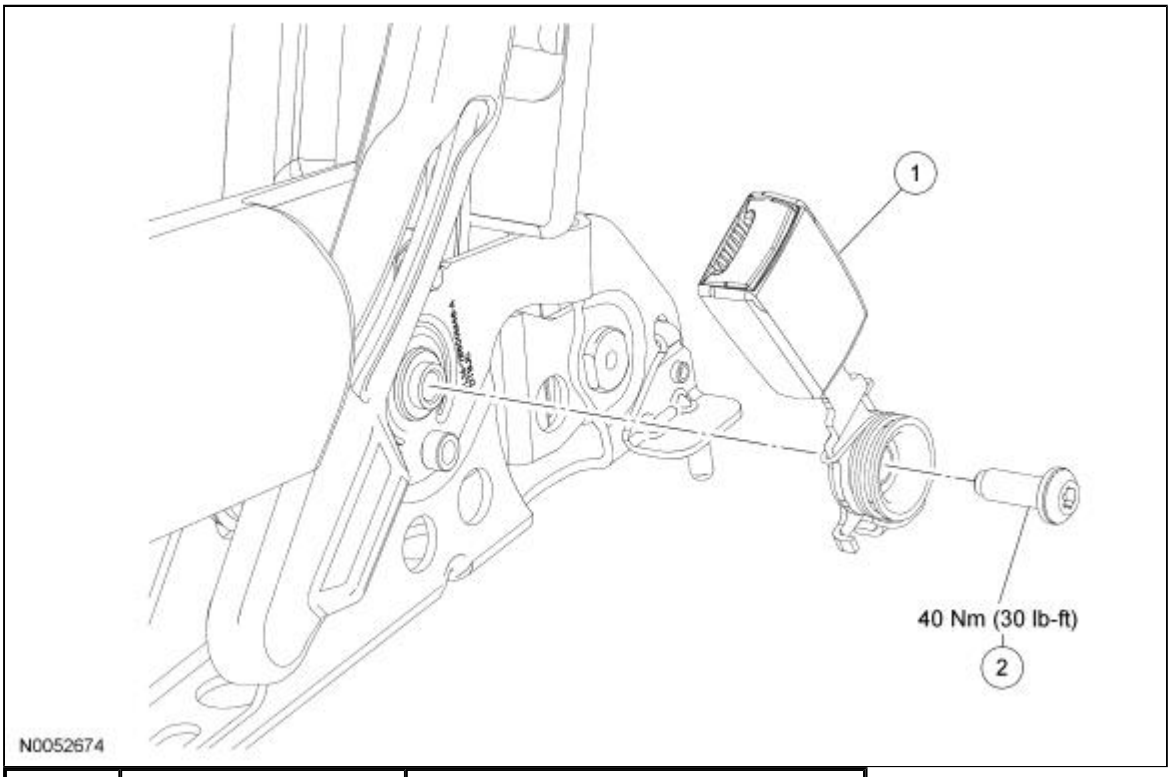
4. **NOTE:** When installing the safety belt buckle, make sure to engage the anti-rotation tab to the seat frame.

   To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Buckle — Third Row, 40 Percent Seat

Printable View (158 KB)



Item	Part Number	Description
1	60044	Safety belt buckle
2	N807750	Bolt, safety belt buckle

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Remove the third row 40 percent seat. For additional information, refer to Section 501-10 .

2. Remove the bolt and the safety belt buckle.
   - To install, tighten to 40 Nm (30 lb-ft).

3. **NOTE:** When installing the safety belt buckle, make sure to engage the anti-rotation tab to the sheet metal.

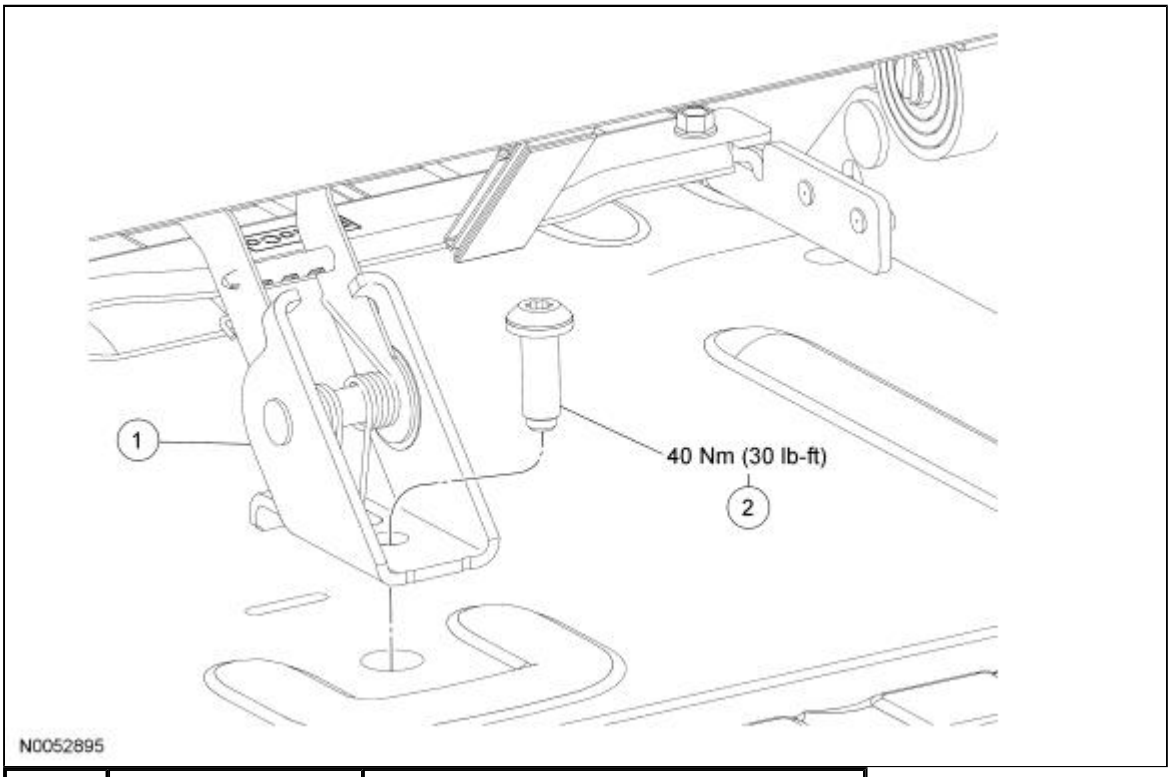
   NOTE: Make sure the safety belt buckle is accessible to the passenger after installation.

   To install, reverse the removal procedure.

4. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Buckle — Third Row, 60 Percent Seat

Printable View (146 KB)



Item	Part Number	Description
1	60044	Safety belt buckle assembly
2	N807750	Bolt, safety belt buckle

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Fold the 60 percent seat down.
2. Position the load floor panels up.
3. Remove the bolt and safety belt buckle assembly.
   - To install, tighten to 40 Nm (30 lb-ft).
4. Fold the 60 percent seat up and remove the safety belt buckle assembly through the seat.
5. **NOTE:** When installing the safety belt buckle assembly, make sure to engage the anti-rotation tab to the sheet metal.

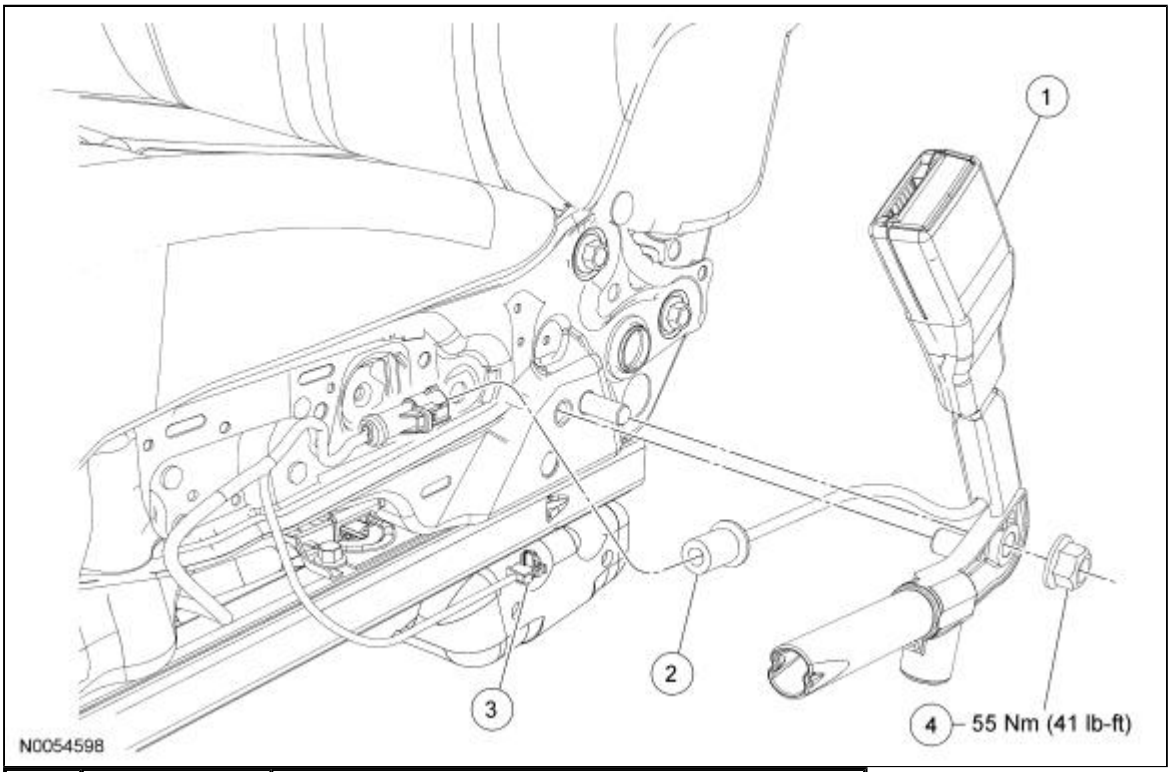
NOTE: Make sure the safety belt buckles are accessible to the passengers after installation.

To install, reverse the removal procedure.

6. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Buckle and Pretensioner — 40 Percent

Printable View (215 KB)



Item	Part Number	Description
1	61202	Safety belt buckle pretensioner assembly
2	—	Electrical connector, safety belt buckle switch
3	—	Electrical connector, safety belt pretensioner
4	W800937	Nut, safety belt buckle pretensioner

Removal and Installation

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS] if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

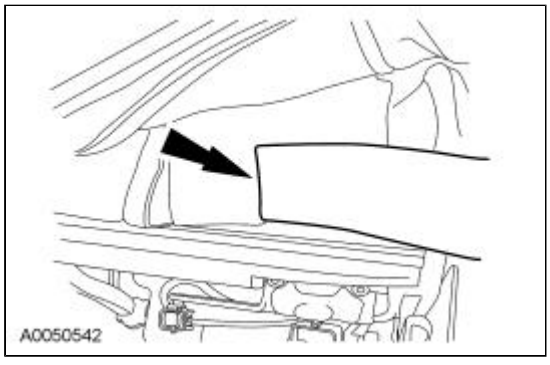
NOTE: LH shown, RH similar.

1. Position the seat to gain access to all seat fasteners.

2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

3. Remove the 40 percent front seat. For additional information, refer to Section 501-10 .

4. Release the hook-and-loop strip and pull the seat cushion trim cover up enough to expose the safety belt buckle and pretensioner.



5. **NOTE:** Make note of the wire harness routing for installation.

   Remove the tie strap from the pretensioner.
   - Disconnect the safety belt buckle switch electrical connector.
   - Disconnect the safety belt buckle pretensioner electrical connector.

6. Remove the nut and safety belt buckle and pretensioner.
   - To install, tighten to 55 Nm (41 lb-ft).

7. To install, reverse the removal procedure.

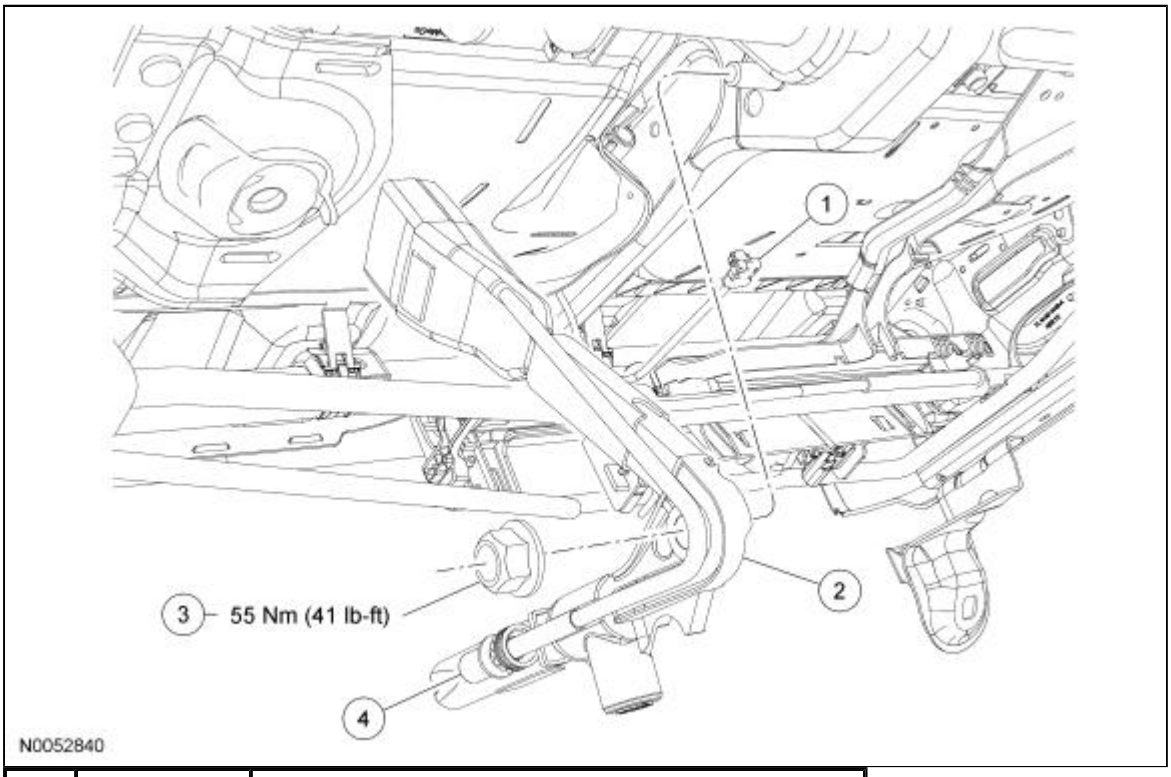
8. Install the 40 percent front seat. For additional information, refer to Section 501-10 .

9. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

10. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in the Diagnosis and Testing portion of this section.

Safety Belt Buckle and Pretensioner — 60 Percent

Printable View (216 KB)



Item	Part Number	Description
1	—	Electrical connector, safety belt buckle pretensioner
2	61202	Safety belt buckle pretensioner assembly
3	W800937	Nut, safety belt buckle pretensioner
4	—	Electrical connector, safety belt buckle switch

Removal

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the seat to gain access to all seat fasteners.

2. Depower the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

3. Remove the 60 percent front seat. For additional information, refer to Section 501-10 .

4. **NOTE:** Make note of the wire harness routing for installation.

   Remove the tie strap from the pretensioner.
   - Disconnect the safety belt buckle switch electrical connector.
   - Disconnect the safety belt buckle pretensioner electrical connector.

5. Remove the nut and safety belt buckle pretensioner assembly.

Installation

1. Install the safety belt buckle and pretensioner.
   1. Position the safety belt buckle and pretensioner to the seat.
      - Align the safety belt buckle and pretensioner locator tab to the hole in the seat frame.
      - Check that the safety belt buckle end is accessible after positioning.
   2. Install the nut.
      - Tighten to 55 Nm (41 lb-ft).
   3. Route the safety belt buckle switch and pretensioner electrical connectors as noted in removal.

2. Connect the electrical connectors. Attach the electrical connectors and route the wire harnesses as noted in removal.

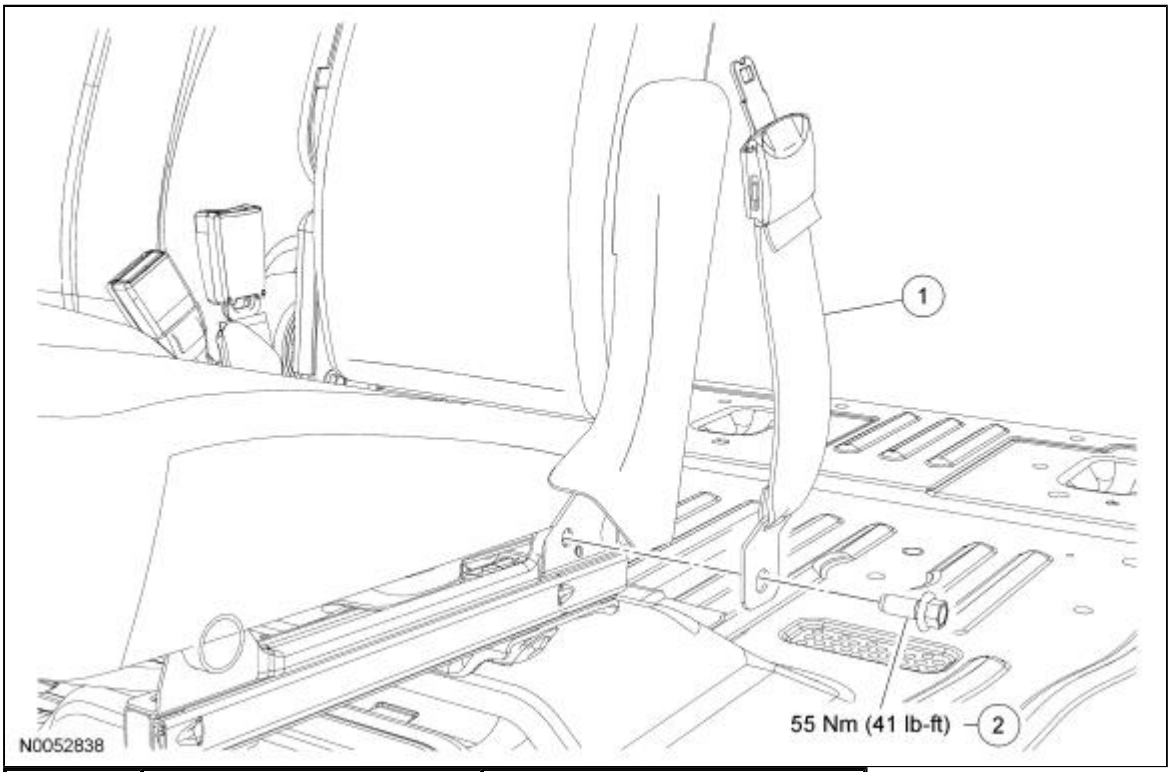
3. Install the 60 percent front seat. For additional information, refer to Section 501-10 .

4. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in the Diagnosis and Testing portion of this section.

Safety Belt — Front, Center

Printable View (176 KB)



Item	Part Number	Description
1	611B60	Safety belt
2	W710482	Bolt, safety belt

Removal and Installation

WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Move the driver seat to the most forward position.
2. Move the passenger seat to the most rearward position.
3. Remove the bolt and route the safety belt out from the seat.
   - To install, tighten to 55 Nm (41 lb-ft).
4. **NOTE:** Make sure the safety belt webbing is not twisted prior to installation.

   NOTE: When installing, make sure the safety belt anchor is on top of the seat bracket.

   NOTE: Make sure the safety belt is accessible to the occupant after installation.

To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Child Safety Seat Tether Anchor

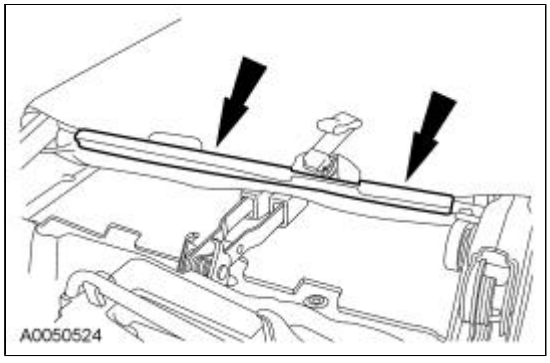
Printable View (122 KB)

Removal and Installation

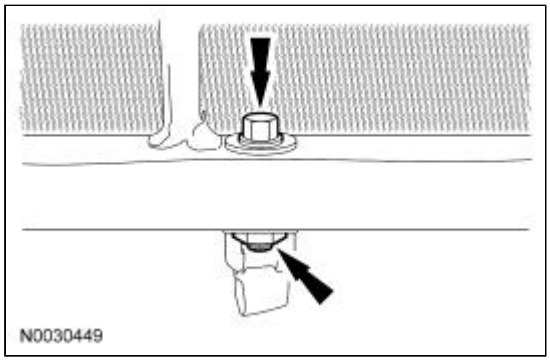
WARNING: All safety belt assemblies (including retractors, belt tension sensor [BTS], if equipped, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after every collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to follow these instructions could increase the risk of injury in collisions.

1. Position the third row seat backrest downward.

2. Release the seat back J-clips.



3. With the seat backrest trim cover and cushion positioned aside, remove the nut, bolt and the tether anchor.
   - To install, tighten to 15 Nm (11 lb-ft).



4. **WARNING: It is important that the bolt/anchor be securely tightened to specification. Otherwise, the child's safety seat may not be correctly secured and the child could be injured in case of a sudden stop or accident.**

   NOTE: Inspect the seat for damage. If the seat is found to be damaged, install new seat components.

   To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Printable View (65 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Front impact severity sensor bolt	11	8	—
Passenger air bag module bolts (Expedition)	9	—	80
Passenger air bag module bolts (Navigator)	9	—	80
Restraints control module (RCM) bolts	11	8	—
Safety canopy module front tether cord bracket bolt	6	—	53
Safety canopy module retaining bolts	9	—	80
Second row safety belt retractor anchor bolt	40	30	—
Second row safety belt retractor D-ring	40	30	
Side air bag module nuts	7		62
Side impact sensor C-pillar bolt	12	9	—
Side impact sensor front door screws	3		27
Steering column manual tilt lever	6	—	53

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

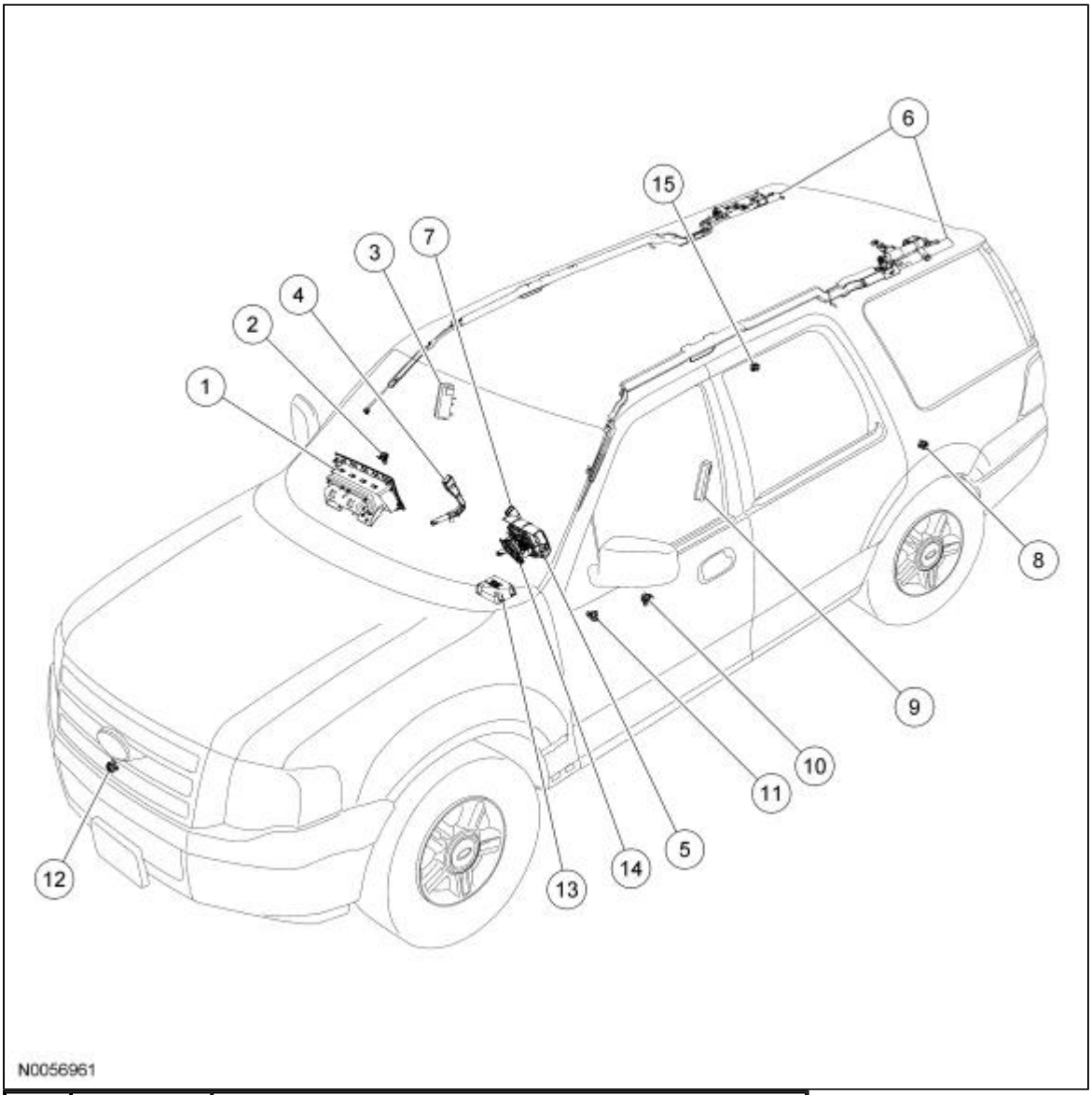
Printable View (206 KB)

The air bag supplemental restraint system (SRS) is designed to provide increased collision protection for front seat and second row outboard occupants in addition to that provided by the 3-point safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS.

This vehicle line contains dual stage deployment (advanced restraint system) driver and front passenger air bag modules. These vehicles are also equipped with safety canopies that deploy from the A-pillar to the D-pillar upon a side impact or if a rollover condition is detected. Vehicles are also equipped with seat side air bag modules in the front seats. These vehicles are also equipped with driver and front passenger safety belt buckle pretensioners.

Seat side air bag modules deploy from the outboard front seat backrest upon a side impact. In addition, a front impact severity sensor is mounted to the lower radiator support and there are an additional 4 side impact sensors. A seat position sensor is mounted to the driver seat and a usage detection switch is added to the front driver and passenger outboard buckles.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components



Item	Part Number	Description
1	044A74	Passenger air bag module
2	14B345	First row, passenger door, side impact (pressure) sensor
3	611D10	Passenger side air bag module
4	61202	Passenger safety belt buckle and pretensioner (includes safety belt buckle switch)
5	043B13	Driver air bag module
6	042D95	Driver side safety canopy module
6	042D94	Passenger side safety canopy module
7	61203	Driver safety belt buckle and pretensioner (includes safety belt buckle switch)
8	14B345	Driver side second row, C-pillar side impact sensor
9	611D10	Driver side air bag module
10	14B345	First row, driver door, side impact (pressure) sensor
11	14B416	Driver seat track position sensor

12	14B004	Front impact severity sensor
13	14B321	Restraints control module (RCM)
14	14A664	Clockspring
15	14B345	Passenger side second row, C-pillar side impact sensor (if equipped)

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- allows for continuous electrical connections between the driver air bag module and the restraints control module (RCM) when the steering wheel is turned.

Driver Air Bag Module

The driver air bag module:

- is installed new as an assembly.
- is mounted in the center of the steering wheel.
- cannot be interchanged between Expedition and Navigator vehicles.

Side Air Bag Module

NOTE: References to side air bag modules refer to the seat-mounted, not to the steering wheel or instrument panel mounted air bag components of the SRS.

NOTE: When servicing a seat equipped with a side air bag module, refer to Section 501-10 .

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a safety canopy module.

The side air bag module:

- will deploy upon receiving a flow of current from the RCM, initiated by the side impact sensor and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the driver or passenger seat backrest.
- is used in conjunction with a safety canopy module.

High Speed Controller Area Network (HS-CAN)

This vehicle utilizes a communication system called a high-speed controller area network (HS-CAN). The HS-CAN consists of a twisted pair of wires connected to the following:

- Anti-lock brake system (ABS) module
- Instrument cluster module

- Powertrain control module (PCM)
- Transmission control module (TCM)
- Four wheel drive (4WD) control module (if equipped)
- Restraints control module (RCM)
- Air suspension (vehicle dynamics) module (VDM) (if equipped)
- Data link connector (DLC)

The HS-CAN circuits use a bias voltage of approximately 2.5 volts, one is a positive 2.5 volts while the other is a negative 2.5 volts. The HS-CAN also uses 2 terminating resistors, one contained within the PCM, the other in the instrument cluster module. The terminating resistors are not serviced separately. The terminating resistors have a value of 120 ohms each, for a normal operating system total of 60 ohms. The HS-CAN will operate with only one terminating resistor and has the capability to communicate some messages to some of the control modules with only one circuit functioning, but at a reduced rate of performance. For additional information regarding HS-CAN, refer to Section 418-00 .

Loops/Squib

All deployable devices contain an initiating device called a squib. The squib is part of the deployment loop. Air bag/safety canopy modules can contain more than one squib, some vehicles may have up to 4 squibs in one air bag module. Squibs are often referred to as loops during the diagnostic process.

Passenger Air Bag Module

The passenger air bag module:

- is installed new as an assembly.
- is mounted in the passenger side of the instrument panel.
- cannot be interchanged between Expedition and Navigator vehicles.

Safety Canopy Module

Vehicles are equipped with safety canopies for protection during side impacts or rollover.

Vehicles with safety canopies require a specific headliner. When installing a new headliner on a vehicle equipped with safety canopies, make sure a headliner for safety canopies is being used. The word AIRBAG will appear on the headliner where it meets each B-pillar trim panel.

The safety canopy module:

- is installed as an assembly.
- is mounted above the headliner.
- attaches from the A-pillar frame to the D-pillar frame.
- is standard equipment.
- cannot be interchanged from side to side.
- is used in conjunction with side air bag module.

Safety Belt Pretensioners

As part of the SRS, the driver and front outboard passenger safety belt buckles are equipped with pretensioners. The safety belt buckle pretensioners remove excess slack from the safety belt webbing. The pretensioners are activated by the restraints control module (RCM) when the module detects a crash event force exceeding a programmed limit.

Safety Belt Buckle Switches

As part of the supplemental restraint system (SRS), the driver and front outboard passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belts are connected or disconnected. The RCM uses this information in determining the deployment rate of the dual-stage driver and passenger air bag modules.

Seat Track Position Sensor

The seat track position sensor is mounted to a bracket attached to the outboard side of the driver seat track. The seat track position sensor informs the restraints control module (RCM) of the driver seat position. The RCM uses this information in determining the deployment rate of the dual-stage driver air bag module.

Secondary Air Bag Warning (Chime)

The secondary air bag warning chime, is an audible chime controlled by the instrument cluster module (ICM). If the ICM has detected a fault with the air bag warning indicator a diagnostic trouble code (DTC) will be stored in memory of the ICM. Upon receiving the message from the restraints control module (RCM) that a SRS fault has been detected, the ICM will sound the secondary air bag warning chime in a pattern of 5 sets of 5 beeps.

Restraints Control Module (RCM)

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: The restraints control module (RCM) orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, a new RCM must be installed whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition. Failure to follow these instructions may increase the risk of personal injury or death in a crash.

CAUTION: Prior to removal of the RCM module, it is necessary to upload module configuration information to the scan tool. This information needs to be downloaded into the new RCM module once installed. Refer to Section 418-01 .

NOTE: When a new PCM is installed, the air bag warning indicator will illuminate when the ignition switch is ON. The warning indicator will remain on untill PCM configuration is restored. Clear RCM DTCs.

NOTE: When installing a new restraints control module (RCM), always make sure the correct RCM is being installed. RCMs are not interchangeable between vehicles or vehicle lines. If an incorrect RCM is installed, erroneous DTCs and incorrect diagnosis will result.

The restraints control module (RCM) carries out the following functions:

- deploys the air bag(s) in the event of a deployable crash.
- activates the safety belt buckle pretensioners to remove slack from the safety belt.
- monitors the SRS for faults.
- illuminates the air bag warning indicator if a fault is detected.
- communicates through the data link connector (DLC) the current or historical diagnostic trouble codes (DTCs).

The RCM monitors the SRS for possible faults. If a fault is detected while the ignition switch is in the ON position, the RCM will request illumination of the air bag warning indicator located in the instrument cluster.

When the ignition switch is cycled (turned OFF and then ON), the air bag warning indicator will prove out by lighting for 6 seconds and then turn off. If a SRS fault exists, the air bag warning indicator will illuminate and remain illuminated for the rest of the key cycle. The RCM will also communicate the on-demand (current) and continuous (historical) DTCs through the DLC, to the scan tool. If the RCM requests illumination of the air bag warning indicator and the air bag warning indicator does not function, the instrument cluster module will automatically activate an audible chime. The chime is a series of 5 sets of 5 tone bursts. If the chime is heard, the SRS and the air bag warning indicator require repair.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the air bags in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after the battery ground cable is disconnected.

A new RCM installed in a vehicle will flash lamp fault code (LFC) 54 until programmable module installation (PMI) has been carried out on the RCM. If a LFC is present after completing PMI, a fault is present in the SRS and on-demand DTCs must be retrieved and diagnosed.

Electrical System

The electrical system that supports the air bag SRS:

- is powered from the battery through the ignition circuit.
- provides the electrical path from the restraints control module (RCM) to the SRS components.
- provides the electrical path from the RCM to the air bag warning indicator.
- provides the electrical path from the RCM to the data link connector (DLC).
- provides the electrical path from the RCM to the instrument cluster module.

Sensors

WARNING: The restraints control module (RCM) orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, a new RCM must be installed whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition. Failure to follow these instructions may increase the risk of personal injury or death in a crash.

WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Install a new and correctly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed. Failure to follow these instructions may increase the risk of personal injury or death in a crash.

For these vehicles, the SRS uses 5 satellite sensors in addition to the RCM. The RCM is mounted to the center tunnel beneath the console. All vehicles will have one front impact severity sensor located in the front-center area of the vehicle, behind the grille mounted on the lower radiator support. The first row impact sensors are located in each of the front doors behind the trim panel, the second row sensors are located on each C-pillar. The side impact sensors are **not** interchangeable between the first and second row. Mounting orientation is critical for correct operation of all impact sensors.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Printable View (105 KB)

Special Tool(s)

ST1137-A	FLUKE 73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure to make sure the second stage has been deployed.

- For information on driver or passenger air bag module remote deployment, refer to Pyrotechnic Device Disposal in this section.

Diagnosing Customer Concerns With On-Demand Diagnostic Trouble Codes (DTCs)

Most supplemental restraint system (SRS) diagnostic procedures will require depowering and repowering of the system. Depowering and repowering requires disconnecting of the battery and removal of the restraints control module (RCM) fuse. This reduces the risk of inadvertent deployment of SRS components while diagnostic procedures are being carried out.

Diagnosing Customer Concerns With Continuous Memory Diagnostic Trouble Codes (DTCs)

If an air bag warning indicator lamp ON is reported by the customer but is not present when the vehicle

comes in for service, follow the Diagnostic Instruction procedures in this section to identify the intermittent DTC.

Once the DTC is known, read the Normal Operation section of the pinpoint test for the DTC involved.

- Follow the depowering procedure as directed in this section.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
    - components.
    - connectors.
    - splices and wiring harnesses.
    - insulation on conductors.

Refer to the Possible Causes section of the pinpoint test for the DTC involved, which lists the common concerns that relate to the DTC. Concerns are listed according to priority.

Prove Out Procedure

Turn the ignition switch from the OFF to the ON position and visually monitor the air bag warning indicator with all SRS components connected. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:

- fail to light.
- remain lit continuously.
- flash.

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Glossary

Secondary Air Bag Warning

The secondary air bag warning is an audible fault format that consists of 5 sets of 5 tone bursts, with each set of 5 tone bursts separated by a 5-second quiet period. One tone burst cycle will consist of one-second ON and one-second OFF. This series of 5 activations is repeated every 30 minutes.

Disconnect the Component

Disconnect the component means to disconnect the component vehicle harness connector, not to remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the System

Deactivate the system means to carry out a deactivation procedure. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Depower the System

Depower the system means to disconnect the battery and remove the restraints control module (RCM)

fuse. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Deployment Loop

The deployment loop is made up of the RCM, deployable device, air bag(s), safety belt pretensioners (safety canopies, deployable steering columns, load limiting retractor, adaptive tether, adaptive vent, if equipped) and associated circuits.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Prove Out the System

Prove out the system means to turn the ignition switch from the OFF to the ON position, and to visually monitor the air bag warning indicator with the air bag modules, safety canopies/curtains and safety belt pretensioners connected. Refer to Prove Out Procedure in this section.

Reactivate the System

Reactivate the system means to carry out the reactivation procedure. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Repower the System

Repower the system means, turn the ignition ON, install the RCM fuse and connect the battery ground cable. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Reconnect the System

Reconnect the system means to reconnect all system components. Refer to Air Bag System Reconnect Checklist in this section.

Squib

A squib (igniter) is a device designed to convert electrical energy to the heat energy necessary to deploy a pyrotechnic restraints system device.

Verify the System

Verify the system means to prove out the system with restraint system components in place.

Air Bag Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

- All in-seat harness connectors connected?
- All air bag modules connected?
- Safety canopy modules connected?
- Safety belt pretensioner connectors connected?
- Restraints control module (RCM) connected?
- All sensors (front and side impact sensors) connected?
- RCM fuse installed?
- Battery connected?

Diagnostic Instructions — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Printable View (119 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

The symptom chart can be used to help locate supplemental restraint system (SRS) concerns if no diagnostic trouble codes (DTCs) are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Retrieve all SRS DTCs stored in the restraints control module (RCM) memory.
2. Run the self-test to determine what on-demand and continuous memory DTCs are being sensed by the RCM.
3. If on-demand DTCs are different than continuous memory DTCs, always repair the on-demand DTCs first.

A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

Diagnostic Test Mode

Scan tool options:

- On-demand/continuous memory
- Clear continuous memory DTCs

Refer to the manufacturer's literature for the scan tool being used for correct scan tool test options.

On-Demand

The on-demand Self Test option is used to verify that no electrical concerns exist with the air bag SRS. Upon entering the self-test, the RCM will make an electrical check of each electrical component in the

system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. The self-test should always be run after any repair to verify that the repair was successful.

To run the Self Test, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select RCM.
5. Select Self Test.
6. The module will run the self-test and display on-demand (reflecting hard system concerns) and continuous memory (historic) DTCs on the scan tool.

Continuous Memory and Clear DTCs

During vehicle operation, the RCM will detect and store both intermittent and hard failure DTCs in non-volatile memory. The DTC strategy employed by the RCM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM will detect it. For the RCM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. DTCs can be retrieved with a scan tool using the Self Test option. All DTCs stored in the RCM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM memory, as long as the concern no longer exists.

Once 75 hours of operation have been recorded by the RCM since the concern was last detected, all continuous memory DTCs will automatically be removed from memory.

To retrieve or clear DTCs, follow these steps:

1. Connect the scan tool to the DLC.
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select RCM.
5. Select Self Test.
6. **NOTE:** Before proceeding with the clearing operation, make note of the DTCs displayed. Once cleared, DTCs cannot be retrieved.

   All DTCs will be displayed on the screen.
7. Clear the DTCs. After clearing the DTCs, cycle the key OFF, then ON.
   - Continuous memory DTCs that have been cleared will **not** reoccur as "continuous memory" in the same key cycle. Only new DTCs which were **not** present before clearing can occur as "continuous memory" after clearing.

Bit-Mapped Diagnostic Trouble Codes (DTCs)

Many of the continuous memory and on-demand DTCs that can be present in the RCM provide general fault information and require accessing the associated bit-mapped parameter identification (PIDs) (fault PIDs) to identify the specific concern. DTCs that use fault PIDs are conceptually different from conventional DTCs.

Conventional DTCs identify a specific concern for a given component and point to a particular diagnostic path. In the diagnostic path, PIDs are sometimes used to determine the root cause.

DTCs that use fault PIDs do not identify the specific concern. The DTC identifies the component(s) or type of components in which the concern exists. The next level, fault PIDs, identifies the specific device and fault condition. Fault PIDs are available for both on-demand (active) and continuous memory (historic) DTCs. Those associated PIDs are an extension of the information provided by the DTC and are identified by the same DTC number. Using both DTC and the fault PID is necessary to define the specific fault present (in the same manner as normal DTCs do).

A scan tool must be used to view DTCs and their fault PIDs. Once a scan tool has retrieved a DTC, use the scan tool to view the fault PIDs. Viewing the fault PIDs must be carried out to identify the specific concern that is present. When the viewing of fault PIDs has been carried out, the scan tool can display the PIDs associated with that DTC, including the status or state that exists (on-demand DTC) or existed (continuous memory DTC). Refer to the manufacturer's instructions for the scan tool being used on how to view fault PIDs.

DataLogger PID/Data

The DataLogger PID/Data option allows the scan tool operator to read the state of several parameter IDs (PIDs) to aid in diagnosing the system. PIDs are real time measurements of parameters, such as voltages and resistances, calculated by the restraints control module (RCM) sent to the scan tool for display. Many of the PIDs supported by the modules are calculated periodically and are, therefore, not true real time readings.

To retrieve PIDs, follow these steps:

1. Connect the scan tool to the DLC.
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select RCM.
5. Select DataLogger.
6. Record all PIDs that are to be retrieved and initiate PID retrieval. PIDs are updated continuously on the display.

Inspection and Verification

1. Verify the customer concern by checking the air bag warning indicator in the instrument cluster. Refer to Prove Out the System in this section.
2. Visually inspect for obvious signs of mechanical or electrical damage. Do not disconnect electrical connectors until directed to do so within the pinpoint test.

Visual Inspection Chart

Mechanical	Electrical
• Damaged restraints control module (RCM) or loose mounting • Damaged front impact severity sensor or loose mounting • Damaged side impact sensors or loose mounting (if equipped)	• Open smart power distribution junction box (SPDJB) fuse 32 (10A) • Damaged wiring harness • Loose or damaged connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

   If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the RCM.

9. If the DTCs retrieved are related to the concern, go to Supplemental Restraint System (SRS) Diagnostic Trouble Code (DTC) Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Lamp Fault Codes

This vehicle supports lamp fault codes (LFC) **only** when the RCM is in plant mode. A new RCM installed in a vehicle will be in plan mode until:

- programmable module installation (PMI) has been carried out.
- the RCM sees a fault-free supplemental restraint system (no DTCs present).

If a LFC is present after completing PMI, a fault is present in the SRS and on-demand DTCs must be retrieved and diagnosed.

Restraints Control Module (RCM) Diagnostic Trouble Codes (DTCs)

The DTCs can be retrieved from the restraints control module (RCM) with a scan tool via the data link connector (DLC).

Supplemental Restraint System (SRS) Diagnostic Trouble Code (DTC) Chart

DTC [a]	Description	Action To Take
—	The Air Bag Warning Indicator is Illuminated Continuously (RCM Disconnected or Inoperative, Loss of Battery Feed or Loss of Signal Ground)	Go To Pinpoint Test A .
B1231	Event Threshold Exceeded (Crash Data Memory Full)	INSTALL a new RCM and impact sensors. REFER to Inspection and Repair After a Supplemental Restraint System (SRS) Deployment in this section.
B1317	Battery Voltage High	CHECK battery voltage; to be below 18 volts. REFER to Section 414-00 .
B1318	Battery Voltage Low	CHECK battery voltage; to be above 8 volts. REFER to Section 414-00 .
B1342	ECU (RCM) is Faulted	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.
B2292	Restraint System — Seatbelt Pretensioner Fault	Go To Pinpoint Test B .
B2293	Restraint System — Air Bag Fault	Go To Pinpoint Test C .
B2294	Restraint System — Curtain Fault	Go To Pinpoint Test D .
B2295	Restraint System — Side Air Bag Fault	Go To Pinpoint Test E .
B2296	Restraint System — Impact Sensor Fault	Go To Pinpoint Test F .
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	Go To Pinpoint Test G .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	Go To Pinpoint Test H .
B2438	Passengers Seat Belt Buckle Switch Short to Ground	Go To Pinpoint Test I .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	Go To Pinpoint Test J .
B2477	Module Configuration Failure	This DTC indicates programmable module installation (PMI) has not been done to a newly installed module. CARRY OUT PMI. REFER to Section 418-01 . CLEAR the DTC. CARRY OUT the self-test.
B2607	Harness/Configuration Mismatch	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.
B2691	Seat Belt Buckle Switch Circuit Fault,	Go To Pinpoint Test K .

	Front Driver's Side	
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	Go To Pinpoint Test L .
B2792	Cross Link Between Firing Loops (This DTC and the associated firing loops that are crossed will set applicable loop fault with low resistance on squib.)	Go To Pinpoint Test M .
B2900 —	VIN Mismatch	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.
C1414	Incorrect Module Design Level	Go To Pinpoint Test N .
C1946	Front Driver's Seat Track Position Switch Circuit Open	Go To Pinpoint Test O .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	Go To Pinpoint Test P .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	Go To Pinpoint Test Q .
C1981	Front Driver's Seat Track Position Switch Circuit Fault	Go To Pinpoint Test R .
U0300	Internal Control Module Software Incompatibility	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.
U1900	CAN Communication Bus Fault — Receive Error	**NOTE:** DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of repair for a RCM DTC U1900 fault. VIEW and RECORD U1900 fault PIDs to determine the module with the concern. REFER to Section 418-00 to diagnosis the HS-CAN/module concern.
U2050	No Application Present	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.
U2051	One or More Calibration Files Missing/Corrupt	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section.

[a] DTC: Diagnostic trouble code, retrieved using scan tool.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Air bag warning indicator is illuminated continuously	• Fuse • DTC • Wiring, terminals or connectors • Faulty diagnostic	• Go To Pinpoint Test A .

	connector • RCM • Instrument cluster module	
• Air bag warning indicator flashing	• RCM not configured or in plant mode	• CARRY OUT programmable module installation (PMI). REFER to Section 418-01 . If air bag warning indicator is flashing or has a continuous light after carrying out PMI, REFER to Supplemental Restraint System (SRS) Diagnostic Trouble Code (DTC) Chart to diagnose the concern.
• Audible tone (secondary warning) — DTCs retrieved	• Air bag SRS system fault	• REFER to Supplemental Restraint System (SRS) Diagnostic Trouble Code (DTC) Chart.
• No communication with the restraints control module (RCM)	• Open fuse • Circuitry • Scan tool • Data link connector (DLC) • RCM	• REFER to Section 418-00 to diagnose the no communication concern.

Pinpoint Tests — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Printable View (1074 KB)

Special Tool(s)

ST1137-A	FLUKE 73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Pinpoint Tests

Pinpoint Test A: The Air Bag Warning Indicator is Illuminated Continuously

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

During normal operation, the air bag warning indicator will illuminate continuously for 6 seconds after the ignition switch is placed to the RUN or ON position. Be sure to cycle the ignition switch and look for a 6-second indicator prove-out without diagnostic trouble codes (DTCs). The restraints control module (RCM) will communicate to the instrument cluster module to turn the air bag warning indicator on or off. via the high-speed controller area network (HS-CAN). The RCM will also communicate over the HS-CAN DTCs to the scan tool through the data link connector (DLC).

Possible Causes

An air bag warning indicator that is illuminated continuously or no communication with the RCM can be caused by:

- a DTC.
- damaged wiring, terminals or connectors.
- damaged ignition circuit.

- RCM disconnected from the vehicle harness.
- a loss of RCM (case) ground.
- instrument cluster module.
- RCM is faulted.

PINPOINT TEST A: THE AIR BAG WARNING INDICATOR IS ILLUMINATED CONTINUOUSLY

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Never probe the electrical connector on a safety canopy module. Doing so can result in safety canopy deployment.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
A1 CHECK FOR CONTINUOUS OR ON-DEMAND SELF TEST DTCs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Were any continuous memory or on-demand DTCs retrieved?**	**Yes** If continuous memory DTCs were retrieved, GO to A2 . If on-demand DTCs were retrieved, GO to the Supplemental Restraint System (SRS) Diagnostic Trouble Code (DTC) Chart in this section for pinpoint test direction. **No** If the RCM **does** communicate with the scan tool, GO to A2 . If the RCM **does not** communicate with the scan tool, REFER to Section 418-00 to diagnose the HS-CAN concern. GO to A4 .
A2 CHECK FOR INSTRUMENT	

CLUSTER MODULE DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Were any continuous memory or on-demand DTCs retrieved?**	**Yes** REFER to Section 413-01 to diagnosis instrument cluster module concerns. GO to A4 . **No** If the instrument cluster module **does** communicate with the scan tool, GO to A3 . If the instrument cluster module **does not** communicate with the scan tool, REFER to Section 418-00 to diagnose the HS-CAN concern. GO to A4 .
A3 CHECK INSTRUMENT CLUSTER MODULE	
• Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Module Active Command — All Warning Lamps. • **Does the air bag warning indicator turn ON and OFF when using the active command?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to A4 . **No** INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to A4 .
A4 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step A1. • **Were any continuous memory DTCs retrieved during Step A1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. RETEST the communication to the RCM. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test B: DTC B2292 — Restraint System — Seatbelt Pretensioner Fault

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors safety belt buckle pretensioner circuits for faults. The RCM will set a diagnostic trouble code (DTC) if a short to battery or short to ground fault is detected. The RCM will also set a DTC if the loop resistance is less than 0.9 ohm or greater than 5.0 ohms. The normal expected resistance range is 1.31 to 4.29 ohms. If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5.0 ohms, there exists a strong potential for an intermittent fault. If the RCM detects one of the following faults on any of the safety belt buckle pretensioner circuits, it will store diagnostic trouble code (DTC) B2292 in memory and illuminate the air bag warning indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Loop resistance less than 0.9 ohm (Low resistance)

- Loop resistance greater than 5.0 ohms (Circuit open)
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A safety belt buckle pretensioner fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty safety belt buckle pretensioner.
- RCM is faulted.

PINPOINT TEST B: DTC B2292 — RESTRAINT SYSTEM — SEATBELT PRETENSIONER FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

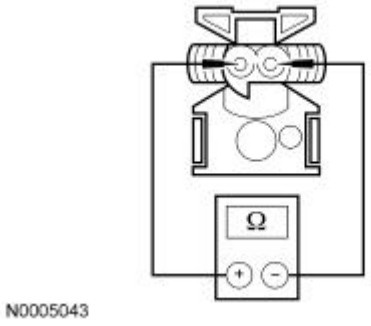
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

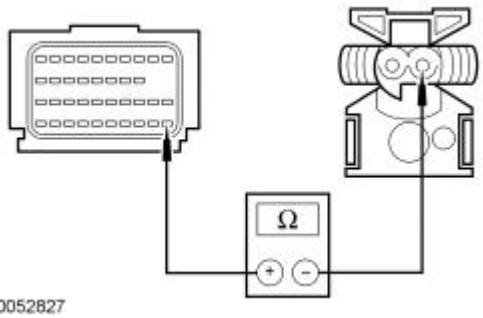
NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
B1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **Was on-demand DTC B2292 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver safety belt buckle

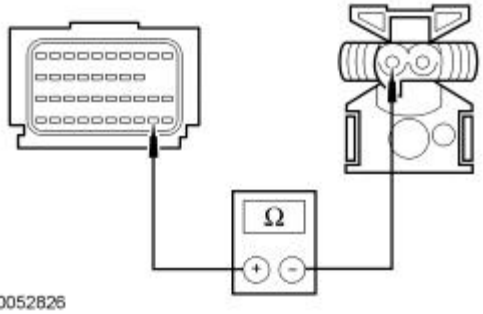
	pretensioner with a low resistance fault, GO to B2 . For driver safety belt buckle pretensioner with an open circuit fault, GO to B2 . For driver safety belt buckle pretensioner with a short to ground fault, GO to B9 . For driver safety belt buckle pretensioner with a short to battery fault, GO to B11 . For passenger safety belt buckle pretensioner with a low resistance fault, GO to B12 . For passenger safety belt buckle pretensioner with an open circuit fault, GO to B12 . For passenger safety belt buckle pretensioner with a short to ground fault, GO to B19 . For passenger safety belt buckle pretensioner with a short to battery fault, GO to B21 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver or passenger safety belt buckle pretensioner with a low resistance or open circuit fault, GO to B24 . For driver or passenger safety belt buckle pretensioner with a short to ground fault, GO to B26 . For driver or passenger safety belt buckle pretensioner with a short to battery fault, GO to B27 .
B2 CHECK THE DRIVER SAFETY BELT PRETENSIONER RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID.	**Yes** GO to B23 .

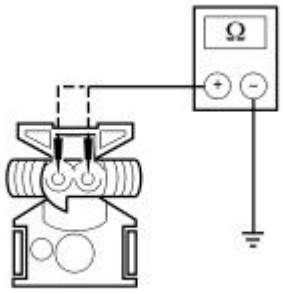
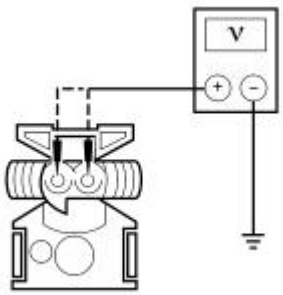
• Enter the following diagnostic mode on the diagnostic tool: Driver Safety Belt Buckle Pretensioner Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms?**	**No** GO to B3 .
B3 CHECK DRIVER SAFETY BELT BUCKLE PRETENSIONER RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the driver safety belt buckle pretensioner resistance PID while carrying out a harness test of the driver safety belt buckle pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out a harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B28 . **No** If the driver safety belt buckle pretensioner resistance PID is less than 1.31 ohms, GO to B4 . If the driver safety belt buckle pretensioner resistance PID is greater than 4.29 ohms, GO to B6 .
B4 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to B22 . **No** GO to B5 .
B5 CHECK DRIVER SAFETY BELT BUCKLE PRETENSIONER CIRCUIT CR120 (BU/OG) AND CIRCUIT RR120 (BN/GN) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to B23 .

• Disconnect: RCM C310a and C310b. • Measure the resistance between driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (GN/RD), harness side.  N0005043 • **Is the resistance greater than 1,000,000 ohms?**	**No** REPAIR circuit CR120 (BU/OG) and circuit RR120 (BN/GN). GO to B28 .
B6 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Connect a jumper wire between driver safety belt pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (BN/GN), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to B22 . **No** GO to B7 .
B7 CHECK CIRCUIT CR120 (BU/OG) FOR AN OPEN	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the driver safety belt buckle pretensioner C3201. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-31, circuit CR120 (BU/OG), harness side and driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side.	**Yes** GO to B8 . **No** REPAIR circuit CR120 (BU/OG). GO to B28 .

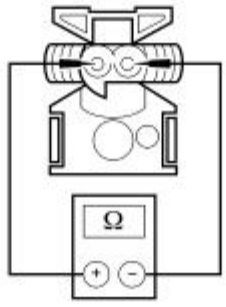


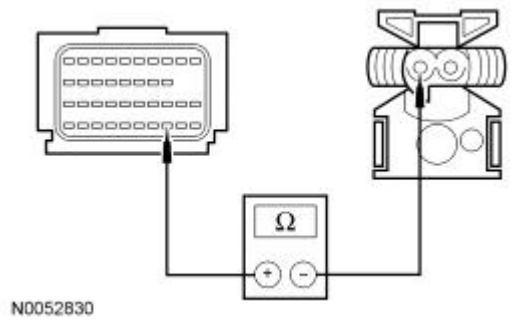
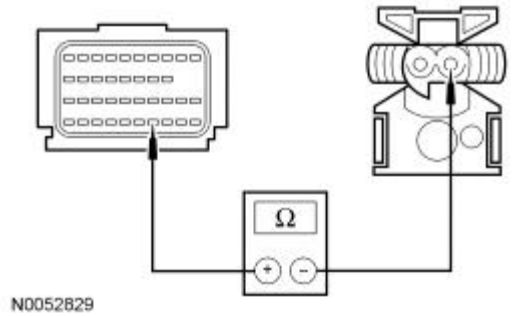
- **Is the resistance less than 0.5 ohm?**

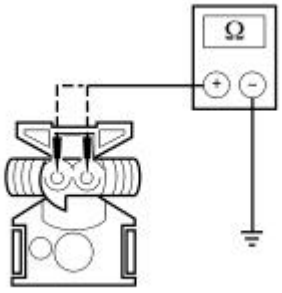
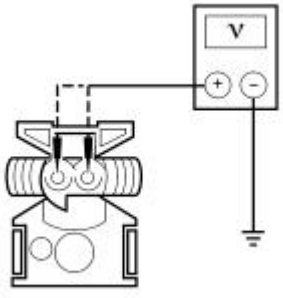
B8 CHECK CIRCUIT RR120 (BN/GN) FOR AN OPEN	
• Measure the resistance between RCM C310b-32, circuit RR120 (BN/GN), harness side and driver safety belt buckle pretensioner C3201-2, circuit RR120 (GN/RD), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to B23 . **No** REPAIR circuit RR120 (BN/GN). GO to B28 .
B9 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to B22 . **No** GO to B10 .
B10 CHECK CIRCUIT CR120 (BU/OG) AND CIRCUIT RR120 (BN/GN) FOR A SHORT TO GROUND	
• Key in OFF position.	**Yes** GO to B23 .

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side and ground; and between driver safety belt buckle pretensioner C3201-2, circuit RR120 (GN/RD), harness side and ground.  A0094831 • **Are the resistances greater than 1,000,000 ohms?**	**No** REPAIR circuit CR120 (BU/OG) or circuit RR120 (GN/RD). GO to B28 .
B11 CHECK CIRCUIT CR120 (BU/OG) AND CIRCUIT RR120 (BN/GN) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3051. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side and ground; and between driver safety belt buckle pretensioner C3201-2, circuit RR120 (GN/RD), harness side and ground.  A0094832 • **Are the voltages less than 0.2 volt?**	**Yes** GO to B23 . **No** REPAIR circuit CR120 (BU/OG) or circuit RR120 (BN/GN). GO to B28 .
B12 CHECK THE PASSENGER SAFETY BELT PRETENSIONER RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Passenger Safety Belt Buckle Pretensioner Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to B23 . **No** GO to B13 .
B13 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER RESISTANCE PID WHILE CARRYING OUT A	

HARNESS TEST	
• Continue monitoring the passenger safety belt buckle pretensioner resistance PID while carrying out a harness test of the passenger safety belt buckle pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B28 . **No** If the passenger safety belt buckle pretensioner resistance PID is less than 1.31 ohms, GO to B14 . If the passenger safety belt buckle pretensioner resistance PID is greater than 4.29 ohms, GO to B16 .
B14 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to B22 . **No** GO to B15 .
B15 CHECK PASSENGER SAFETY BELT BUCKLE PRETENSIONER CIRCUIT RR122 (BN) AND CIRCUIT CR122 (WH/OG) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger safety belt buckle pretensioner C3202-1, circuit CR122 (WH/OG),	**Yes** GO to B23 . **No** REPAIR circuit CR122 (WH/OG) and circuit RR122

harness side and C3202-2, circuit RR122 (BN), harness side.  N0005043 • **Is the resistance greater than 1,000,000 ohms?**	(BN). GO to B28 .
B16 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Connect a jumper wire between passenger safety belt pretensioner C3202-1, circuit CR122 (WH/OG), harness side and C3202-2, circuit RR122 (BN), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to B22 . **No** GO to B17 .
B17 CHECK CIRCUIT RR122 (BN) FOR AN OPEN	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger safety belt buckle pretensioner C3202. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-33, circuit RR122 (BN), harness side and passenger safety belt buckle pretensioner C3202-2, circuit RR122 (BU/RD), harness side.	**Yes** GO to B18 . **No** REPAIR circuit RR122 (BN). GO to B28 .

 N0052830 • **Is the resistance less than 0.5 ohm?**	
B18 CHECK CIRCUIT CR122 (WH/OG) FOR AN OPEN	**Yes** GO to B23 . **No** REPAIR circuit CR122 (WH/OG). GO to B28 .
• Measure the resistance between RCM C310b-34, circuit CR122 (WH/OG), harness side and passenger safety belt buckle pretensioner C3202-1, circuit CR122 (YE/BK), harness side.  N0052829 • **Is the resistance less than 0.5 ohm?**	
B19 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER FOR A SHORT TO GROUND	**Yes** GO to B22 . **No** GO to B20 .
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
B20 CHECK CIRCUIT RR122 (BN) AND CIRCUIT CR122 (YE/BK) FOR A SHORT TO GROUND	**Yes**

• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger safety belt buckle pretensioner C3202-2, circuit RR122 (BU/RD), harness side and ground; and between passenger safety belt buckle pretensioner C3202-1, circuit CR122 (YE/BK), harness side and ground.  A0094831 • **Are the resistances greater than 1,000,000 ohms?**	GO to B23 . **No** REPAIR circuit RR122 (BN) or circuit CR122 (YE/BK). GO to B28 .
B21 CHECK CIRCUIT RR122 (BN) AND CIRCUIT CR122 (WH/OG) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3052. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger safety belt buckle pretensioner C3202-2, circuit RR122 (BU/RD), harness side and ground; and between passenger safety belt buckle pretensioner C3202-1, circuit CR122 (YE/BK), harness side and ground.  A0094832 • **Are the voltages less than 0.2 volt?**	**Yes** GO to B23 . **No** REPAIR circuit RR122 (BN) or circuit CR122 (WH/OG). GO to B28 .
B22 CONFIRM THE SAFETY BELT BUCKLE PRETENSIONER FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** INSTALL a new driver or passenger safety belt buckle pretensioner. REFER to Section 501-20A . GO to B28 .

• Connect: Affected Safety Belt Buckle Pretensioner C3201 (Driver) C3202 (Passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **Was on-demand DTC B2292 retrieved?**	**No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver or passenger safety belt buckle pretensioner with a low resistance or open circuit fault, GO to B24 . For driver or passenger safety belt buckle pretensioner with a short to ground fault, GO to B26 . For driver or passenger safety belt buckle pretensioner with a short to battery fault, GO to B27 .
B23 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: All Restraint System Components (If previously disconnected). • Connect: RCM C310a and C310b (If previously disconnected). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs. • **Was on-demand DTC B2292 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) . GO to B28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver or passenger safety belt buckle pretensioner with a low resistance or open circuit fault, GO to B24 . For driver or passenger safety belt buckle pretensioner with a short to ground fault, GO to B26 . For driver or passenger safety belt buckle pretensioner with

	a short to battery fault, GO to B27 .
B24 CHECK FOR AN INTERMITTENT SAFETY BELT BUCKLE PRETENSIONER LOW RESISTANCE OR OPEN CIRCUIT FAULT	

• If the fault PID was reported for the driver safety belt buckle pretensioner, monitor the following on the scan tool:
  ▪ driver safety belt buckle pretensioner resistance PID.
• If the fault PID was reported for the passenger safety belt buckle pretensioner, monitor the following on the scan tool:
  ▪ passenger safety belt buckle pretensioner resistance PID.
• **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.
• Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
• **Does any safety belt buckle pretensioner resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to B28 .
	
	No
	GO to B25 .

B25 CHECK THE HARNESS AND CONNECTORS	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Disconnect the affected safety belt buckle pretensioner C3201 (driver) or C3202 (passenger):
  ▪ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ inspect wire harness for any damage, pinched, cut or pierced wires.
• **Were any concerns found?**
	Yes
	REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to B28 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to B28 .

B26 CHECK FOR AN INTERMITTENT SAFETY BELT BUCKLE PRETENSIONER CIRCUIT SHORT TO GROUND FAULT	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • If the fault PID was reported for the driver safety belt buckle pretensioner, monitor the driver safety belt buckle pretensioner short to ground on-demand fault PID on the scan tool. • If the fault PID was reported for the passenger safety belt buckle pretensioner, monitor the passenger safety belt buckle pretensioner short to ground on-demand fault PID on the scan tool. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any safety belt buckle pretensioner on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B28 . **No** The fault is not present and cannot be recreated at this time. GO to B28 .

B27 CHECK FOR AN INTERMITTENT SAFETY BELT PRETENSIONER CIRCUIT SHORT TO BATTERY FAULT	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Disconnect the side air bag module electrical connector C3051 (driver) or C3252 (passenger) on the side with the affected pretensioner.
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• If the fault PID was reported for the driver safety belt buckle pretensioner:
  ▪ monitor the driver safety belt buckle pretensioner short to battery on-demand fault PID.
• If the fault PID was reported for the passenger safety belt buckle pretensioner:
  ▪ monitor the passenger safety belt buckle pretensioner short to battery on-demand fault PID.
• Key in ON position.
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs.
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2292 Fault PIDs.
• **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
• Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
• **Does the safety belt buckle pretensioner short to battery on-demand fault PID indicate a fault is present?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5, Connector Repair Procedures for schematic and connector information.
	
	GO to B28.
	
	No
	The fault is not present and cannot be recreated at this time. GO to B28.

B28 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step B1. • **Were any continuous memory DTCs retrieved during Step B1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test C: DTC B2293 — Restraint System — Air Bag Fault

Refer to Wiring Diagrams Cell 46, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all front air bag module circuits for faults. The RCM will set a diagnostic trouble code (DTC) if a short to battery or short to ground fault is detected. The RCM will also set a DTC if the loop resistance is less than 1.31 ohm or greater than 5.0 ohms. The normal expected resistance range is 1.31 to 4.29 ohms. If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5.0 ohms, there exists a strong potential for an intermittent fault. If the RCM detects a fault on any of the front air bag circuits, it will store DTC B2293 in memory and illuminate the air bag warning indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Loop resistance less than 0.9 ohm (Low resistance)
- Loop resistance greater than 5.0 ohms (Circuit open)
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A driver air bag fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty clockspring.
- a faulty driver air bag module.
- RCM is faulted.

A passenger air bag fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty passenger air bag module.
- RCM is faulted.

PINPOINT TEST C: DTC B2293 — RESTRAINT SYSTEM — AIR BAG FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

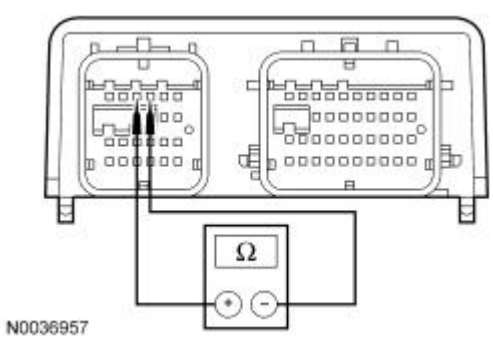
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

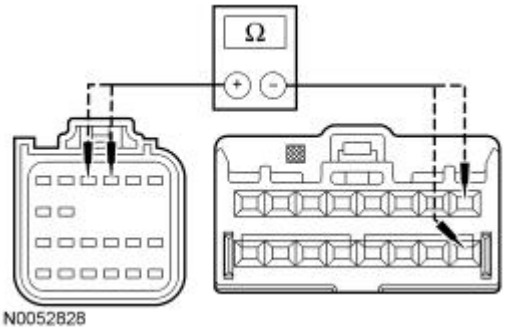
Test Step	Result / Action to Take
C1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **Was on-demand DTC B2293 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver air bag module loop 1 with a low resistance fault, GO to C2 . For driver air bag module loop 1 with an open circuit fault, GO to C2 . For driver air bag module loop 1 with a short to ground fault, GO to C10 . For driver air bag module loop 1 with a short to battery fault, GO to C13 . For driver air bag module loop 2 with a low resistance fault, GO to C15 . For driver air bag module loop 2 with an open circuit fault, GO to C15 . For driver air bag module loop 2 with a short to ground fault, GO to C23 . For driver air bag module loop 2 with a short to battery fault, GO to C26 . For passenger air bag module loop 1 with a low resistance fault, GO to C28 . For passenger air bag module loop 1 with an open circuit fault, GO to C28 . For passenger air bag module loop 1 with a short to ground fault, GO to C34 . For passenger air bag module loop 1 with a short to battery fault, GO to C36 .

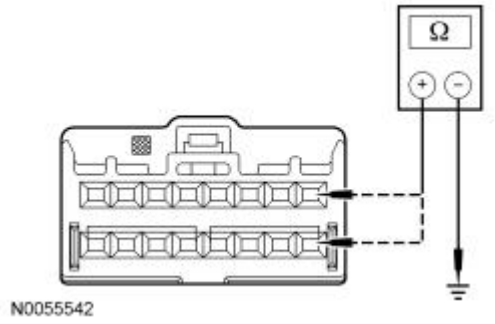
	For passenger air bag module loop 2 with a low resistance fault, GO to C37 . For passenger air bag module loop 2 with an open circuit fault, GO to C37 . For passenger air bag module loop 2 with a short to ground fault, GO to C43 . For passenger air bag module loop 2 with a short to battery fault, GO to C45 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver air bag module loop 1 or loop 2 with a low resistance fault, GO to C50 . For driver air bag module loop 1 or loop 2 with an open circuit fault, GO to C50 . For driver air bag module loop 1 with a short to ground fault, GO to C51 . For driver air bag module loop 1 with a short to battery fault, GO to C53 . For driver air bag module loop 2 with a short to ground fault, GO to C51 . For driver air bag module loop 2 with a short to battery fault, GO to C53 . For passenger air bag module loop 1 or loop 2 with a low resistance fault, GO to C50 . For passenger air bag module loop 1 or loop 2 with an open circuit fault, GO to C50 .

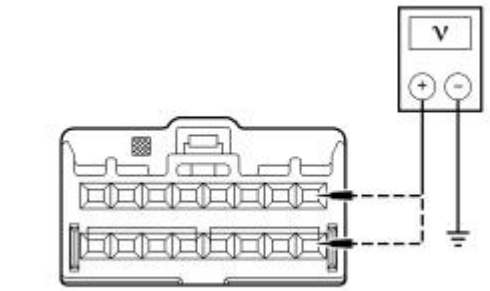
	For passenger air bag module loop 1 with a short to ground fault, GO to C52 . For passenger air bag module loop 1 with a short to battery fault, GO to C54 . For passenger air bag module loop 2 with a short to ground fault, GO to C52 . For passenger air bag module loop 2 with a short to battery fault, GO to C54 .
C2 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Driver Air Bag Module Loop 1 Resistance PID. • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to C49 . **No** GO to C3 .
C3 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, continue monitoring the driver air bag module loop 1 resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to Clockspring in this section. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** If the driver air bag module loop 1 resistance PID is less than 1.31 ohms, GO to C4 . If the driver air bag module loop 1 resistance PID is greater than 4.29 ohms, GO to C7 .
C4 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag	**Yes** GO to C46 . **No** GO to C5 .

Module in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
C5 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR LOW RESISTANCE BETWEEN THE CLOCKSPRING AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Disconnect: Clockspring C218a. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to C48 . **No** GO to C6 .
C6 CHECK THE RCM FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a pin 3 and C310a pin 4, component side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR101 (VT/BN) and circuit RR101 (YE/GN). GO to C56 . **No** GO to C49 .
C7 CHECK THE DRIVER AIR BAG MODULE LOOP 1	

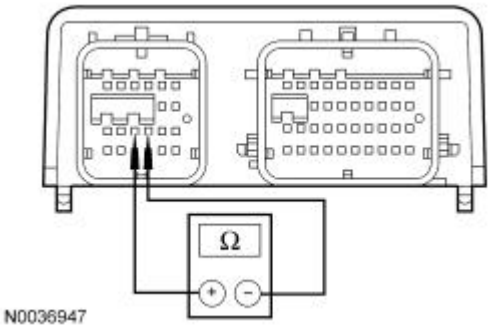
CIRCUITS FOR AN OPEN BETWEEN THE DRIVER AIR BAG MODULE AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect a jumper wire between driver air bag module loop 1 electrical connector pin-1, harness side and pin-2, harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	**Yes** GO to C46 . **No** GO to C8 .
C8 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR OPEN BETWEEN THE CLOCKSPRING AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Remove the jumper wire from driver air bag module loop 1 electrical connector. • Disconnect: Clockspring C218a. • Connect a jumper wire between clockspring C218a-1, circuit CR101 (VT/BN), harness side and clockspring C218a-9, circuit RR101 (YE/GN), harness side. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	**Yes** GO to C48 . **No** GO to C9 .

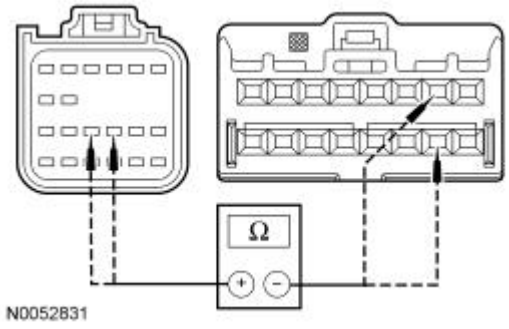
C9 CHECK DRIVER AIR BAG MODULE LOOP 1 CIRCUIT CR101 (VT/BN) AND CIRCUIT RR101 (YE/GN) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the clockspring connector. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a-4, circuit CR101 (VT/BN), harness side and clockspring C218a-1, circuit CR101 (VT/BN), harness side; and between RCM C310a-3, circuit RR101 (YE/GN), harness side and clockspring C218a-9, circuit RR101 (YE/GN), harness side.  N0052828 • **Are the resistances less than 0.5 ohm?**	**Yes** GO to C49 . **No** REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). GO to C56 .
C10 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to C46 . **No** GO to C11 .
C11 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the	**Yes** GO to C48 . **No**

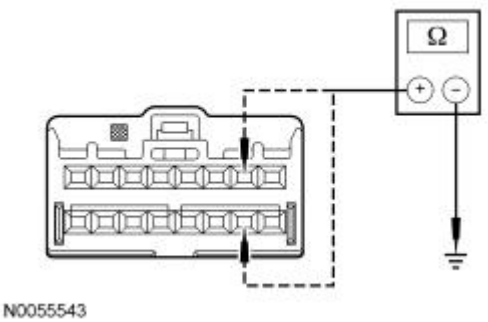
fault. • Key in OFF position. • Disconnect: Clockspring C218a. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	GO to C12 .
C12 CHECK CIRCUIT CR101 (VT/BN) AND CIRCUIT RR101 (YE/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between clockspring C218a-1, circuit CR101 (VT/BN), harness side and ground; and between clockspring C218a-9, circuit RR101 (YE/GN), harness side and ground.  • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). GO to C56 .
C13 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Disconnect: Clockspring C218a. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool:	**Yes** GO to C48 . **No** GO to C14 .

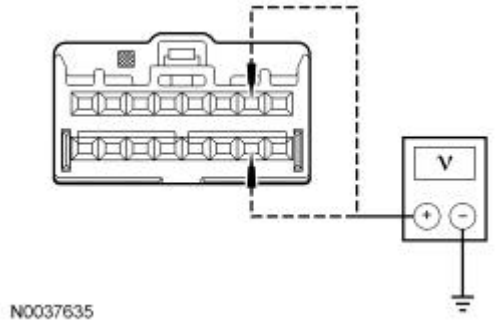
DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**	
C14 CHECK CIRCUIT CR101 (VT/BN) AND CIRCUIT RR101 (YE/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between clockspring C218a-1, circuit CR101 (VT/BN), harness side and ground; and between clockspring C218a-9, circuit RR101 (YE/GN), harness side and ground.  N0036962 • **Are the voltages less than 0.2 volt?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). GO to C56 .
C15 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Driver Air Bag Module Loop 2 Resistance PID. • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to C49 . **No** GO to C16 .
C16 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, continue monitoring the driver air bag module loop 2 resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors), by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No**

	If the driver air bag module loop 2 resistance PID is less than 1.31 ohms, GO to C17 . If the driver air bag module loop 2 resistance PID is greater than 4.29 ohms, GO to C20 .
C17 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to C46 . **No** GO to C18 .
C18 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR LOW RESISTANCE BETWEEN THE CLOCKSPRING AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Disconnect: Clockspring C218a. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to C48 . **No** GO to C19 .
C19 CHECK THE RCM FOR LOW RESISTANCE	

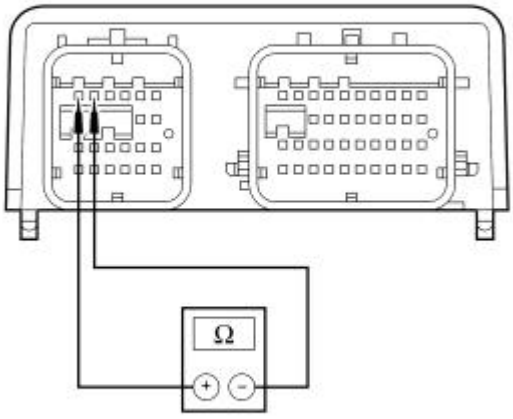
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a pin 15 and C310a pin 16, component side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR102 (BU) and circuit RR102 (WH). GO to C56. **No** GO to C49.
C20 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE DRIVER AIR BAG MODULE AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect a jumper wire between driver air bag module loop 2 electrical connector, pin-1, harness side and pin-2, harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to C46. **No** GO to C21.
C21 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position.	**Yes** GO to C48. **No** GO to C22.

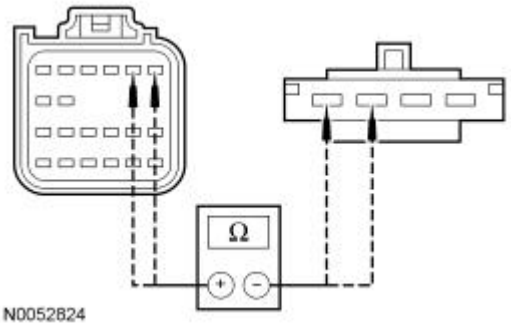
• Remove the jumper wire from driver air bag module loop 2 electrical connector. • Disconnect: Clockspring C218a. • Connect a jumper wire between clockspring C218a-2, circuit CR102 (BU), harness side and clockspring C218a-10, circuit RR102 (WH), harness side. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
C22 CHECK DRIVER AIR BAG MODULE LOOP 2 CIRCUIT CR102 (BU) AND CIRCUIT RR102 (WH) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the clockspring connector. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a-16, circuit CR102 (BU), harness side and clockspring C218a-2, circuit CR102 (BU), harness side; and between RCM C310a-15, circuit RR102 (WH), harness side and clockspring C218a-10, circuit RR102 (WH), harness side.  • **Are the resistances less than 0.5 ohm?**	**Yes** GO to C49 . **No** REPAIR circuit CR102 (BU) or circuit RR102 (WH). GO to C56 .
C23 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to C46 . **No** GO to C24 .

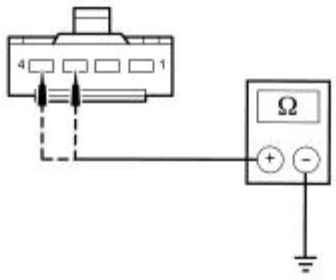
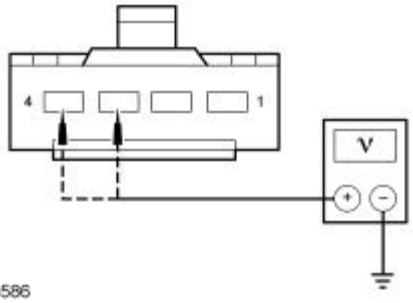
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
C24 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Disconnect: Clockspring C218a. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to C48 . **No** GO to C25 .
C25 CHECK CIRCUIT CR102 (BU) AND CIRCUIT RR102 (WH) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between clockspring C218a-2, circuit CR102 (BU), harness side and ground; and between clockspring C218a-10, circuit RR102 (WH), harness side and ground.  N0055543 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR102 (BU) or circuit RR102 (WH). GO to C56 .
C26 CHECK THE DRIVER AIR BAG MODULE LOOP 2	

CIRCUITS FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Disconnect: Clockspring C218a. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**	**Yes** GO to C48 . **No** GO to C27 .
C27 CHECK CIRCUIT CR102 (BU) AND CIRCUIT RR102 (WH) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between clockspring C218a-2, circuit CR102 (BU), harness side and ground; and between clockspring C218a-10, circuit RR102 (WH), harness side and ground.  N0037635 • **Are the voltages less than 0.2 volt?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR102 (BU) or circuit RR102 (WH). GO to C56 .
C28 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID.	**Yes** GO to C49 .

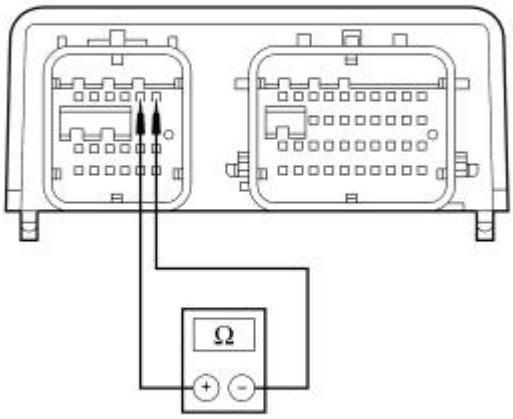
• Enter the following diagnostic mode on the diagnostic tool: Passenger Air Bag Module Loop 1 Resistance PID. • **Is the resistance between 1.31 and 4.29 ohms?**	**No** GO to C29 .
C29 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the passenger air bag module loop 1 resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** If the passenger air bag module loop 1 resistance PID is less than 1.31 ohms, GO to C30 . If the passenger air bag module loop 1 resistance PID is greater than 4.29 ohms, GO to C32 .
C30 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to C47 . **No** GO to C31 .
C31 CHECK THE RCM FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b.	**Yes** REPAIR circuit CR103 (GY/BU) and circuit RR103 (VT/GN). GO to C56 .

• Measure the resistance between RCM C310a pin 1 and C310a pin 2, component side.  A0041266 • **Is the resistance greater than 10,000 ohms?**	**No** GO to C49 .
C32 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Connect a jumper wire between passenger air bag module C256-4, circuit CR103 (GY/BU), harness side and C256-3, circuit RR103 (VT/GN), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the passenger air bag being disconnected. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to C47 . **No** GO to C33 .
C33 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM	

• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module C256. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a-1, circuit CR103 (GY/BU), harness side and passenger air bag module C256-3, circuit CR103 (GY/BU), harness side; and between RCM C310a-2, circuit RR103 (VT/GN), harness side and passenger air bag module C256-4, circuit RR103 (VT/GN), harness side.  • **Are the resistances less than 0.5 ohm?**	**Yes** GO to C49 . **No** REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). GO to C56 .
C34 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to C47 . **No** GO to C35 .
C35 CHECK CIRCUIT CR103 (GY/BU) AND CIRCUIT RR103 (VT/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger air bag module C256-3, circuit CR103 (GY/BU), harness side and ground;	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical

and between passenger air bag module C256-4, circuit RR103 (VT/GN), harness side and ground.  A0090688 • **Are the resistances greater than 1,000,000 ohms?**	connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). GO to C56 .
C36 CHECK CIRCUIT CR103 (GY/BU) AND CIRCUIT RR103 (VT/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger air bag module C256-3, circuit CR103 (GY/BU), harness side and ground; and between passenger air bag module C256-4, circuit RR103 (VT/GN), harness side and ground.  A0088586 • **Are the voltages less than 0.2 volt?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). GO to C56 .
C37 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Passenger Air Bag Module Loop 2 Resistance PID. • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to C49 . **No** GO to C38 .
C38 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the passenger air bag module loop 2 resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell

the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** If the passenger air bag module loop 2 resistance PID is less than 1.31 ohms, GO to C39 . If the passenger air bag module loop 2 resistance PID is greater than 4.29 ohms, GO to C41 .
C39 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to C47 . **No** GO to C40 .
C40 CHECK THE RCM FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a pin 5 and C310a pin 6, component side.	**Yes** REPAIR circuit CR104 (YE/GY) and circuit RR104 (WH/BU). GO to C56 . **No** GO to C49 .



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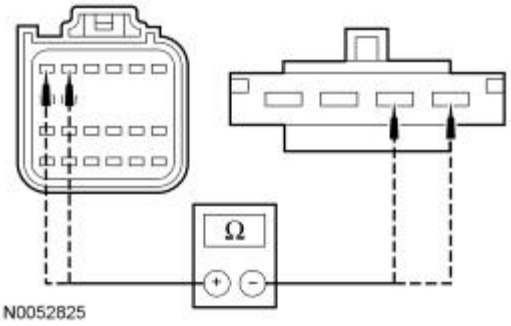
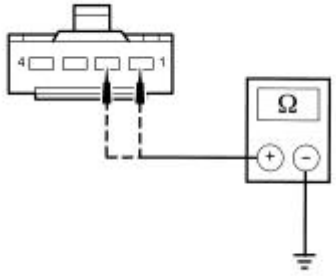
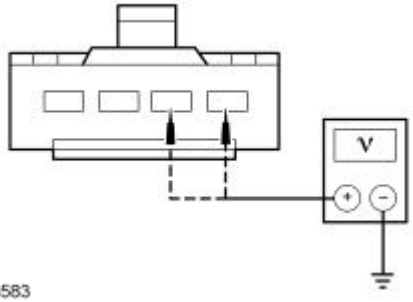
- **Is the resistance greater than 10,000 ohms?**

C41 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Connect a jumper wire between passenger air bag module C256-1, circuit CR104 (YE/GY), harness side and C256-2, circuit RR104 (WH/BU), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the passenger air bag module being disconnected. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to C47 . **No** GO to C42 .
C42 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM	
• Key in OFF position.	**Yes**

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module C256. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310a-5, circuit CR104 (YE/GY), harness side and passenger air bag module C256-1, circuit CR104 (YE/GY), harness side; and between RCM C310a-6, circuit RR104 (WH/BU), harness side and passenger air bag module C256-2, circuit RR104 (WH/BU), harness side.  • **Are the resistances less than 0.5 ohm?**	GO to C49 . **No** REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). GO to C56 .
C43 CHECK THE PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to C47 . **No** GO to C44 .
C44 CHECK CIRCUIT CR104 (YE/GY) AND CIRCUIT RR104 (WH/BU) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger air bag module C256-1, circuit CR104 (YE/GY), harness side and ground; and between passenger air bag module C256-2, circuit	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist

RR104 (WH/BU), harness side and ground.  A0090687 • **Are the resistances greater than 1,000,000 ohms?**	in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). GO to C56 .
C45 CHECK CIRCUIT CR104 (YE/GY) AND CIRCUIT RR104 (WH/BU) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger air bag module C256-1, circuit CR104 (YE/GY), harness side and ground; and between passenger air bag module C256-2, circuit RR104 (WH/BU), harness side and ground.  A0088583 • **Are the voltages less than 0.2 volt?**	**Yes** GO to C49 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). GO to C56 .
C46 CONFIRM THE DRIVER AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self-test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install the driver air bag module. Refer to Driver Air Bag Module . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs.	**Yes** INSTALL a new driver air bag module. REFER to Driver Air Bag Module . GO to C56 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were

• **Was DTC B2293 retrieved during the on-demand self test?**	disconnected. For driver air bag module loop 1 or loop 2 with a low resistance fault, GO to C50 . For driver air bag module loop 1 or loop 2 with an open circuit fault, GO to C50 . For driver air bag module loop 1 or loop 2 with a short to ground fault, GO to C51 . For driver air bag module loop 1 or loop 2 with a short to battery fault, GO to C53 .
C47 CONFIRM THE PASSENGER AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Passenger Air Bag Module C256 (if previously disconnected). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **Was DTC B2293 retrieved during the on-demand self test?**	**Yes** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module . GO to C56 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For passenger air bag module loop 1 or loop 2 with a low resistance fault, GO to C50 . For passenger air bag module loop 1 or loop 2 with an open circuit fault, GO to C50 . For passenger air bag module loop 1 or loop 2 with a short to ground fault, GO to C52 . For passenger air bag module loop 1 or loop 2 with a short to battery fault, GO to C54 .
C48 CONFIRM THE CLOCKSPRING FAULT	
NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying	**Yes** INSTALL a new clockspring.

out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Clockspring C218a. • Install the driver air bag module. Refer to Driver Air Bag Module . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **Was DTC B2293 retrieved during the on-demand self test?**	REFER to Clockspring . GO to C56 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver air bag module loop 1 or loop 2 with a low resistance fault, GO to C50 . For driver air bag module loop 1 or loop 2 with an open circuit fault, GO to C50 . For driver air bag module loop 1 or loop 2 with a short to ground fault, GO to C51 . For driver air bag module loop 1 or loop 2 with a short to battery fault, GO to C53 .
C49 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If previously removed, install the driver air bag module. Refer to Driver Air Bag Module . • Connect: Clockspring C218a (if previously disconnected). • Connect: Passenger Air Bag Module C256 (if previously disconnected). • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2293 Fault PIDs. • **Was DTC B2293 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to C56 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver air bag module loop 1 with a low resistance fault, GO to C50 . For driver air bag module

	loop 1 with an open circuit fault, GO to C50 . For driver air bag module loop 1 with a short to ground fault, GO to C51 . For driver air bag module loop 1 with a short to battery fault, GO to C53 . For driver air bag module loop 2 with a low resistance fault, GO to C50 . For driver air bag module loop 2 with an open circuit fault, GO to C50 . For driver air bag module loop 2 with a short to ground fault, GO to C51 . For driver air bag module loop 2 with a short to battery fault, GO to C53 . For passenger air bag module loop 1 with a low resistance fault, GO to C50 . For passenger air bag module loop 1 with an open circuit fault, GO to C50 . For passenger air bag module loop 1 with a short to ground fault, GO to C52 . For passenger air bag module loop 1 with a short to battery fault, GO to C54 . For passenger air bag module loop 2 with a low resistance fault, GO to C50 . For passenger air bag module loop 2 with an open circuit fault, GO to C50 . For passenger air bag module loop 2 with a short to ground fault, GO to C52 . For passenger air bag module loop 2 with a short to battery fault, GO to C54 .
C50 CHECK THE DRIVER OR PASSENGER AIR BAG MODULE FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT	
• If the fault PID was reported for the driver air bag module	**Yes**

loop 1 or loop 2, monitor the following on the scan tool: ▪ driver air bag module loop 1 resistance PID. ▪ driver air bag module loop 2 resistance PID. • If the fault PID was reported for the passenger air bag module loop 1 or loop 2, monitor the following on the scan tool: ▪ passenger air bag module loop 1 resistance PID. ▪ passenger air bag module loop 2 resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • **NOTE:** Do not remove the driver or passenger air bag module from its mounted position at this time. • With the driver or passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any driver or passenger air bag resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** GO to C55 .
C51 CHECK THE DRIVER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT	
• Monitor the driver air bag module loop 1 and loop 2 short to ground on-demand fault PIDs. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any driver air bag module short to ground fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** GO to C55 .
C52 CHECK THE PASSENGER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT	
• Key in ON position. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Monitor the passenger air bag module loop 1 and loop 2 short to ground on-demand fault PIDs. • **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any passenger air bag module short to ground fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** GO to C55 .
C53 CHECK THE DRIVER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section.	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell

• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Monitor the driver air bag module loop 1 and loop 2 short to battery on-demand fault PIDs. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any driver air bag module short to battery fault PID indicate a fault is present?**	5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** GO to C55 .
C54 CHECK THE PASSENGER AIR BAG MODULE CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Monitor the passenger air bag module loop 1 and loop 2 short to battery on-demand fault PIDs. • **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any passenger air bag module short to battery fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to C56 . **No** GO to C55 .
C55 CHECK THE HARNESS AND CONNECTORS	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• If the fault PID was reported for the driver air bag:
  ▪ remove the driver air bag module.
  ▪ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ inspect wire harness for any damage, pinched, cut or pierced wires.
• If the fault PID was reported for the passenger air bag:
  ▪ disconnect the passenger air bag module C256.
  ▪ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ inspect wire harness for any damage, pinched, cut or pierced wires.
• **Were any concerns found?**
	Yes
	REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to C56 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to C56 .

C56 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step C1. • **Were any continuous memory DTCs retrieved during Step C1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control

	Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test D: DTC B2294 — Restraint System — Curtain Fault

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all safety canopy module circuits for faults. The RCM will set a diagnostic trouble code (DTC) if a short to battery or short to ground fault is detected. The RCM will also set a DTC if the loop resistance is less than 0.9 ohm or greater than 5.0 ohms. The normal expected resistance range is 1.31 to 4.29 ohms. If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5.0 ohms, there exists a strong potential for an intermittent fault. If the RCM detects a fault on any of the safety canopy module circuits, it will store DTC B2294 in memory and illuminate the air bag warning indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Loop resistance less than 0.9 ohm (Low resistance)
- Loop resistance greater than 5.0 ohms (Circuit open)
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A safety canopy module fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty safety canopy module.
- RCM is faulted.

PINPOINT TEST D: DTC B2294 — RESTRAINT SYSTEM — CURTAIN FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the electrical connector on a safety canopy module. Doing so can result in safety canopy deployment.

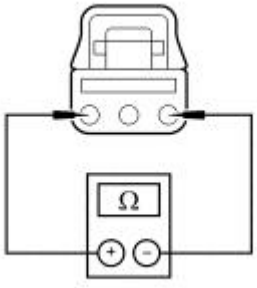
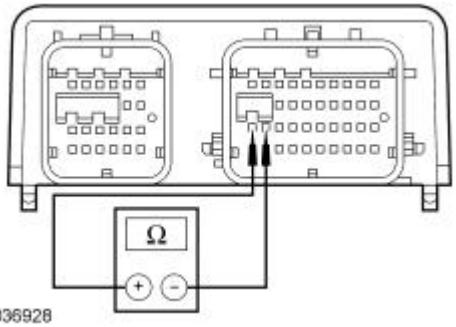
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

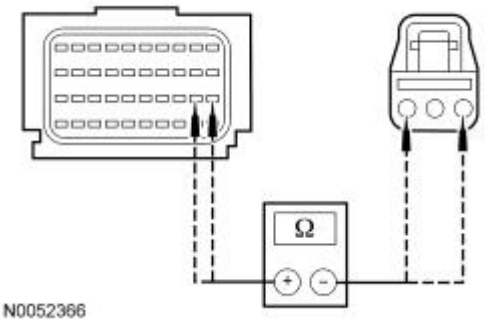
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

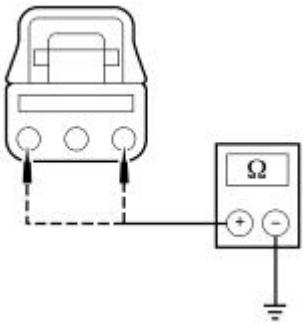
NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

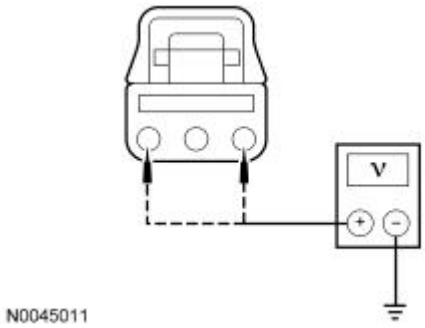
Test Step	Result / Action to Take
D1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **Was on-demand DTC B2294 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver safety canopy with a low resistance fault, GO to D2 . For driver safety canopy with an open circuit fault, GO to D2 . For driver safety canopy with a short to ground fault, GO to D9 . For driver safety canopy with a short to battery fault, GO to D11 . For passenger safety canopy with a low resistance fault, GO to D12 . For passenger safety canopy with an open circuit fault, GO to D12 . For passenger safety canopy with a short to ground fault, GO to D19 . For passenger safety canopy with a short to battery fault, GO to D21 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not

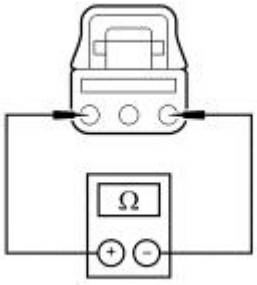
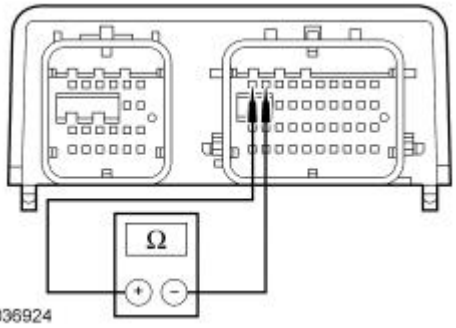
	retrieved on demand). The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver or passenger safety canopy with a low resistance or open circuit, GO to D24 . For driver or passenger safety canopy with a short to ground fault, GO to D26 . For driver or passenger safety canopy with a short to battery fault, GO to D27 .
D2 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Driver Safety Canopy Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to D23 . **No** GO to D3 .
D3 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the driver safety canopy resistance PID while carrying out a harness test of the driver safety canopy circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to D28 . **No** If the driver safety canopy resistance PID is less than 1.31 ohm, GO to D4 . If the driver safety canopy resistance PID is greater than 4.29 ohms, GO to D7 .
D4 CHECK THE DRIVER SAFETY CANOPY MODULE FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C9006.	**Yes** GO to D22 . **No** GO to D5 .

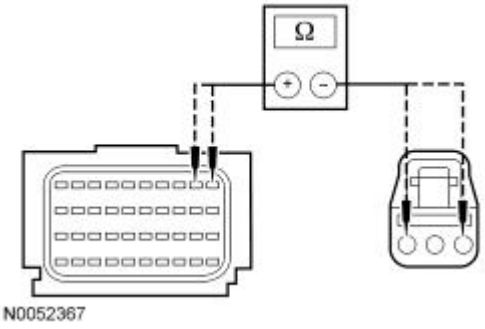
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
D5 CHECK CIRCUIT CR109 (BN/BU) AND CIRCUIT RR109 (BU/GN) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between driver safety canopy C9006-1, circuit CR109 (BN/BU), harness side and C9006-3, circuit RR109 (BU/GN), harness side.  DR1050-A • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D23. **No** GO to D6.
D6 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b pin 21, component side, and C310b pin 22, component side.  N0036928 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR109 (BN/BU) and circuit RR109 (BU/GN). GO to D28. **No** GO to D23.
D7 CHECK THE DRIVER SAFETY CANOPY MODULE FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.	**Yes** GO to D22. **No** GO to D8.

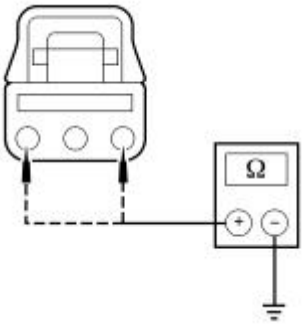
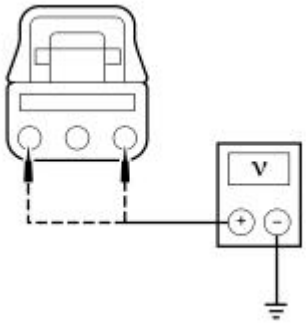
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C9006. • Connect a jumper wire between driver safety canopy C9006-1, circuit CR109 (BN/BU), harness side and C9006-3, circuit RR109 (BU/GN), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
D8 CHECK CIRCUIT CR109 (BN/BU) AND CIRCUIT RR109 (BU/GN) FOR AN OPEN BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the driver safety canopy C9006. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-21, circuit CR109 (BN/BU), harness side and driver safety canopy C9006-1, circuit CR109 (BN/BU), harness side; and between RCM C310b-22, circuit RR109 (BU/GN), harness side and driver safety canopy C9006-3, circuit RR109 (BU/GN), harness side.  • **Are the resistances less than 0.5 ohm?**	**Yes** GO to D23 . **No** REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). GO to D28 .
D9 CHECK THE DRIVER SAFETY CANOPY MODULE FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C9006.	**Yes** GO to D22 . **No** GO to D10 .

• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
D10 CHECK CIRCUIT CR109 (BN/BU) AND CIRCUIT RR109 (BU/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between driver safety canopy C9006-1, circuit CR109 (BN/BU), harness side and ground; and between driver safety canopy C9006-3, circuit RR109 (BU/GN), harness side and ground.  • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to D23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). GO to D28 .
D11 CHECK CIRCUIT CR109 (BN/BU) AND CIRCUIT RR109 (BU/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C9006. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between driver safety canopy C9006-1, circuit CR109 (BN/BU), harness side and ground; and between driver safety canopy C9006-3, circuit RR109 (BU/GN), harness side and ground.	**Yes** GO to D23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). GO to D28 .

 • **Are the voltages less than 0.2 volt?**	
D12 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Passenger Safety Canopy Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to D23 . **No** GO to D13 .
D13 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the passenger safety canopy resistance PID while carrying out a harness test of the passenger safety canopy circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to D28 . **No** If the passenger safety canopy resistance PID is less than 1.31 ohm, GO to D14 . If the passenger safety canopy resistance PID is greater than 4.29 ohms, GO to D17 .
D14 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C9007. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool:	**Yes** GO to D22 . **No** GO to D15 .

Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
D15 CHECK CIRCUIT CR111 (BN/WH) AND CIRCUIT RR111 (YE/VT) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between passenger safety canopy module C9007-1, circuit CR111 (BN/WH), harness side and C9007-3, circuit RR111 (YE/VT), harness side.  DR1050-A • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D23 . **No** GO to D16 .
D16 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b pin 1, component side, and C310b pin 2, component side.  N0036924 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR111 (BN/WH) and circuit RR111 (YE/VT). GO to D28 . **No** GO to D23 .
D17 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C9007. • Connect a jumper wire between passenger safety canopy	**Yes** GO to D22 . **No** GO to D18 .

C9007-1, circuit CR111 (BN/WH), harness side and C9007-3, circuit RR111 (YE/VT), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
D18 CHECK CIRCUIT CR111 (BN/WH) AND CIRCUIT RR111 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the passenger safety canopy C9007. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-1, circuit CR111 (BN/WH), harness side and passenger safety canopy module C9007-1, circuit CR111 (BN/WH), harness side; and between RCM C310b-2, circuit RR111 (YE/VT), harness side and passenger safety canopy module C9007-3, circuit RR111 (YE/VT), harness side.  • **Are the resistances less than 0.5 ohm?**	**Yes** GO to D23. **No** REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). GO to D28.
D19 CHECK THE PASSENGER SAFETY CANOPY MODULE FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C9007. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool:	**Yes** GO to D22. **No** GO to D20.

Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
D20 CHECK CIRCUIT CR111 (BN/WH) AND CIRCUIT RR111 (YE/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger safety canopy C9007-1, circuit CR111 (BN/WH), harness side and ground; and between passenger safety canopy C9007-3, circuit RR111 (YE/VT), harness side and ground.  N0045012 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to D23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). GO to D28 .
D21 CHECK CIRCUIT CR111 (BN/WH) AND CIRCUIT RR111 (YE/VT) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C9007. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger safety canopy C9007-1, circuit CR111 (BN/WH), harness side and ground; and between passenger safety canopy C9007-3, circuit RR111 (YE/VT), harness side and ground.  N0045011	**Yes** GO to D23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). GO to D28 .

• **Are the voltages less than 0.2 volt?**	
D22 CONFIRM THE SAFETY CANOPY MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Safety Canopy C9006 (Driver) C9007 (Passenger). • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **Was on-demand DTC B2294 retrieved?**	**Yes** INSTALL a new driver or passenger safety canopy. REFER to Safety Canopy Module . GO to D28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver or passenger safety canopy with a low resistance or open circuit, GO to D24 . For driver or passenger safety canopy with a short to ground fault, GO to D26 . For driver or passenger safety canopy with a short to battery fault, GO to D27 .
D23 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • If previously directed to disconnect any SRS component(s): ▪ depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. ▪ connect all previously disconnected restraint system component(s), including RCM C310a and C310b. ▪ repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2294 Fault PIDs. • **Was on-demand DTC B2294 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to D28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver or passenger safety canopy with a low resistance or open circuit, GO to D24 . For driver or passenger safety

	canopy with a short to ground fault, GO to D26 . For driver or passenger safety canopy with a short to battery fault, GO to D27 .

D24 CHECK FOR AN INTERMITTENT SAFETY CANOPY MODULE LOW RESISTANCE OR OPEN CIRCUIT FAULT
 	
• If the fault PID was reported for the driver safety canopy, monitor the following on the scan tool:
  ▪ driver safety canopy resistance PID.
• If the fault PID was reported for the passenger safety canopy, monitor the following on the scan tool:
  ▪ passenger safety canopy resistance PID.
• **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.
• Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
• **Does any safety canopy resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to D28 .
	
	No
	GO to D25 .

D25 CHECK THE HARNESS AND CONNECTORS
 	
• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Disconnect the affected safety canopy module C9006 (driver) or C9007 (passenger):
  ▪ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ inspect wire harness for any damage, pinched, cut or pierced wires.
• **Were any concerns found?**
	Yes
	REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to D28 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to D28 .

D26 CHECK FOR AN INTERMITTENT SAFETY CANOPY MODULE CIRCUIT SHORT TO GROUND FAULT
 	
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID.
• If the fault PID was reported for the driver safety canopy:
  ▪ monitor the driver safety canopy short to ground on-demand fault PID on the scan tool.
• If the fault PID was reported for the passenger safety canopy:
  ▪ monitor the passenger safety canopy short to ground on-demand fault PID on the scan tool.
• **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2 second delay for the scan tool display to update.
• Attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness.
• **Does any safety canopy on-demand fault PID indicate a fault is present?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to D28 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to D28 .

D27 CHECK FOR AN INTERMITTENT SAFETY CANOPY MODULE CIRCUIT SHORT TO BATTERY FAULT	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• If the fault PID was reported for the driver safety canopy,
  ▪ disconnect the driver safety canopy module C9006.
• If the fault PID was reported for the passenger safety canopy,
  ▪ disconnect the passenger safety canopy module C9007.
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Key in ON position.
• **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2 second delay for the scan tool display to update.
• Monitor the driver or passenger safety canopy short to battery on-demand fault PIDs on the scan tool.
• Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
• **Does any safety canopy on-demand fault PID indicate a fault is present?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5, Connector Repair Procedures for schematic and connector information.
	
	GO to D28.
	
	No
	The fault is not present and cannot be recreated at this time. GO to D28.

D28 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step D1. • **Were any continuous memory DTCs retrieved during Step D1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test E: DTC B2295 — Restraint System — Side Air Bag Fault

Refer to Wiring Diagrams Cell 46, Supplemental Restraint System for schematic and connector information.

Normal Operation

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a safety canopy module. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The restraints control module (RCM) monitors the side air bag module circuits for faults. The RCM will

set a diagnostic trouble code (DTC) if a short to battery or short to ground fault is detected. The RCM will also set a DTC if the loop resistance is less than 0.9 ohm or greater than 5.0 ohms. The normal expected resistance range is 1.31 to 4.29 ohms. If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5.0 ohms, there exists a strong potential for an intermittent fault. If the RCM detects one of the following faults on any of the side air bag circuits, it will store DTC B2295 in memory and illuminate the air bag warning indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Loop resistance less than 0.9 ohm (Low resistance)
- Loop resistance greater than 5.0 ohms (Circuit open)
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A side air bag fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulted side air bag module.
- a faulted RCM.

PINPOINT TEST E: DTC B2295 — RESTRAINT SYSTEM — SIDE AIR BAG FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

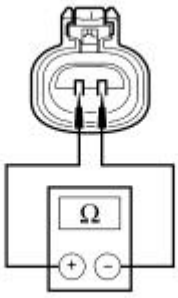
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

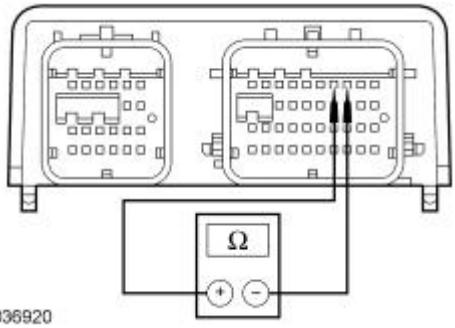
Test Step	Result / Action to Take
E1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **Was on-demand DTC B2295 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

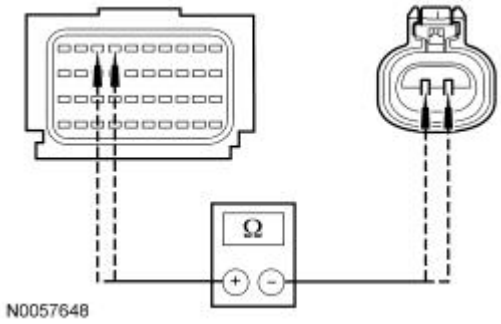
	Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver side air bag low resistance fault, GO to E2 . For driver side air bag with an open circuit fault, GO to E2 . For driver side air bag with a short to ground fault, GO to E9 . For driver side air bag with a short to battery fault, GO to E11 . For passenger side air bag with a low resistance fault, GO to E12 . For passenger side air bag with an open circuit fault, GO to E12 . For passenger side air bag with a short to ground fault, GO to E19 . For passenger side air bag with a short to battery fault, GO to E21 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For driver or passenger side air bag with a low resistance, open circuit or short to ground fault, GO to E24 . For driver or passenger side air bag with a short to ground fault, GO to E26 . For driver or passenger side air bag with a short to battery fault, GO to E27 .
E2 CHECK THE DRIVER SIDE AIR BAG MODULE RESISTANCE PID	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool:	**Yes** GO to E23 . **No**

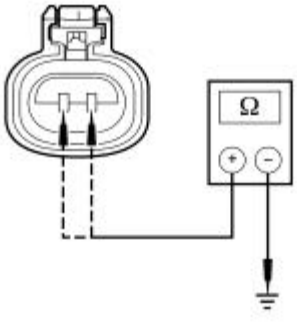
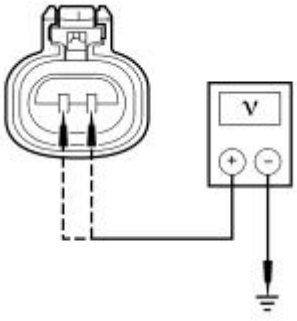
Driver Side Air Bag Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms**	GO to E3 .
E3 CHECK THE DRIVER SIDE AIR BAG RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the driver side air bag resistance PID while carrying out a harness test of the driver side air bag circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to E28 . **No** If the driver side air bag resistance PID is less than 1.31 ohms, GO to E4 . If the driver safety canopy resistance PID is greater than 4.29 ohms, GO to E7 .
E4 CHECK THE DRIVER SIDE AIR BAG MODULE FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag disconnected, an open circuit fault would normally be retrieved. • **Did the driver side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to E22 . **No** GO to E5 .
E5 CHECK CIRCUIT CR110 (GN/BN) AND CIRCUIT RR110 (GY/OG) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between driver side air bag C3051-1, circuit CR110 (GN/BN), harness side and C3052-2, circuit RR110 (GY/OG), harness side.	**Yes** GO to E22 . **No** GO to E6 .



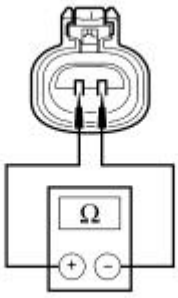
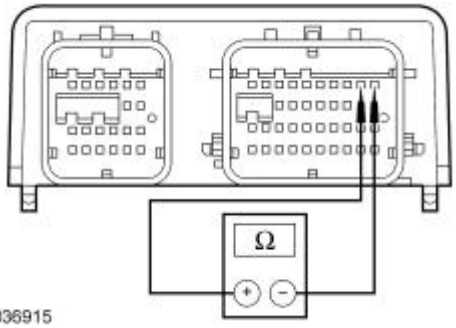
- **Is the resistance greater than 10,000 ohms?**

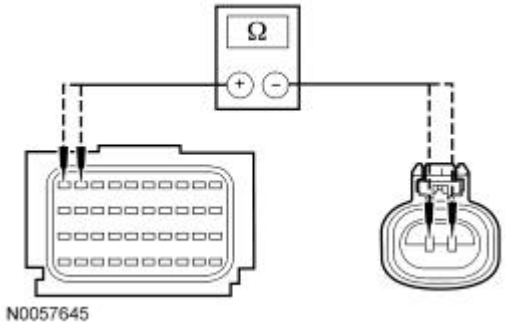
E6 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b pin 7, component side, and C310b pin 8, component side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR110 (GN/BN) and circuit RR110 (GY/OG). GO to E25 . **No** GO to E23 .
E7 CHECK THE DRIVER SIDE AIR BAG MODULE FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3051. • Connect a jumper wire between driver side air bag C3051-1, circuit CR110 (GN/BN), harness side and C3051-2, circuit RR110 (GY/OG), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to E22 . **No** GO to E8 .
E8 CHECK CIRCUIT CR110 (GN/BN) AND CIRCUIT RR110	

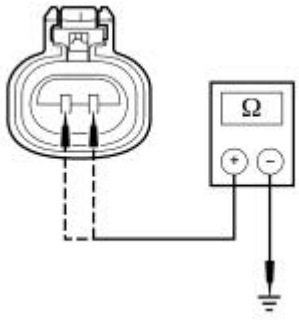
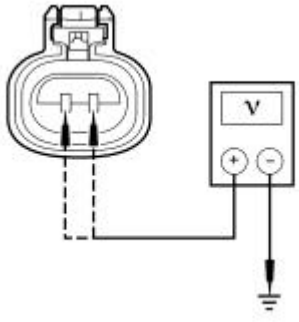
(GY/OG) FOR AN OPEN BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the driver side air bag C3051. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-8, circuit CR110 (GN/BN), harness side and driver side air bag C3051-1, circuit CR110 (GN/BU), harness side; and between RCM C310b-7, circuit RR110 (GY/OG), harness side and driver side air bag C3051-2, circuit RR110 (GY/OG), harness side.  • **Are the resistances less than 0.5 ohm?**	**Yes** GO to E23 . **No** REPAIR circuit CR110 (GN/BN) or circuit RR110 (GY/OG). GO to E28 .
E9 CHECK THE DRIVER SIDE AIR BAG MODULE FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module disconnected, an open circuit fault would normally be retrieved. • **Did the driver side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to E22 . **No** GO to E10 .
E10 CHECK CIRCUIT CR109 (BN/BU) AND CIRCUIT RR109 (BU/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between driver side air bag C3051-1, circuit CR110 (GN/BN), harness side and ground; and	**Yes** GO to E23 . **No** Due to the shorting bar feature in the RCM electrical

between driver side air bag C3051-2, circuit RR110 (GY/OG), harness side and ground.  N0057647 • **Is the resistance greater than 1,000,000 ohms?**	connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR110 (GN/BN) or circuit RR110 (GY/OG). GO to E28 .
E11 CHECK CIRCUIT CR110 (GN/BN) AND CIRCUIT RR110 (GY/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3051. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between driver side air bag C3051-1, circuit CR110 (GN/BN), harness side and ground; and between driver side air bag C3051-2, circuit RR110 (GY/OG), harness side and ground.  N0057646 • **Are the voltages less than 0.2 volt?**	**Yes** GO to E23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR110 (GN/BN) or circuit RR110 (GY/OG). GO to E28 .
E12 CHECK THE PASSENGER SIDE AIR BAG MODULE RESISTANCE PID	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/PID. • Enter the following diagnostic mode on the diagnostic tool: Passenger Side Air Bag Resistance PID . • **Is the resistance between 1.31 and 4.29 ohms?**	**Yes** GO to E23 . **No** GO to E13 .
E13 CHECK THE PASSENGER SIDE AIR BAG RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the passenger side air bag resistance PID while carrying out a harness test of the passenger side air bag circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed.

• **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to E28 . **No** If the passenger side air bag resistance PID is less than 1.31 ohms, GO to E14 . If the passenger side air bag resistance PID is greater than 4.29 ohms, GO to E17 .
E14 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR LOW RESISTANCE	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3052. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit faults would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to E22 . **No** GO to E15 .
E15 CHECK CIRCUIT CR112 (BU/GY) AND CIRCUIT RR112 (GN/OG) FOR LOW RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between passenger side air bag C3052-1, circuit CR112 (BU/GY), harness side and C3052-2, circuit RR112 (GN/OG), harness side.	**Yes** GO to E23 . **No** GO to E16 .

 A0091743 • **Is the resistance greater than 10,000 ohms?**	
E16 CHECK THE RCM FOR LOW RESISTANCE	**Yes** REPAIR circuit CR112 (BU/GY) and circuit RR112 (GN/OG). GO to E28 . **No** GO to E23 .
• Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b pin 9, component side, and C310b pin 10, component side.  N0036915 • **Is the resistance greater than 10,000 ohms?**	
E17 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR AN OPEN	**Yes** GO to E22 . **No** GO to E18 .
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3052. • Connect a jumper wire between passenger side air bag C3052-1, circuit CR112 (BU/GY), harness side and C3052-2, circuit RR112 (GN/OG), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
E18 CHECK CIRCUIT CR112 (BU/GY) AND CIRCUIT RR111 (GN/OG) FOR AN OPEN BETWEEN THE RCM AND	

PASSENGER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the passenger side air bag C3052. • Disconnect: RCM C310a and C310b. • Measure the resistance between RCM C310b-9, circuit CR112 (BU/GY), harness side and passenger side air bag module C3052-1, circuit CR112 (BU/GY), harness side; and between RCM C310b-10, circuit RR112 (GN/OG), harness side and passenger side air bag module C3052-2, circuit RR112 (GN/OG), harness side.  N0057645 • **Are the resistances less than 0.5 ohm?**	**Yes** GO to E23 . **No** REPAIR circuit CR112 (BU/GY) or circuit RR112 (GN/OG). GO to E28 .
E19 CHECK THE PASSENGER SIDE AIR BAG MODULE FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3052. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to E22 . **No** GO to E20 .
E20 CHECK CIRCUIT CR112 (BU/GY) AND CIRCUIT RR112 (GN/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger side air bag	**Yes** GO to E23 . **No** Due to the shorting bar

C3052-1, circuit CR112 (BU/GY), harness side and ground; and between passenger side air bag C3052-2, circuit RR112 (GN/OG), harness side and ground.  N0057647 • **Is the resistance greater than 1,000,000 ohms?**	feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR112 (BU/GY) or circuit RR112 (GN/OG). GO to E28 .
E21 CHECK CIRCUIT CR112 (BU/GY) AND CIRCUIT RR112 (GN/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3052. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger side air bag C3052-1, circuit CR112 (BU/GY), harness side and ground; and between passenger side air bag C3052-2, circuit RR112 (GN/OG), harness side and ground.  N0057646 • **Are the voltages less than 0.2 volt?**	**Yes** GO to E23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR112 (BU/GY) or circuit RR112 (GN/OG). GO to E28 .
E22 CONFIRM THE SIDE AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Side Air Bag C3051 (Driver) C3052 (Passenger). • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position.	**Yes** REMOVE and INSPECT the seat side air bag module jumper harness, connector terminals for damage. REFER to Side Air Bag Module in this section. If a concern is found, REPAIR or INSTALL a new seat jumper harness. GO to E28 If a concern was not found, INSTALL a new driver or passenger side air bag

• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs. • **Was on-demand DTC B2295 retrieved?**	module. GO to E28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For driver or passenger side air bag with a low resistance, open circuit or short to ground fault, GO to E24 . For driver or passenger side air bag with a short to ground fault, GO to E26 . For driver or passenger side air bag with a short to battery fault, GO to E27 .
E23 CONFIRM THE RCM FAULT	

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.
• Key in OFF position.
• If previously directed to disconnect any SRS component(s):
  ▪ depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
  ▪ connect all previously disconnected restraint system component(s), including RCM C310a and C310b.
  ▪ repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Key in ON position.
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTC.
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2295 Fault PIDs.
• **Was on-demand DTC B2295 retrieved?**
	Yes
	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to E28 .
	
	No
	In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.
	
	For driver or passenger side air bag with a low resistance, open circuit or short to ground fault, GO to E24 .
	
	For driver or passenger side air bag with a short to ground fault, GO to E26 .
	
	For driver or passenger side air bag with a short to battery

	fault, GO to E27 .
E24 CHECK FOR AN INTERMITTENT SIDE AIR BAG MODULE LOW RESISTANCE OR OPEN CIRCUIT FAULT	

• If the fault PID was reported for the driver side air bag module, monitor the following on the scan tool:
  ▪ driver side air bag resistance PID.
• If the fault PID was reported for the passenger side air bag, monitor the following on the scan tool:
  ▪ passenger side air bag resistance PID.
• **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.
• Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
• **Does any side air bag on-demand fault PID indicate a fault is present or is the side air bag resistance PID less than 1.31 ohms or greater than 4.29 ohms?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to E28 .
	
	No
	GO to E25 .

E25 CHECK THE HARNESS AND CONNECTORS	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Disconnect the affected side air bag module C3051 (driver) C3052 (passenger):
  ▪ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ inspect wire harness for any damage, pinched, cut or pierced wires.
• **Were any concerns found?**
	Yes
	REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to E28 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to E28 .

E26 CHECK FOR AN INTERMITTENT SIDE AIR BAG MODULE CIRCUIT SHORT TO GROUND FAULT	

• If the fault PID was reported for the driver side air bag module, monitor the following on the scan tool:
  ▪ driver side air bag short to ground on-demand fault PID.
• If the fault PID was reported for the passenger side air bag, monitor the following on the scan tool:
  ▪ passenger side air bag short to ground on-demand fault PID.
• **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
• Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
• **Does any side air bag on-demand fault PID indicate a fault is present?**
	Yes
	DEPOWER the SRS and REPAIR as necessary.
	
	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
	
	GO to E28 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to E28 .

E27 CHECK FOR AN INTERMITTENT SIDE AIR BAG MODULE CIRCUIT SHORT TO BATTERY FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** DEPOWER the SRS and REPAIR as necessary.

• Disconnect the affected side air bag module C3051 (driver) C3052 (passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Monitor the driver or passenger side air bag module short to battery on-demand fault PIDs on the scan tool. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any side air bag on-demand fault PID indicate a fault is present?**	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to E28 . **No** The fault is not present and cannot be recreated at this time. GO to E28 .
E28 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step E1. • **Were any continuous memory DTCs retrieved during Step E1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test F: DTC B2296 — Restraint System — Impact Sensor Fault

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all of the impact sensor circuits for faults. If the RCM detects one of the following faults on any of the impact sensor circuits, it will store diagnostic trouble code (DTC) B2296 in memory and illuminate the air bag warning indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- Circuit open
- Circuit short to voltage
- Circuit short to ground

Possible Causes

An impact sensor fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty impact sensor.
- incorrect sensor mounting.
- RCM is faulted.

PINPOINT TEST F: DTC B2296 — RESTRAINT SYSTEM — IMPACT SENSOR FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

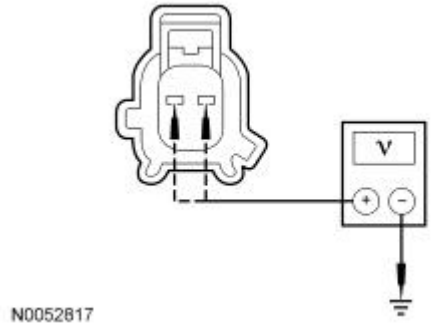
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

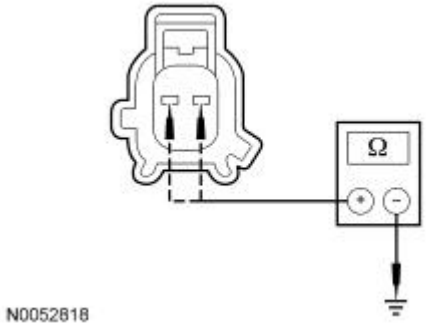
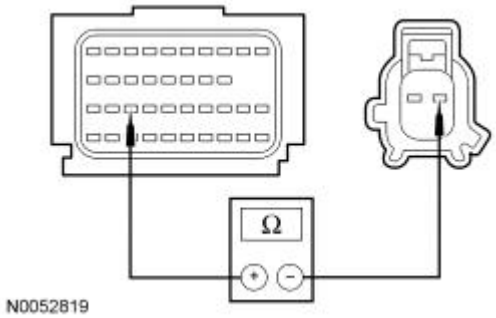
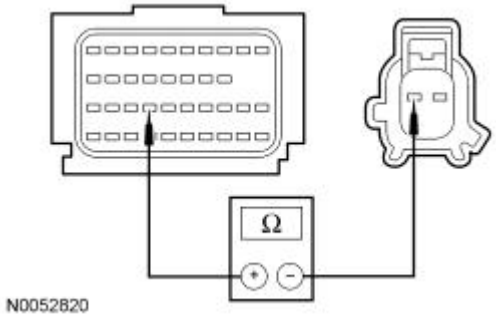
NOTE: Do not probe any impact sensor. The impact sensor is an electronic device and can not be tested using a multi-meter.

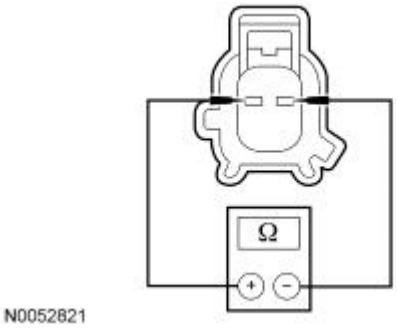
Test Step	Result / Action to Take
F1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For first row driver side impact sensor with a mounting/communications fault, GO to F2 . For first row driver side impact sensor with an internal fault, INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor — Front Door in this section. GO to F50 . For first row passenger side impact sensor with a mounting/communications fault, GO to F10 .

	For first row passenger side impact sensor with an internal fault, INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor — Front Door in this section. GO to F50. For second row driver side impact sensor with a mounting/communication fault, GO to F18. For second row driver side impact sensor with an internal fault, INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor — C-Pillar in this section. GO to F50. For second row passenger side impact sensor with a mounting/communications fault, GO to F28. For second row passenger side impact sensor with an internal fault, INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor — C-Pillar in this section. GO to F50. For front impact severity sensor with a mounting/communications fault, GO to F38. For front impact severity sensor with an internal fault, INSTALL a new front impact severity sensor. REFER to Front Impact Severity Sensor in this section. GO to F50. **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to F49.
F2 INSPECT THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	

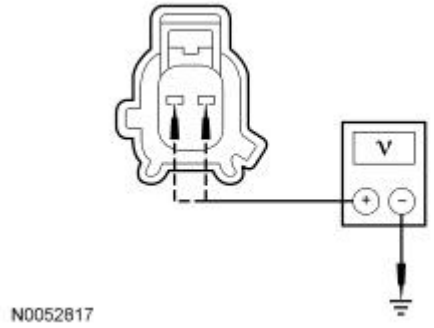
• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Access the first row driver side impact sensor located in the driver front door. Refer to Side Impact Sensor — Front Door in this section.
• Inspect the first row driver side impact sensor for:
  ▪ loose electrical connector.
  ▪ improper mounting.
• Remove the first row driver side impact sensor.
• Visually inspect the first row driver side impact sensor, electrical connector and mounting surface
	Yes
	If the first row driver side impact sensor was not attached to the mounting surface correctly, REINSTALL the sensor correctly or REPAIR the mounting surface as necessary. GO to F50.
	
	If the first row driver side impact sensor was damaged, INSTALL a new first row driver side impact sensor. GO to F50.

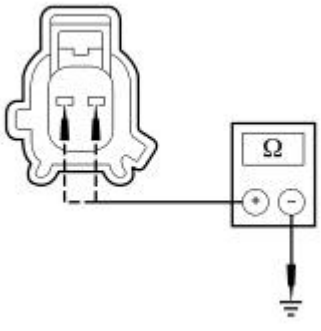
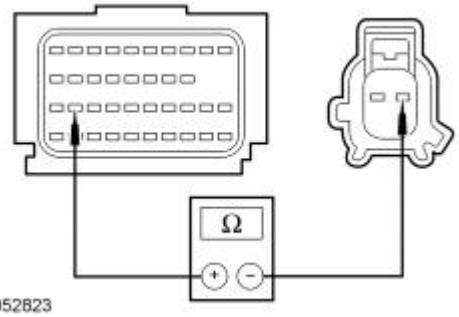
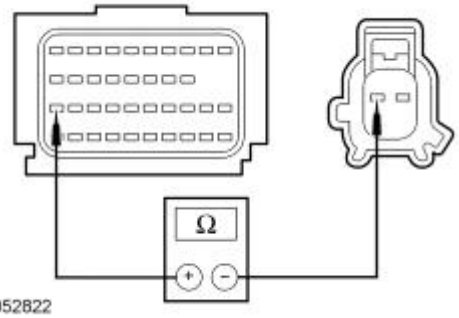
for damage. • **Was the first row driver side impact sensor damaged, attached to the mounting surface incorrectly or not fully seated and tightened correctly?**	**No** GO to F3 .
F3 INSTALL THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Install the first row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F4 . **No** Fault corrected. GO to F50 .
F4 CHECK CIRCUIT VR217 (GY/YE) AND CIRCUIT RR131 (VT/GY) FOR A SHORT TO VOLTAGE BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Driver Side Impact Sensor C539. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between first row driver side impact sensor C539-2, circuit RR131 (VT/GY), harness side and ground; and between C539-1, circuit VR217 (GY/YE), harness side and ground.  N0052817 • **Are the voltages less than 0.2 volt?**	**Yes** GO to F5 . **No** REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). GO to F50 .
F5 CHECK CIRCUIT VR217 (GY/YE) AND CIRCUIT RR131 (VT/GY) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND RCM	

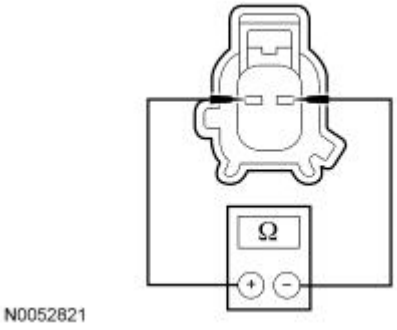
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between first row driver side impact sensor C539-2, circuit RR131 (VT/GY), harness side and ground; and between C539-1, circuit VR217 (GY/YE), harness side and ground.  N0052818 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to F6 . **No** REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). GO to F50 .
F6 CHECK CIRCUIT VR217 (GY/YE) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-28, circuit VR217 (GY/YE), harness side and first row driver side impact sensor C539-1, circuit VR217 (GY/YE), harness side.  N0052819 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F7 . **No** REPAIR circuit VR217 (GY/YE). GO to F50 .
F7 CHECK CIRCUIT RR131 (VT/GY) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-27, circuit RR131 (VT/GY), harness side and first row driver side impact sensor C539-2, circuit RR131 (VT/GY), harness side.  N0052820 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F8 . **No** REPAIR circuit RR131 (VT/GY). GO to F50 .

F8 CHECK CIRCUIT VR217 (GY/YE) FOR A SHORT TO CIRCUIT RR131 (VT/GY) BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between first row driver side impact sensor C539-1, circuit VR217 (GY/YE), harness side and C539-2, circuit RR131 (VT/GY), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to F9 . **No** REPAIR circuit VR217 (GY/YE) and circuit RR131 (VT/GY). GO to F50 .
F9 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b. • Install a known good first row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Were any on-demand fault PIDs for the first row driver side impact sensor indicating a fault?**	**Yes** GO to F48 . **No** Fault corrected. GO to F50 .
F10 INSPECT THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	

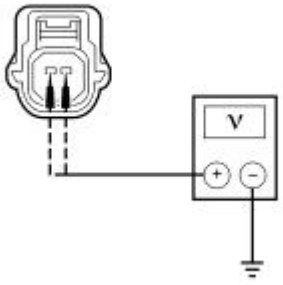
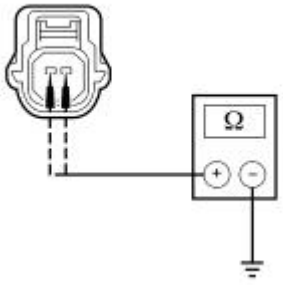
• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Access the first row passenger side impact sensor located in the front door. Refer to Side Impact Sensor — Front Door in this section.
• Inspect the first row passenger side impact sensor for:
  ▪ loose electrical connector.
  ▪ improper mounting.
• Remove the first row passenger side impact sensor.
• Visually inspect the first row passenger side impact sensor, electrical connector and mounting surface for damage.
• **Was the first row passenger side impact sensor damaged, attached to the mounting surface incorrectly or not fully seated and tightened correctly?**
	Yes
	If the first row passenger side impact sensor was not attached to the mounting surface correctly, REINSTALL the sensor correctly or REPAIR the mounting surface as necessary. GO to F50 .
	
	If the first row passenger side impact sensor was damaged, INSTALL a new first row passenger side impact sensor. GO to F50 .
	
	No
	GO to F11 .

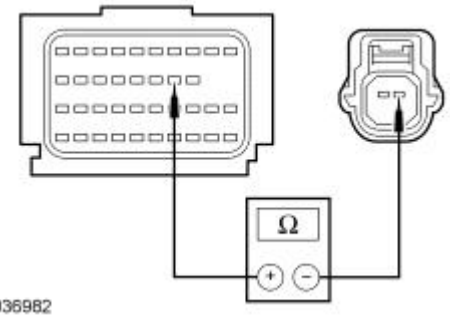
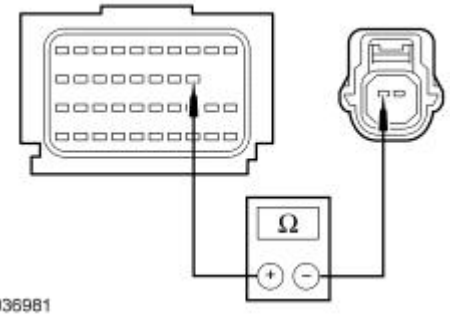
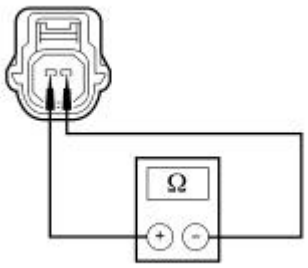
F11 INSTALL THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Install the first row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F12 . **No** Fault corrected. GO to F50 .
F12 CHECK CIRCUIT VR218 (YE/OG) AND CIRCUIT RR132 (BU/WH) FOR A SHORT TO VOLTAGE BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Passenger Side Impact Sensor C631. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between first row passenger side impact sensor C631-1, circuit VR218 (YE/OG), harness side and ground; and between C631-2, circuit RR132 (BU/WH), harness side and ground.  • **Are the voltages less than 0.2 volt?**	**Yes** GO to F13 . **No** REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). GO to F50 .
F13 CHECK CIRCUIT VR218 (YE/OG) AND CIRCUIT RR132 (BU/WH) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between first row passenger side impact sensor C631-1, circuit	**Yes** GO to F14 . **No** REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). GO to F50 .

VR218 (YE/OG), harness side and ground; and between C631-2, circuit RR132 (BU/WH), harness side and ground.  N0052818 • **Are the resistances greater than 1,000,000 ohms?**	
F14 CHECK CIRCUIT VR218 (YE/OG) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-29, circuit VR218 (YE/OG), harness side and first row passenger side impact sensor C631-1, circuit VR218 (YE/OG), harness side.  N0052823 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F15 . **No** REPAIR circuit VR218 (YE/OG). GO to F50 .
F15 CHECK CIRCUIT RR132 (BU/WH) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-30, circuit RR132 (BU/WH), harness side and first row passenger side impact sensor C631-2, circuit RR132 (BU/WH), harness side.  N0052822 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F16 . **No** REPAIR circuit RR132 (BU/WH). GO to F50 .
F16 CHECK CIRCUIT VR218 (YE/OG) FOR A SHORT TO CIRCUIT RR132 (BU/WH) BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR	

• Measure the resistance between first row passenger side impact sensor C631-1, circuit VR218 (YE/OG), harness side and C631-2, circuit RR132 (BU/WH), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to F17 . **No** REPAIR short between circuit VR218 (YE/OG) and circuit RR132 (BU/WH). GO to F50 .
F17 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b. • Install a known good first row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Were any on-demand fault PIDs for the first row passenger side impact sensor indicating a fault?**	**Yes** GO to F48 . **No** Fault corrected. GO to F50 .
F18 INSPECT THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the second row driver side impact sensor and inspect the mounting and make sure that the retaining bolt is fully seated and tightened correctly. Refer to Side Impact Sensor — C-Pillar in this section. • Remove the second row driver side impact sensor. • Visually inspect the second row driver side impact sensor and mounting surface for damage, corrosion or dirt. • **Was the second row driver side impact sensor damaged, a significant amount of corrosion or dirt found, attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** If the second row driver side impact sensor was not attached to the mounting surface correctly, REINSTALL the sensor correctly and CLEAN or REPAIR the mounting surface as necessary. GO to F50 . If the second row driver side impact sensor was damaged, INSTALL a new second row driver side impact sensor. GO to F50 . **No** GO to F19 .
F19 INSTALL THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	

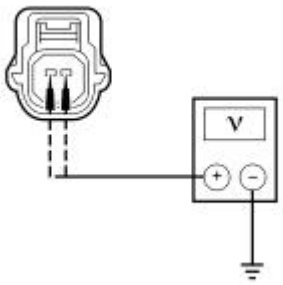
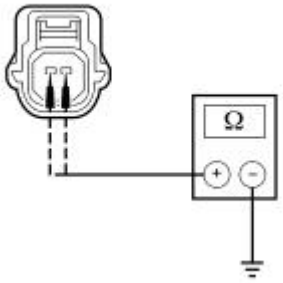
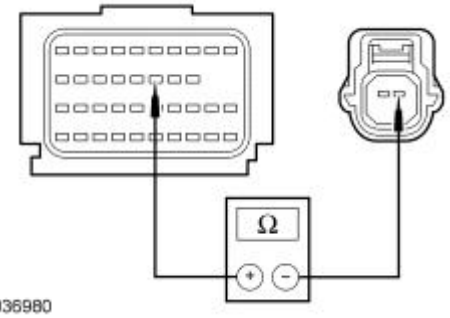
• Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolt. • Install the second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F20 . **No** Fault corrected. GO to F50 .
F20 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT RR133 (GY/BN) FOR HIGH RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Driver Side Impact Sensor C3314. • Measure the resistance between second row driver side impact sensor C3248-2, circuit RR133 (GY/BN), harness side and the second row driver side impact sensor case ground. • **Is the resistance less than 10 ohms?**	**Yes** GO to F22 . **No** GO to F21 .
F21 CLEAN THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the second row driver side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolt. • Install the second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F22 . **No** Fault corrected. GO to F50 .
F22 CHECK CIRCUIT VR219 (GN/WH) AND CIRCUIT RR133 (GY/BN) FOR A SHORT TO VOLTAGE BETWEEN THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to F23 . **No**

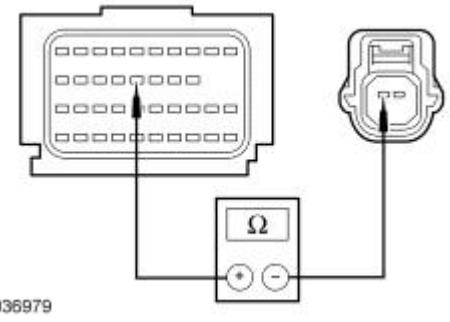
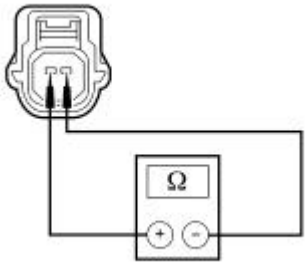
• Disconnect: Second Row Driver Side Impact Sensor C3314. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between second row driver side impact sensor C3314-1, circuit VR219 (GN/WH), harness side and ground; and between C3314-2, circuit RR133 (GY/BN), harness side and ground.  N0036990 • **Are the voltages less than 0.2 volt?**	REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). GO to F50 .
F23 CHECK CIRCUIT VR219 (GN/WH) AND CIRCUIT RR133 (GY/BN) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between second row driver side impact sensor C3314-1, circuit VR219 (GN/WH), harness side and ground; and between C3314-2, circuit RR133 (GY/BN), harness side and ground.  N0036989 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to F24 . **No** REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). GO to F50 .
F24 CHECK CIRCUIT VR219 (GN/WH) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-14, circuit VR219 (GN/WH), harness side and second row driver side impact sensor C3314-1, circuit VR219 (GN/WH), harness side.	**Yes** GO to F25 . **No** REPAIR circuit VR219 (GN/WH). GO to F50 .

 N0036982 • **Is the resistance less than 0.5 ohm?**	
F25 CHECK CIRCUIT RR133 (GY/BN) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-13, circuit RR135 (GY/BN), harness side and second row driver side impact sensor C3314-2, circuit RR133 (GY/BN), harness side.  N0036981 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F26 . **No** REPAIR circuit RR133 (GY/BN). GO to F50 .
F26 CHECK CIRCUIT VR219 (GN/WH) FOR A SHORT TO CIRCUIT RR133 (GY/BN) BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between second row driver side impact sensor C3314-1, circuit VR219 (GN/WH), harness side and C3314-2, circuit RR135 (GY/BN), harness side.  N0036987 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to F27 . **No** REPAIR circuit VR219 (GN/WH) and circuit RR133 (GY/BN). GO to F50 .
F27 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b. • Install a known good second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this	**Yes** GO to F48 . **No** Fault corrected. GO to F50 .

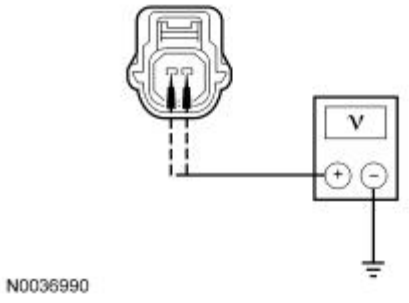
section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Were any on-demand fault PIDs for the second row driver side impact sensor indicating a fault?**	
F28 INSPECT THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the second row passenger side impact sensor and inspect the mounting and make sure that the retaining bolt is fully seated and tightened correctly. Refer to Side Impact Sensor — C-Pillar in this section. • Remove the second row passenger side impact sensor. • Visually inspect the second row passenger side impact sensor and mounting surface for damage, corrosion or dirt. • **Was the second row passenger side impact sensor damaged, a significant amount of corrosion or dirt found, attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** If the second row passenger side impact sensor was not attached to the mounting surface correctly, REINSTALL the sensor correctly and CLEAN or REPAIR the mounting surface as necessary. GO to F50. If the second row passenger side impact sensor was damaged, INSTALL a new second row passenger side impact sensor. GO to F50. **No** GO to F29.
F29 INSTALL THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolt. • Install the second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F30. **No** Fault corrected. GO to F50.
F30 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT RR130 (GN/BU) FOR HIGH RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental	**Yes** GO to F32.

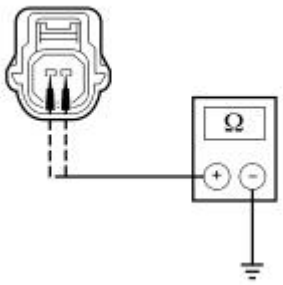
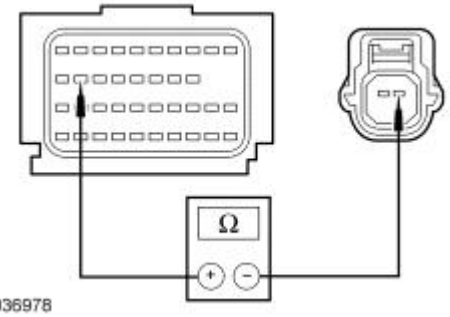
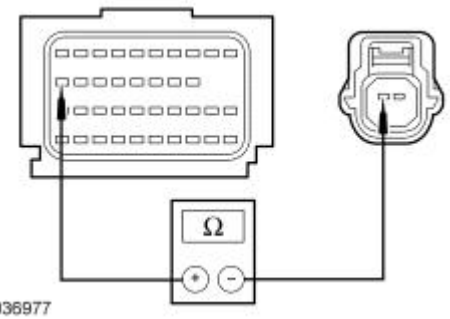
Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Passenger Side Impact Sensor C3315. • Measure the resistance between second row passenger side impact sensor C3315-2, circuit RR130 (GN/BU), harness side and the second row passenger side impact sensor case ground. • **Is the resistance less than 10 ohms?**	**No** GO to F31 .
F31 CLEAN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the second row passenger side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolt. • Install the second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F32 . **No** Fault corrected. GO to F50 .
F32 CHECK CIRCUIT VR220 (VT/OG) AND CIRCUIT RR130 (GN/BU) FOR A SHORT TO VOLTAGE BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Passenger Side Impact Sensor C3315. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between second row passenger side impact sensor C3315-1, circuit VR220 (VT/OG), harness side and ground; and between C3315-2, circuit RR130 (GN/BU), harness side and ground.	**Yes** GO to F33 . **No** REPAIR circuit VR220 (VT/OG) or circuit RR130 (GN/BU). GO to F50 .

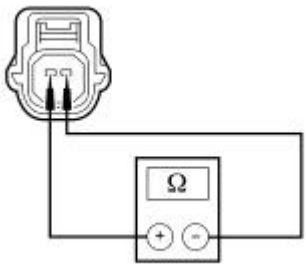
 N0036990 • **Are the voltages less than 0.2 volt?**	
F33 CHECK CIRCUIT VR220 (VT/OG) AND CIRCUIT RR130 (GN/BU) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND RCM	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between second row passenger side impact sensor C3315-1, circuit VR220 (VT/OG), harness side and ground; and between C3315-2, circuit RR130 (GN/BU), harness side and ground.  N0036989 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to F34 . **No** REPAIR circuit VR220 (VT/OG) or circuit RR130 (GN/BU). GO to F50 .
F34 CHECK CIRCUIT VR220 (VT/OG) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-15, circuit VR220 (VT/OG), harness side and second row passenger side impact sensor C3315-1, circuit VR220 (VT/OG), harness side.  N0036980 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F35 . **No** REPAIR circuit VR220 (VT/OG). GO to F50 .
F35 CHECK CIRCUIT RR130 (GN/BU) FOR AN OPEN	

BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-16, circuit RR130 (GN/BU), harness side and second row passenger side impact sensor C3315-2, circuit RR130 (GN/BU), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F36 . **No** REPAIR circuit RR130 (GN/BU). GO to F50 .
F36 CHECK CIRCUIT VR220 (VT/OG) FOR A SHORT TO CIRCUIT RR130 (GN/BU) BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between second row passenger side impact sensor C3315-1, circuit VR220 (VT/OG), harness side and C3315-2, circuit RR130 (GN/BU), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to F37 . **No** REPAIR circuit VR220 (VT/OG) and circuit RR130 (GN/BU). GO to F50 .
F37 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b. • Install a known good second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Were any on-demand fault PIDs for the second row passenger side impact sensor indicating a fault?**	**Yes** GO to F48 . **No** Fault corrected. GO to F50 .
F38 INSPECT THE FRONT IMPACT SEVERITY	

SENSOR MOUNTING AND MOUNTING SURFACE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Inspect the front impact severity sensor mounting and make sure that the retaining bolt is fully seated and tightened correctly. • Remove the front impact severity sensor. Refer to Front Impact Severity Sensor in this section. • Visually inspect the front impact severity sensor and mounting surface for damage, corrosion or dirt. • **Was the front impact severity sensor damaged, a significant amount of corrosion or dirt found, attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** If the front impact severity sensor was not attached to the mounting surface correctly, REINSTALL the sensor correctly and CLEAN or REPAIR the mounting surface as necessary. GO to F50 . If the front impact severity sensor was damaged, INSTALL a new front impact severity sensor. GO to F50 . **No** GO to F39 .
F39 INSTALL THE FRONT IMPACT SEVERITY SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the front impact severity sensor mounting bolt. • Install the front impact severity sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** GO to F40 . **No** Fault corrected. GO to F50 .
F40 CHECK FRONT IMPACT SEVERITY SENSOR GROUND CIRCUIT RR129 (YE/GY) FOR HIGH RESISTANCE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Front Impact Severity Sensor C177. • Measure the resistance between front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and the front impact severity sensor case ground. • **Is the resistance less than 10 ohms?**	**Yes** GO to F42 . **No** GO to F41 .
F41 CLEAN THE FRONT IMPACT SEVERITY SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF-TEST	
• Remove the front impact severity sensor. • Clean and repair the mounting surface as necessary. • Clean the front impact severity sensor mounting bolts. • Install the front impact severity sensor. • Repower the system. **Do not** prove out the system	**Yes** GO to F42 . **No** Fault corrected. GO to F50 .

at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	
F42 CHECK CIRCUIT VR213 (VT/GN) AND CIRCUIT RR129 (YE/GY) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Front Impact Severity Sensor C177. • Disconnect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and ground; and between front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and ground.  N0036990 • **Are the voltages less than 0.2 volt?**	**Yes** GO to F43 . **No** REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). GO to F50 .
F43 CHECK CIRCUIT VR213 (VT/GN) AND CIRCUIT RR129 (YE/GY) FOR A SHORT TO GROUND BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and ground; and between front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and ground.	**Yes** GO to F44 . **No** REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). GO to F50 .

 N0036989 • **Are the resistances greater than 1,000,000 ohms?**	
F44 CHECK CIRCUIT VR213 (VT/GN) FOR AN OPEN BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR	
• Measure the resistance between RCM C310b-19, circuit VR213 (VT/GN), harness side and front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side.  N0036978 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F45 . **No** REPAIR circuit VR213 (VT/GN). GO to F50 .
F45 CHECK CIRCUIT RR129 (YE/GY) FOR AN OPEN BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR	
• Measure the resistance between RCM C310b-20, circuit RR129 (YE/GY), harness side and front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side.  N0036977 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to F46 . **No** REPAIR circuit RR129 (YE/GY). GO to F50 .
F46 CHECK CIRCUIT VR213 (VT/GN) FOR A SHORT TO CIRCUIT RR129 (YE/GY) BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR	
• Measure the resistance between front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and C177-2, circuit RR129 (YE/GY), harness side.	**Yes** GO to F47 . **No**

 N0036987 • **Is the resistance greater than 1,000,000 ohms?**	REPAIR circuit VR213 (VT/GN) and circuit RR129 (YE/GY). GO to F50 .
F47 CHECK FRONT IMPACT SEVERITY SENSOR • Connect: RCM C310a and C310b. • Install a known good front impact severity sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Were any on-demand fault PIDs for the front impact severity sensor indicating a fault?**	**Yes** GO to F48 . **No** Fault corrected. GO to F50 .
F48 CONFIRM THE RCM FAULT **NOTE:** Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install the original sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to F50 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to F49 .
F49 CHECK FOR AN INTERMITTENT FAULT • Key in OFF position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2296 Fault PIDs. • **Was on-demand DTC B2296 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. The fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to

	the appropriate pinpoint test step. For first row driver side impact sensor with a mounting/communications fault, GO to F2 . For first row driver side impact sensor with an internal fault, INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor — Front Door in this section. GO to F50 . For first row passenger side impact sensor with a mounting/communications fault, GO to F10 . For first row passenger side impact sensor with an internal fault, INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor — Front Door in this section. GO to F50 . For second row driver side impact sensor with a mounting/communication fault, GO to F18 . For second row driver side impact sensor with an internal fault, INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor — C-Pillar in this section. GO to F50 . For second row passenger side impact sensor with a mounting/communications fault, GO to F28 . For second row passenger side impact sensor with an internal fault, INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor — C-Pillar in this section. GO to F50 . For front impact severity sensor with a mounting/communications fault, GO to F38 . For front impact severity sensor with an internal fault, INSTALL a new front impact severity sensor. REFER to Front Impact Severity Sensor in this section. GO to F50 . **No** VISUALLY INSPECT the affected impact sensor, mounting brackets and mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage,

	corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. REPAIR any intermittent concerns found. GO to F50 .
F50 CHECK FOR ADDITIONAL DTCs • Refer to the continuous memory DTCs recorded during Step F1. • **Were any continuous memory DTCs retrieved during Step F1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test G: DTC B2434 — Drivers Seat Belt Buckle Switch Short to Ground

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store diagnostic trouble code (DTC) B2434 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver safety belt buckle switch circuit fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver safety belt buckle assembly.
- a faulted RCM.

PINPOINT TEST G: DTC B2434 — DRIVERS SEAT BELT BUCKLE SWITCH SHORT TO GROUND

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air

bag deployment, which can result in personal injury.

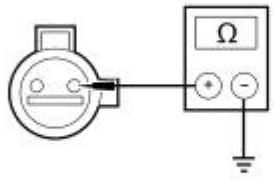
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
G1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2434 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to G2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to G5 .
G2 CHECK DRIVER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Switch C3065. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, a open circuit fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change from indicating B2434 to B2691?**	**Yes** INSTALL a new driver safety belt buckle assembly. Refer to Section 501-20A . GO to G6 . **No** GO to G3 .
G3 CHECK CIRCUIT CR201 (BU/OG) FOR A SHORT TO	

GROUND BETWEEN THE RCM AND DRIVER SAFETY BELT BUCKLE SWITCH	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between driver safety belt buckle switch C3065-2, circuit CR201 (BU/OG), harness side and ground.  A0090711 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G4 . **No** REPAIR circuit CR201 (BU/OG). Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G6 .
G4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Connect: Driver Safety Belt Buckle Switch C3065. • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2434 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to G6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to G5 .
G5 CHECK FOR AN INTERMITTENT FAULT	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2434 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to G2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to G6 .

G6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step G1. • **Were any continuous memory DTCs retrieved during Step G1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Chart in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test H: DTC B2435 — Drivers Seat Belt Buckle Switch Resistance Out of Range

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store diagnostic trouble code (DTC) B2435 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver safety belt buckle switch current out of range fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver safety belt buckle assembly.
- RCM is faulted.

PINPOINT TEST H: DTC B2435 — DRIVERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle

pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
H1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2435 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to H2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to H4 .
H2 CHECK SAFETY BELT BUCKLE SWITCH	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Switch C3065. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, a open circuit fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change from indicating B2435 to B2691?**	**Yes** INSTALL a new driver safety belt buckle assembly. REFER to Section 501-20A . GO to H5 . **No** GO to H3 .
H3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system	**Yes**

components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Driver Safety Belt Buckle Switch C3065. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2435 retrieved?**	INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to H5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to H4 .
H4 CHECK FOR AN INTERMITTENT FAULT	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Disconnect the driver safety belt buckle switch C3065:
  ▪ Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  ▪ Inspect wire harness for any damage, pinched, cut or pierced wires.
  ▪ Repair any concerns found. REFER to
 	
Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.
 	
• Connect: All Previously Disconnected Component(s)/Connector(s).
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Key in ON position.
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs.
• **Was on-demand DTC B2435 retrieved?**
	Yes
	This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to H2 .
	
	No
	The fault is not present and cannot be recreated at this time. GO to H5 .

H5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step H1. • **Were any continuous memory DTCs retrieved during Step H1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously

	directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test I: DTC B2438 — Passengers Seat Belt Buckle Switch Short to Ground

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the passenger safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store diagnostic trouble code (DTC) B2438 in memory and illuminate the air bag warning indicator.

Possible Causes

A passenger safety belt buckle switch short to ground fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty passenger safety belt buckle assembly.
- RCM is faulted.

PINPOINT TEST I: DTC B2438 — PASSENGERS SEAT BELT BUCKLE SWITCH SHORT TO GROUND

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

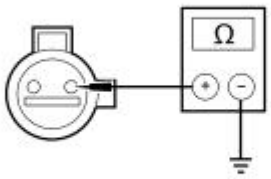
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
I1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2438 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to I2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to I5 .
I2 CHECK PASSENGER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Switch C3066. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, a open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2438 to B2692?**	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to I6 . **No** GO to I3 .
I3 CHECK CIRCUIT CR202 (BN/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between passenger seat belt buckle switch C3066-1, circuit CR202 (BN/GN), harness side and ground.	**Yes** GO to I4 . **No** REPAIR circuit CR202 (BN/GN). GO to I6 .



A0090711

- **Is the resistance greater than 1,000,000 ohms?**

I4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Connect: Passenger Safety Belt Buckle Switch C3066. • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2438 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to I6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to I5 .
I5 CHECK FOR AN INTERMITTENT FAULT	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2438 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to I2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to I6 .
I6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step I1. • **Were any continuous memory DTCs retrieved during Step I1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Chart in this section for pinpoint test direction. **No**

	RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test J: DTC B2439 — Passengers Seat Belt Buckle Switch Resistance Out of Range

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the passenger safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store diagnostic trouble code (DTC) B2439 in memory and illuminate the air bag warning indicator.

Possible Causes

A passenger safety belt buckle switch current out of range fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty passenger safety belt buckle assembly.
- RCM is faulted.

PINPOINT TEST J: DTC B2439 — PASSENGERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
J1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2439 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to J2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to J4 .
J2 CHECK SAFETY BELT BUCKLE SWITCH	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Switch C3066. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, a open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2439 to B2692?**	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to J5 . **No** GO to J3 .
J3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Passenger Safety Belt Buckle Switch C3066. • Repower the system. **Do not** prove out the	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to J5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to

system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2439 retrieved?**	J4 .
J4 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the passenger safety belt buckle switch C3066: ▪ Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ▪ Inspect wire harness for any damage, pinched, cut or pierced wires. ▪ Repair any concerns found. REFER to Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. • Connect: All Previously Disconneced Component(s)/Connector(s). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2439 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to J2 . **No** The fault is not present and cannot be recreated at this time. GO to J5 .
J5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step J1. • **Were any continuous memory DTCs retrieved during Step J1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test K: DTC B2691 — Seat Belt Buckle Switch Circuit Fault, Front Driver's Side

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the safety belt buckle switch circuits for faults. If the RCM detects an open circuit or short to voltage fault, it will store diagnostic trouble code (DTC) B2691 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver safety belt buckle switch open circuit or short to voltage fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver safety belt buckle assembly.
- a faulted RCM.

PINPOINT TEST K: DTC B2691 — SEAT BELT BUCKLE SWITCH CIRCUIT FAULT, FRONT DRIVER'S SIDE

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

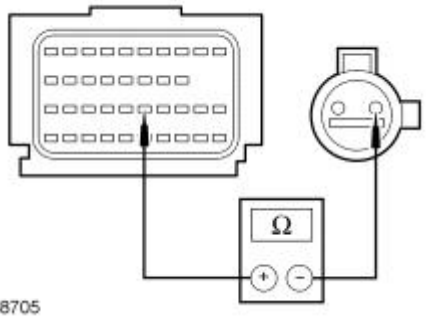
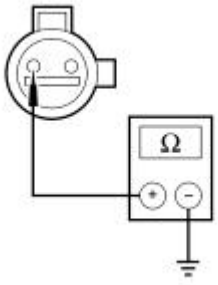
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

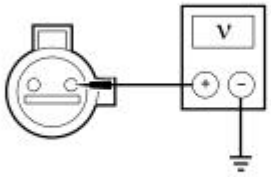
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
K1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2691 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to K2 . **No** This is an intermittent fault when present as a continuous

	memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to K7 .
K2 CHECK CIRCUIT CR201 (BU/OG) FOR AN OPEN BETWEEN THE RCM AND DRIVER SAFETY BELT BUCKLE SWITCH • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Disconnect: Driver Safety Belt Buckle Switch C3065. • Measure the resistance between RCM C310b-25, circuit CR201 (BU/OG), harness side and driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG), harness side.  A0048705 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K3 . **No** REPAIR circuit CR201 (BU/OG). GO to K8 .
K3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN • Measure the resistance between driver safety belt buckle switch C3065-2, circuit GD133 (BK), harness side and ground.  A0048711 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K4 . **No** REPAIR circuit GD133 (BK). GO to K8 .
K4 CHECK CIRCUIT CR201 (BU/OG) FOR A SHORT TO VOLTAGE • Disconnect: Driver Side Air Bag Module C3051. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG), harness side and ground.	**Yes** GO to K5 . **No** REPAIR circuit CR201 (BU/OG). GO to K8 .

 A0048712 • **Is the voltage less than 0.2 volt?**	
K5 CHECK DRIVER SAFETY BELT BUCKLE SWITCH **NOTE:** This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Drive Side Air Bag Module C3051. • Connect: RCM C310a and C310b. • Connect a jumper wire between driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG), harness side and C3065-2, circuit GD133 (BK), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change from indicating B2691 to B2434?**	**Yes** INSTALL a new driver safety belt buckle assembly. REFER to Section 501-20A . GO to K8 . **No** GO to K6 .
K6 CONFIRM THE RCM FAULT **NOTE:** Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from driver safety belt buckle switch C3065. • Connect: Driver Safety Belt Buckle Switch C3065. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2691 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to K8 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to K7 .
K7 CHECK FOR AN INTERMITTENT FAULT	

• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2691 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to K2. **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to K8.
K8 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step K1. • **Were any continuous memory DTCs retrieved during Step K1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test L: DTC B2692 — Front Passenger's Safety Belt Buckle Switch Circuit Fault

Refer to Wiring Diagrams Cell 46, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the passenger safety belt buckle switch circuits for faults. If the RCM detects an open circuit or short to voltage fault, it will store diagnostic trouble code (DTC) B2692 in memory and illuminate the air bag warning indicator.

Possible Causes

A passenger safety belt buckle switch open circuit or short to voltage fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty passenger safety belt buckle assembly.
- RCM is faulted.

PINPOINT TEST L: DTC B2692 — FRONT PASSENGER'S SAFETY BELT BUCKLE SWITCH CIRCUIT FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

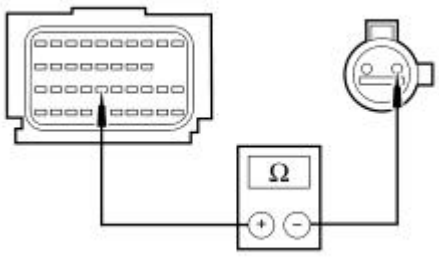
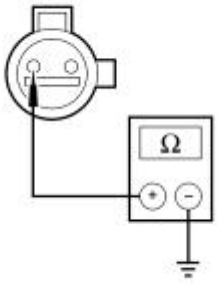
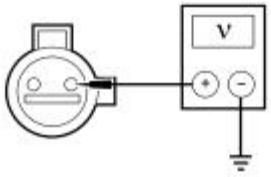
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
L1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2692 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to L2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to L7 .
L2 CHECK CIRCUIT CR202 (BN/GN) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Disconnect: Passenger Safety Belt Buckle Switch C3066. • Measure the resistance between RCM C310b-26, circuit CR202 (BN/GN), harness side and the passenger safety belt buckle switch C3066-1, circuit CR202 (BN/GN), harness side.	**Yes** GO to L3 . **No** REPAIR circuit CR202 (BN/GN). GO to L8 .

 A0048715 • **Is the resistance less than 0.5 ohm?**	
L3 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between passenger safety belt buckle switch C3066-2, circuit GD133 (BK), harness side and ground.  A0048711 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to L4 . **No** REPAIR circuit GD133 (BK). GO to L8 .
L4 CHECK CIRCUIT CR202 (BN/GN) FOR A SHORT TO VOLTAGE	
• Disconnect: Passenger Side Air Bag Module C3052. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between passenger seat belt buckle switch C3066-1, circuit CR202 (BN/GN), harness side and ground.  A0048712 • **Is the voltage less than 0.2 volt?**	**Yes** GO to L5 . **No** REPAIR circuit CR202 (BN/GN). GO to L8 .
L5 CHECK SAFETY BELT BUCKLE SWITCH	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to L8 .

• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Passenger Side Air Bag Module C3052. • Connect: RCM C310a and C310b. • Connect a jumper wire between passenger safety belt buckle switch C3066-1, circuit CR202 (BN/GN), harness side and C3066-2, circuit GD133 (BK), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2692 to B2438?**	**No** GO to L6 .
L6 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from driver safety belt buckle switch C3065. • Connect: Passenger Safety Belt Buckle Switch C3066. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2692 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to L8 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to L7 .
L7 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202. • Disconnect: Passenger Side Air Bag Module C3052. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC B2692 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to L2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to L8 .
L8 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during	**Yes**

Step L1. • **Were any continuous memory DTCs retrieved during Step L1?**	Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test M: DTC B2792 — Cross Link Between Firing Loops

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all the deployable devices for a cross link between the circuits of another deployable device. If the RCM detects a short between the circuits of the deployable devices, it will store diagnostic trouble code (DTC) B2792 and illuminate the air bag warning indicator.

Possible Causes

A cross link fault between the circuits of deployable devices can be caused by:

- damaged wiring, terminals or connectors.
- a faulted RCM.

PINPOINT TEST M: DTC B2792 — CROSS LINK BETWEEN FIRING LOOPS

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Never probe the electrical connector on a safety canopy module. Doing so can result in safety canopy deployment.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the pinpoint test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>M1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs</td><td></td></tr>
<tr><td>

Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs.
Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2792 Fault PIDs.
Was on-demand DTC B2792 retrieved?

</td><td>Yes
This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to M2 .

No
This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to M4 .</td></tr>
<tr><td>M2 CHECK DEPLOYABLE CIRCUITS FOR A CROSS LINK FAULT</td><td></td></tr>
<tr><td>

Key in OFF position.
Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
Disconnect: RCM C310a and C310b.
Disconnect ALL of the affected deployable devices.
Using the following table, measure the resistance between the circuits of the affected deployable devices.

Deployable Devices
<table>
<tr><th>Loop</th><th>Connector - Pin</th><th>Circuit</th></tr>
<tr><td>Driver air bag module loop 1</td><td>Driver air bag module loop 1 electrical connector
Driver air bag module loop 1 electrical connector</td><td>RR101 (YE/GN)
CR101 (VT/BN)</td></tr>
<tr><td>Driver air bag module loop 2</td><td>Driver air bag module loop 2 electrical connector
Driver air bag</td><td>RR102 (WH)
CR102 (BU)</td></tr>
</table>
</td><td>Yes
GO to M3 .

No
REPAIR the affected circuits. GO to M5 .</td></tr>
</table>

	module loop 2 electrical connector	
Passenger air bag module loop 1	• C256-3 • C256-4	• CR103 (GY/BU) • RR103 (VT/GN)
Passenger air bag module loop 2	• C256-1 • C256-2	• CR104 (YE/GY) • RR104 (WH/BU)
Driver side air bag module	• C3226-1 • C3226-2	• CR110 (GN/BN) • RR110 (GY/OG)
Passenger side air bag module	• C3227-1 • C3227-2	• CR112 (BU/GY) • RR112 (GN/OG)
Driver safety canopy module	• C9006-1 • C9006-2	• CR109 (BN/BU) • RR109 (BU/GN)
Passenger safety canopy module	• C9007-1 • C9007-2	• CR111 (BN/WH) • RR111 (YE/VT)
Driver safety belt buckle pretensioner	• C3201-1 • C3201-2	• CR120 (BU/OG) • RR120 (BN/GN)
Passenger safety belt buckle pretensioner	• C3202-1 • C3202-2	• CR122 (WH/OG) • RR122 (BN)

- **Are the resistances greater than 10,000 ohms between the affected circuits?**

M3 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Connect: All Previously Disconnected Restraint System Component(s).
- Connect: RCM C310a and C310b.
- Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2792 Fault PIDs.
- **Was on-demand DTC B2792 retrieved?**

Yes
INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to M5 .

No
In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were

	disconnected. GO to M4 .
M4 CHECK FOR AN INTERMITTENT FAULT	

• Key in OFF position.
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• If a cross link fault for driver air bag loop 1 or loop 2 is present continuous:
  ▪ remove the driver air bag module. Refer to Driver Air Bag Module in this section.
• If a cross link fault for passenger air bag module loop 1 or loop 2 is present continuous:
  ▪ disconnect the passenger air bag module C256.
• If a cross link fault for driver side air bag is present continuous:
  ▪ disconnect the driver side air bag module C3051.
• If a cross link fault for passenger side air bag is present continuous:
  ▪ disconnect the passenger side air bag module C3052.
• If a cross link fault for driver safety canopy module is present continuous:
  ▪ disconnect the driver safety canopy module C9006.
• If a cross link fault for passenger safety canopy module is present continuous:
  ▪ disconnect the passenger safety canopy module C9007.
• If a cross link fault for driver safety belt buckle pretensioner is present continuous:
  ▪ disconnect the driver safety belt buckle pretensioner C3201.
• If a cross link fault for passenger safety belt buckle pretensioner is present continuous:
  ▪ disconnect the passenger safety belt buckle pretensioner C3202.
• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs.
• Enter the following diagnostic mode on the diagnostic tool: DataLogger/View and Record DTC B2792 Fault PIDs.
• **Was on-demand DTC B2792 retrieved?**
	Yes
	This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to M2 .
	
	No
	CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to M5 .

M5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step M1. • **Were any continuous memory DTCs retrieved during Step M1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering

	in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test N: LFC 15/DTC C1414 — Incorrect Module Design Level

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

NOTE: When a new PCM is installed, the air bag warning indicator will illuminate when the ignition switch is ON. The warning indicator will remain on until PCM configuration is restored.

Normal Operation

The restraints control module (RCM) monitors the communication from the powertrain control module (PCM) for an embedded vehicle ID. If the RCM detects an unexpected condition or incorrect data from the PCM, it will store diagnostic trouble code (DTC) C1414 in memory and illuminate the air bag warning indicator.

Possible Causes

An incorrect module design level can be caused by:

- incorrect or non configured PCM for vehicle.
- incorrect RCM for vehicle.

PINPOINT TEST N: LFC 15/DTC C1414 — INCORRECT MODULE DESIGN LEVEL

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
N1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1414 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to N2 . **No** The fault condition is not present at this time. CLEAR the DTC and GO to N4 .
N2 CHECK RCM PART NUMBER	
• Enter the following diagnostic mode on the diagnostic tool: Network Test. • Enter the following diagnostic mode on the diagnostic tool: Log Viewer . • **Did the RCM part number in the log viewer match the part number listed in the master parts catalog?**	**Yes** GO to N3 . **No** INSTALL a new RCM with the correct part number. REFER to Restraints Control Module (RCM) in this section. GO to N4 .
N3 CHECK PCM PART NUMBER	
• Enter the following diagnostic mode on the diagnostic tool: Log Viewer . • **Did the PCM part number in the log viewer match the part number listed in the master parts catalog?**	**Yes** This indicates that a new PCM has been installed and is not yet configured. CARRY OUT the programmable module installation (PMI). GO to N4 . **No** INSTALL a new PCM with the correct part number. GO to N4 .
N4 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step N1. • **Were any continuous memory DTCs retrieved during Step N1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test O: DTC C1946 — Front Driver's Seat Track Position Switch Circuit Open

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects an open circuit, it will store diagnostic trouble code (DTC) C1946 in memory and illuminate the

air bag warning indicator.

Possible Causes

A driver seat track position sensor open circuit fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver seat track position sensor.
- RCM is faulted.

PINPOINT TEST O: DTC C1946 — FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT OPEN

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

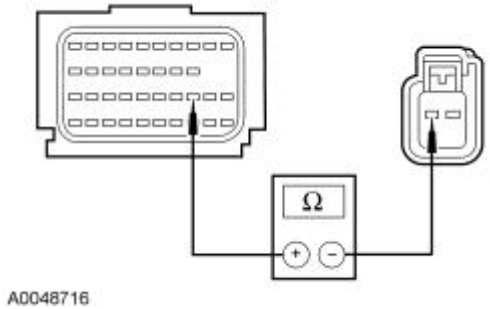
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

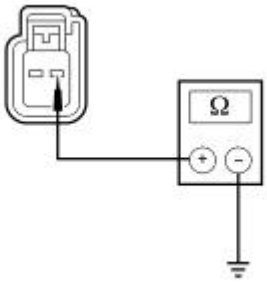
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
O1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1946 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to O2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to O6 .

O2 CHECK DRIVER SEAT TRACK POSITION SENSOR FOR AN OPEN	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Track Position Sensor C356. • Connect a jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD133 (BK), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved. • **Did the driver seat track position switch on-demand DTC change from indicating C1946 to C1947?**	**Yes** INSTALL a new driver seat track position sensor. REFER to Seat Position Sensor in this section. GO to O7. **No** GO to O3.
O3 CHECK CIRCUIT VR215 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND DRIVER SEAT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Remover the jumper wire from the driver seat track position sensor C356. • Measure the resistance between RCM C310b-23, circuit VR215 (YE/VT), harness side and driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side.  A0048716 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to O4. **No** REPAIR circuit VR215 (YE/VT). GO to O7.
O4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between driver seat track position sensor C356-1, circuit GD143 (BK/VT) and ground.	**Yes** GO to O5. **No** REPAIR circuit GD133 (BK). GO to O7.

 A0088601 • **Is the resistance less than 0.5 ohm?**	
O5 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Driver Seat Track Position Sensor C356. • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1946 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to O7 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to O6 .
O6 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1946 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to O2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to O7 .
O7 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step O1. • **Were any continuous memory DTCs retrieved during Step O1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No**

	RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test P: DTC C1947 — Front Driver's Seat Track Position Switch Circuit Short to Ground

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a short to ground, it will store diagnostic trouble code (DTC) C1947 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver seat track position sensor short to ground fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver seat track position sensor.
- RCM is faulted.

PINPOINT TEST P: DTC C1947 — FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT SHORT TO GROUND

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

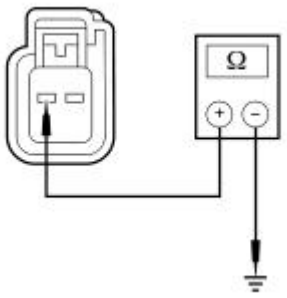
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
P1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1947 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to P2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to P5 .
P2 CHECK SEAT TRACK POSITION SENSOR FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Seat Track Position Sensor C356. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor disconnected, an open circuit fault would normally be retrieved. • **Did the driver seat track position switch on-demand DTC change from indicating C1947 to C1946?**	**Yes** INSTALL a new driver seat track position sensor. REFER to Seat Position Sensor in this section. GO to P6 . **No** GO to P3 .
P3 CHECK CIRCUIT VR215 (YE/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND SEAT TRACK POSITION SENSOR	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Measure the resistance between driver seat track position sensor C356-2, circuit VR215 (YE/VT) and ground.	**Yes** GO to P4 . **No** REPAIR circuit VR215 (YE/VT). GO to P6 .

 N0056815 • **Is the resistance greater than 1,000,000 ohms?**	
P4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Seat Track Position Sensor C356. • Connect: RCM C310a and C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1947 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to P6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to P5 .
P5 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1947 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to P2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to P6 .
P6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step P1. • **Were any continuous memory DTCs retrieved during Step P1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No**

	RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test Q: DTC C1948 — Front Driver's Seat Track Position Switch Circuit Resistance Out of Range

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a current out of range condition, it will store diagnostic trouble code (DTC) C1948 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver seat track position sensor circuit resistance out of range fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver seat track position sensor.
- RCM is faulted.

PINPOINT TEST Q: DTC C1948 — FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT RESISTANCE OUT OF RANGE

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: Due to the seat track position sensor being a Hall-effect type sensor, this pinpoint test will be diagnosing a current out of range fault instead of the current diagnostic trouble code (DTC) definition for a resistance out of range fault.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Q1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1948 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Q2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. GO to Q4 .
Q2 CHECK DRIVER SEAT TRACK POSITION SENSOR	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Track Position Sensor C356. • Connect a jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD133 (BK), harness side. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved. • **Did the driver seat track position sensor on-demand DTC change from indicating C1948 to C1947?**	**Yes** INSTALL a new driver seat track position sensor. REFER to Seat Position Sensor in this section. GO to Q5 . **No** GO to Q3 .
Q3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI).

connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Driver Seat Track Position Sensor C356. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1948 retrieved?**	REFER to Restraints Control Module (RCM) . GO to Q5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to Q4 .
Q4 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1948 retrieved?**	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Q2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to Q5 .
Q5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step Q1. • **Were any continuous memory DTCs retrieved during Step Q1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Pinpoint Test R: DTC C1981 — Front Driver's Seat Track Position Switch Circuit Fault

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a short to battery, it will store diagnostic trouble code (DTC) C1981 in memory and illuminate the air bag warning indicator.

Possible Causes

A driver seat track position sensor short to battery fault can be caused by:

- damaged wiring, terminals or connectors.
- RCM is faulted.

PINPOINT TEST R: DTC C1981 — FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT FAULT

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

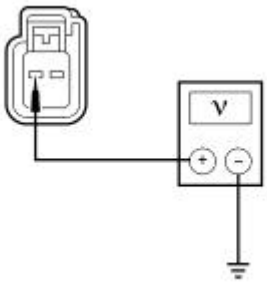
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
R1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs	
• Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1981 retrieved?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No** This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this

	time. GO to R4 .
R2 CHECK CIRCUIT VR215 (YE/VT) FOR A SHORT TO VOLTAGE	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b. • Disconnect: Driver Seat Track Position Sensor C356. • Disconnect: Driver Side Air Bag Module C3051. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Key in ON position. • Measure the voltage between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and ground.  A0088603 • **Is the voltage less than 0.2 volt?**	**Yes** GO to R3 . **No** REPAIR circuit VR215 (YE/VT). GO to R5 .
R3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a and C310b. • Connect: Driver Seat Track Position Sensor C356. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1981 retrieved?**	**Yes** INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to Restraints Control Module (RCM) in this section. GO to R5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. GO to R4 .
R4 CHECK FOR AN INTERMITTENT FAULT	
• Key in OFF position. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Side Air Bag Module C3051. • Repower the system. **Do not** prove out the system at this	**Yes** This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No**

time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the diagnostic tool: Self Test/Retrieve and Record On-Demand and Continuous Memory DTCs. • **Was on-demand DTC C1981 retrieved?**	CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to R5 .
R5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous memory DTCs recorded during Step R1. • **Were any continuous memory DTCs retrieved during Step R1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to depower the system, REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all RCM DTCs.

Supplemental Restraint System (SRS) Depowering and Repowering

Printable
View (91 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Depowering Procedure

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the smart power distribution junction box (SPDJB), located in the RH lower kick panel, remove the cover and the restraints control module (RCM) fuse 32 (10A) from the SPDJB. For additional information, refer to the Wiring Diagram Manual.
4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition switch to OFF.
6. **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

The front impact severity sensor is located on the bottom of the radiator support bracket.

The front door side impact sensors (if equipped) are located in the first row doors, behind the door trim panel.

The C-pillar side impact sensors (if equipped) are located on the C-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may increase the risk of personal injury or death in a crash.

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to Section 414-01 .

Repowering Procedure

1. Make sure that all supplemental restraint system (SRS) components are connected.

2. Turn the ignition switch from OFF to ON.

3. Install restraints control module (RCM) fuse 32 (10A) to the SPDJB and close the cover.

4. **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected. Failure to follow these instructions may increase the risk of personal injury or death in a crash.**

   Connect the battery ground cable.

5. Prove out the SRS as follows:
   Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will either:
   - fail to light.
   - remain lit continuously.
   - flash.

   The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.
   Clear all continuous memory DTCs from the restraints control module using a scan tool.

Supplemental Restraint System (SRS) Deactivation and Reactivation

Printable
View (579 KB)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Deactivation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Never probe the connectors on the safety canopy module. Doing so can result in safety canopy deployment, which can result in personal injury.

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Turn all vehicle accessories off.

2. Turn the ignition switch to OFF.

3. At the smart power distribution junction box (SPDJB), located in the RH lower kick panel, remove the cover and the restraints control module (RCM) fuse 32 (10A) from the SPDJB. For additional information, refer to the Wiring Diagram Manual.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

   The front impact severity sensor is located on the bottom of the radiator support bracket.

   The front door side impact sensors are located in the first row doors, behind the door trim panel.

   The C-pillar side impact sensors (if equipped) are located on the C-pillar.

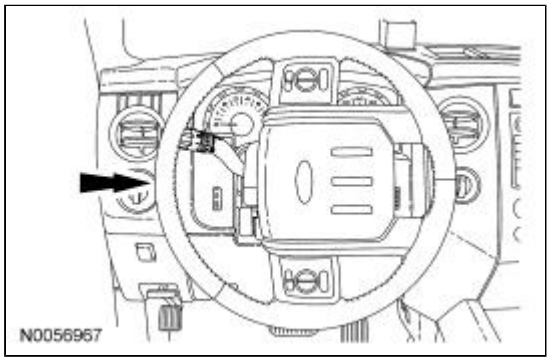
   To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may increase the risk of personal injury or death in a crash.

   Disconnect the battery ground cable and wait at least one minute. For additional information, refer to Section 414-01 .

7. Make sure the road wheels are in the straight-ahead position.

8. Center the tilt steering column.

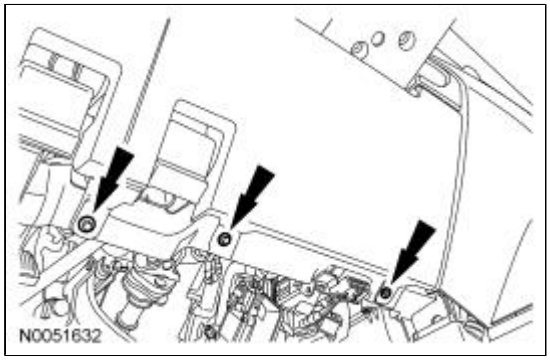
9. Turn the steering wheel so the top of the wheel is 90 degrees to the left (at the 9 o'clock position).



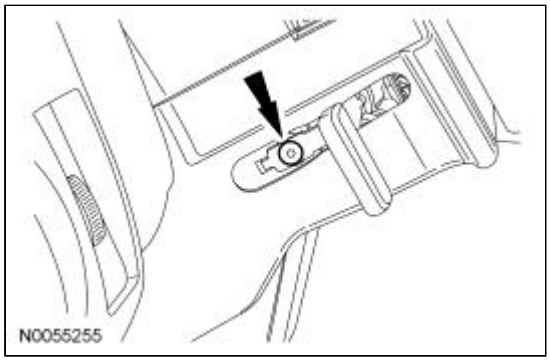
Vehicles with manual tilt wheel

10. Remove the lower steering column opening cover.

- Remove the 3 screws and pull out to release the top retaining clips and remove the lower steering column opening cover.



11. Remove the screw and steering column manual tilt lever.



All vehicles

12. Remove the 3 steering column lower shroud screws.

13. Release the clips and remove the steering column upper shroud.

14. Remove the steering column lower shroud.
    - If equipped, disconnect the power tilt steering column switch located on the lower shroud.

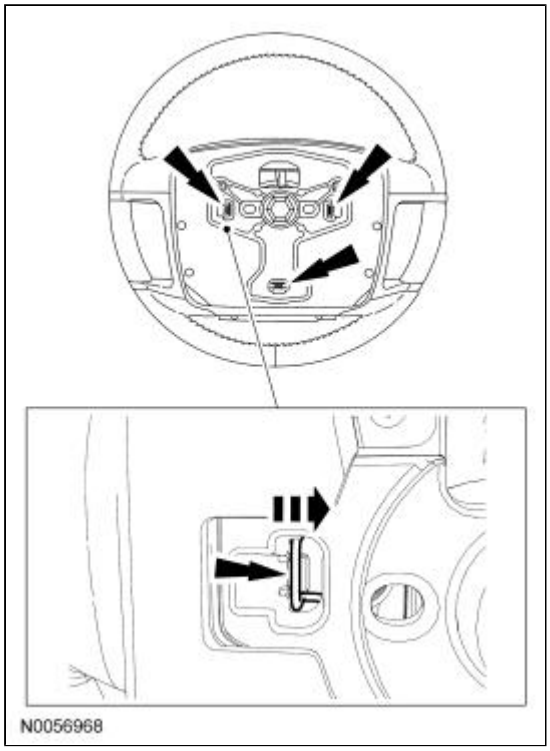
15. **CAUTION: Make sure each of the 3 driver air bag module wire clips are disengaged from each of the 3 steering wheel hooks before removing the driver air bag module from the steering wheel. Failure to do so will damage the driver air bag module and steering wheel.**

    NOTE: Steering wheel is removed for clarity. The rear of the steering wheel is shown.

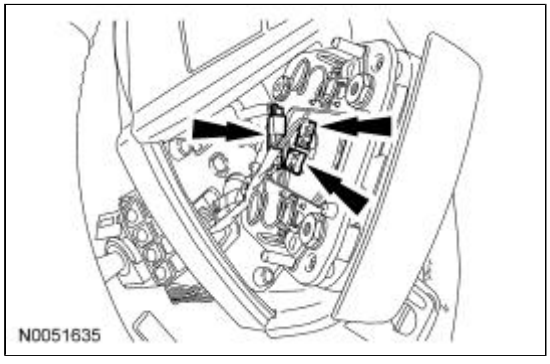
    NOTE: Use a mirror to look at the rear of the steering wheel to locate where the 3 driver air bag module wire clips attach to the steering wheel hooks.

    NOTE: Note the position of the 2 driver air bag module locator pins to the steering wheel for installation.

    Using a screwdriver or a suitable tool, release each of the 3 driver air bag module wire clips from the steering wheel hooks.
    - Access the 3 driver air bag module wire clips through the back of the steering wheel cover and push the wire clips toward the center of the steering wheel to release.



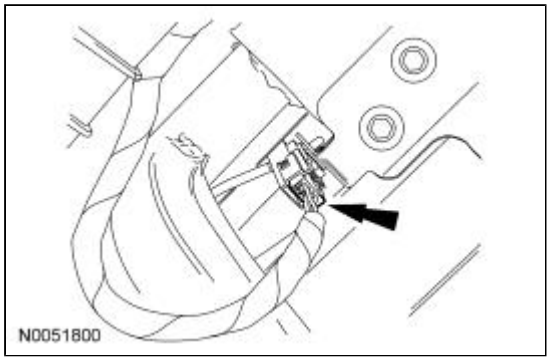
16. Disconnect the 2 driver air bag module electrical connectors, then disconnect the horn switch electrical connector and remove the driver air bag module.



17. Turn the steering wheel so the top of the wheel is back in the straight ahead position (the 12 o'clock position).

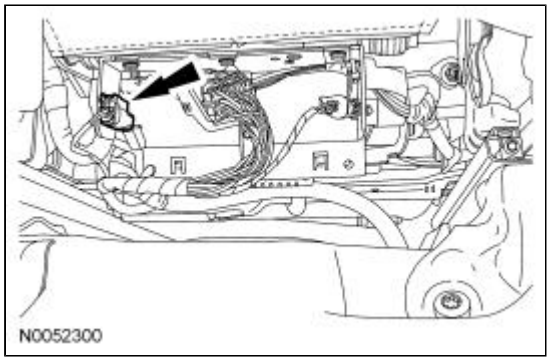
18. Open and lower the glove compartment door.
    - If equipped, disconnect the glove compartment door dampener.

19. Disconnect the passenger air bag module electrical connector.

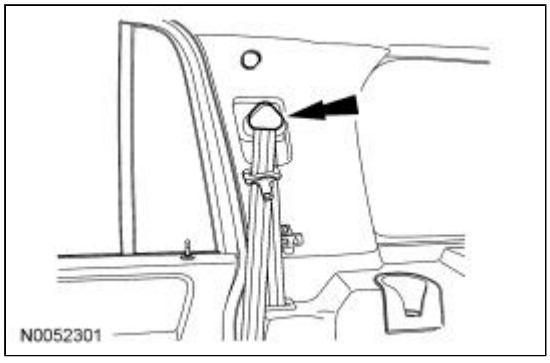


20. **NOTE:** There are 2 similar connectors under the passenger seat. The passenger seat side air bag module electrical connector is located toward the seat outboard position.

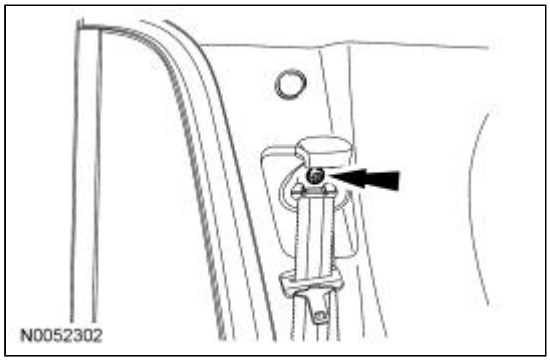
    Remove the passenger front seat cushion panel shield and disconnect the passenger seat side air bag module electrical connector.



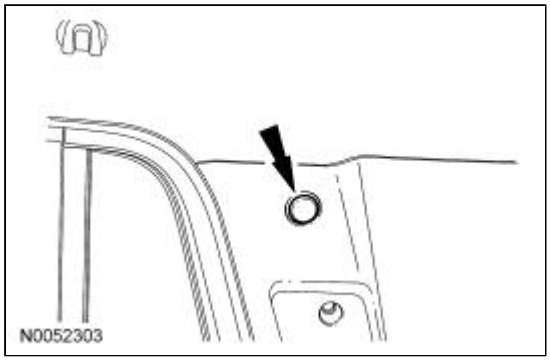
21. Release the passenger side second row safety belt retractor D-ring cover.



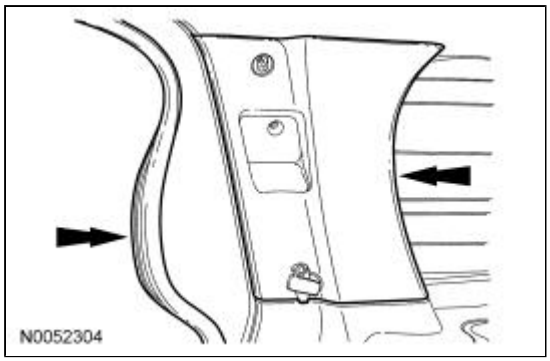
22. Remove the bolt and the passenger side second row safety belt retractor D-ring.



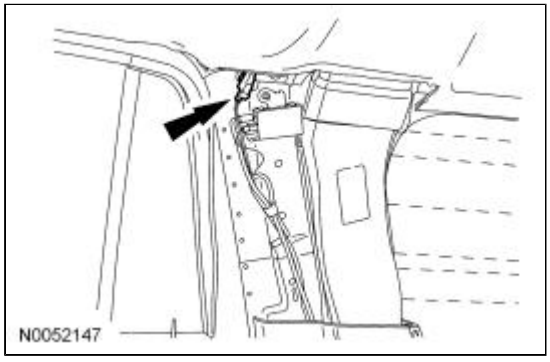
23. Remove the cover and the passenger side C-pillar trim panel nut.



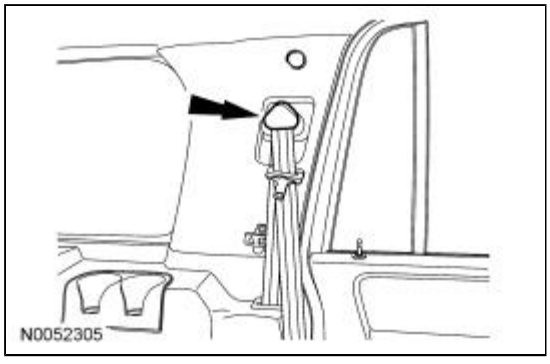
24. Release the rear door weatherstrip and remove the passenger side C-pillar trim panel.



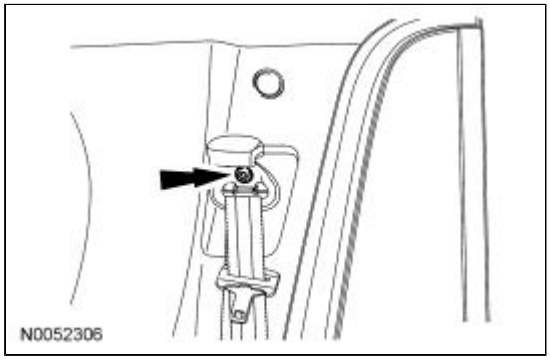
25. Disconnect the passenger side safety canopy module electrical connector.



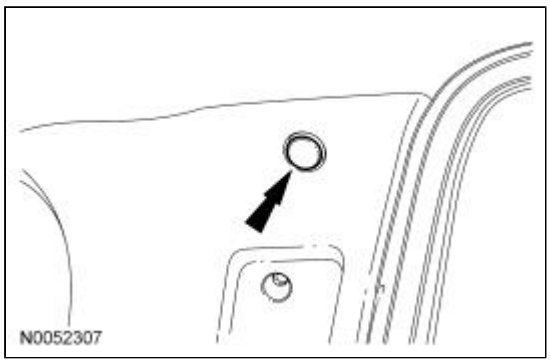
26. Release the driver side second row safety belt retractor D-ring cover.



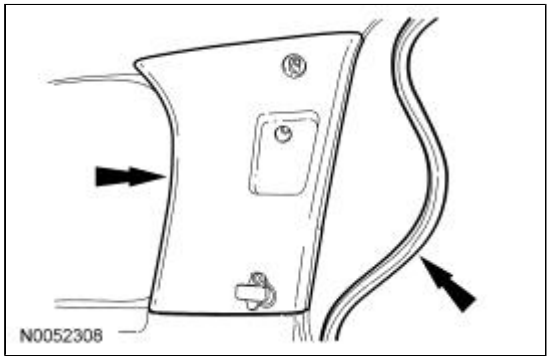
27. Remove the bolt and the driver side second row safety belt retractor D-ring.



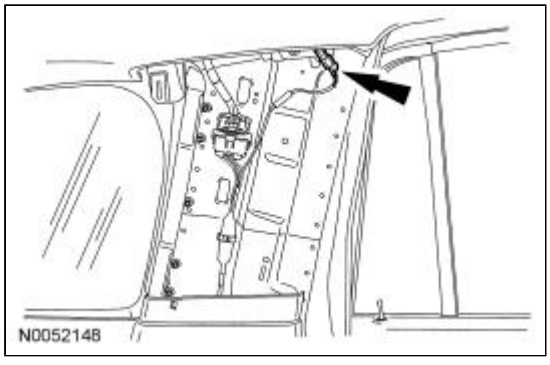
28. Remove the cover and the driver side C-pillar trim panel nut.



29. Release the rear door weatherstrip and remove the driver side C-pillar trim panel.

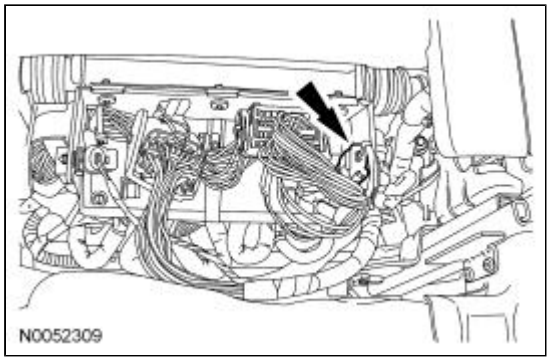


30. Disconnect the driver side safety canopy module electrical connector.



31. **NOTE:** There are 2 similar connectors under the driver seat. The driver seat side air bag module electrical connector is located toward the seat outboard position.

    Remove the driver front seat cushion panel shield and disconnect the driver seat side air bag module electrical connector.



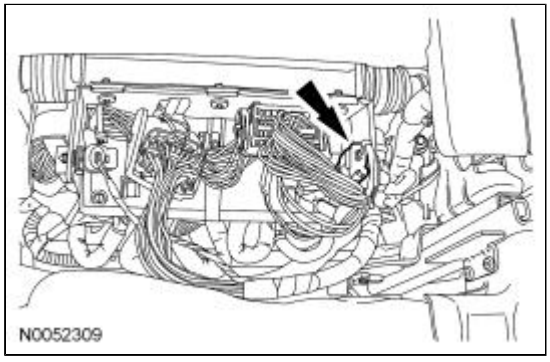
32. Install the RCM fuse 32 (10A) to the SPDJB.

33. Connect the battery ground cable. For additional information, refer to Section 414-01 .

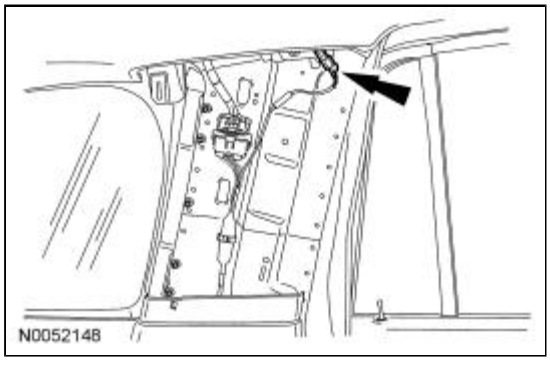
Reactivation

All vehicles

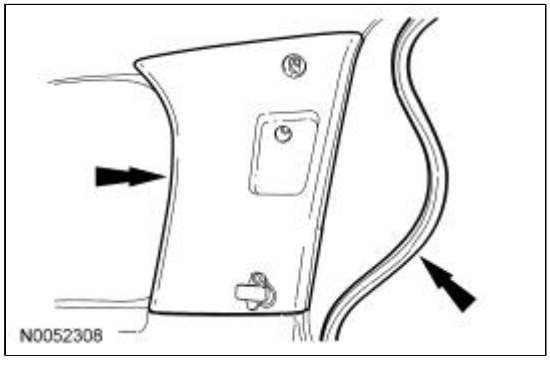
1. Remove the RCM fuse 32 (10A) from the SPDJB.
2. Disconnect the battery ground cable and wait at least one minute.
3. Connect the driver seat side air bag module electrical connector and install the driver front seat cushion panel shield.



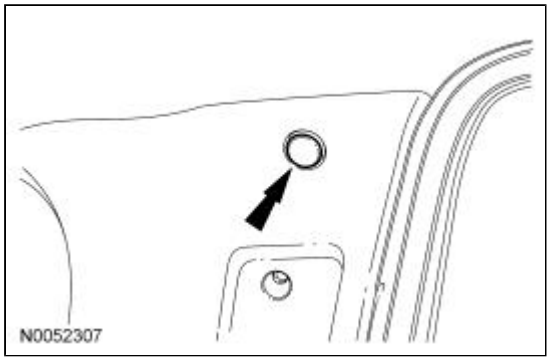
4. Connect the driver side safety canopy module electrical connector.



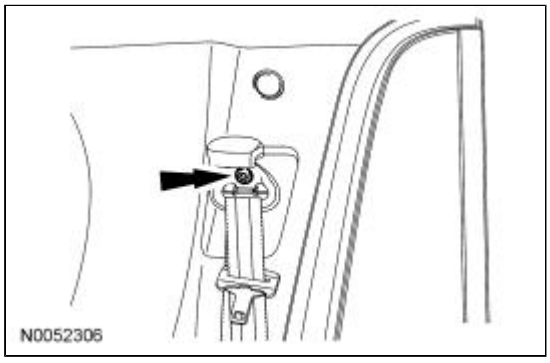
5. Install the driver side C-pillar trim panel and attach the rear door weatherstrip.



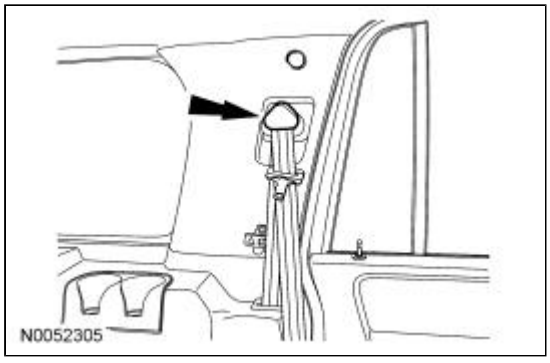
6. Install the driver side C-pillar trim panel nut and cover.



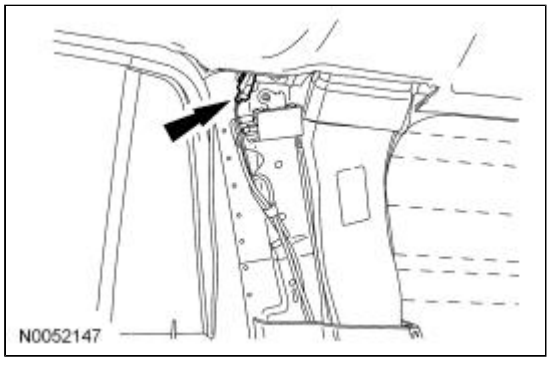
7. Install the driver side second row safety belt retractor D-ring and bolt.
    - Tighten to 40 Nm (30 lb-ft).



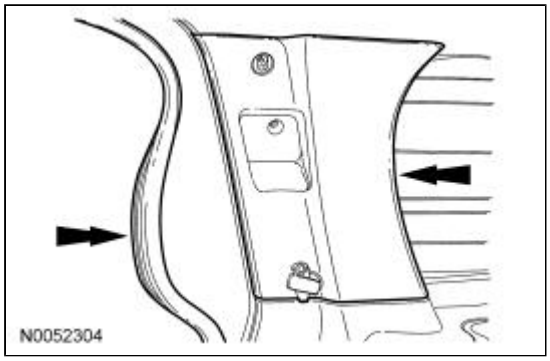
8. Attach the driver side second row safety belt retractor D-ring cover.
    - Verify the safety belt retractor operates without excessive effort or binding.



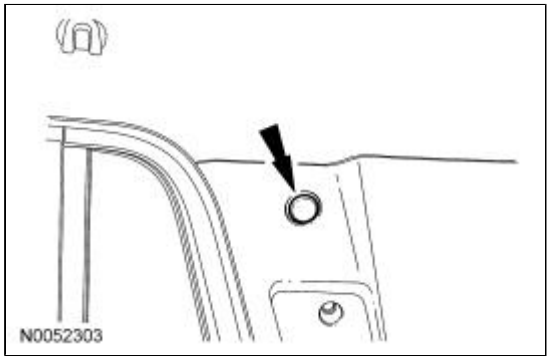
9. Connect the passenger side safety canopy module electrical connector.



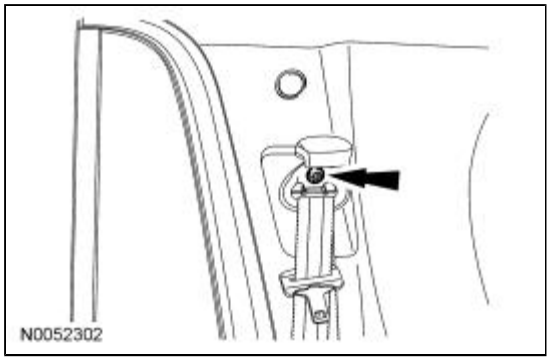
10. Install the passenger side C-pillar trim panel and attach the rear door weatherstrip.



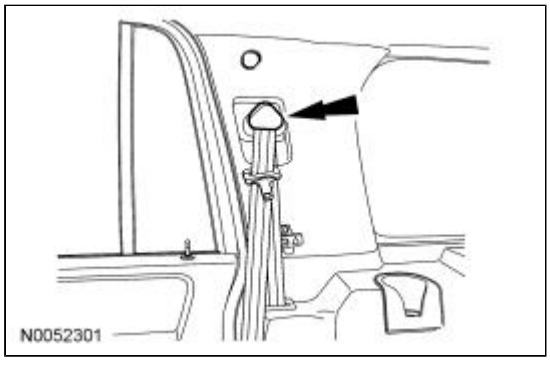
11. Install the passenger side C-pillar trim panel nut and cover.



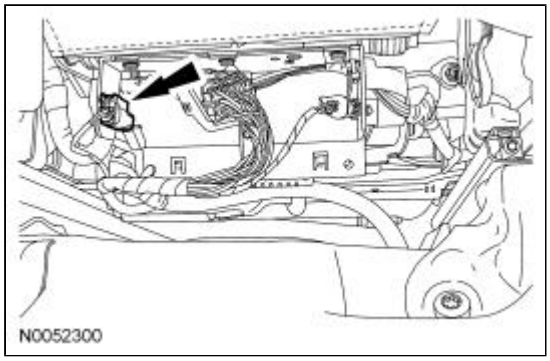
12. Install the passenger side second row safety belt retractor D-ring and bolt.
    - Tighten to 40 Nm (30 lb-ft).



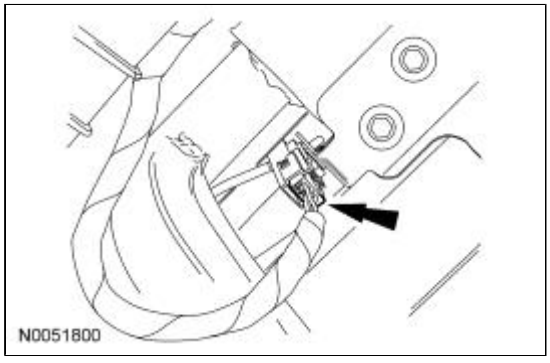
13. Attach the passenger side second row safety belt retractor D-ring cover.
    - Verify the safety belt retractor operates without excessive effort or binding.



14. Connect the passenger seat side air bag module electrical connector and install the passenger front seat cushion panel shield.



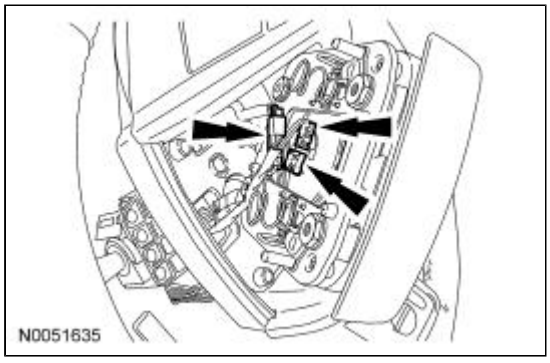
15. Connect the passenger air bag module electrical connector.



16. Close the glove compartment door.
    - If equipped, connect the glove compartment door dampener.

17. **CAUTION: The clockspring electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module.**

    Connect the horn switch electrical connector, then connect the 2 driver air bag module electrical connectors.



18. Position the driver air bag module to the steering wheel, lining up the locator pins.

19. **NOTE:** Make sure that all 3 driver air bag module wire clips are fully engaged and seated correctly to the steering wheel.

    NOTE: Audible clicks will be heard when the 3 driver air bag module wire clips are fully engaged.

    Firmly press the driver air bag module to the steering wheel, seating the 3 driver air bag module wire clips to the steering wheel hooks.

- Check the driver air bag module trim cover to the steering wheel for an even gap clearance and correct movement.

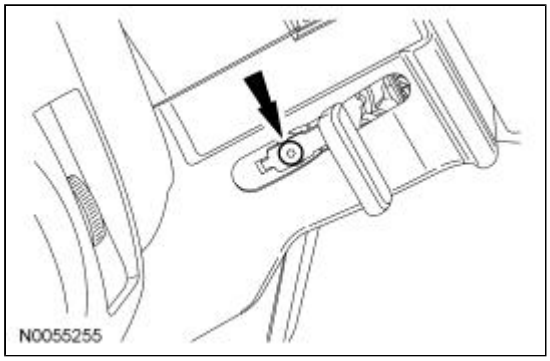
20. Install the steering column lower shroud.
    - If equipped, connect the power tilt steering column switch located on the lower shroud.

21. Install the steering column upper shroud.

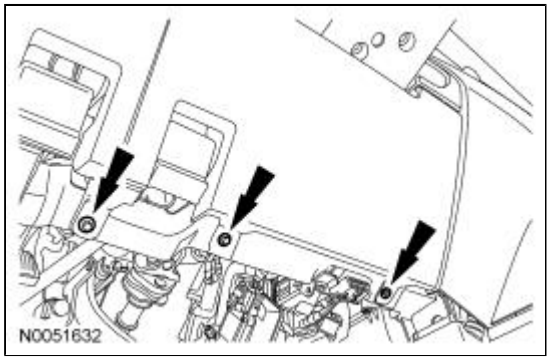
22. Install the 3 steering column lower shroud screws.

Vehicles with manual tilt wheel

23. Install the steering column manual tilt lever and screw.
    - Tighten to 6 Nm (53 lb-in).



24. Install the lower steering column opening cover and the 3 screws.



All vehicles

25. Turn the ignition switch from OFF to ON.

26. Install the RCM fuse 32 (10A) to the SPDJB and install the cover.

27. **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**

    Connect the battery ground cable.

28. Prove out the SRS as follows:
    Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will either:

- fail to light.
- remain lit continuously.
- flash.

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Clear all continuous memory DTCs from the restraints control module using a scan tool.

Inspection and Repair After a Supplemental Restraint System (SRS) Deployment

Printable View (85 KB)

WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: After diagnosing or repairing a supplemental restraint system (SRS), **the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.**

NOTE: Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

NOTE: Always refer to the appropriate workshop manual procedures prior to carrying out vehicle repairs affecting the supplemental restraint system (SRS) and safety belt system.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. **NOTE:** Refer to the correct removal and installation procedure for all SRS components being installed.

   When any deployable device or combination of devices are deployed and/or the restraints control module (RCM) has the diagnostic trouble code (DTC) B1231 (Crash Data Memory Full) in memory, the repair of the vehicle's SRS is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors, and the removal and installation of a new RCM. DTCs must cleared from all required modules after repairs are carried out.

Vehicles with occupant classification sensor (OCS) system

2. **NOTE:** After installation of new occupant classification sensor (OCS) components carry out the OCS System Reset procedure as instructed in the workshop manual. Refer to the appropriate workshop manual (WSM) for OCS system removal and installation procedure.

   When a vehicle has been involved in a collision and the occupant classification sensor (OCS) module has DTC B1231 stored in memory, the repair of the OCS system is to include the following procedures for the specified system:
   - For rail type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS rails.
   - For weight sensor bolt type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS weight sensor bolts.
   - **NOTE:** Most bladder type OCS modules do not store a DTC B1231 in memory after deployment. The DTC B1231 is stored only by the RCM.

     For bladder type OCS system, inspect for damage and repair as necessary. If installation of an OCS component is required, an OCS service kit must be installed.

All vehicles

3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.

4. When the driver air bag module has deployed, a new clockspring must be installed.

5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners. For additional information, refer to Section 501-20A .

6. Inspect the entire vehicle for damage, including the following components:
    - Steering column (deployable column if equipped)
    - Instrument panel knee bolsters and mounting points
    - Instrument panel braces and brackets
    - Instrument panel and mounting points
    - Seats and seat mounting points
    - Safety belts, safety belt buckles and safety belt retractors. For additional information, refer to Section 501-20A
    - SRS wiring, wiring harnesses and connectors

7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

Pyrotechnic Device Disposal

Printable View (346 KB)

Disposal of Deployable Devices and Pyrotechnic Devices That Are Undeployed/Inoperative

NOTE: All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the undeployed/inoperative device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the vehicle identification number (VIN) must be recorded and sent to Ford Motor Company.

   If installing a new air bag module record the necessary information and return the inoperative air bag module to Ford Motor Company.

Disposal of Deployable Devices and Pyrotechnic Devices That Are Deployed

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the deployed device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   Dispose of the deployed device in the same manner as any other part to be scrapped.

Disposal of Deployable Devices and Pyrotechnic Devices That Require Manual Deployment

1. Safety and environmental concerns require consideration and treatment of restraints system deployable and pyrotechnic devices when disposing of vehicles, deployable devices or pyrotechnic devices. Deploying deployable and pyrotechnic devices before scrapping a vehicle or the device eliminates the potential for hazardous exposures or reactions during processing. If special handling procedures are followed, deployable and pyrotechnic devices can be deployed safely and recycled with the vehicle, shipped separately to a recycling facility or disposed of safely.

   NOTE: To determine the deployable devices a vehicle is equipped with, refer to the Description

and Operation portion of this section.

A vehicle equipped with any of the following deployable devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

- Driver air bag module
- Passenger air bag module
- Seat side air bag modules
- Safety canopy modules
- Side air curtain modules

2. **NOTE:** To determine the pyrotechnic devices a vehicle is equipped with, refer to the Description and Operation portion of this section.

   A vehicle equipped with any of the following pyrotechnic devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.
   - Safety belt buckle pretensioners
   - Safety belt retractor pretensioners
   - Adaptive load limiting retractors
   - Deployable steering column

3. **NOTE:** To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. For additional information, refer to Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules — Remote Deployment in this procedure.

Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules — Remote Deployment

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Carry a live seat side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Deployment is to be carried out outdoors with all personnel at least 9.14 meters

(30 feet) away to make sure of personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

NOTE: For air bag modules with multiple squibs, all the squibs on the air bag module must be deployed.

NOTE: Some driver and passenger front air bags have 2 deployment stages. After a crash event it is possible that Stage 1 has deployed and Stage 2 has not.

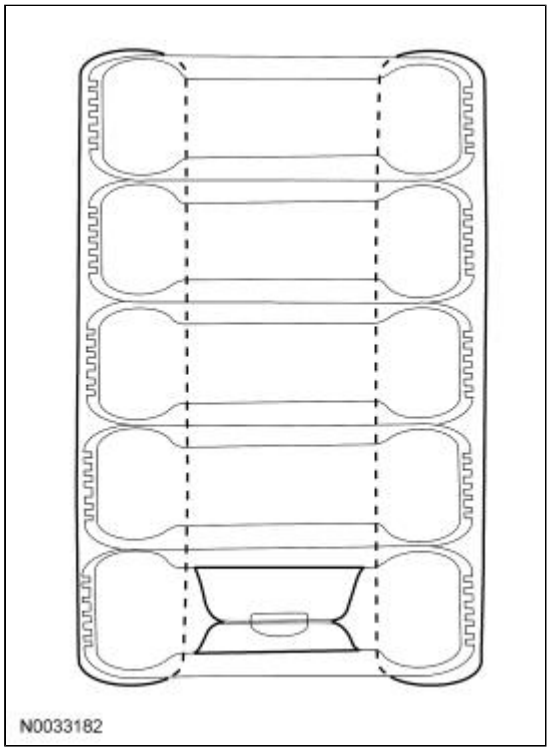
If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

NOTE: A typical air bag disposal is shown that is similar for all vehicles.

All driver, passenger and seat side air bag modules

1. Make a container to house the air bag module for deployment.
    - **NOTE:** The tires must be of sufficient size to accommodate the air bag module.

      Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
    - With the tire and wheel assembly on the bottom, stack the tires.
    - Securely tie all of the tires together.



2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the air bag module. For additional information, refer to the appropriate procedure in this section.

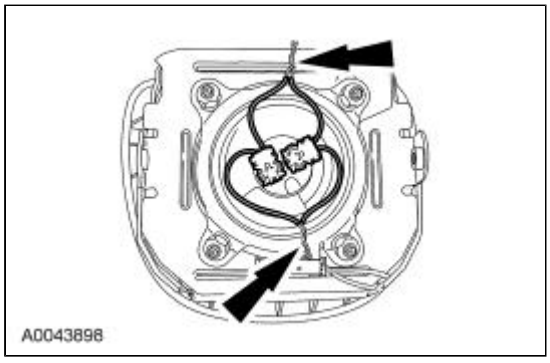
4. **NOTE:** If the air bag module does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the air bag module.

   Cut each of the air bag module wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

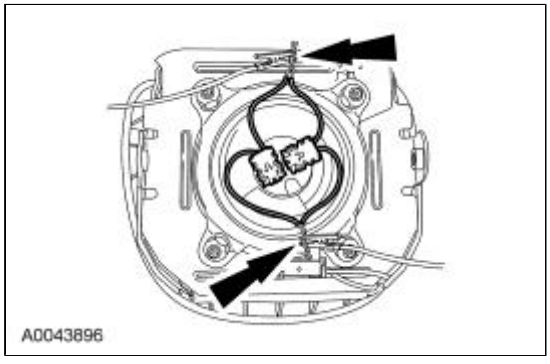
6. **NOTE:** Typical driver air bag module with 2 squibs shown, other air bag modules with multiple squibs similar.

   For air bag modules with multiple squibs, twist together a wire from each squib then repeat for the remaining wires from each squib.



7. Make a jumper harness to deploy the air bag module.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 meters (30 feet) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

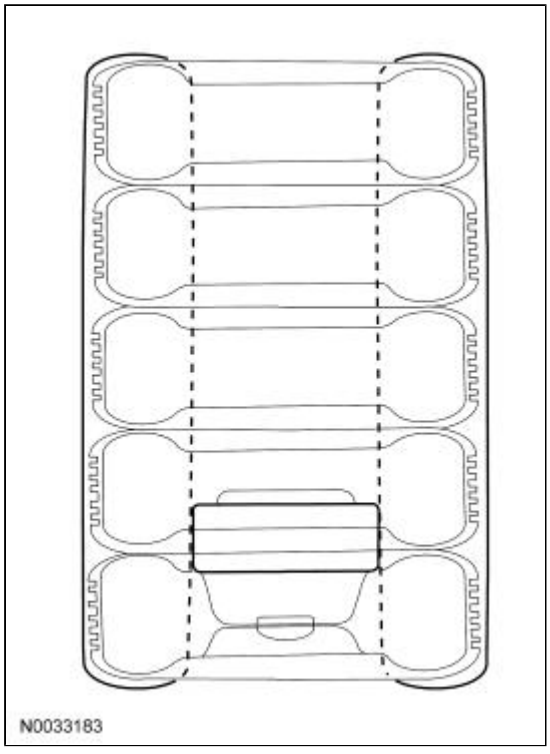
8. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the air bag module or to the twisted-together wires if multiple squibs. Use tape or other insulating material to make sure that the leads do not make contact with each other.



Driver air bag modules

9. **NOTE:** Make sure to maintain the connections to the air bag module.

   With the stack of tires upright and the wheel on the bottom, carefully place the driver air bag module, with the trim cover facing up, on the wheel.

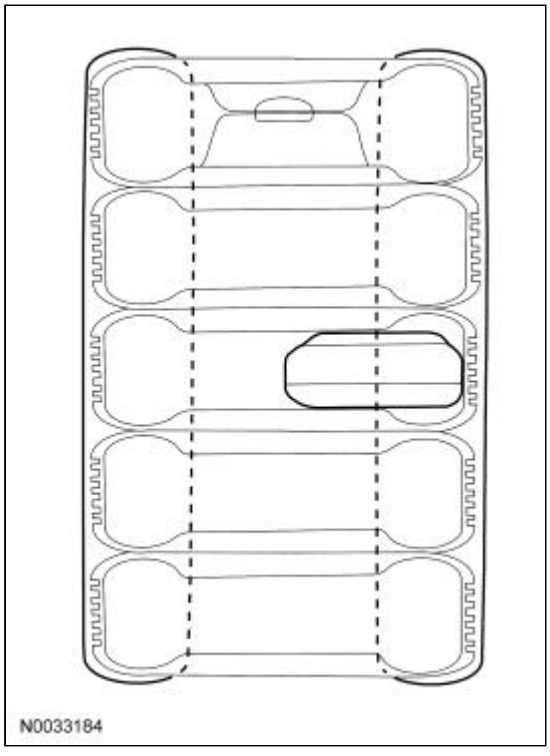


Passenger and seat side air bag modules

10. **NOTE:** Make sure to maintain the connections to the air bag module.

    Tip the stack of tires on its side and place the air bag module inside the center tire, making sure that there are 2 tires beneath the tire containing the air bag module and 2 tires (including the tire and wheel assembly) above the tire containing the air bag module.

11. Place the tire stack upright, with the wheel on top.



All driver, passenger and seat side air bag modules

12. Remain at least 9.14 meters (30 feet) away from the air bag module.

13. From the end of the jumper harness that is not connected to the air bag module, disconnect the 2 wires of the jumper harness from each other.

14. Deploy the air bag module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

15. To allow for cooling, wait at least 10 minutes before approaching the deployed air bag module.

16. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Adaptive Load Limiting Safety Belt Retractors — Remote Deployment

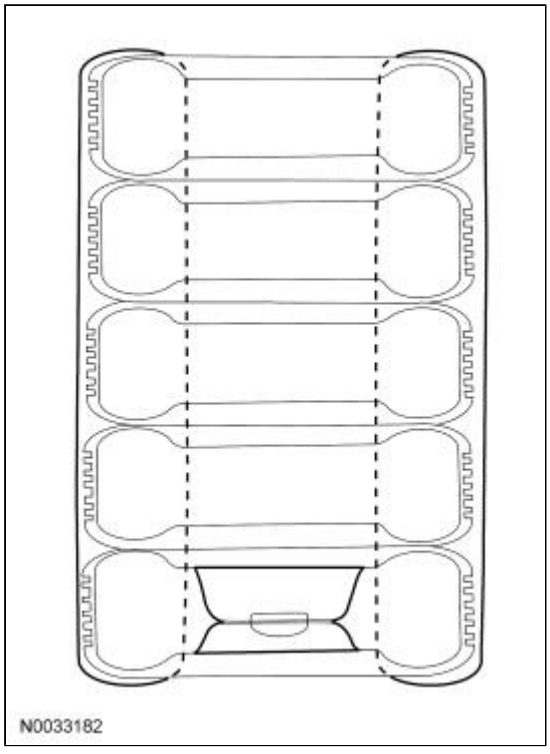
WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Deployment is to be carried out outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when the pretensioner or adaptive load limiting retractor is deployed, hearing protection is required.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Make a container to house the safety belt buckle or retractor for deployment.
    - **NOTE:** The tires must be of sufficient size to accommodate the safety belt buckle or retractor.

      Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
    - With the tire and wheel assembly on the bottom, stack the tires.
    - Securely tie all of the tires together.



2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the safety belt buckle or retractor. For additional information, refer to the appropriate procedure in Section 501-20A .
   - When deploying a safety belt buckle pretensioner, install a nut and bolt of sufficient length and of the same diameter as was used to retain it to the seat.

4. **NOTE:** If the safety belt buckle or retractor does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the safety belt buckle or retractor.

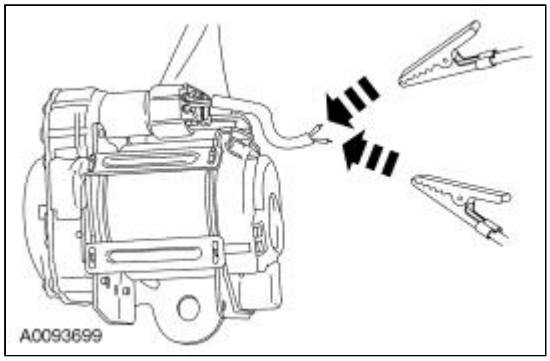
   Cut each of the safety belt buckle or retractor wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

6. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 meters (30 feet) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

7. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load limiting retractors similar.

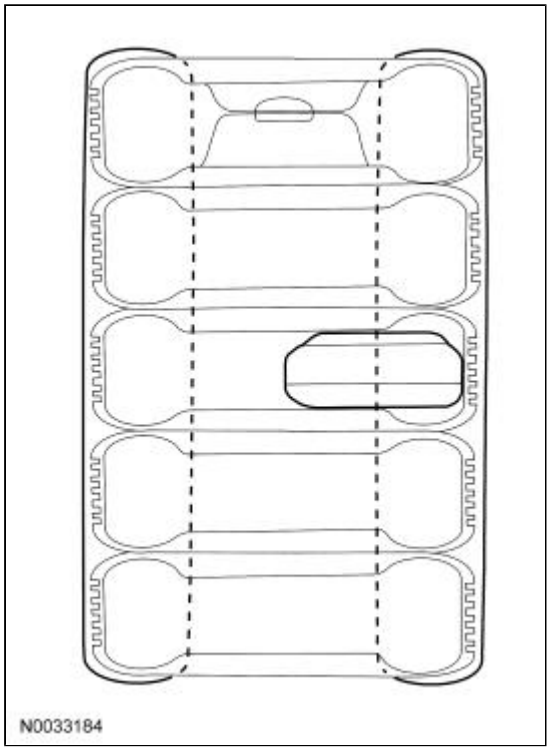
   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. **NOTE:** Make sure to maintain the connections to the safety belt buckle or retractor.

   Tip the stack of tires on its side and place the safety belt buckle or retractor inside the center tire, making sure that there are 2 tires beneath the tire containing the safety belt buckle or retractor and 2 tires (including the tire and wheel assembly) above the tire containing the safety belt buckle or retractor.

9. Place the tire stack upright, with the wheel on top.



10. Remain at least 9.14 meters (30 feet) away from the safety belt buckle or retractor.

11. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

12. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

13. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

14. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Load Limiting Safety Belt Retractors — In-Vehicle Deployment

WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

WARNING: Deployment is to be carried out outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when the pretensioner or adaptive load limiting retractor is deployed, hearing protection is required.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Access the safety belt buckle or retractor electrical connectors. For additional information, refer to Section 501-20A .

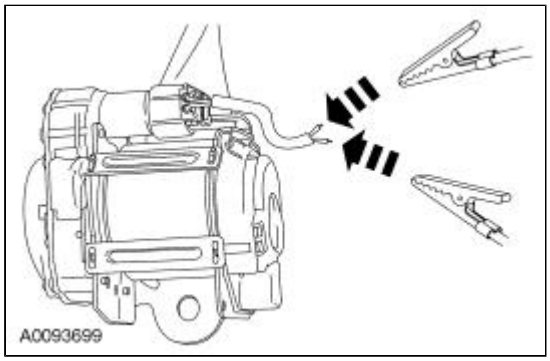
3. Cut each of the safety belt buckle or retractor wires, leaving at least 4 inches to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 meters (30 feet) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

6. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load limiting retractors are similar.

   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 meters (30 feet) away from the safety belt buckle or retractor.

8. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper

harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

11. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Canopy Modules and Side Air Curtain Modules — In-Vehicle Deployment

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Deployment is to be carried out outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when the safety canopy or side air curtain is deployed, hearing protection is required.

NOTE: The safety canopy module deployment for a scrapped vehicle will occur in its installed position in the vehicle.

NOTE: A typical safety canopy module disposal is shown that is similar for all vehicles.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

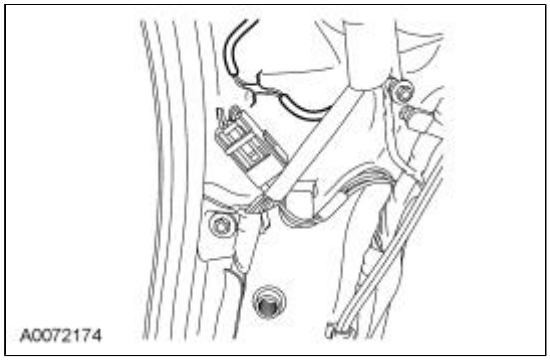
2. Access the safety canopy/side air curtain module electrical connectors. For additional information, refer to the appropriate procedure in this section.

3. Cut each of the safety canopy/side air curtain module wires leaving at least 4 inches to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

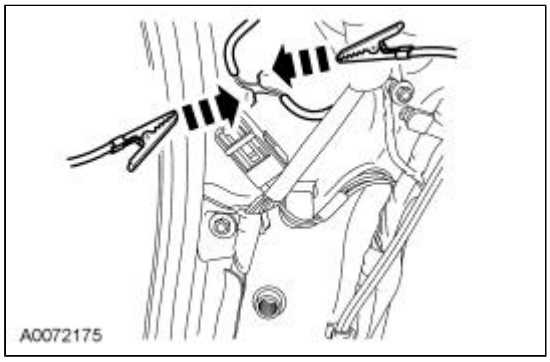
5. **NOTE:** Typical safety canopy/side air curtain module with 2 squibs shown, other safety canopy/side air curtain modules with 2 squibs are similar.

   For safety canopy/side air curtain modules with multiple squibs, twist together a wire from each squib then repeat for the remaining wires from each squib.



6. Make a jumper harness to deploy the safety canopy/side air curtain module.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 meters (30 feet) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

7. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety canopy/side air curtain module or to the twisted-together wires if multiple squibs. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. From the end of the jumper harness that is not connected to the safety canopy/side air curtain module, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the safety canopy/side air curtain module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety canopy/side air curtain module.

11. Dispose of the deployed safety canopy/side air curtain module in the same manner as any other part to be scrapped.

Deployable Steering Column — In-Vehicle Deployment

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Deployment is to be carried out outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when the deployable steering column is deployed, hearing protection is required.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. **NOTE:** It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering column electrical connector.

   Access the deployable steering column electrical connector.

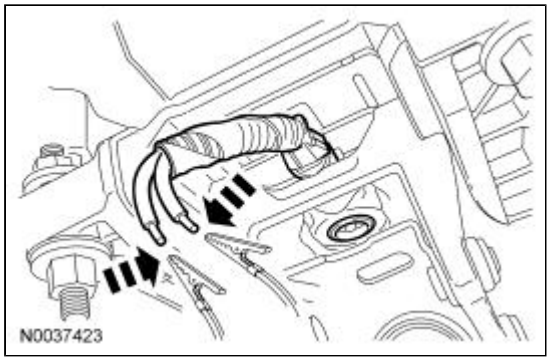
3. **NOTE:** If the deployable steering column does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the deployable steering column.

Cut each of the deployable steering column wires, leaving at least 4 inches to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the deployable steering column.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 meters (30 feet) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 meters (30 feet) away from the deployable steering column.

8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column.

11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.

Rivet Nut Replacement

Printable View (112 KB)

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

CAUTION: If the safety canopy module has deployed, the tether cord rivet nut must be inspected and replaced if damaged before installing a new safety canopy.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

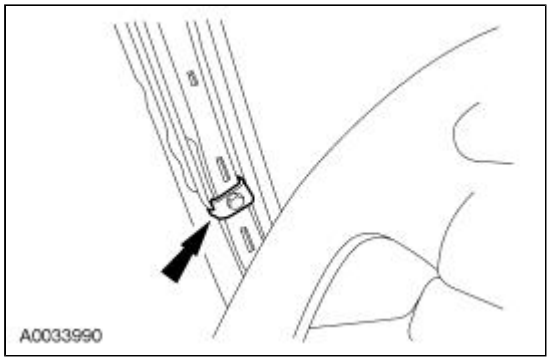
NOTE: A typical rivet nut replacement is shown that is similar for all vehicles.

NOTE: The left-hand drive driver side is shown, all others are similar.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

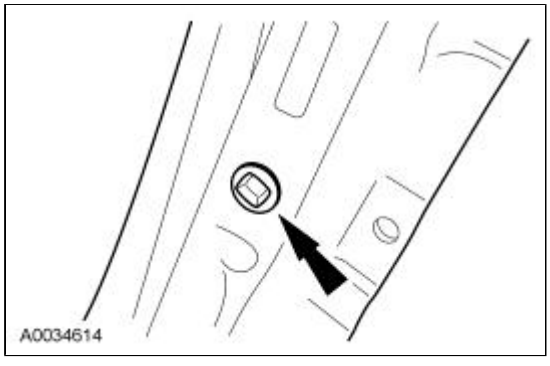
2. Remove the A-pillar trim panel. For additional information, refer to Section 501-05 .

3. Remove the bolt and bracket for the tether cord from the A-pillar.



4. Position and secure the side air curtain tether cord and bracket assembly out of the way.

5. Using the appropriate service tool, sand the rivet nut shoulder until the shoulder surface is removed.



6. Punch the remaining portion of the rivet nut through the rivet nut hole.

7. **NOTE:** Use only Ford Motor Company factory-authorized replacement parts for rivet nut repair procedure.

   Obtain the correct square shank rivet nut for the vehicle application from the Ford Master Parts Catalog, and insert it into the rivet nut hole.

8. Using a suitable rivet nut installing tool, install the rivet nut. For additional information, refer to the tool manufacturer's operating instructions.

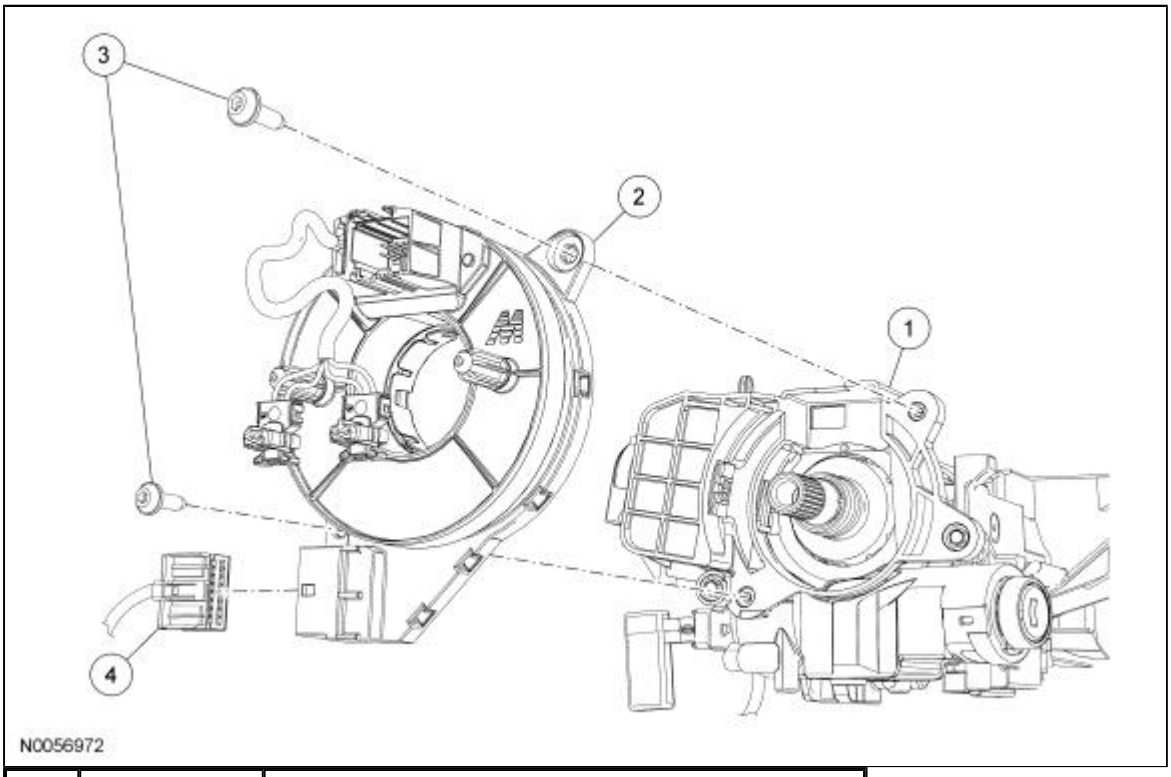
9. Position the A-pillar tether cord. Install the bolt. See the appropriate component removal and installation procedure or Specifications for the correct torque specification.

10. **NOTE:** The tether cord must be positioned correctly in place before installing the A-pillar trim panel.

    Install the A-pillar trim panel. For additional information, refer to Section 501-05.

Clockspring

Printable View (249 KB)



Item	Part Number	Description
1	3F791	Multi-function switch carrier
2	14A644	Clockspring
3	W506943	Clockspring screws (2 required)
4	—	Clockspring electrical connector (part of 14401)

Removal

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Center the tilt steering column.

2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.

4. **NOTE:** Make sure the road wheels are in the straight-ahead position.

   Remove the steering wheel. For additional information, refer to Section 211-04 .

5. Disconnect the clockspring electrical connector.

6. Remove the 2 screws and remove the clockspring.

Installation

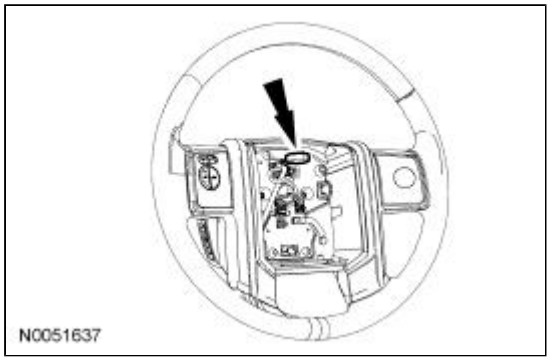
All vehicles

1. Install the clockspring and the 2 screws.

2. Connect the clockspring electrical connector.

Vehicles installing a new clockspring

3. Install the steering wheel. For additional information, refer to Section 211-04 .
   - After the steering wheel installation, remove the clockspring sealing key.



Vehicle repairs reusing the same clockspring

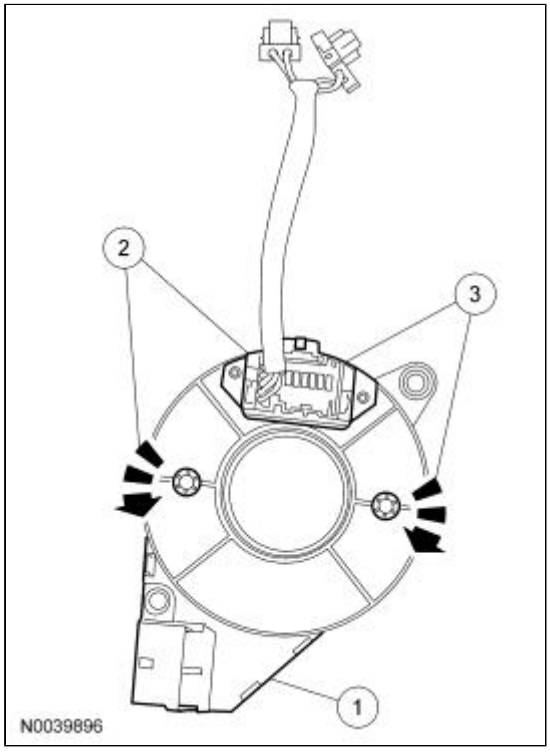
4. **WARNING: Incorrect centralization may result in premature component failure. If in doubt when centralizing the clockspring, repeat the centralizing procedure. Failure to follow this instruction may result in personal injury.**

   CAUTION: Make sure the road wheels are in the straight-ahead position.

   If the vehicle's clockspring has rotated out of center, follow these steps to center the clockspring.
   1. Hold the clockspring outer housing stationary.
   2. **CAUTION: Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.**

      While turning the rotor counterclockwise, carefully feel for the ribbon wire to run out of length and for a slight resistance. Stop turning at this point.
   3. Turn the clockspring clockwise (approximately 2 turns) until the clockspring rotor wiring and connector are in the 12 o'clock position. clockspring is now centered.

- Do not allow the rotor to turn from this position.



5. **CAUTION: If the vehicle is left unattended by the technician between centralizing the clockspring and installing the steering wheel, the centralizing procedure must be repeated.**

   Install the steering wheel. For additional information, refer to Section 211-04 .

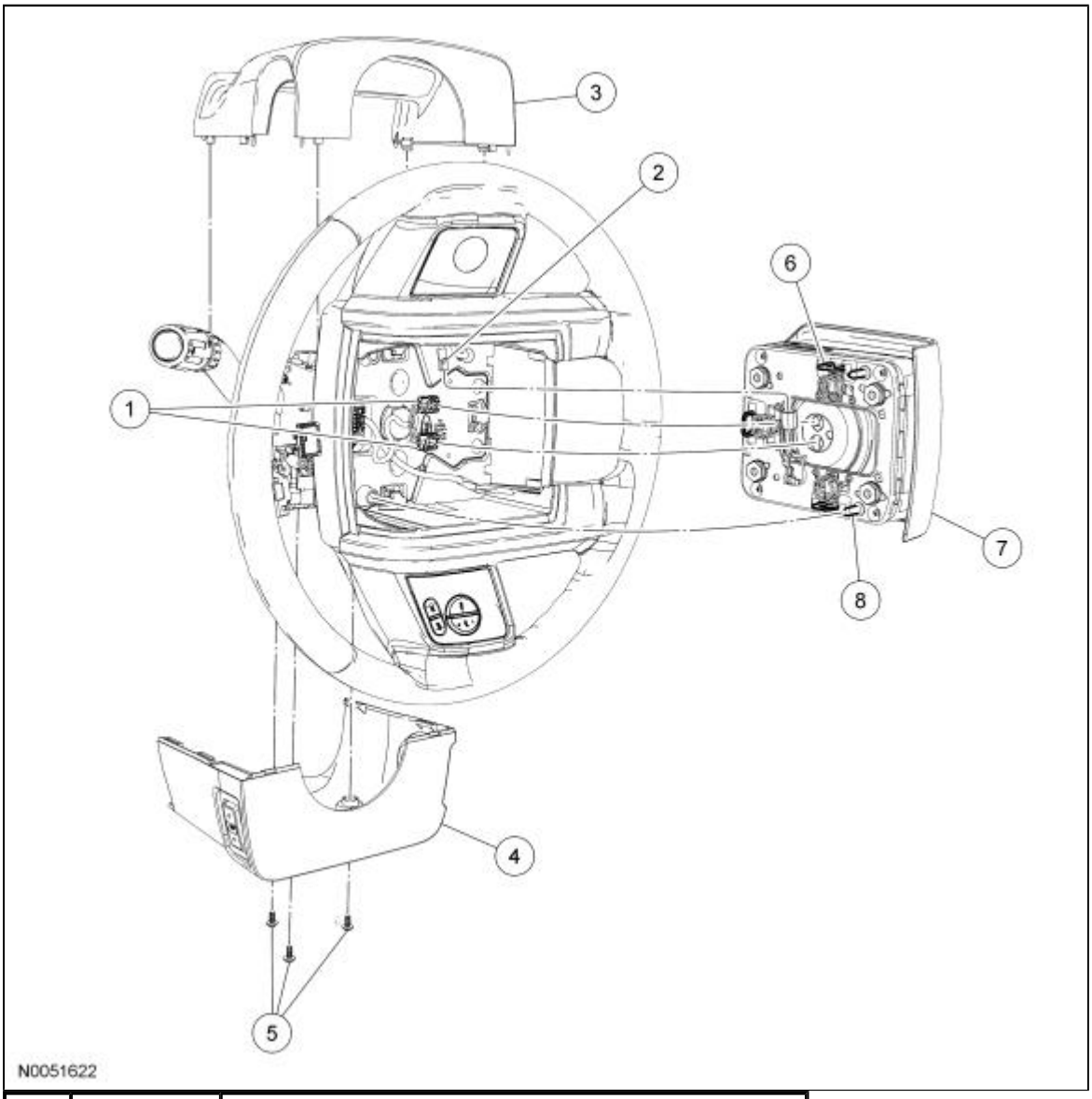
All vehicles

6. Install the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.

7. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Driver Air Bag Module

Printable View (367 KB)



Item	Part Number	Description
1	—	Driver air bag module electrical connectors (part of 14A664) (2 required)
2	—	Horn switch electrical connector (part of 3600)
3	3530	Steering column upper shroud
4	3K512	Steering column lower shroud
5	W710485	Steering column lower shroud screws (3 required)
6	—	Driver air bag module wire clip (part of 043B13) (3 required)
7	043B13	Driver air bag module
8	—	Driver air bag module locator pin (2 required) (part

		of 043B13)

Removal and Installation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

CAUTION: Make sure each of the 3 driver air bag module wire clips are disengaged from each of the 3 steering wheel hooks before removing the driver air bag module from the steering wheel. Failure to do so will damage the driver air bag module and steering wheel.

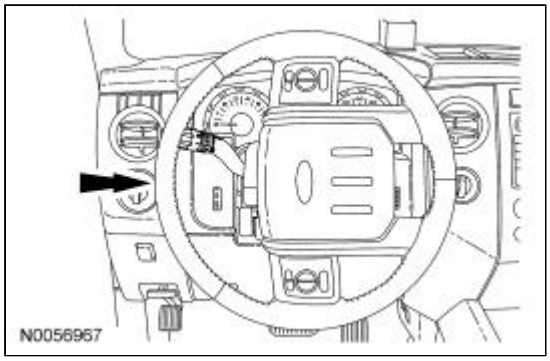
NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

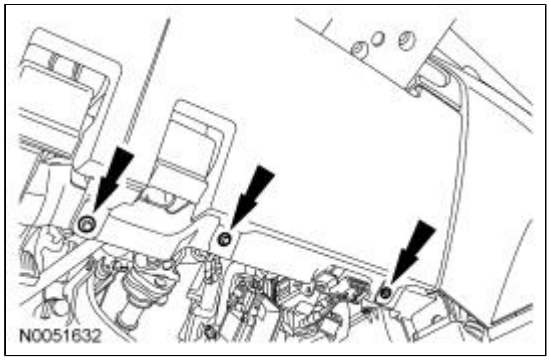
1. Make sure the road wheels are in the straight-ahead position.
2. Center the tilt steering column.
3. Turn the steering wheel so the top of the wheel is 90 degrees to the left (at the 9 o'clock position).



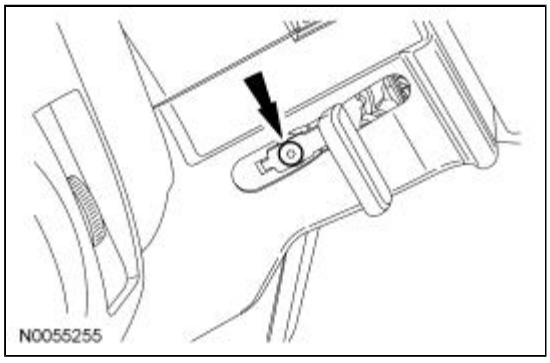
4. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Vehicles with manual tilt wheel

5. Remove the lower steering column opening cover.
   - Remove the 3 screws and pull out to release the top retaining clips and remove the lower steering column opening cover.



6. Remove the screw and steering column manual tilt lever.



All vehicles

7. Remove the 3 steering column lower shroud screws.

8. Release the clips and remove the steering column upper shroud.

9. Remove the steering column lower shroud.
   - If equipped, disconnect the power tilt steering column switch located on the lower shroud.

10. **CAUTION: Make sure each of the 3 driver air bag module wire clips are disengaged**

from each of the 3 steering wheel hooks before removing the driver air bag module from the steering wheel. Failure to do so will damage the driver air bag module and steering wheel.

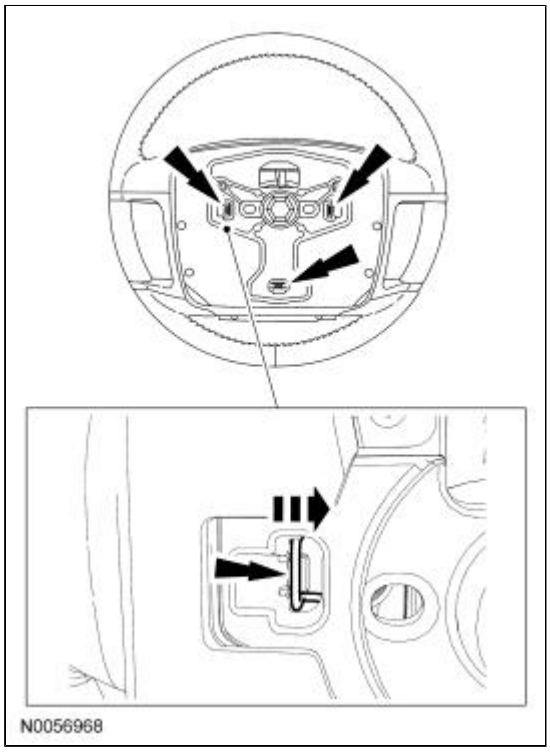
NOTE: Steering wheel is removed for clarity. The rear of the steering wheel is shown.

NOTE: Use a mirror to look at the rear of the steering wheel to locate where the 3 driver air bag module wire clips attach to the steering wheel hooks.

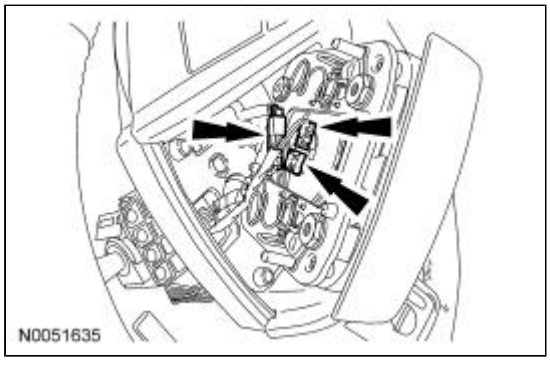
NOTE: Note the position of the 2 driver air bag module locator pins to the steering wheel for installation.

Using a screwdriver or a suitable tool, release each of the 3 driver air bag module wire clips from the steering wheel hooks.

- Access the 3 driver air bag module wire clips through the back of the steering wheel cover and push the wire clips toward the center of the steering wheel to release.



11. Disconnect the 2 driver air bag module electrical connectors, then disconnect the horn switch electrical connector and remove the driver air bag module.



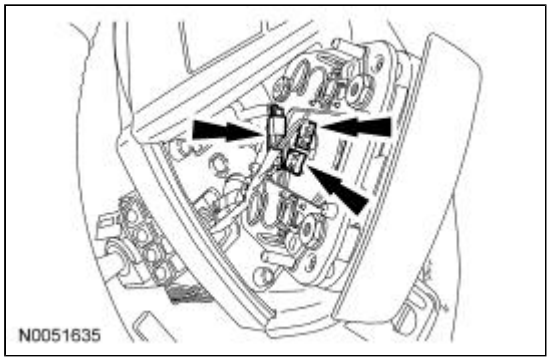
12. Turn the steering wheel so the top of the wheel is back in the straight ahead position (the 12 o'clock position).

Installation

All vehicles

1. **CAUTION: The clockspring electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module.**

   Connect the horn switch electrical connector, then connect the 2 driver air bag module electrical connectors.

2. Position the driver air bag module to the steering wheel lining up the locator pins.

3. **NOTE:** Make sure that all 3 driver air bag module wire clips are fully engaged and seated correctly to the steering wheel.

   NOTE: Audible clicks will be heard when the 3 driver air bag module wire clips are fully engaged.

   Firmly press the driver air bag module to the steering wheel, seating the 3 driver air bag module wire clips to the steering wheel hooks.
   - Check the driver air bag module trim cover to the steering wheel for an even gap clearance and correct movement.

4. Install the steering column lower shroud.
   - If equipped, connect the power tilt steering column switch.

5. Install the steering column upper shroud.

6. Install the 3 steering column lower shroud screws.

Vehicles with manual tilt wheel

7. Install the steering column manual tilt lever and screw.
   - Tighten to 6 Nm (53 lb-in).

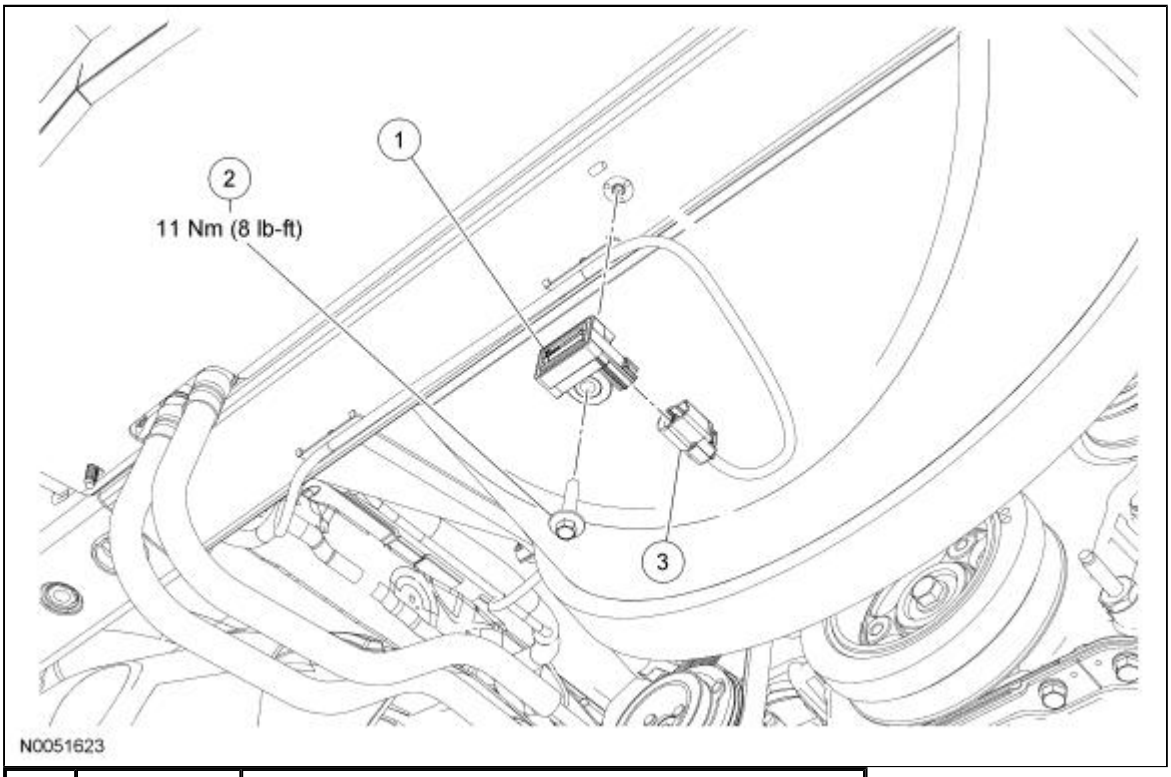
8. Install the lower steering column opening cover and the 3 screws.

All vehicles

9. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Front Impact Severity Sensor

Printable View (195 KB)



Item	Part Number	Description
1	14B004	Front impact severity sensor
2	W711619	Front impact severity sensor bolt
3	—	Front impact severity sensor electrical connector (part of 14290)

Removal and Installation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system SRS is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Install and correctly position the sensor or any other damaged SRS components whether or not the air bag is deployed.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

NOTE: The front impact severity sensor is located on the bottom of the lower radiator support.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Disconnect the front impact severity sensor electrical connector.

3. **WARNING: The tightening torque of the air bag front impact severity sensor retaining bolt is critical for correct system operation.**

   NOTE: Make sure the radiator support and front impact severity sensor mating surfaces are clean and free of foreign material.

   NOTE: Note position of the locator tab on the front impact severity sensor for installation.

   Remove the bolt and front impact severity sensor.
   - To install, tighten to 11 Nm (8 lb-ft).

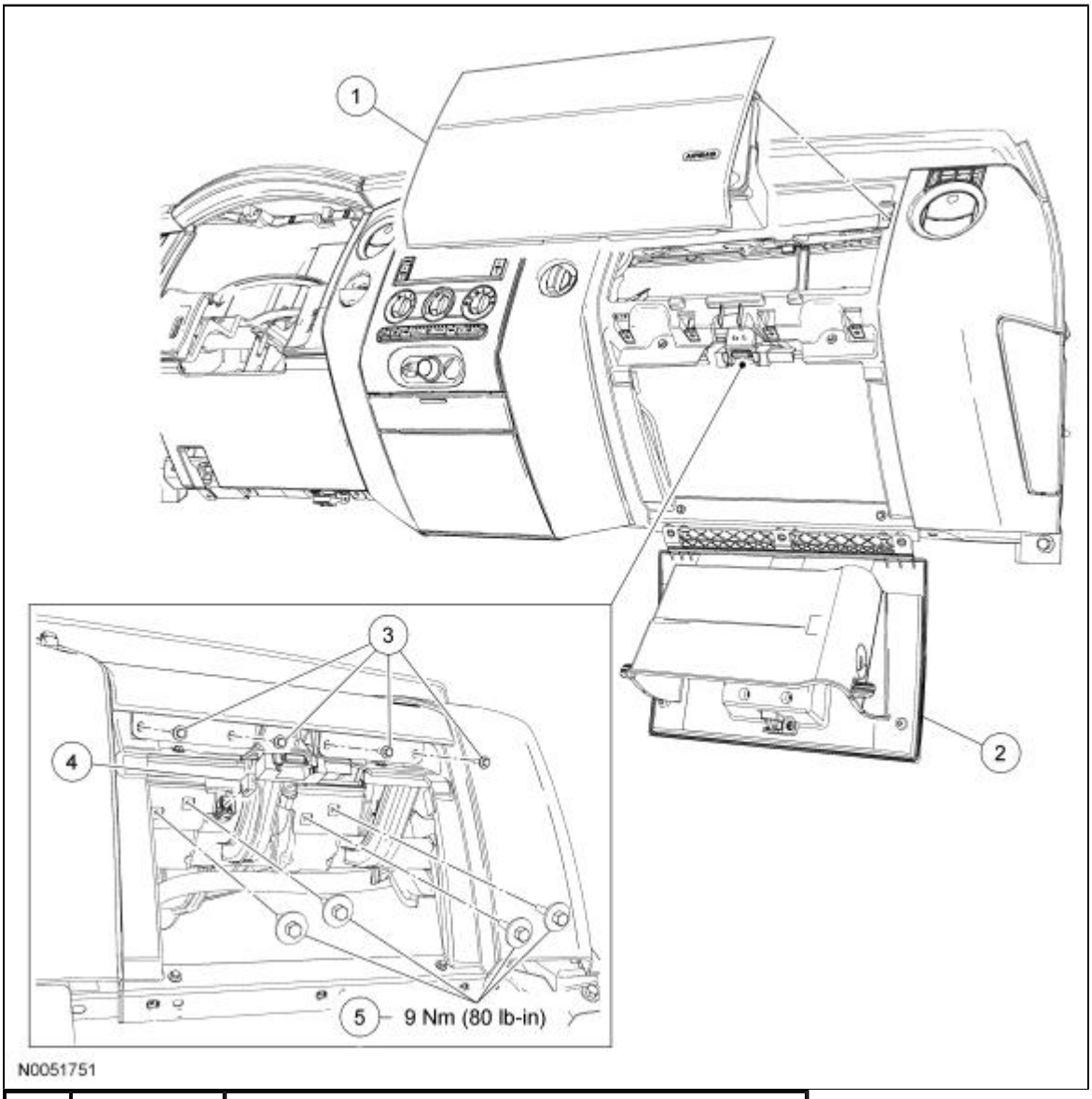
4. To install, reverse the removal procedure.

5. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Passenger Air Bag Module

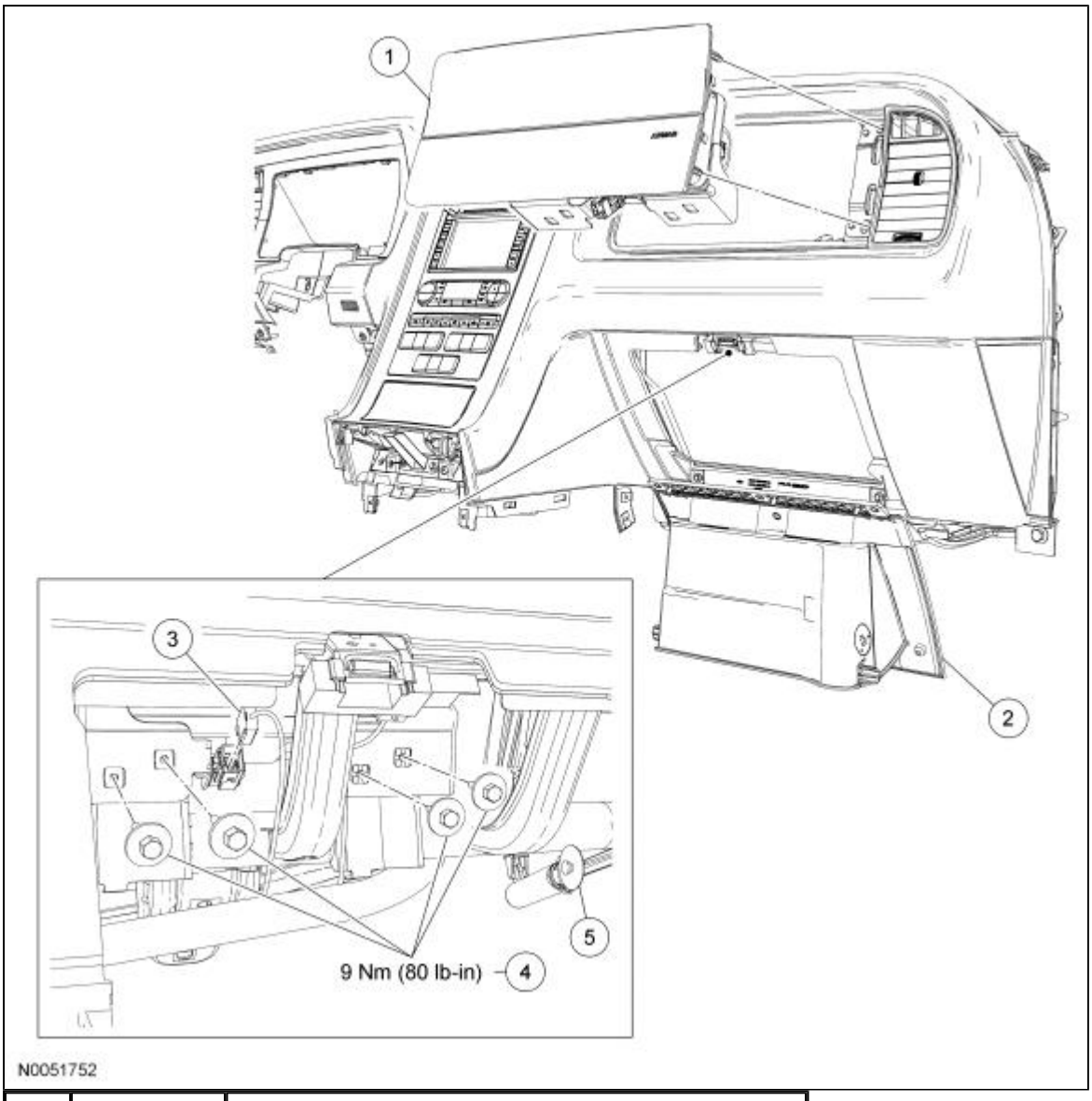
Printable View (404 KB)

Expedition Passenger Air Bag



Item	Part Number	Description
1	044A74	Passenger air bag module
2	—	Glove compartment door
3	W707628	Passenger air bag module deployment door screws (4 required)
4	—	Passenger air bag module electrical connector (part of 14401)
5	W709027	Passenger air bag module bolts (4 required)

Navigator Passenger Air Bag



Item	Part Number	Description
1	044A74	Passenger air bag module
2	—	Glove compartment door
3	—	Passenger air bag module electrical connector (part of 14401)
4	W709027	Passenger air bag module bolts (4 required)
5	—	Glove box door dampener (if equipped)

Removal and Installation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Carry a live air bag module with the air bag and deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live air bag module down with the deployment door face down. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Air bag modules with discolored or damaged deployment doors must be replaced, not repainted.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Open and lower the glove compartment door.
   - If equipped, disconnect the glove compartment door dampener.

3. Disconnect the passenger air bag module electrical connector.

Expedition vehicles

4. Remove the 4 passenger air bag module deployment door screws.

All vehicles

5. Remove the 4 passenger air bag module bolts.
   - To install, tighten to 9 Nm (80 lb-in).

6. **CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment door.**

   Reaching one hand into the glove box opening, push out on the bottom of the passenger air bag module deployment door releasing the bottom clips. Then remove the passenger air bag module from the instrument panel.

7. **NOTE:** During passenger air bag module installation, make sure all the deployment door clips are fully seated into the instrument panel.

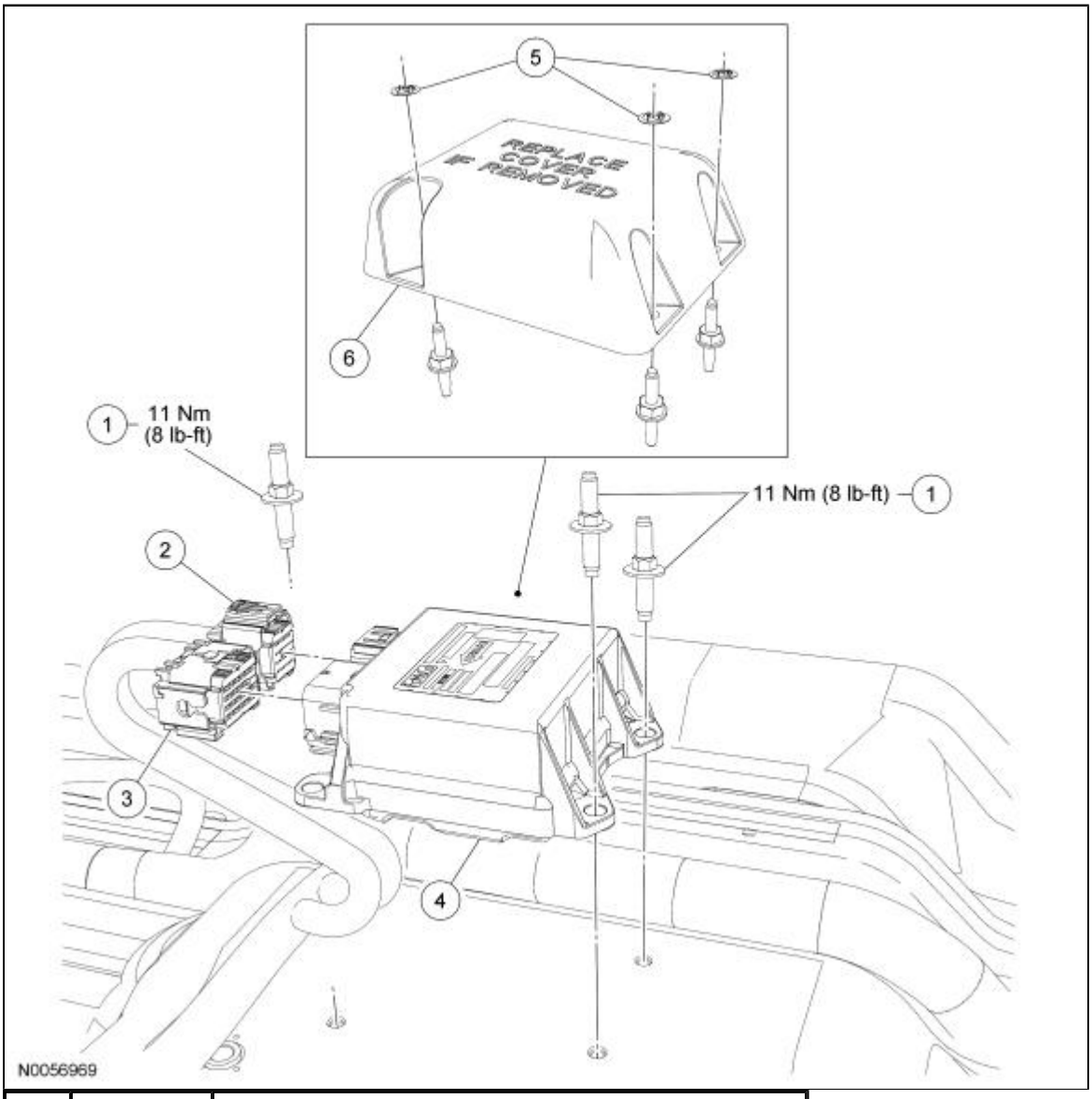
   To install, reverse the removal procedure.

8. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Restraints Control Module (RCM)

Printable View (365 KB)

NOTE: Seats removed for clarity.



Item	Part Number	Description
1	W710898	Restraints control module (RCM) bolts (3 required)
2	—	Small RCM electrical connector (part of 14A005)
3	—	Large RCM electrical connector (part of 14A005)
4	14B321	RCM
5	W623482	RCM cover push-nut retainers (3 required) (vehicles with bucket seats and no center console only)
6	14A099	RCM cover (vehicles with bucket seats and no center console only)

Removal

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow these instructions may result in the inadvertent deployment of the safety canopy and risk of personal injury.

WARNING: The RCM orientation is critical for proper air bag SRS operation. If a vehicle equipped with an SRS system has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, a new RCM must be installed whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage can result.

CAUTION: When installing a new RCM, it is necessary to carry out programmable module installation (PMI). For additional information, refer to Section 418-01 .

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: When installing a new RCM, always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

1. If installing a new restraints control module (RCM), carry out the steps necessary to prepare for programmable module installation (PMI). For additional information, refer to Section 418-01 .

2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Vehicles with a center console

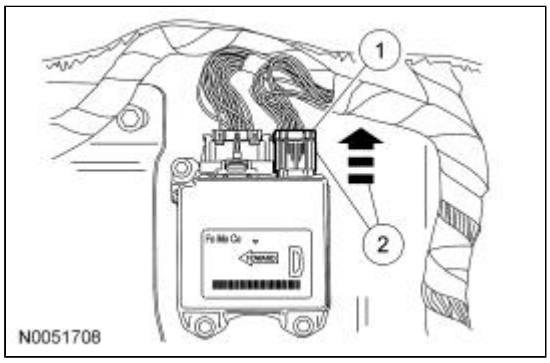
3. Remove the center console. For additional information, refer to Section 501-12 .

Vehicles with bucket seats and no center console

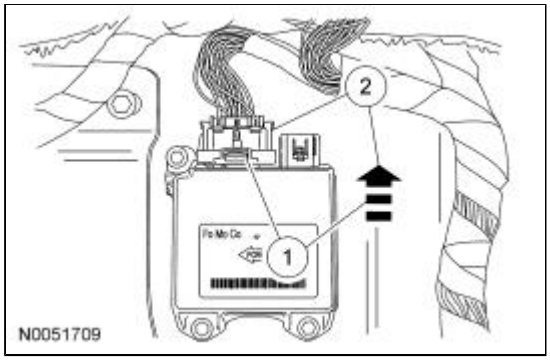
4. Remove the 3 RCM push-nut retainers and the RCM cover.

All vehicles

5. Disconnect the small RCM electrical connector.
    1. Push down to release the retaining tab.
    2. While releasing the retaining tab, pull out and disconnect the small RCM electrical connector.



6. Disconnect the large RCM electrical connector.
    1. Pinch the thumb tab and pivot the connector position assurance lever away from the RCM, disengaging the lever.
    2. Pull out and disconnect the large RCM electrical connector.



7. Remove the 3 bolts and RCM.

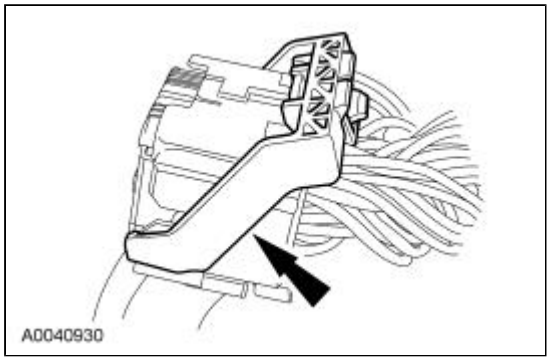
Installation

All vehicles

1. **WARNING: The tightening torque of the air bag RCM retaining bolts is critical for correct system operation.**

   Install the RCM and 3 bolts.
   - Tighten to 11 Nm (8 lb-ft).

2. Make sure the connector position assurance lever is in the full release position before attempting to connect the connector.

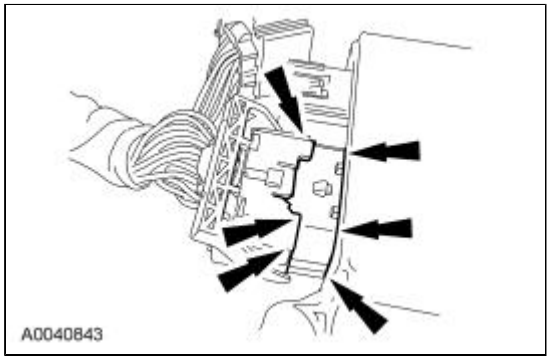


3. **CAUTION: Putting the large RCM electrical connector into the RCM on an angle can cause bad electrical connections and damage components.**

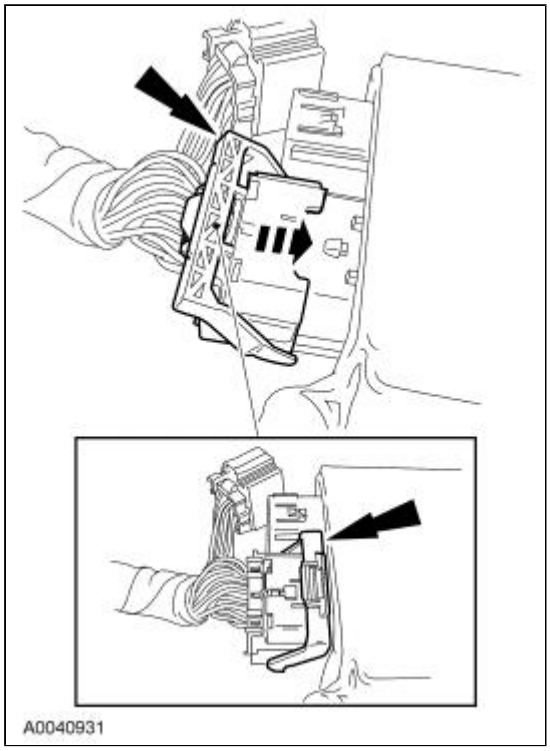
   Position the large RCM electrical connector into the RCM.

   - **CAUTION: Do not push the connector on to where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the RCM before using the lever to fully seat the connector.**

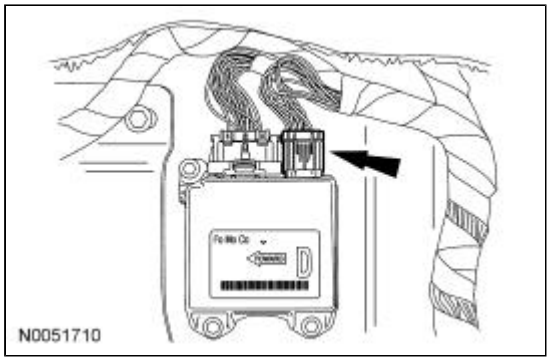
     With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.



4. Connect the RCM electrical connector.
   - Pivot the connector position assurance lever toward the RCM, drawing the connector in to the RCM.
     - Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.



5. Connect the small RCM electrical connector.



Vehicles with bucket seats and no center console

6. Install the 3 RCM push-nut retainers and the RCM cover.

Vehicles with a center console

7. Install the center console. For additional information, refer to Section 501-12 .

All vehicles

8. Repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

9. When installing a new RCM, carry out the steps necessary to complete programmable module installation (PMI). For additional information, refer to Section 418-01 .

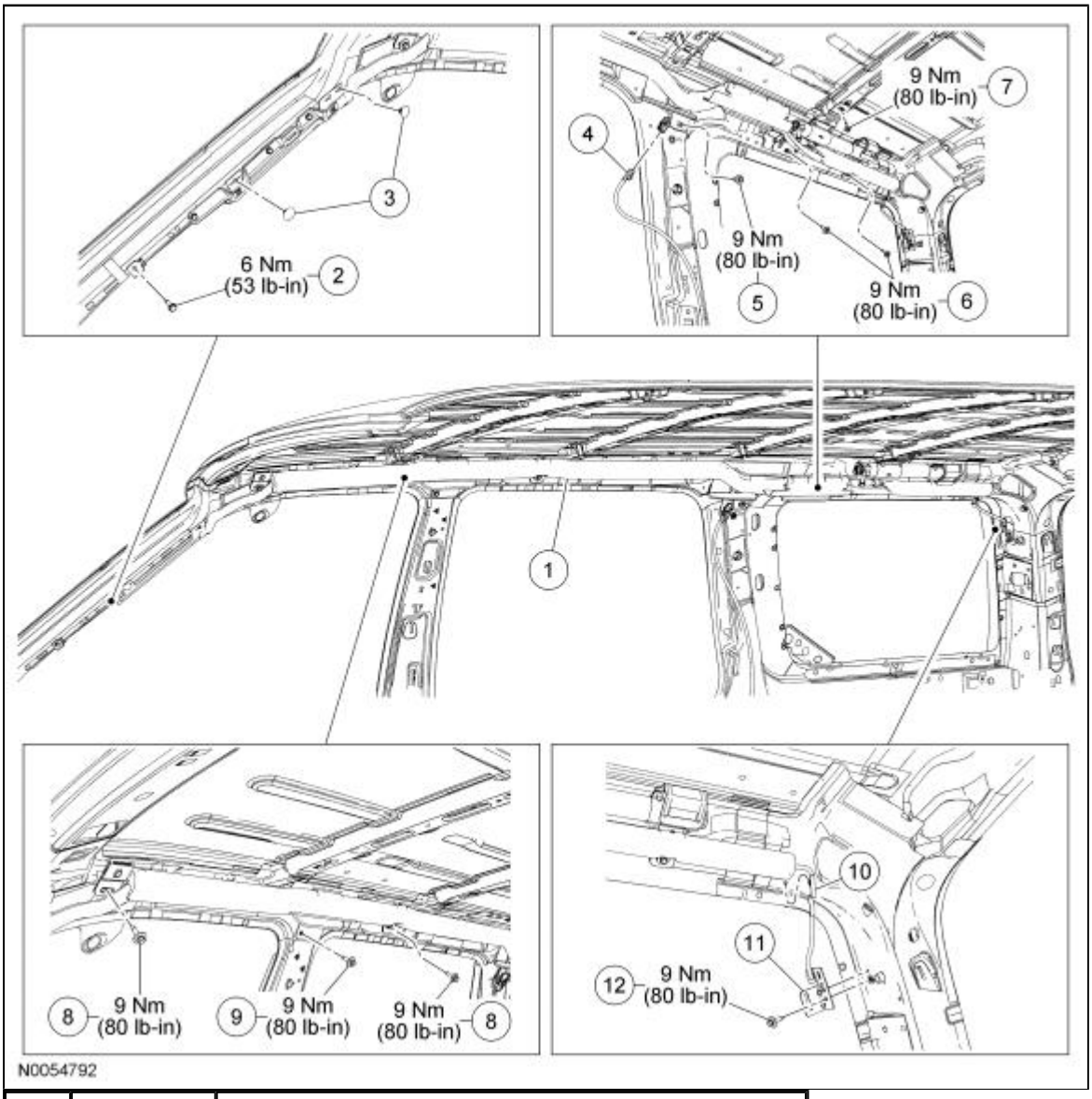
10. Prove out the supplemental restraint system (SRS) as follows:
Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an

air bag SRS fault is present, the air bag warning indicator will:
— fail to light.
— remain lit continuously.
— flash.
The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.
Clear all continuous memory diagnostic trouble codes (DTCs) from the RCM.

Safety Canopy Module

Printable View (434 KB)

NOTE: Expedition shown, Navigator, Expedition EL and Navigator L similar.



Item	Part Number	Description
1	042D94	Safety canopy module
2	—	Front tether cord bracket bolt (part of 042D94)
3	—	Front tether cord pin-type retainers (2 required) (part of 042D94)
4	—	Safety canopy module electrical connector (part of 14A005)
5	W706681	Safety canopy module C-pillar bolt
6	W706681	Safety canopy module rear bolts (2 required)

7	W706681	Safety canopy module roof bracket bolt
8	W706681	Safety canopy module front bolts (2 required)
9	W706681	Safety canopy module B-pillar bracket bolt
10	—	Safety canopy module rear tether cord routing clip pin-type retainer (part of 042D94)
11	—	Safety canopy module rear tether cord anchor bracket (part of 042D94)
12	W706681	Safety canopy module rear tether cord anchor bracket bolt

Removal

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: To reduce the risk of personal injury from an accidental deployment, always carry or place a live safety canopy module with the safety canopy and tear seam pointed away from your body. Failure to do so can result in personal injury in the event of a safety canopy module deployment.

WARNING: After deployment, the surface of the safety canopy can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connector on the safety canopy module. Doing so can result in safety canopy deployment which can result in personal injury.

WARNING: Anytime the safety canopy has deployed, the headliner, and all A, B, C, and D-pillar upper trim panels and attaching hardware must be replaced along with any other damaged components and hardware. Failure to do so can result in personal injury in the event of a safety canopy deployment.

WARNING: Vehicles equipped with safety canopy modules require a specific headliner. When installing a new headliner on a vehicle equipped with safety canopy modules, make sure a headliner for safety canopy modules is being used. The word AIRBAG will appear on the headliner where it meets each B-pillar trim panel. Failure to do so can result in personal injury in the event of a safety canopy module deployment.

WARNING: Before installing the safety canopy module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. All damaged fasteners must be replaced and any foreign objects removed. Failure to do so may result in personal injury in the event of a safety canopy deployment.

WARNING: Inspect the safety canopy before installation. If the safety canopy is damaged or the cover has separated or safety canopy material has been exposed, a new safety canopy module must be installed. Do not attempt to repair the safety canopy module. Failure to follow these instructions can result in personal injury in the event of a safety canopy module deployment.

WARNING: To reduce the risk of injury, do not obstruct or place objects in the deployment path of the safety canopy module. Failure to follow these instructions can result in personal injury in the event of a safety canopy module deployment.

WARNING: Never put any type of fastener or tie strap around any part of the safety canopy module or interior trim panel. This will prevent the safety canopy module from deploying correctly. Failure to do so can result in personal injury in the event of a safety canopy module deployment.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

NOTE: The passenger side safety canopy module is shown, driver side similar.

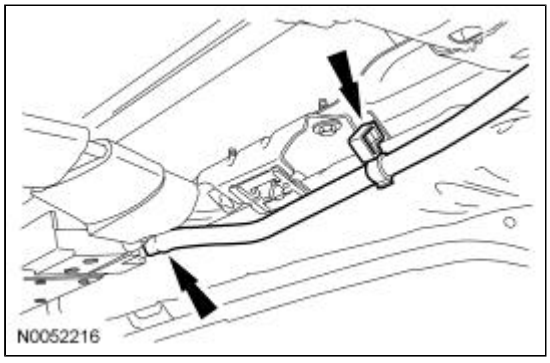
All vehicles

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the headliner. For additional information, refer to Section 501-05 .

Vehicles with a moon roof

3. Disconnect the moon roof rear drain hose and release the drain hose retainer from the coat hook bracket.



All vehicles

4. Disconnect the safety canopy module electrical connector.

5. **NOTE:** Note the locator tab on the front tether anchor bracket to the A-pillar sheetmetal for installation.

   Remove the front tether cord bolt and bracket from the A-pillar.

6. Remove the 2 front tether cord pin-type retainers from the A-pillar sheetmetal.

7. Remove the 2 safety canopy module front bolts and the one B-pillar bracket bolt.

Expedition/Navigator vehicles

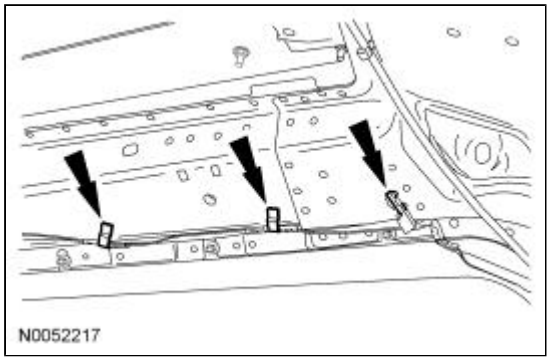
8. Detach the safety canopy module rear tether cord routing clip pin-type retainer from the sheetmetal.

9. **NOTE:** Note the locator tab on the rear tether cord anchor bracket to the D-pillar sheetmetal for installation.

   Remove the bolt and the safety canopy module rear tether cord anchor bracket from the D-pillar.

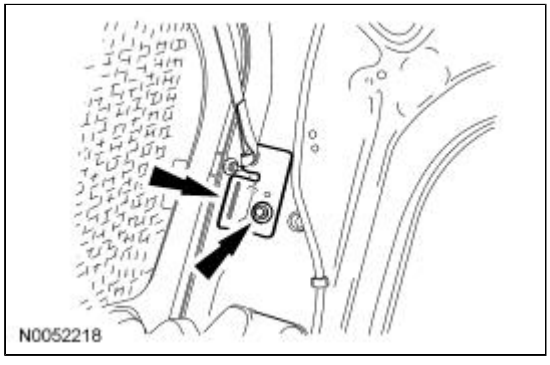
Expedition EL/Navigator L vehicles

10. Detach the 3 safety canopy module rear tether cord routing clip pin-type retainers from the sheetmetal.



11. **NOTE:** Note the locator tab on the rear tether cord anchor bracket to the D-pillar sheetmetal for installation.

    Remove the bolt and the safety canopy module rear tether cord anchor bracket from the D-pillar.

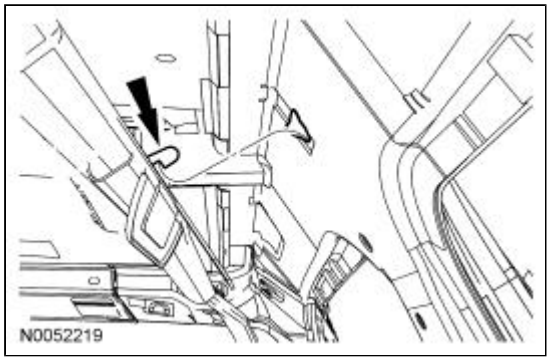


All vehicles

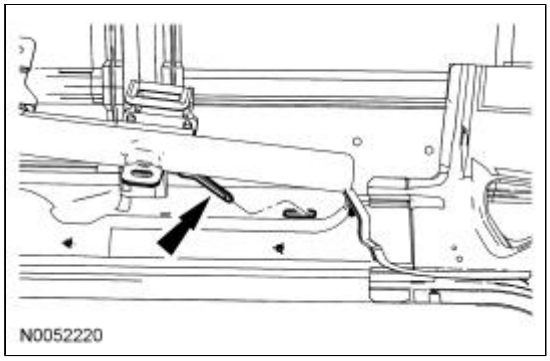
12. Remove the C-pillar safety canopy module bolt.

13. Remove the 2 safety canopy module rear bolts and the one roof bracket bolt.

14. Gently lift the safety canopy module up and inward at the B-pillar to release the bracket hook from the sheetmetal.



15. Move the safety canopy module forward to release the rear bracket hook from the sheetmetal and remove the safety canopy module.



Installation

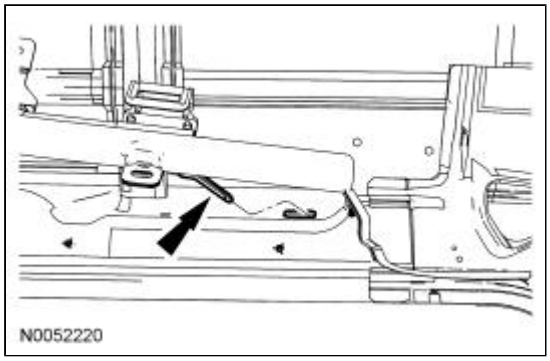
All vehicles

1. **WARNING: Before installing the safety canopy module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. All damaged fasteners must be replaced and any foreign objects removed. Failure to do so may result in personal injury in the event of a safety canopy module deployment.**

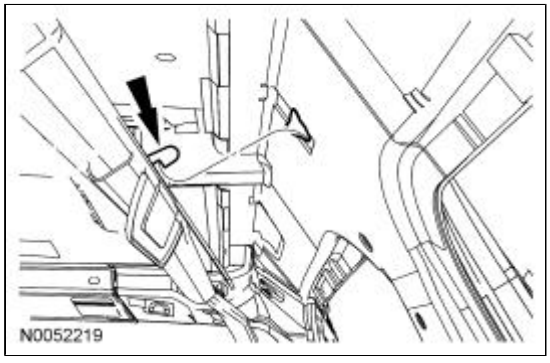
   WARNING: Before installing the safety canopy module, if the module is damaged or the cover has separated or the safety canopy material has been exposed, install a new safety canopy module. Do not attempt to repair the safety canopy. Failure to follow these instructions could result in personal injury in the event of a safety canopy deployment.

   WARNING: Never put any type of fastener or tie strap around any part of the safety canopy module or interior trim panel. This will prevent the safety canopy module from deploying correctly. Failure to do so can result in personal injury in the event of a safety canopy module deployment.

   Position safety canopy module by moving it rearward installing the rear bracket hook in the sheetmetal.



2. Install the safety canopy module B-pillar bracket hook in the sheetmetal.



3. Install the safety canopy module B-pillar bracket bolt.
    - Tighten to 9 Nm (80 lb-in).

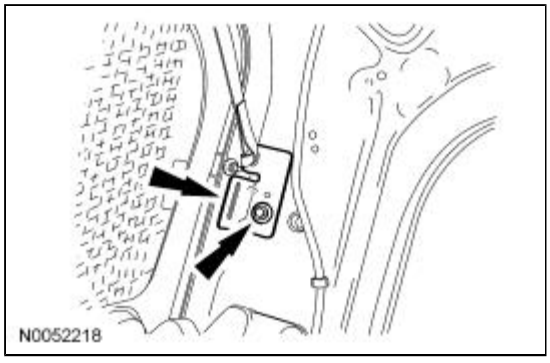
4. Install the safety canopy module roof bracket bolt.
    - Tighten to 9 Nm (80 lb-in).

5. Install the 2 safety canopy module rear bolts.
    - Tighten to 9 Nm (80 lb-in).

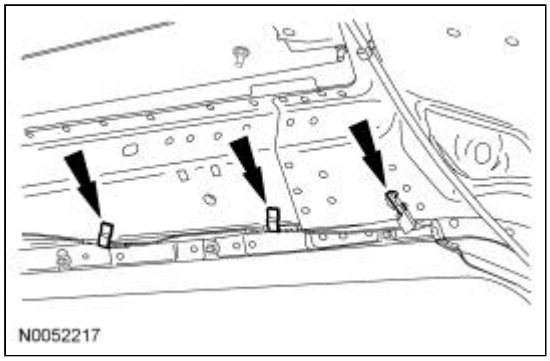
6. Install the C-pillar safety canopy module bolt.
    - Tighten to 9 Nm (80 lb-in).

Expedition EL/Navigator L vehicles

7. Install the safety canopy module rear tether cord anchor bracket and bolt to the D-pillar.
    - Tighten to 9 Nm (80 lb-in).



8. Attach the 3 safety canopy module rear tether cord routing clip pin-type retainers to the sheetmetal.



Expedition/Navigator vehicles

9. Install the safety canopy module rear tether cord anchor bracket and bolt to the D-pillar.
    - Tighten to 9 Nm (80 lb-in).

10. Attach the safety canopy module rear tether cord routing clip pin-type retainer to the sheetmetal.

All vehicles

11. Install the 2 safety canopy module front bolts.
    - Tighten to 9 Nm (80 lb-in).

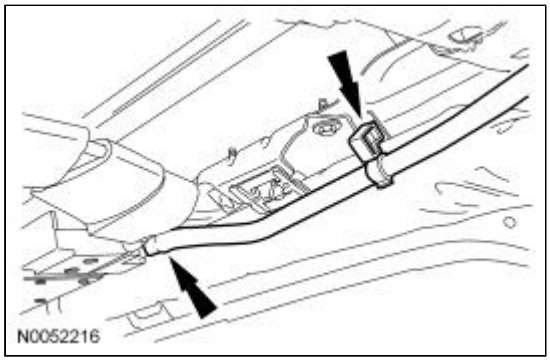
12. Install the 2 front tether cord pin-type retainers to the A-pillar sheetmetal.

13. Install the front tether cord bracket and bolt to the A-pillar.
    - Tighten to 6 Nm (53 lb-in).

14. Connect the safety canopy module electrical connector.

Vehicles with a moonroof

15. Connect the moon roof rear drain hose and attach the drain hose retainer to the coat hook bracket.



All vehicles

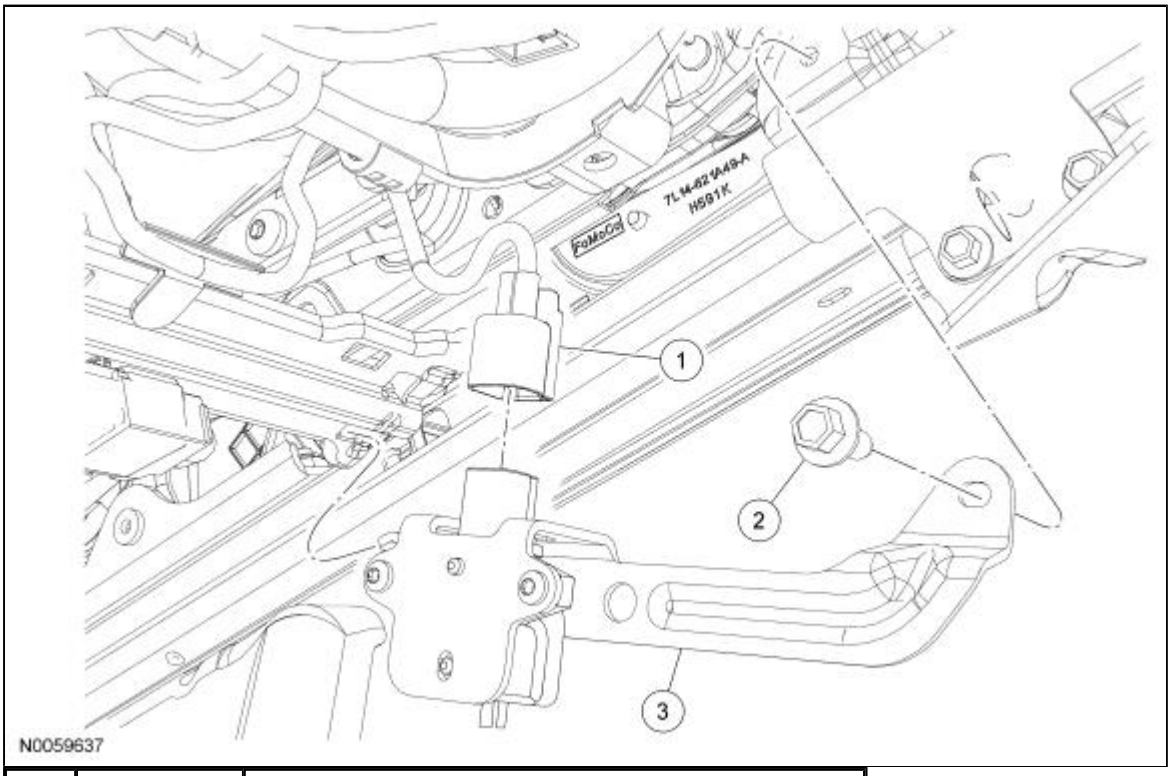
16. Install the headliner. For additional information, refer to Section 501-05 .

17. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Seat Position Sensor

Printable View (201 KB)

NOTE: Power seat shown, manual similar.



Item	Part Number	Description
1	—	Seat position sensor electrical connector (part of 14A699)
2	—	Seat position sensor and bracket bolt (part of 14B416)
3	14B416	Seat position sensor and bracket

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

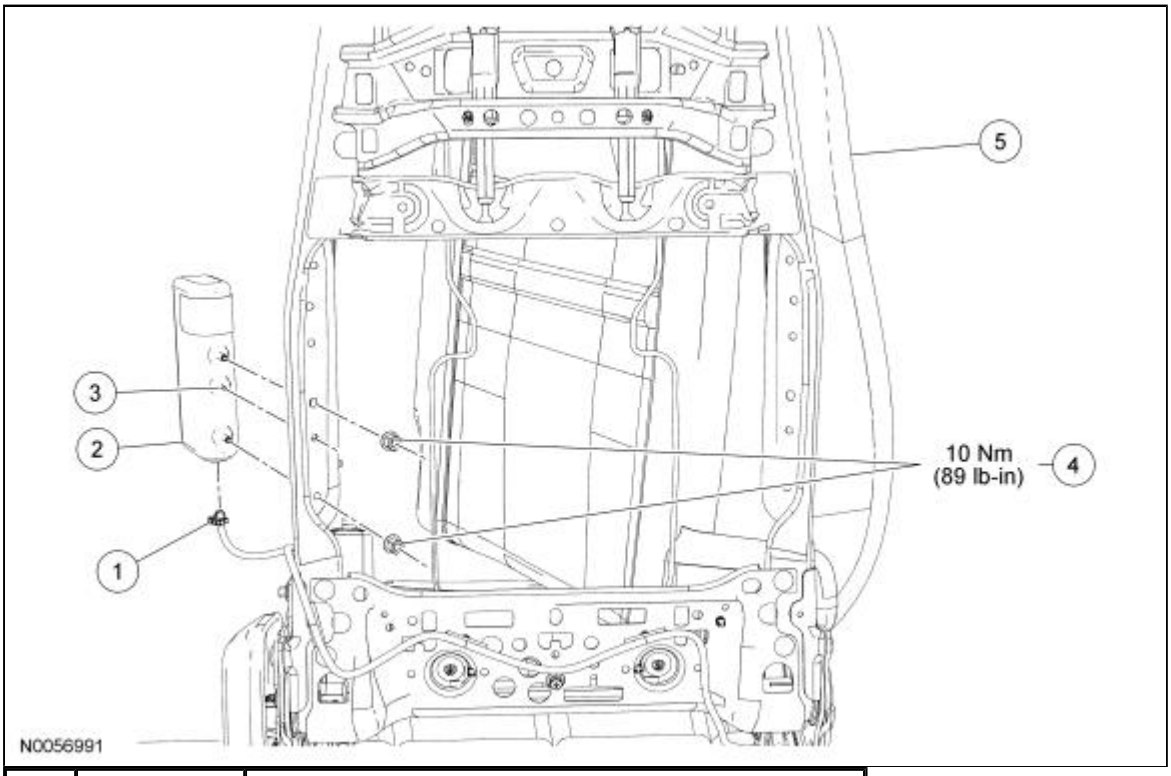
NOTE: Power seat track seat position sensor shown, manual seat track position sensor similar.

1. Raise the driver seat and then position it to the rear of the track.
2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.
3. Remove the seat position sensor and bracket bolt.
4. Unhook the seat position sensor and bracket from the seat track cross brace.
5. Disconnect the seat position sensor electrical connector and remove the seat position sensor and bracket.
6. To install, reverse the removal procedure.
7. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Side Air Bag Module

Printable View (232 KB)

NOTE: Driver side shown, passenger similar.



Item	Part Number	Description
1	—	Side air bag module electrical connector (part of 14K155)
2	611D10	Side air bag module
3	—	Side air bag module locator pin (part of 611D10)
4	N620480	Side air bag module nuts (2 required)
5	—	Seat backrest trim cover and foam pad

Removal and Installation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

WARNING: Side air bag modules with damaged covers must be replaced.

WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced. Cleaning is permissible.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, a new seat back pad, trim cover, side air bag module and nuts must be installed. The seat back frame should be replaced if necessary. For additional information, refer to front seat backrest disassembly and assembly procedure in Section 501-10 .

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system SRS fault.

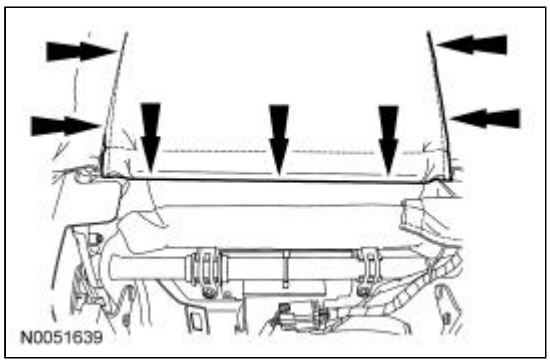
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Position the affected seat and backrest fully up and forward.

2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Release the seat backrest cover lower rear J-clip, then unzip the 2 side zippers.

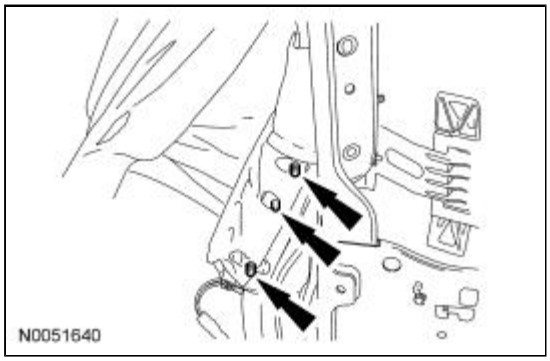


4. **NOTE:** Note the position of the side air bag module locator pin to the seat backrest frame for installation.

   Remove the 2 side air bag module nuts.
   - To install, tighten to 10 Nm (89 lb-in).

5. **NOTE:** Note the position of the side air bag module locator pin and mounting studs in the seat backrest trim cover deployment chute for installation.

Position the seat backrest foam aside and remove the side air bag module from the seat backrest frame. Then slide the side air bag module out of the seat backrest trim cover deployment chute.



6. Disconnect the electrical connector and remove the side air bag module.

7. **WARNING: Check the side air bag module deployment chute for damage. The side air bag module deployment chute must not be repaired. If there is any damage to the side air bag module deployment chute, a new seat back trim cover and side air bag module deployment chute must be installed as a unit.**

   WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   WARNING: If the side air bag module cover has separated or the side air bag module material has been exposed, install a new side air bag module. Do not attempt to repair the side air bag module. Failure to do so may result in personal injury in the event of an air bag deployment.

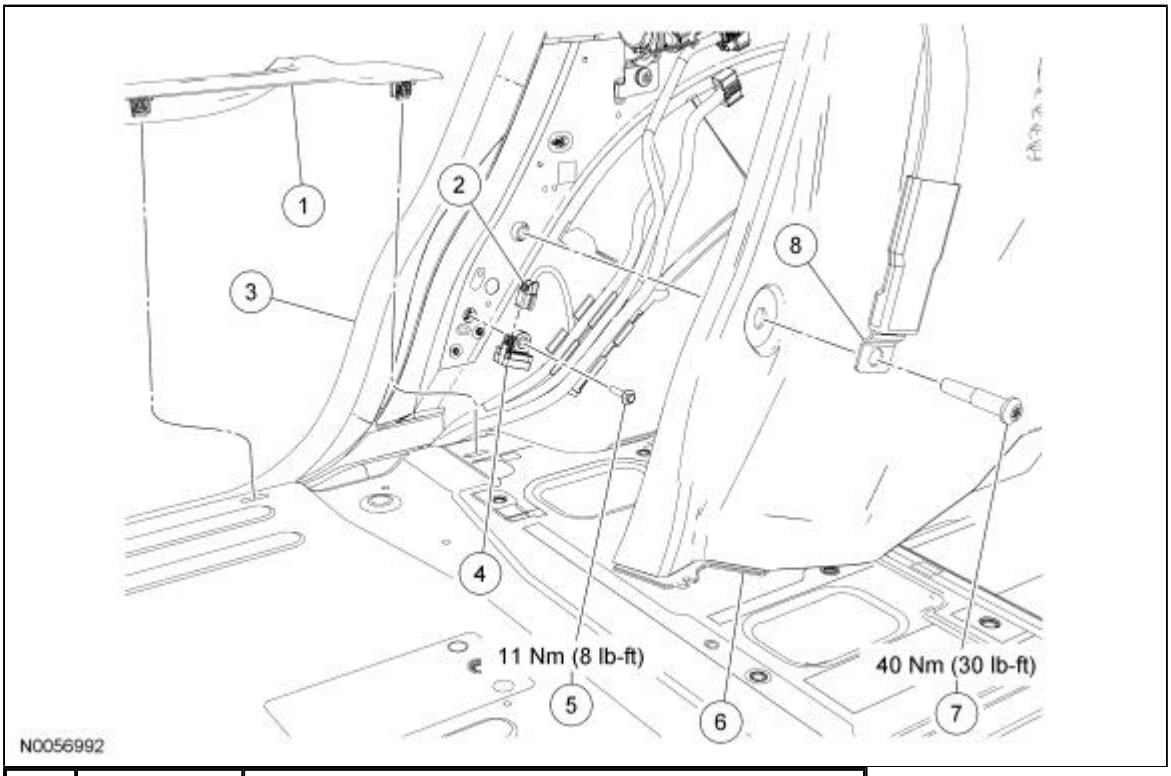
   To install, reverse the removal procedure.

8. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Side Impact Sensor — C-Pillar

Printable View (185 KB)

NOTE: Expedition/Navigator shown, Expedition EL/Navigator L similar.



Item	Part Number	Description
1	13228	Rear door scuff plate
2	—	Side impact sensor electrical connector (part of 14A005)
3	253A10	Rear door weatherstrip
4	14B345	Side impact sensor
5	W711619	Side impact sensor bolt
6	31012	Quarter trim panel
7	—	Second row safety belt retractor anchor bolt (part of 611B68)
8	—	Second row safety belt retractor anchor (part of 611B68)

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag SRS is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Install and correctly position the sensor or any other damaged

SRS components whether or not the air bag is deployed.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

NOTE: RH side shown, LH similar.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the rear door scuff plate.

3. Detach the rear door weatherstrip.

4. **NOTE:** Make sure the second row safety belt retractor belt webbing is not twisted prior to installation.

   Remove the bolt and second row safety belt retractor anchor.
   - To install, tighten to 40 Nm (30 lb-ft).

5. Position aside the quarter trim panel.
   - Pull out on the quarter trim panel at the C-pillar to release the retaining clips to access the C-pillar side impact sensor.

6. **WARNING: The tightening torque of the side impact sensor retaining bolt is critical for correct system operation.**

   NOTE: Note the position of the side impact sensor locating tab for installation.

   NOTE: Make sure the C-pillar and side impact sensor mating surfaces are clean and free of foreign material.

   Remove the side impact sensor bolt.
   - To install, tighten to 11 Nm (8 lb-ft).

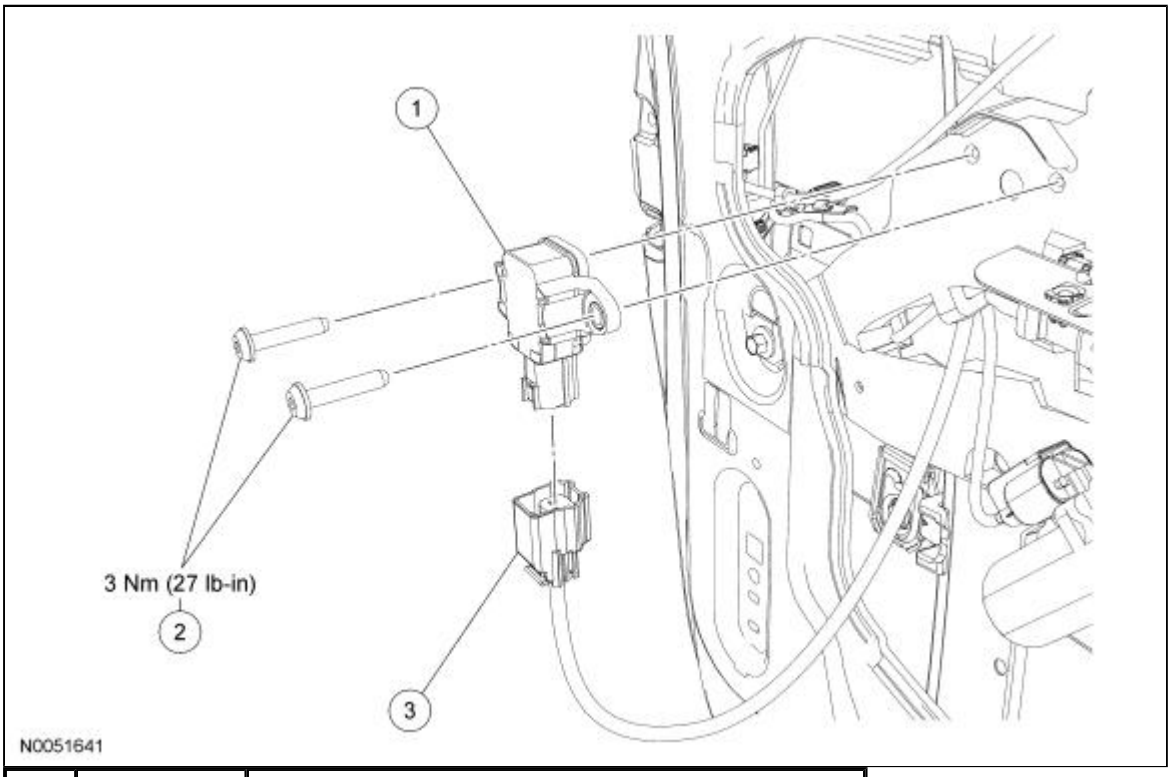
7. Disconnect the electrical connector and remove the side impact sensor.

8. To install, reverse the removal procedure.

9. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Side Impact Sensor — Front Door

Printable View (206 KB)



Item	Part Number	Description
1	14B345	Side impact sensor
2	W506966	Side impact sensor screws (2 required)
3	—	Side impact sensor electrical connector (part of 14631A)

Removal and Installation

WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag SRS is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Install and correctly position the sensor or any other damaged SRS components whether or not the air bag is deployed.

WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: Avoid applying corrosion protection to any safety, mechanical and electrical parts, electric motors, speakers, door locks and drain holes.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed

and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

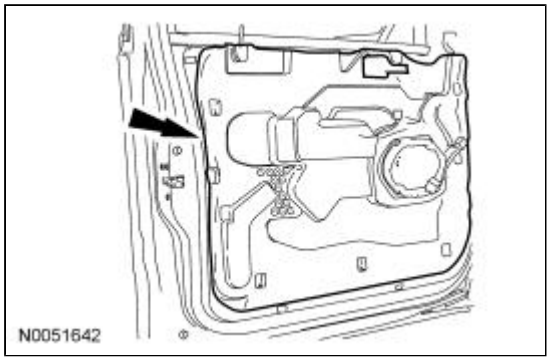
NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

NOTE: Driver side shown, passenger similar.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the front interior door trim panel on the side with the affected side impact sensor. For additional information, refer to Section 501-05 .

3. Separate the weathershield from the door enough to access the side impact sensor.



4. Disconnect the side impact sensor electrical connector.

5. **WARNING: The tightening torque of the side impact sensor retaining screws is critical for correct system operation.**

   NOTE: Make sure the side impact sensor mating surfaces are clean and free of foreign material.

   NOTE: Note the position of the side impact sensor locating tab for installation.

   Remove the 2 screws and side impact sensor.
   - To install, tighten to 3 Nm (27 lb-in).

6. To install, reverse the removal procedure.

7. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Printable View (63 KB)

General Specifications

Item	Specification
Motorcraft Acid Neutralizer ZC-1-A	—
Motorcraft Alkaline Neutralizer ZC-2-A	—
Motorcraft Detail Wash ZC-3-A	—
Motorcraft Adhesion Promoter PM-19A316-AA	—
Wax and Grease Remover	—
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Motorcraft Metal Surface Prep ZC-31	—
Metal Bonding Adhesive TA-1	—
Metal Patch Panel Adhesive TA-3	—
Seam Sealer TA-2	—
Clear Silicone Rubber TA-32	ESB-M4G92-A
Trim and Weatherstrip Adhesive TA-14	—
Plastic Bonding Adhesive TA-9	—
Structural Foam Kit TA-12	WSS-M99P35-A
Motorcraft Interior Spray Paint PM-19M547-XXXXH (XXXX= color code)	—
Low Temperature Anti-Corrosion Coating PM-12-A	—
High Temperature Anti-Corrosion Coating PM-13-A	—

General Equipment
Pro 230 MIG Welder 208-00030
Heat Treatment Induction Resistance Spot Welder 254-00001

Body

Printable View (990 KB)

The body consists of the following:

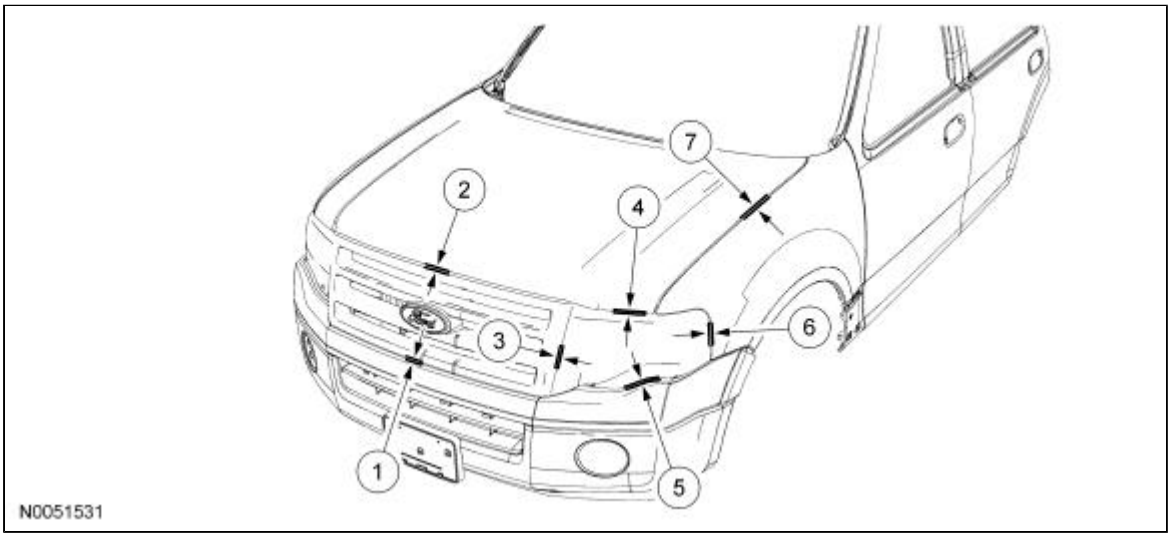
- Body-on full-frame design
- High-strength low alloy (HSLA), high-strength and mild steels
- Unique front structure constructed of high-strength hydroformed steel tubes
- Upper rail of radiator support constructed of magnesium
- Lower rail of radiator support constructed of hydroformed high-strength steel
- Expedition hood constructed of aluminum
- Navigator hood constructed of sheet-molded compound (SMC) plastic
- Bolt-on high-strength front bumper beam
- Expedition and Navigator have unique front fascia, grille and headlamps
- Bolted, removable front fenders, hinged doors, liftgate and hood
- Steel doors
- Steel fenders
- Steel quarter panels
- Expedition and Navigator liftgate constructed of aluminum
- Welded-on high-strength rear bumper beam
- Standard 3,023 mm (119.01 in) and optional 3,327 mm (130.98 in) wheelbase
- Structural adhesive used in rear sill and quarter panel D-pillar inner to outer panel
- Structural foam with nylon insert used in D-pillar

For dimensional information, refer to the following illustrations:

Body Margins

NOTE: Expedition shown, Navigator similar.

NOTE: Dimensions apply to right and left side.

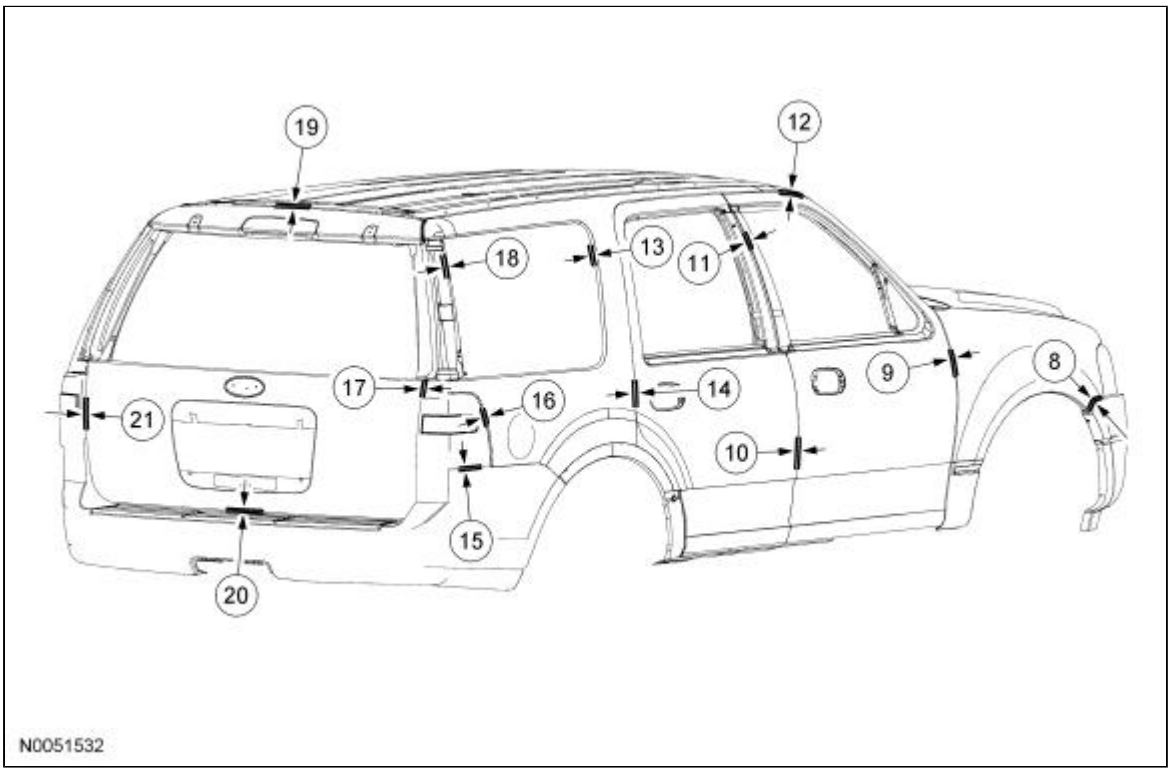


Item	Description	Specification
1	Grille to fascia	2.0 mm (0.07 in) ± 0.5 mm (0.01 in)

2	Hood to grille	6.5 mm (0.25 in) ± 2.5 mm (0.09 in)
3	Headlamp to grille	4.0 mm (0.15 in) ± 2.5 mm (0.09 in)
4	Hood to headlamp	6.5 mm (0.25 in) ± 2.5 mm (0.09 in)
5	Headlamp to fascia	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
6	Fender to headlamp	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
7	Hood to fender	4.5 mm (0.17 in) ± 2.0 mm (0.07 in)

Body Margins

NOTE: Dimensions apply to right and left side.

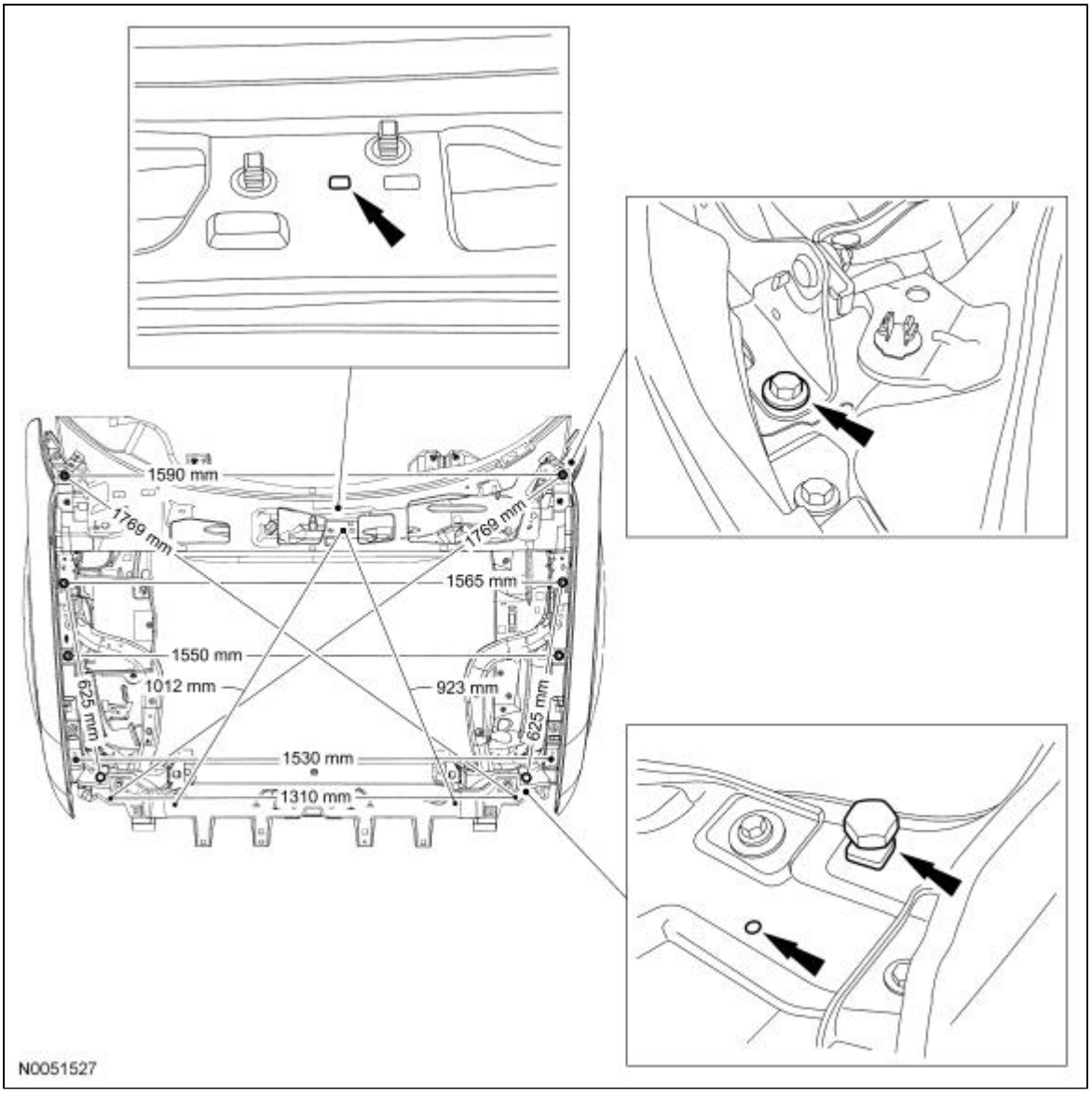


Item	Description	Specification
8	Fascia to fender	0.0 mm (in) ± 1.5 mm (0.05 in)
9	Front door to fender	4.5 mm (0.17 in) ± 2.0 mm (0.07 in)
10	Front door to rear door	4.5 mm (0.17 in) ± 2.0 mm (0.07 in)
11	Front door to rear door (upper)	4.5 mm (0.17 in) ± 2.0 mm (0.07 in)
12	Door to roof	5.0 mm (0.19 in) ± 0.5 mm (0.01 in)
13	Glass to quarter panel	5.0 mm (0.19 in) ± 2.5 mm (0.09 in)
14	Rear door to quarter panel	4.5 mm (0.17 in) ± 2.5 mm (0.09 in)
15	Tail lamp to rear fascia	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
16	Tail lamp to quarter panel	2.0 mm (0.07 in) ± 1.5 mm (0.05 in)
17	Liftgate to quarter panel	5.0 mm (0.19 in) ± 2.5 mm (0.09 in)
18	Glass to D-pillar outer panel	5.5 mm (0.21 in) ± 2.5 mm (0.09 in)
19	Liftgate to roof	10.0 mm (0.39 in) ± 2.5 mm (0.09 in)
20	Liftgate to fascia	3.0 mm (0.11 in) ± 1.0 mm (0.03 in)

21	Liftgate to quarter panel	5.0 mm (0.19 in) ± 2.5 mm (0.09 in)

Underhood Dimensions

NOTE: Measurements are obtained on center, unless otherwise indicated.

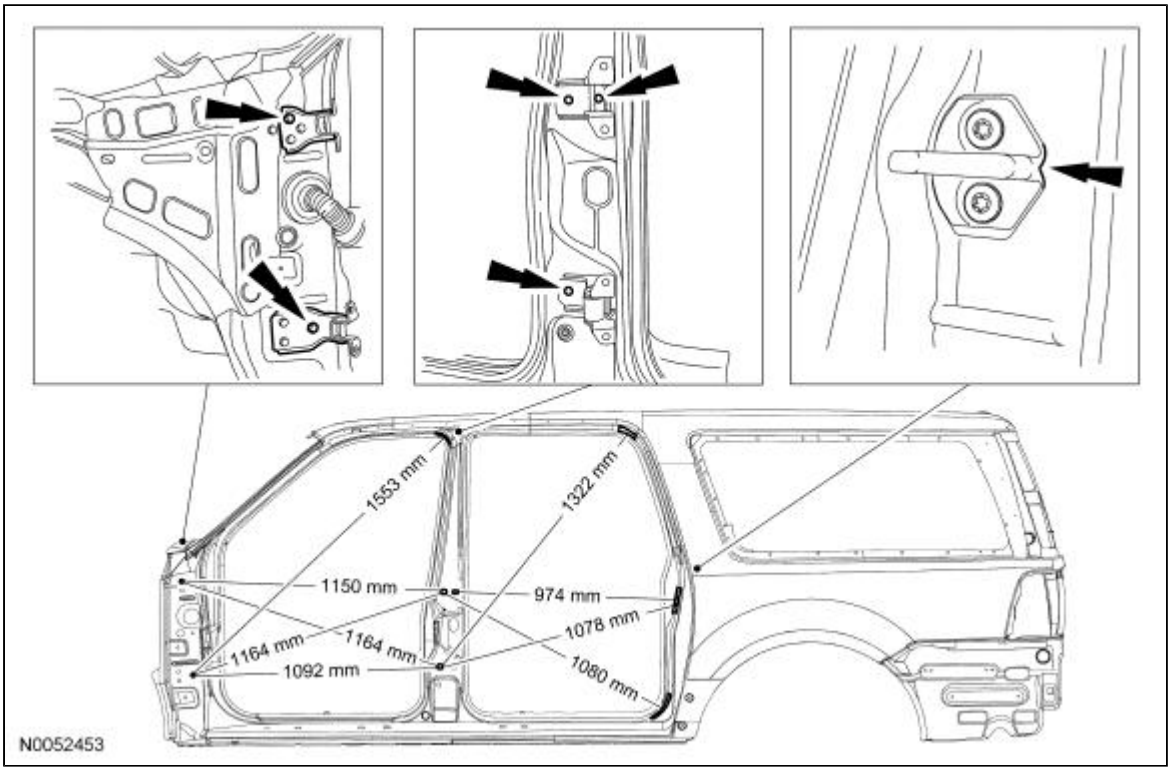


Bodyside Dimensions

NOTE: Measurements are obtained on center, unless otherwise indicated.

NOTE: Expedition 3,327 mm (130.98 in) extended wheelbase shown, front door opening is common to all models.

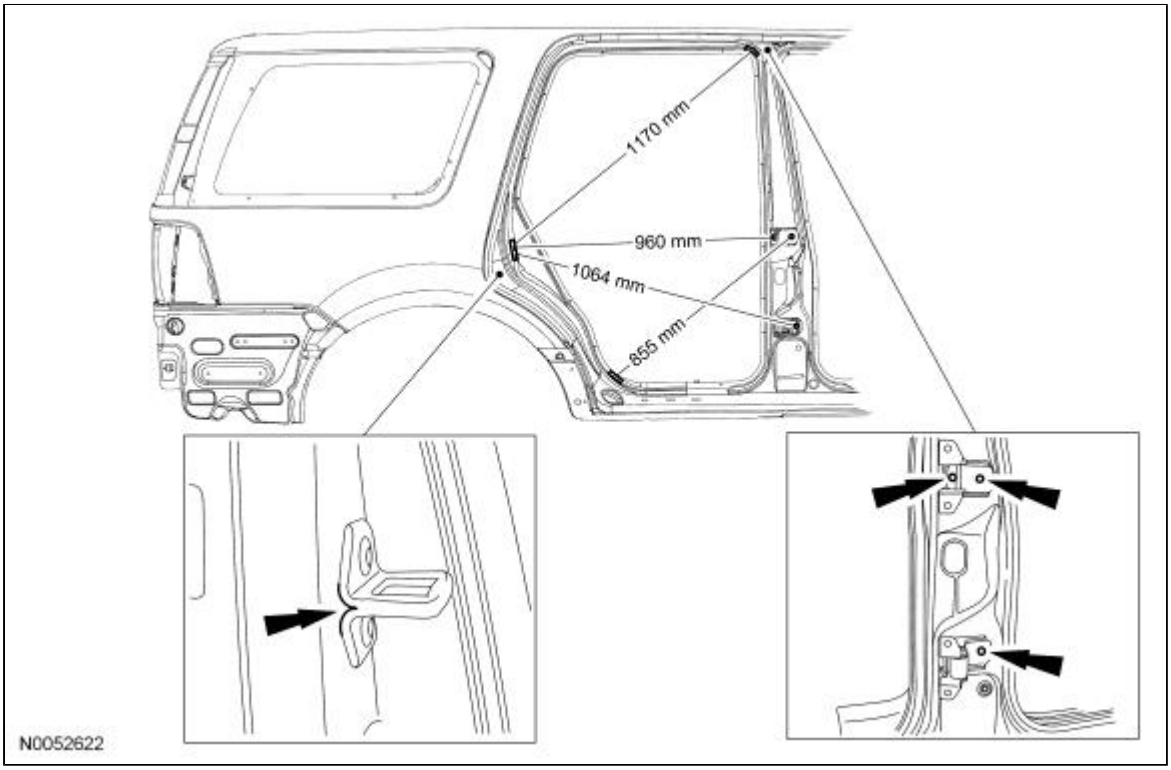
NOTE: Dimensions apply to right and left side.



Rear Door Opening — 3,023 mm (119.01 in) Wheelbase

NOTE: Dimensions apply to right and left side.

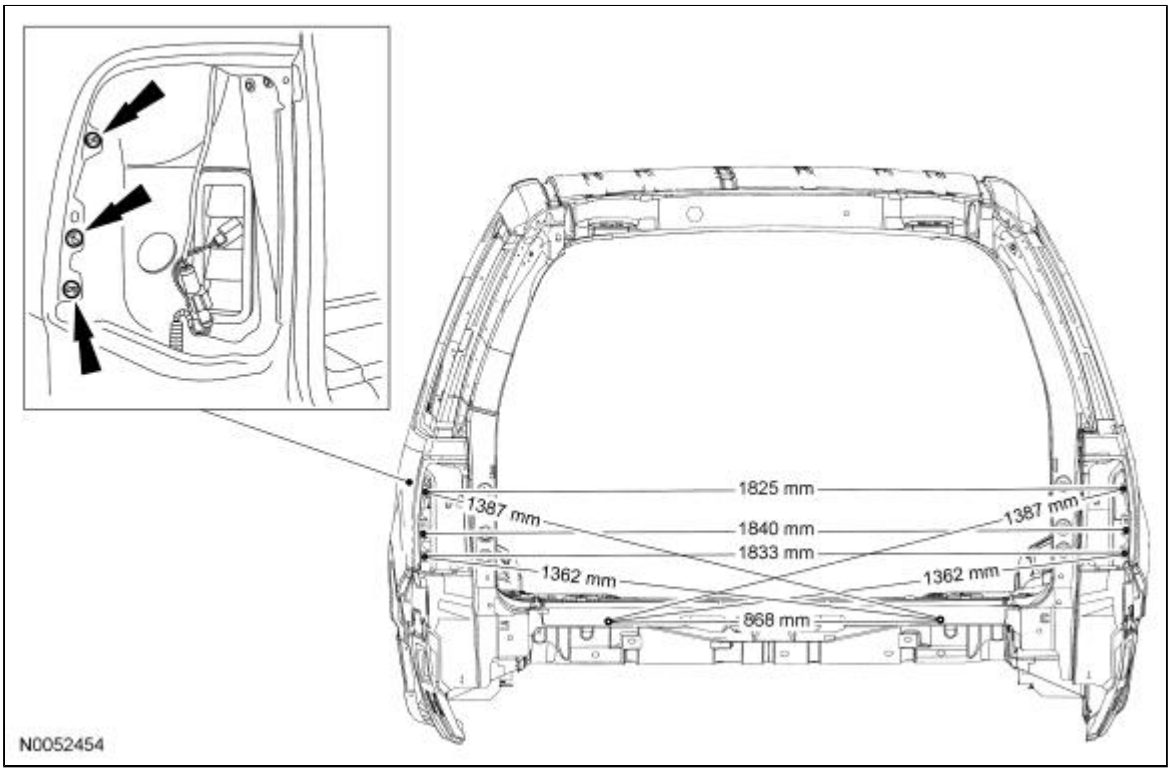
NOTE: Measurements are obtained on center, unless otherwise indicated.



Body Rear Opening Dimensions

NOTE: Dimensions common to all models.

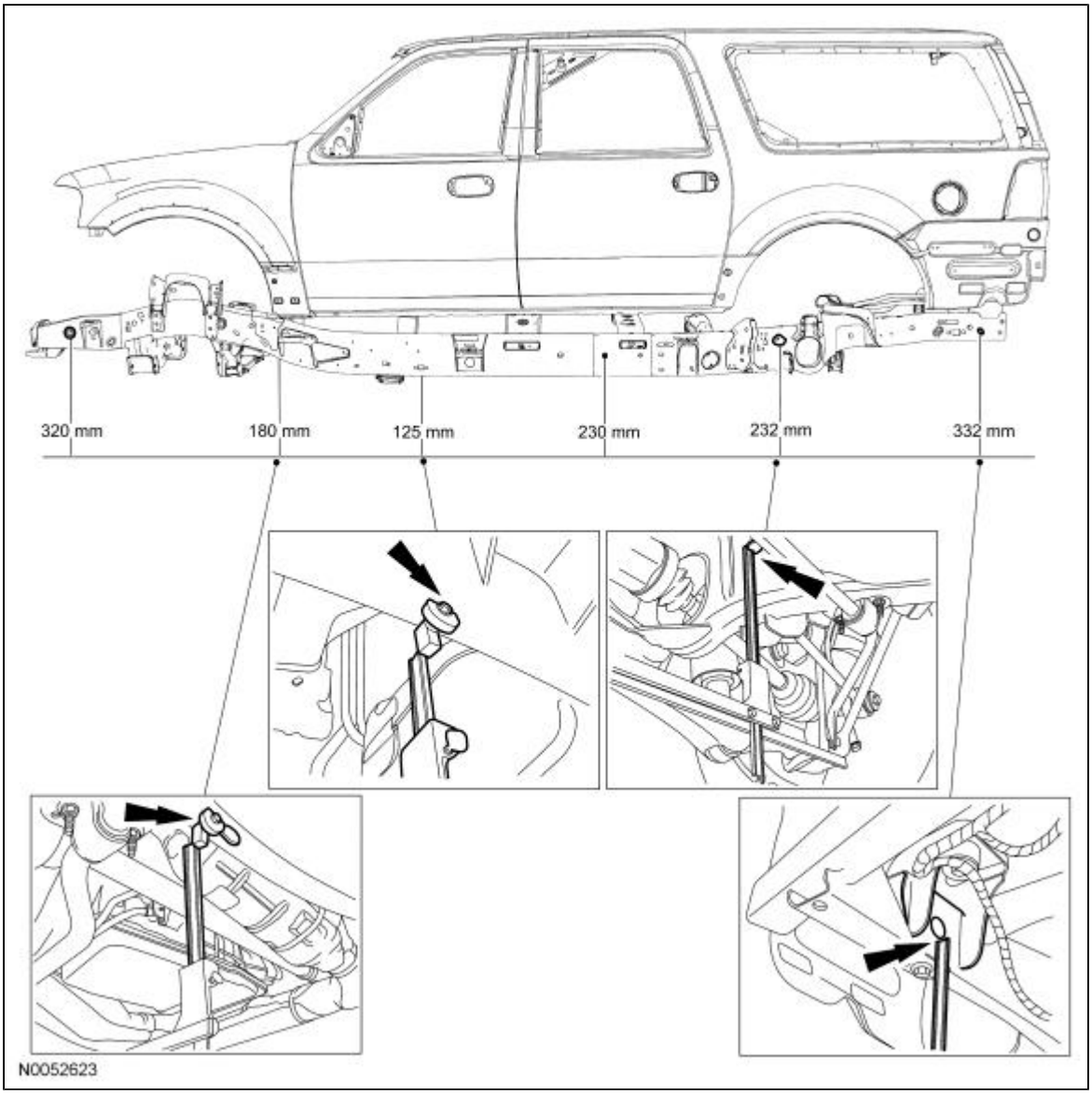
NOTE: Measurements are obtained on center, unless otherwise indicated.



Underbody Dimensions

Frame Datum Height

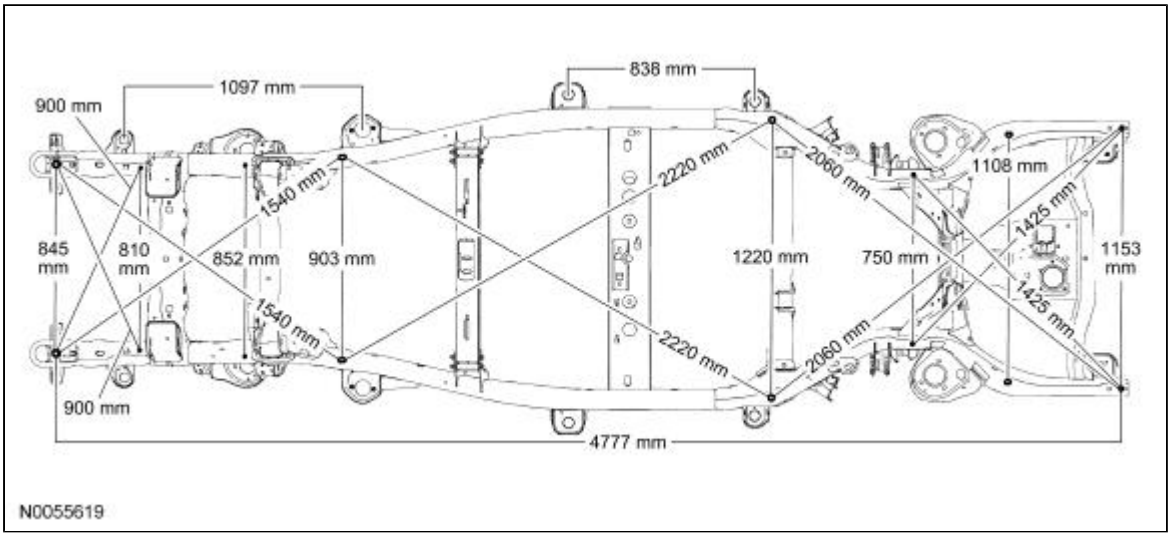
NOTE: Datum measurements indicated from front (No. 1) to the rear (No. 6). The gauge for the No. 3 datum measurement is located 28 mm (1.1 in) rearward from the transmission No. 3 crossmember flange. Inset views indicated from left side.



Frame Dimensions — 3,023 mm (119.01 in) Wheelbase

NOTE: Measurements are obtained on center, unless otherwise indicated.

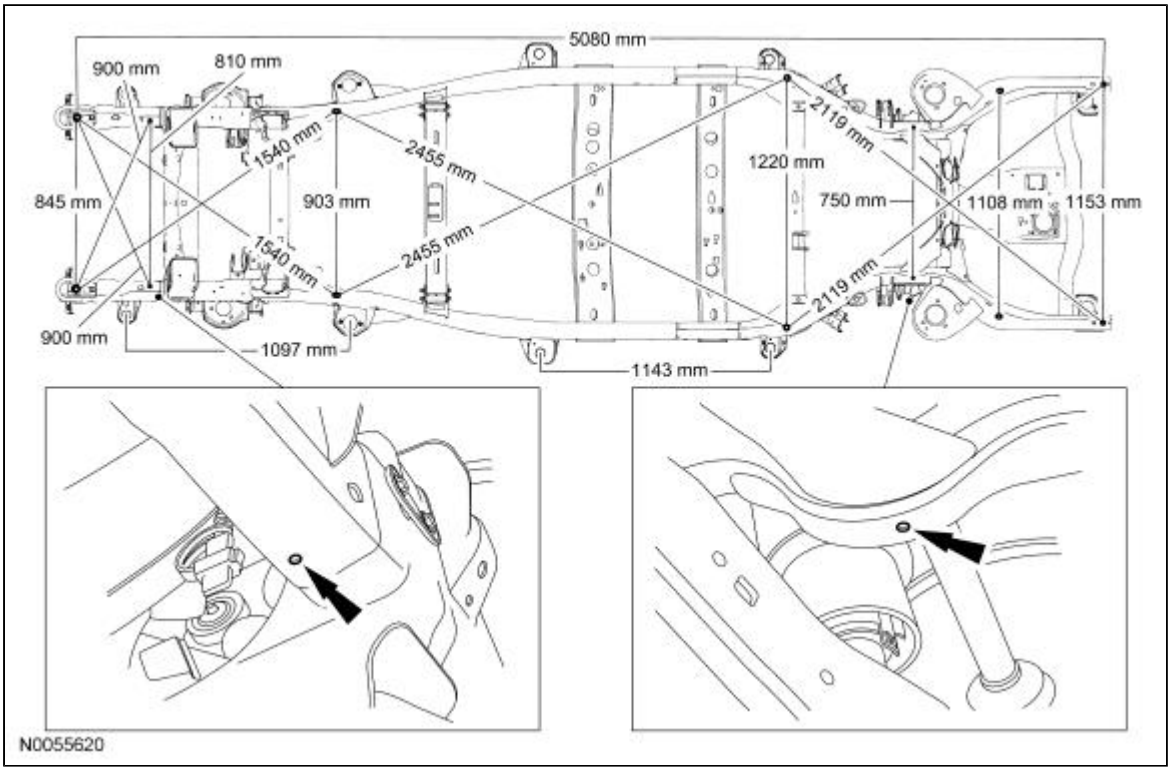
NOTE: A structural frame rail sectioning kit is available for the front frame rail section. It is mandatory to maintain factory frame dimensions when carrying out any repair procedure to the frame. Refer to Frame Members in this section.



Frame Dimensions — 3,327 mm (130.98 in) Wheelbase

NOTE: Measurements are obtained on center, unless otherwise indicated.

NOTE: A structural frame rail sectioning kit is available for the front frame rail section. It is mandatory to maintain factory frame dimensions when carrying out any repair procedure to the frame. Refer to Frame Members in this section.



Welding Precautions — Aluminum

Printable View (64 KB)

Correct equipment and cleaning procedures must be used when welding aluminum. Gas-metal-arc-welding (GMAW) or MIG and Gas-tungsten-arc-welding (GTAW) or TIG are used for welding aluminum and aluminum alloys.

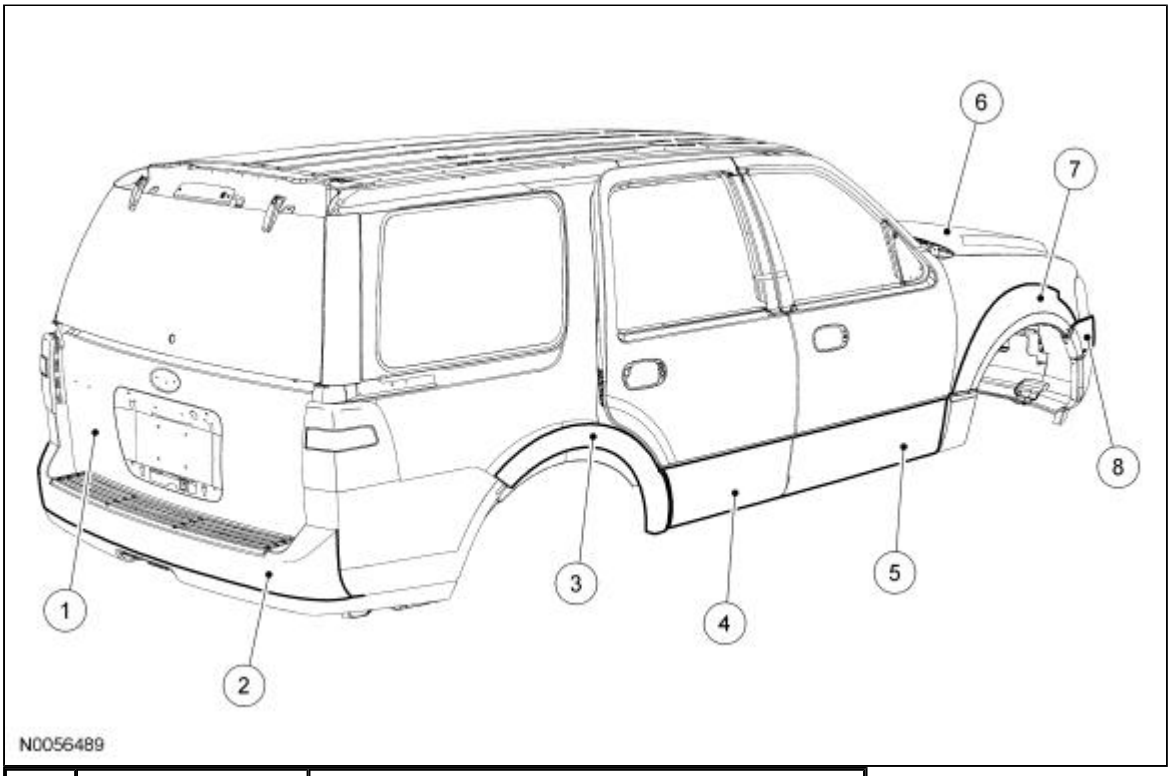
- The correct protective clothing should always be worn.
- Proper ventilation must be provided to avoid the accumulation of poisonous gases.
- Disconnect the battery ground cable from the battery.
- Disconnect on-vehicle modules and protect them from possible heat damage and electrical currents when welding.
- Use a stainless steel wire brush to remove aluminum oxides.
- Make sure the surface is clean and free of foreign materials.
- Use degreasers that do not contain hydrocarbons.
- Do not use a wire brush that has been used on stainless or carbon steel.
- Follow equipment manufacturer's prescribed procedures as aluminum and aluminum alloys have a higher thermal conductivity and lower melting point which can lead to easier burn through.
- A test weld should always be carried out on a test sample.
- Preheating the aluminum workpiece can help prevent weld cracking. The preheating temperature should not exceed 110°C (230°F).
- Use a temperature indicator to prevent overheating.
- Attach the ground clamp as close as possible to the work area.
- Types of filler rods to use when TIG welding aluminum:
  - Aluminum-silicon alloy.
  - Aluminum-magnesium alloy.
- Adequate power supply needs to be used to make sure of correct equipment performance.
- Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. Refer to Restoring Corrosion Protection Following Repair in this section.

Plastic Components

Printable View (162 KB)

Exterior Plastic Components — Painted

NOTE: The following illustration(s) are not all-inclusive of trim levels available. The actual trim level of the vehicle will determine the viability of carrying out a plastic repair.



Item	Part Number	Description
1	40010	Liftgate (Navigator) — Sheet-molded compound (SMC)
2	17K835	Bumper cover (rear) — Thermoplastic polyolefin (TPO)
3	25557 LH/ 25556 RH	Wheel arch molding (rear) — TPO
4	20879 LH/ 20878 RH	Door molding (rear) — TPO
5	20879 LH/ 20878 RH	Door molding (front) — TPO
6	16612	Hood (Navigator) — SMC
7	16039 LH/ 16038 RH	Wheel arch molding (front) — TPO
8	17D597	Bumper cover (front) — TPO

Several considerations will determine viability of plastic repair procedure(s):

- Is the damage cosmetic or structural?

- Can the repair be carried out on the vehicle?
- Is the part readily available?
- Is component repair the most cost effective method?
- Can the component be economically restored to original strength and appearance?
- Will the repair provide for the fastest, highest quality repair?

Several types of plastic are in use for automotive application. However, all plastics will fall into 2 primary categories of thermoplastic or thermosetting plastic.

Thermosetting Plastic

Generally, thermosetting plastics are made with 2-part thermosetting resins. When mixed together, heat is generated, producing a cure that is irreversible. Because of this, thermosetting plastics will require the use of a 2-part adhesive for repair.

Sheet-Molded Compound

Sheet-molded compound (SMC) is a type of thermosetting plastic that uses glass fibers or nylon fibers in combination with thermosetting polyester resins. When fully cured, SMC is strong and rigid.

SMC is similar to, but not identical to, fiberglass. Ford Motor Company uses SMC in components such as fenders, hoods and liftgates.

Thermoplastic Compounds

Thermoplastic compounds are manufactured by a process that is reversible. Thermoplastics can be remolded repeatedly by reheating. This characteristic of thermoplastics makes plastic welding a possible repair alternative. A repair of thermoplastic compounds is still possible through the use of 2-part adhesive and filler repair materials and reinforcements as needed. Thermoplastics are widely used in interior trim components, wheel flares, body side cladding and bumper covers.

Polyolefin

Polyolefins fall into the family of thermoplastics with one unique characteristic, an oily or waxy feel to the material when sanded or ground. Polyolefin lends itself very well to remolding through the use of heat. Because of this, components made of this material lend themselves well to the possibility of plastic welding. Most adhesive repair materials and paint will not bond to a surface of polyolefin unless an adhesion promoter specially formulated for plastic is first applied to the exposed raw surface. Otherwise, polyolefins are repaired like most other thermoplastics. Some typical uses of polyolefins are:

- bumper covers.
- fan shrouds.
- wheel housings.

Correct identification of the various types of plastic is necessary to select the appropriate repair method (s) to carry out high quality plastic repairs. Refer to Plastics Identification in this section.

Welding Precautions — Steel

Printable View (66 KB)

General Specifications

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—

General Equipment
Pro 230 MIG Welder 208-00030
Heat Treatment Induction Resistance Spot Welder 254-00001

The correct equipment and settings must be used when welding mild or high strength steel. Metal inert gas (MIG) and squeeze-type resistance spot welding (STRW) are the preferred methods. Surfaces must be clean and free of foreign materials.

- Correct eye protection must be worn.
- The correct protective clothing should always be worn.
- Adequate ventilation must be provided to avoid accumulation of poisonous gases.
- A test weld should always be carried out on a test sample.
- Follow equipment manufacturer's prescribed procedures and equipment settings for the type of weld being used.
- Disconnect the battery ground cable from the battery.
- Disconnect on-vehicle modules and protect them from possible heat damage and electrical currents when welding.
- Use grinding discs and wire brushes dedicated to the type of material being welded.
- Follow equipment manufacturer's prescribed procedures and equipment settings for the type of weld being used. ER70S-2 or ER70S-6 wire are typically used for MIG welding steel.
- Components made of high-strength steel should not be heated to straighten or repair. Severely bent or kinked components should be replaced with new ones.
- Factory spot welds may be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

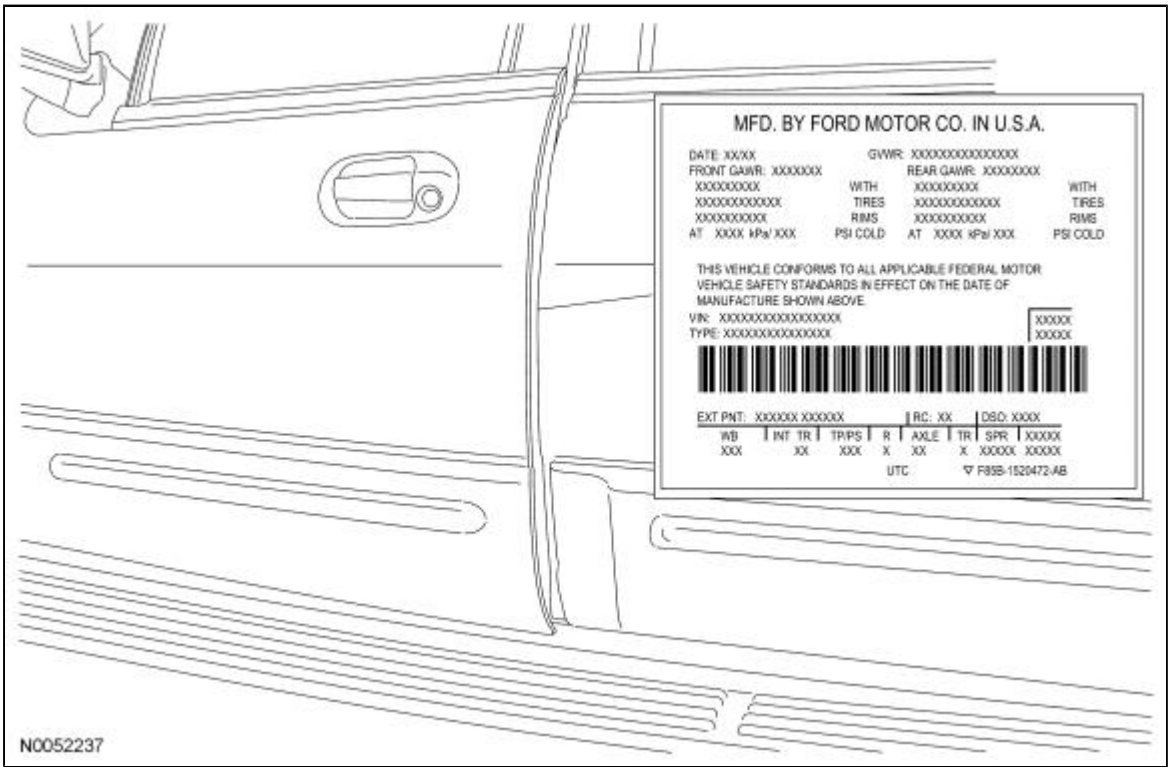
Arc welding is an acceptable method for welding heavier metal components such as frame parts. When arc welding, the following guidelines should be followed:

- Attach the ground clamp as close as possible to the work area.
- Choose welding electrodes according to the type of steel, thickness and polarity of the arc welder (AC or DC).
- Do not use water or compressed air to cool welding. This can cause the metal to become brittle and weak.
- Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. Refer to Restoring Corrosion Protection Following Repair in this section.

Paint Codes

Printable View (180 KB)

Vehicle Certification Label Locator



Vehicle exterior paint codes can be found on the Vehicle Certification Label. All colors are base coat/clear coat.

Paint codes are listed as a 2-part code. The first set of characters listed identifies the vehicle primary paint color. The second set of characters listed (if applicable) identifies the vehicle accent or 2-tone color.

- DX — Dark Blue Pearl
- G2 — Redfire
- G3 — Pueblo Gold
- G4 — Alloy Gray
- JP — Silver Birch Metallic
- PG — Dark Amethyst
- PV — White Chocolate (tri-coat)
- T5 — Dark Copper
- UA — Ebony
- YZ — Oxford White

Sealers

Printable View (63 KB)

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Roof Ditch Sealer TA-15	—
Seam Sealer TA-2	—

The correct sealing of joints is essential to repairing the vehicle correctly. Sealers are used to prevent wind noise, water leaks, exhaust fumes and dust from entering the vehicle. They also provide anti-corrosion barriers. Sealers are applied to areas such as door and rear compartment hem flanges, wheelhouse, quarter outer, floor, cowl, roof and other panel-to-panel attaching points. The following joint sealers are recommended for use depending upon the application:

- Brushable Seam Sealer — A sealer intended to restore the original brushed seam appearance. It is used to seal lap joints in sheet metal that are spot welded (for example, floorpans and cowls).
- Roof Ditch Sealer — A self-leveling sealer used for drip rails, roof seams, quarter panels to rear deck and for water leaks.
- Seam Sealer — A fast curing, non-sag, paintable, permanently flexible sealer typically used for cosmetic seams, truck bed seams, floor pans and door skin seams.
- Clear Silicone Rubber — Used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

Sealers should remain flexible after curing and must be paintable. Follow the manufacturer's directions for correct application of these materials.

Any damage to originally sealed joints should be repaired by resealing. Along with attaching points of new panels, open joints that require bridging of sealer to close a gap should be sealed using a heavy-bodied sealer.

Adhesives

Printable View (238 KB)

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Trim and Weatherstrip Adhesive TA-14	—
Plastic Bonding Adhesive TA-9	—
Metal Bonding Adhesive TA-1	—
Metal Patch Panel Adhesive TA-3	—
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Motorcraft Metal Surface Prep ZC-31	—
Seam Sealer TA-2	—

Adhesives are used in a variety of applications. Typical uses for adhesives include roof panels, door skins and quarter panels. Trim applications include body side mouldings, emblems, stationary glass and weatherstripping. Combination sealer/adhesives are also used. Surface preparation is critical to a high quality repair. Following the label instructions for the product is essential.

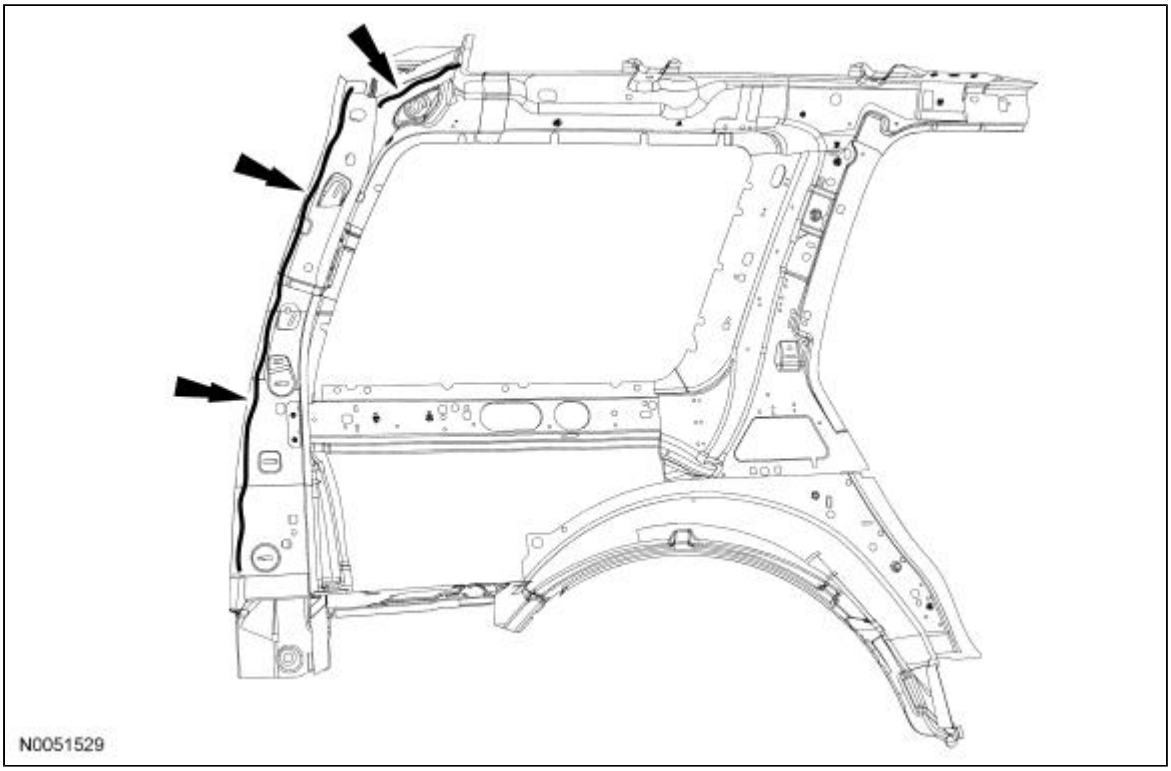
Work in a well-ventilated area and protect adjacent surfaces when working with adhesives. The use of eye protection and protective clothing is also recommended when working with adhesives. Carry out a trial fit, mark and align the surfaces before bonding the materials together.

Seam sealers and corrosion protection may be necessary once the adhesive(s) has cured, depending on the application. The following is a list of adhesives recommended for certain types of applications:

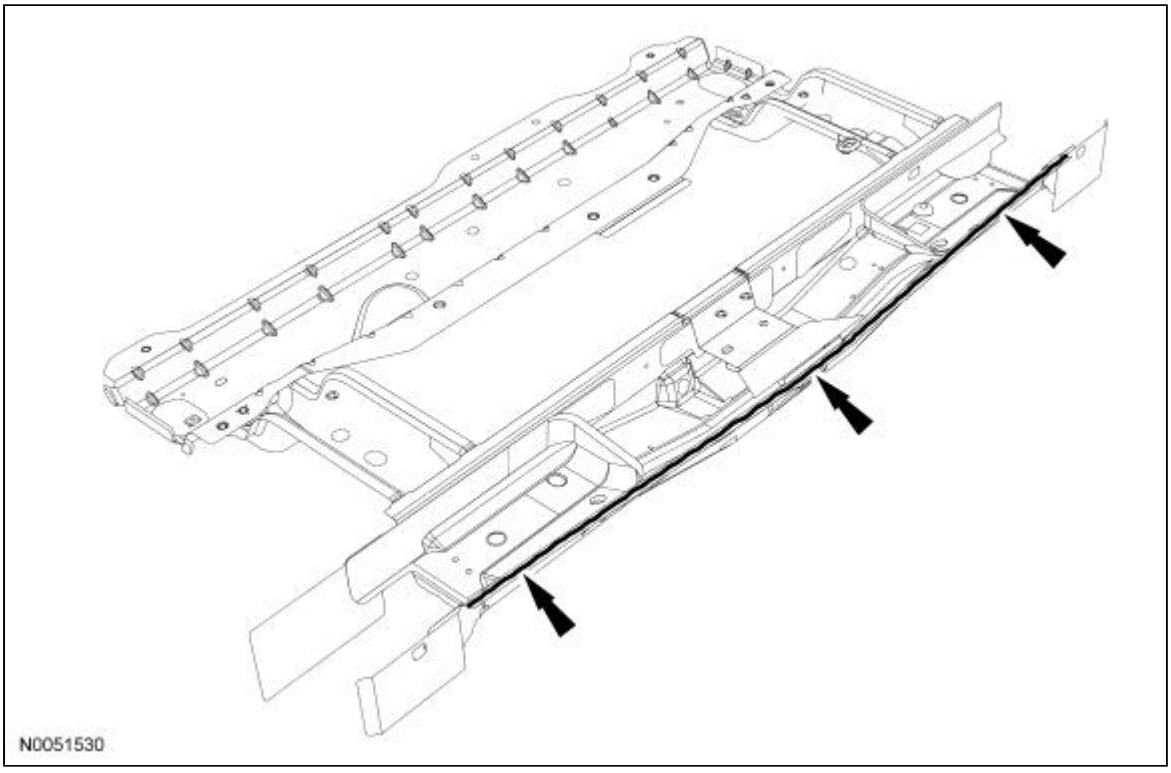
- Metal Bonding Adhesive — For bonding cold-rolled steel, galvanized steel, aluminum and correctly prepared E-coat. It is used for door skin and roof panel replacement and OEM structural adhesive replacement.
- Plastic Bonding Adhesive — For bonding a variety of plastics to plastics and plastics to primed, painted or E-coated metals. Also for general purpose bonding of trim components.
- Seam Sealer — Heavy-bodied, non-sag adhesive/sealer for use on: standing cosmetic seams, truck bed seams, tooled door skin seams and floor pans.
- Trim and Weatherstrip Adhesive — For use on body side moulding, emblems, trim, bumper impact strips and carpeting.
- Clear Silicone Rubber — Used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

NOTE: The following illustrations identify structural adhesive locations.

Quarter Panel Corner



Underbody — Rear Sill

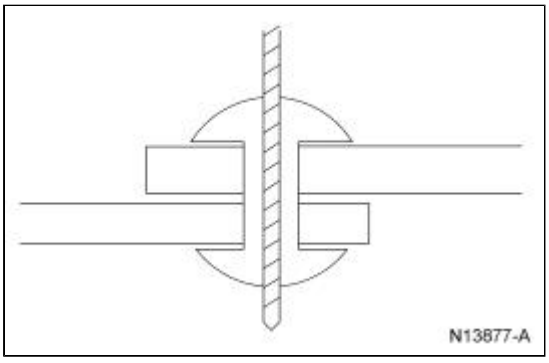


Frame Rivets

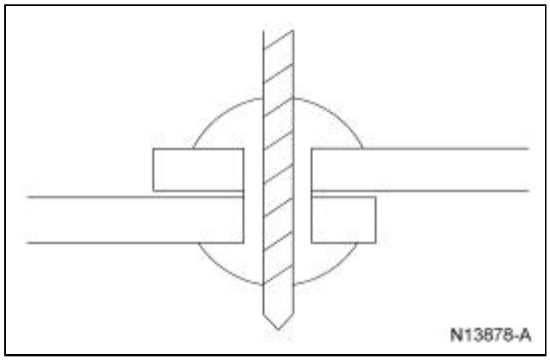
Printable View (114 KB)

Rivet Removal

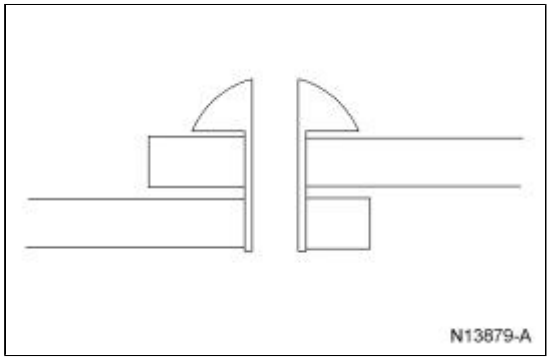
CAUTION: Do not drill outside the rivet into the frame as that will weaken the frame.



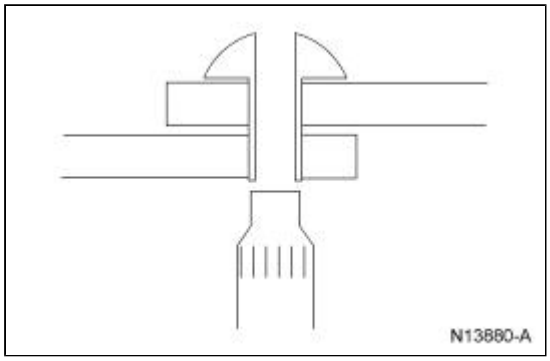
1. Drill a 3.20 mm (1/8 in) pilot hole through the center of the rivet.
2. Drill a 8.5 mm (11/32 in) hole through the pilot hole.



3. Remove the rivet head using an air chisel.



4. Drive out the rivet with a punch.



5. Remove the support.

Replacing Rivets with Bolts

CAUTION: Drill only where a rivet was removed. Drilling outside the rivet hole will weaken the frame.

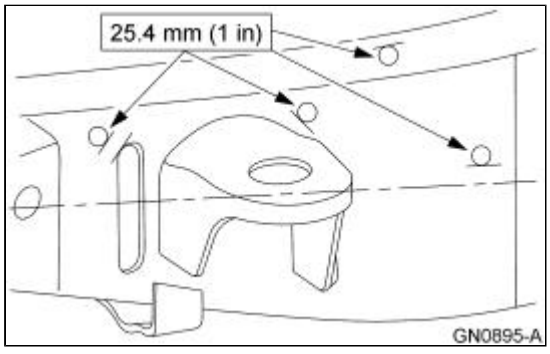
1. Line drill a hole the size of the bolt through the old rivet hole. Example: for a 11.11 mm (7/16 in) diameter rivet, use a 12.7 mm (1/2 in) drill bit.

2. Position the support.

3. Replace the rivets that were removed with the next larger size bolts. Insert the bolts, nuts and washer that are Property Class 9.8 metric (Grade 8) in the drilled holes.

Drilling Precautions

1. Observe the following precautions when carrying out drilling operations.
   - The hole is at least the specified distance from the edge of the nearest hole.
   - The edge of the drilled hole is at least the specified distance from the edge of the flange.
   - The hole is at least the specified distance above the frame centerline.
   - The drilled hole is at least the specified distance from any other existing bracket or component of the frame.



Frame Repairs

Printable View (84 KB)

Material

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—

Welding Precautions

NOTE: Whenever factory E-coat has been removed by sanding, grinding or weld burn-off, the coating must be restored.

1. If welding must be done on a frame, make sure the following requirements are met:
   - If the frame is attached to the vehicle, the battery ground cable must be disconnected before using any electrical welding equipment. For additional information, refer to Section 414-00 .
   - Do not use gas welding equipment.
   - Use a temperature-indicating crayon to make sure that the temperature does not exceed 750°C (1,400°F).
   - Install new spot-welded components by spot welding where possible. If spot welding is not possible, use puddle welding.

Frame Straightening

WARNING: Straightening of front frame rail convolute is prohibited. Failure to follow these instructions may result in personal injury.

CAUTION: Straightening of severely bent or kinked frame components is prohibited. However, before removing these components, restore dimensionally to a pre-collision condition.

NOTE: Whenever factory E-coat has been removed by sanding, grinding or weld burn-off, corrosion protection must be restored.

1. If heat is needed to straighten a frame member, keep the temperature below 650°C (1,200°F) (a dull red glow). A temperature sensitive thermal melt crayon should be used to monitor heat buildup.
   - Heat should be kept to a minimum area so that the hardness of the metal will not be affected.
   - Straightening should only be attempted on frames that fail to meet specifications, or where damage is apparent. For additional information, refer to Body in this section.
   - Straightening should be limited to parts which are not severely bent.
   - Reposition or shield any fuel lines, brake lines or wiring harnesses or components in heated area.

Underbody Misalignment Check

NOTE: Underbody misalignment can be the result of damage or loose frame components. It can affect front and rear wheel alignment and cause incorrect operation and abnormal wear of tires and chassis parts.

NOTE: For additional information, refer to Body in this section, for dimensional data when carrying out repairs on the frame.

1. Inspect the frame for damage and loose parts before checking the frame alignment.
    - Inspect all cross members for cracks, twists or bends.
    - Inspect all of the welded connections for cracks.
    - Check all of the support brackets for looseness.

Frame Reinforcement

Printable View (95 KB)

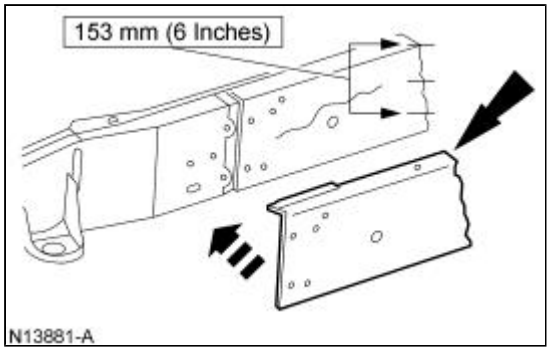
Material

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—

NOTE: The frame must be straightened before any reinforcing can be started.

NOTE: Whenever factory E-coat has been removed by sanding, grinding or weld burn-off, the Anti-Corrosion coating must be restored.

1. After a bent frame member has been straightened, inspect the frame member closely for cracks. If any cracks show, the frame member should be reinforced or replaced. Reinforcements should be made from angle or flat stock of the same material and thickness as the frame member being reinforced, and should extend to either side of the crack. Ideally, the reinforcement should be cut from the corresponding area of a similar frame.



2. Use a wire brush on the area around the crack to remove the paint, wax, grease or mud, etc., and expose the crack completely, this will make sure of good penetration.

3. To stop the crack from spreading, drill a 6.35 mm (1/4 in) hole at a point 12.5 mm (1/2 in) beyond the root of the crack.

4. Grind out the full length of the crack to the hole to form a V-shaped slot with the base of the V-slot contacting the reinforcement.

5. The base of the V-slot should have at least a 1.5 mm (0.06 in) opening to make sure of weld penetration to the reinforcement when welding the crack.

6. **NOTE:** Be sure to weld the V-slot first, then metal finish the area, before installation of the reinforcement.

   Drill clearance holes in the reinforcements to clear rivet heads or nuts where necessary.

7. In the event that a repair is required on more than one frame surface (for example, a flange crack that extends into the web), 2 pieces of flat stock should be welded together where they join. The web reinforcement should be a minimum of 76.2 mm (3.0 in) high and have a 63.5 mm (2.54 in) radius at each of the 2 corners.

8. Completely clean the surface of the frame under and around the reinforcements.

9. Clamp the reinforcements securely to the frame prior to welding. Continuously weld the reinforcement over the welded V-slot repair.

10. Grind the flange edge weld until smooth after all pit holes have been filled by the weld.

11. If a damaged bracket is to be replaced, make sure the new bolts, washers and nuts are of the same specifications and bolt torque as the original parts.

Sectioning Guidelines

Printable View (228 KB)

Special Tool(s)

ST2956-A	Pro 230 MIG Welder 208-00030
ST2738-A	Heat Treatment Induction Resistance Spot Welder 254-00001

Material

Item	Specification
Metal Bonding Adhesive TA-1	—
Motorcraft Metal Surface Prep ZC-31	—
Metal Patch Panel Adhesive TA-3	—
Seam Sealer TA-2	—
Structural Foam Kit TA-12	WSS-M99P35-A

WARNING: On vehicles equipped with safety canopy options, the safety canopy module and related components must be removed prior to carrying out any section repairs near the roof line or sail panel areas of the vehicle. For additional information, refer to Section 501-20B .

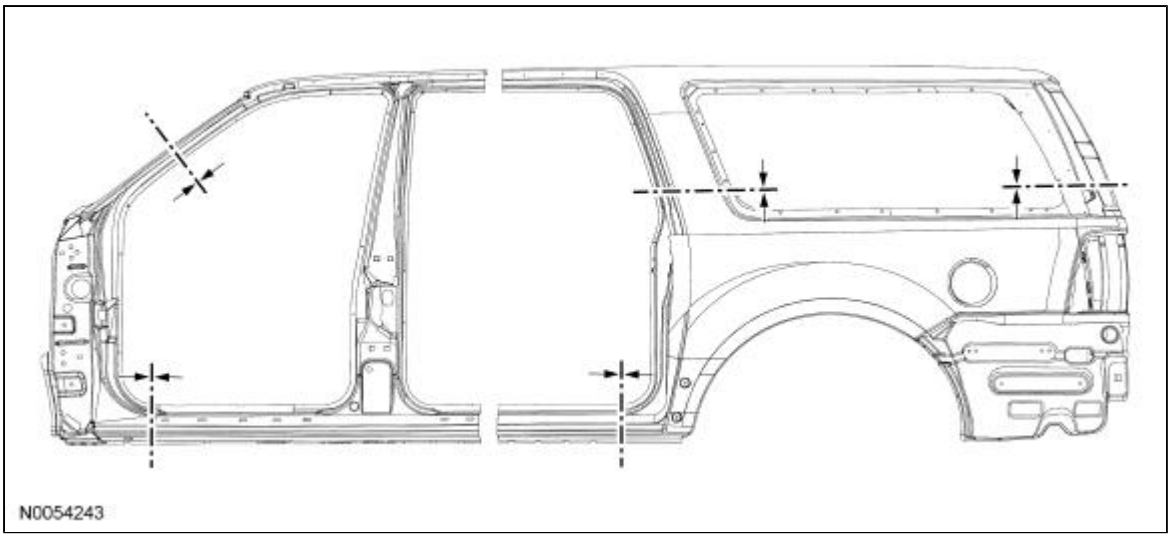
CAUTION: Body side section repairs should not be carried out in areas of laser welds, door hinge or striker anchoring points or near restraints anchoring points. Do not cut or grind body side components within 50 mm (1.96 in) of restraint anchoring points. For additional restraints anchoring location information, refer to Section 501-20A . Cut points shown in illustrations are approximate.

NOTE: Factory spot welds may be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

NOTE: Observe prescribed welding procedures when carrying out any body side section repair. For additional information, refer to Welding Precautions — Steel in this section.

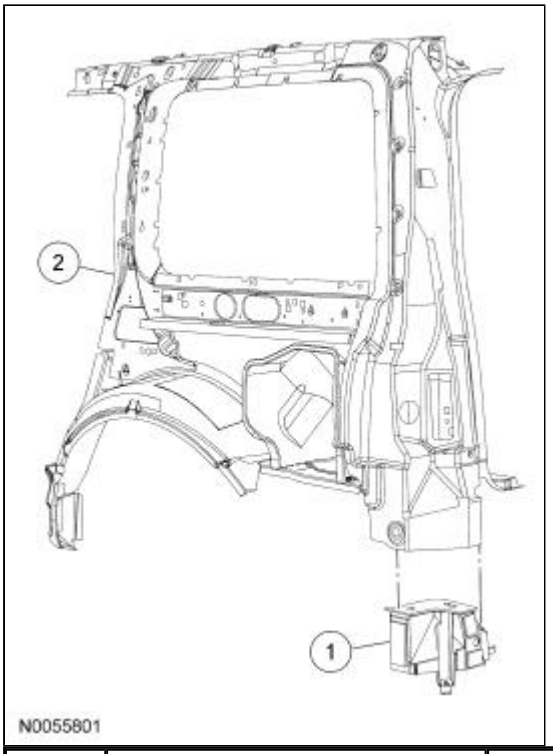
NOTE: Left side shown, right side similar.

NOTE: Illustration cut-lines are approximate. Illustration is intended as a guideline.



Structural Foam Insert Location

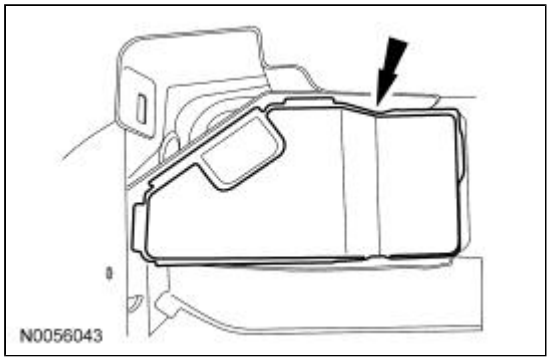
NOTE: Structural foam and a nylon carrier are contained in the lower D-pillar area, RH and LH side. The nylon carrier is located between the D-pillar inner and outer panel. When repairing, not replacing body sheet metal and the structural foam parts appear to be damaged, you must full-fill the area. This will encase reinforcement parts or cracked foam in place and eliminate potential rattles. When carrying out a full-fill application, up to 13 structural foam cartridges may be required to completely fill the cavity depending on the level of damage, etc. to the area. When installing a new nylon carrier only, 3 structural foam cartridges are required. This procedure should be carried out after sheet metal work has been completed and before final painting of the vehicle.



Item	Part Number	Description
1	41017 LH/ 41016 RH	Nylon carrier
2	27865 LH/ 27864 RH	Bodyside inner panel

1. Use duct or masking tape to close in the open bottom of the nylon carrier.
    - Insert and push the nylon carrier upward from the bottom of the vehicle to lock in the space between the D-pillar inner and outer panel.

2. Install and weld in the sheet metal stuffer plate below the nylon carrier.



3. Insert one 140 mm (5.51 in) x 100 mm (3.93 in) x 75 mm (2.95 in) soft foam block into the No. 4 body mount area (oval hole inside the liftgate area). The front edge of the block should be outboard toward the D-pillar. The block will prevent foam expansion into the body mount.

4. Apply aluminum duct tape to cover all holes on the inside of the body and under side of the body in the repair area.

5. Prepare the structural foam cartridges for application by warming with a heat gun or similar method to obtain a working temperature of 46°C (115°F) to 74°C (165°F). This will allow for easier foam flow from the cartridges. A pneumatic or manual application gun can be used.

6. Dispense the foam into the lower D-pillar through the large rectangular hole in the tail light opening.
    - Allow the foam to cure for 15 minutes and remove the aluminum tape as necessary.

7. **NOTE:** When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding in this section.

    Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

Restoring Corrosion Protection Following Repair

Printable View (80 KB)

Material

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Motorcraft Metal Surface Prep ZC-31	—
Roof Ditch Sealer TA-15	—
Metal Bonding Adhesive TA-1	—
Metal Patch Panel Adhesive TA-3	—

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are made.

NOTE: Avoid applying corrosion protection to mechanical and electrical parts, electric motors, speakers, door locks and drain holes.

1. The surfaces must be free of oil, dirt and other foreign material.
    1. Thoroughly clean and degrease metal surfaces using a good wax and grease remover.
    2. Adhesion will be improved by lightly abrading the surface.
    3. Apply anti-corrosion coating with a brush (natural hair brush only) or roller.
    4. The material may also be applied through spraying.
        - Shake the product until all particles are suspended.
        - Filter the material into a spray gun cup and dilute up to 10% with water.
        - Apply the material using a basecoat/clearcoat spray gun equipped with a 1.4 mm (0.05 in) tip.
        - Allow the material to flash dry to remove water and let air dry, or bake at 60°C (140° F) for 45 minutes.
    5. Apply at 2.5 MIL film thickness.
    6. Anti-corrosion products will reach full-bond strength within 48 hours at 21°C (70°F) and 60% relative humidity.

2. **NOTE:** Make sure the corrosion protection material is fully cured before attempting to prime or paint the surface(s).

   When welding overlapping surfaces or substrates, apply corrosion protection between the surfaces prior to welding. When the surfaces have been welded, apply corrosion protection to the exterior surfaces or substrates.

3. When treating exposed seams, apply the appropriate seam sealer, following product guidelines. Prime and paint as required.

Refinishing — Environmental Damage

Printable View (82 KB)

Material

Item	Specification
Motorcraft Detail Wash ZC-3-A	—
Motorcraft Acid Neutralizer ZC-1-A	—
Motorcraft Alkaline Neutralizer ZC-2-A	—

Iron Oxide (Rail Dust) or Acid Rain Decontamination

NOTE: Iron oxide contamination appears as tiny rust spots on horizontal surfaces and in severe cases can be felt. This damage is typically caused from rail shipment, storage near railroad tracks or fallout from industrial manufacturing facilities.

NOTE: Acid rain contamination can be identified as water spotting and in severe cases staining within the water spots.

1. **CAUTION: Never paint over iron particles. Use only the recommended decontamination procedure detailed below.**

   Rinse any dust, dirt and foreign material from the vehicle body with cold water. Flush liberally.

2. Prepare the acid neutralizer by mixing 8 parts of water to 1 part neutralizer in a bucket.

3. **CAUTION: Do not allow the product to dry on the vehicle.**

   NOTE: Use a separate wash mitt for each product applied to the vehicle.

   Working quickly and beginning at the top of the vehicle and working to the sides, apply the acid neutralizer mix to the entire vehicle. Keep the vehicle wet with the solution and lightly agitate for 5 to 7 minutes. Continue around the vehicle 4 to 5 times. For severe conditions, work the product for up to 8 minutes.

4. Rinse the vehicle completely with cold water to remove the product.

5. Dry only the horizontal surfaces of the vehicle, do not dry the glass at this time.

6. **CAUTION: Do not apply the alkaline neutralizer directly to the vehicle plastic trim.**

   NOTE: Use a separate wash mitt for each product applied to the vehicle.

   NOTE: Alkaline neutralizer is a ready to use product. Do not mix with water.

   Pour the alkaline neutralizer into a squirt bottle and apply the solution to a clean wash mitt.

7. **CAUTION: Do not allow the alkaline neutralizer to dry on the vehicle.**

   Apply the product to the vehicle keeping the solution wet and lightly agitate for 5 to 7 minutes. For severe conditions, work the product for up to 8 minutes.

8. Rinse the vehicle completely with cold water to remove the product.

9. Prepare the detail wash by mixing 29.5 ml (1 ounce) with 3.78L (1 gallon) of water.

10. Using a clean wash mitt, shampoo the entire vehicle and rinse with cold water. Dry the vehicle completely.

11. Visually inspect the paint surface for any remaining evidence of ferrous metal particles. Repeat procedure as necessary.

Surface Finishing Following Decontamination

1. **CAUTION: When attempting to affect a repair by buffing, polishing or color sanding, do not remove an excess of 0.3 MIL of paint film or refinishing will be required.**

   NOTE: Acid rain discoloring or etching may require color sanding in addition to buffing and polishing. In extreme cases, refinishing may be required if the following procedure does not restore the vehicle finish.

   NOTE: Do not intermix buffing products. Use only one manufacturer's product.

   NOTE: Always follow the manufacturer's product usage sequence. Use the appropriate buffing or polishing pad at the recommended buffing speed as specified by the product manufacturer.

   Apply rubbing compound to the vehicle surface as recommended by the product manufacturer.

2. Apply machine glaze to the vehicle surface as recommended by the product manufacturer.

3. Use an alcohol and water mixture (1 to 1) to clean the buffed and polished areas. Verify removal of scratches and swirls before the application of the final polish.

4. Apply a final polish material by hand, with a dual-action sander and foam pad, or with an orbital polisher and appropriate polishing bonnet.

5. Wash and dry the vehicle.

Refinishing — Manufacturing Damage

Printable View (80 KB)

Material

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—
Motorcraft Detail Wash ZC-3-A	—

WARNING: The correct protective equipment and clothing must be worn when using paints, solvents, sanding or grinding. Proper ventilation must also be provided to avoid harmful fumes in the work area.

CAUTION: Protect adjacent areas/substrates when preparing for and during refinishing.

NOTE: Peeling/delamination concerns can be described as lack of adhesion, either between the substrate and topcoats or between individual coats of paint.

1. Wash the repair area with pH-neutral soap and water.
2. Remove any trim, emblems and hardware from the area to be repaired.
3. **NOTE:** All delamination must be removed.

   Sand or media blast the damaged surface, keeping the repair area as minimal as possible.
4. Treat any bare metal surface to prevent flash corrosion, and prime and block sand as necessary prior to refinishing.
5. Mask the adjacent panels to protect from overspray.
6. Spot repair the base coat as necessary, following the paint manufacturer's prescribed procedures.
7. Following the paint manufacturer's prescribed procedure, apply clear coat to the entire panel.

Weld-Bonding

Printable View (92 KB)

General Equipment

Heat Treatment Induction Resistance Spot Welder 254-00001
Pro 230 MIG Welder 208-00030

Material

Item	Specification
Low Temperature Anti-Corrosion Coating PM-12-A	—
Metal Bonding Adhesive TA-1	—
Seam Sealer TA-2	—

Weld-Bonding — Squeeze-Type Resistance Spot Welding (STRSW) Method

NOTE: Ford Motor Company does not approve or recognize structural repair procedures using anything but genuine Ford parts.

Structural repairs (frames, rails, aprons and body panels) carried out using other than Ford Motor Company parts have not been tested. In addition, structural equivalence and corrosion protection cannot be assured.

Returning a vehicle to pre-accident condition can only be assured if repair procedures are carried out by skilled technicians using genuine Ford Motor Company parts and approved methods.

Structural component repair procedures approved by Ford using genuine parts have been validated through testing by Ford Motor Company engineers. Should alternative structural component repair procedures and/or parts be used, repairers should be aware of the potential liability they incur.

NOTE: Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: Door shells are manufactured with structural adhesives only, weld bonding door skins is not recommended. Only metal bonding adhesive should be used.

NOTE: Weld-bonding is a method used to join metals using squeeze-type resistance spot welding (STRSW) or metal inert gas welding (MIG) and structural adhesive. The steps listed in this procedure apply to both types of welding. STRSW is the preferred method. MIG welding should only be used when areas to be welded cannot be accessed using STRSW-type machinery.

NOTE: Factory spot welds should be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Verify the vehicle is dimensionally correct on a frame machine. Straighten if necessary.

2. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.

3. Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.

4. Prepare any damaged flanges on the vehicle using hammer and dolly.

5. Grind the mating surface of the original flanges not greater than 25 mm (0.98 in) where the metal bonding adhesive will be applied.
   - Be sure to remove galvanizing on metal. Metal should have a shiny appearance.
   - Be careful not to damage the corners or thin the metal. The E-coat should also be removed on the opposite side of the flange only where the spot welds are to be placed.

6. Bevel any edges to less than 10 degrees on the new panel where a finished section joint is needed.

7. Dry-fit and clamp the replacement service parts to verify a correct fit.
   - Remove the service part after verifying correct fit and alignment.

8. If MIG welding, refer to Weld-Bonding — MIG Welding Method in this section.

9. **NOTE:** The ends of welding clamps should be insulated on the ends using tape or similar material when welding is carried out.

   Follow manufacturer's prescribed welding procedures and settings. For additional information, refer to Welding Precautions — Steel in this section.

10. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of adhesive to make sure of a correct mix ratio.

11. **NOTE:** Working time of the adhesive is 40-50 minutes at 21°C (70°F). For every -7°C (20°F) above 21°C (70°F), decrease the working time by one half. For every -7°C (20°F) below 21°C (70°F), double the working and cure time.

    Create a test sample.
    1. Prepare the metal and adhesive as described. Apply a 6-9 mm (0.23-0.35 in) bead of adhesive and weld the sample.
    2. Place the welded sample in a vice and perform destructive weld tests by peeling the scrap metal apart using large channel lock-type pliers. Measure the weld nugget to determine that the nugget meets Ford weld nugget requirements.
    3. When the correct weld nugget is achieved, the service part can be weld-bonded.

Weld Nugget Chart

Test Thickness of Metal (in millimeters)	Nugget Size (mm)
0.7 + 0.7	4.30
0.7 + 0.7 + 0.7	4.30
0.9 + 0.9	4.70
0.9 + 0.9 + 0.9	4.70
1.0 + 1.0	5.20
1.0 + 1.0 + 1.0	5.20
2.0 + 2.0	7.10

2.0 + 2.0 + 2.0	7.10
3.0 + 3.0	8.70
3.0 + 3.0 + 3.0	8.70
3.0 + 0.7	4.30
0.7 + 3.0 + 1.0	5.20
2.0 + 2.0 + 0.7	4.30
0.9 + 0.9 + 2.0	4.70
2.0 + 0.9 + 1.0	5.20
1.0 + 3.0 + 1.0	5.20
3.0 + 1.0 + 2.0	7.10
0.9 + 0.7 + 0.9	4.30

12. Apply a 6-9 mm (0.23-0.35 in) bead of metal bonding adhesive to the vehicle prepared flange surface.

13. Place the service part(s) in the correct position on the vehicle.
    - When positioned do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the components and adhesive.

14. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

15. **NOTE:** Welding can be carried out anytime during the adhesive curing process, or after the adhesive is fully cured. Welder settings will vary when welding through wet adhesive versus welding through fully cured adhesive. Refer to welder manufacturer's recommended settings for welding through fully cured adhesive. It is recommended to place a shunt weld in an area with no adhesive to make sure of conductivity, particularly when welding through fully cured adhesive.

    NOTE: If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.

    Wipe excess adhesive from the panel before it cures.

16. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, after the adhesive cures, apply conventional body filler and block-sand the area.

17. Prime any bare metal areas with anti-corrosion coating. Apply 2-3 coats allowing it to flash dry between coats.

18. Use seam sealer wherever a cosmetic seam sealer is required.

19. Mix and apply primer surfacer per manufacturer's recommendations.

20. Mix and apply basecoat per manufacturer's recommendations.

21. Mix and apply clearcoat per manufacturer's recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.

Weld-Bonding — MIG Welding Method

NOTE: Metal inert gas (MIG) weld-bonding can be substituted as an alternative to squeeze type resistance spot welding (STRSW). It may only be used to weld areas that are inaccessible to STRSW machinery. However when accessible STRSW is the preferred method.

NOTE: Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: Door shells are manufactured with structural adhesives only, weld-bonding door skins is not recommended. Only metal bonding adhesive should be used.

NOTE: Factory spot welds should be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.
    - Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.

2. After removing the damaged sheet metal panel(s), repair any damaged flanges on the vehicle using hammer and dolly.

3. Using an appropriate grinder, carefully grind around the entire receiving flange area following the original welds. Be sure to remove all E-coat, paint or galvanized coating from the mating surfaces of the joint.
    - Do not grind above the mating surface area to prevent the possibility of corrosion forming later.

4. Repeat the procedure from Step 3 on the mating surface of the replacement service part(s).

5. Prepare the new service panel for plug welds.
    - Using the original panel as a reference, drill or punch holes in the exact number as the original spot welds. The holes should be positioned as close as possible to the original spot weld locations, without lining up exactly on top of an original spot weld site.
    - To make sure of correct weld performance, grind the immediate perimeter of plug weld hole. Grind only in the area of the plug weld, this will keep corrosion to a minimum.

6. Dry-fit and clamp the replacement service parts to verify a correct fit and alignment.
    - Remove the service part after verifying correct fit and alignment.

7. The vehicle prepared flange areas where plug welds will be located must be kept free of adhesive. Apply 25 mm (0.98 in) tape to the plug weld areas to prevent contamination from the adhesive.

8. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of adhesive to make sure of correct mix ratio.

9. **NOTE:** Work time of the adhesive is 40-50 minutes at 21°C (70°F). For every -7°C (20°F) above 21°C (70°F), decrease the working time by one half. For every -7°C (20°F) below 21°C (70°F), double the working and cure time.

    Apply a 6-9 mm (0.23-0.35 in) bead of adhesive to the vehicle prepared flange surface. Remove the tape from the plug weld areas.

10. Place the service part(s) in the correct position on the vehicle.
    - When positioned, do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the

components and adhesive.

11. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

12. **NOTE:** Welding can be carried out anytime during the adhesive curing process, or after the adhesive is fully cured.

    NOTE: If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.

    Wipe excess adhesive from the panel before it cures.

13. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, apply conventional body filler after the adhesive cures and block-sand the area.

14. Prime any bare metal areas with anti-corrosion coating. Apply 2-3 coats allowing it to flash dry between coats.

15. Use seam sealer wherever a cosmetic seam sealer is required.

16. Mix and apply primer surfacer per manufacturer's recommendations.

17. Mix and apply basecoat per manufacturer's recommendations.

18. Mix and apply clearcoat per manufacturer's recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.

Plastics Identification

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NOTE: Identification of the various plastic types is necessary to select the appropriate repair methods to make high quality plastic repairs. Plastics can generally be broken down into 2 categories, thermoplastics and thermosetting plastics. Thermoplastics can be remolded by heating. This makes plastic welding a possible repair alternative.

1. **NOTE:** In some instances a code or material designation is stamped indicating what type of plastic it is.

   Thermoplastics are solvent reactive. Types of thermoplastics include thermoplastic polyolefin (TPO) polyvinyl chloride (PVC) and acrylonitrile butadiene styrene (ABS). Polyolefins have an oily or waxy appearance. Examples include some bumper covers, stone shields, fender aprons and fan shrouds. Polyolefins require an adhesion promoter prior to carrying out any refinish procedure.
   - To determine if the part is a polyolefin, grind the damaged area in an out-of-sight area. Grinding a polyolefin will melt and smear the plastic and leave a ragged edge. If the part is non-polyolefin, the area will grind or sand smoothly, producing a powdery dust.

2. Olefin plastic can also be identified by placing a small sliver in container of water, if the sample floats it is an olefin plastic. A non-olefin will sink when placed in a container of water.

3. Thermosetting plastics are insoluble and infusible and are made with 2-part thermosetting resins. When mixed together, heat is generated, producing a cure that is irreversible. Because of this thermosetting plastics will require the use of a two-part adhesive for repair. Generally, thermosetting plastics are rigid or semi-rigid. sheet-molded compounds (SMC) are reinforced with glass and other fibers and are strong and rigid. SMC is used for large panels such as hoods, liftgates, fenders and quarter panels.
   - A burn test can be a reliable method to determine if a plastic is a thermosetting plastic. Extreme care must be exercised when using this method.
     - Apply an open flame to the corner of the damaged component. If the material crystallizes and becomes hard it is a thermosetting plastic.

Plastics Refinishing — Exterior

Printable View (82 KB)

Material

Item	Specification
Motorcraft Adhesion Promoter PM-19A316-AA	—
Plastic Bonding Adhesive TA-9	—

1. **NOTE:** Care must be used if applying heat to parts, thermoplastics soften and tend to loose their shape when heated.

   The first step to any repair or refinish procedure is to identify the type of plastic. Is it rigid or flexible, grained or smooth? This will determine how it should be cleaned and prepared for refinishing. Refer to Plastics Identification in this section.
   - It is essential that the correct cleaner is used, depending on which painting system is employed, solvent based or water based.
   - Clean part with warm water/mild detergent and gray scuff pad, then with plastic cleaner to remove wax, silicone and other contaminants. As a general rule, if water beads on the part it requires additional cleaning as all the manufacturing release agent has not been removed.

2. New parts may require baking in a spray booth or heating with heat lamps to release trapped solvents or mold release agents used during manufacture.

3. After cleaning, lightly sand with 600-grit or finer sandpaper. Clean sanding residue with plastic cleaner and wipe clean.

4. A sealer may be required to prevent wrinkling and lifting of the topcoat prior to carrying out the refinish procedure.

5. Flexible and non-flexible components should be refinished separately as a flex additive is generally added to the paint material when refinishing flexible plastics.

6. It is recommended to carry out the refinish process with component installed on-vehicle to control color and blending of the adjacent panels.

7. Apply adhesion promoter. For best results, use only when product and surface temperatures are between 15°C (60°F) and 33°C (92°F). In cases of high humidity, apply the adhesion promoter in a spray booth or controlled climate. You may also use a hair dryer or fan to create air movement to speed the adhesion promoter curing process.
   - Shake can vigorously for one full minute before use and repeat for 10 seconds after each full minute of use.
   - Test spray on a hidden area before proceeding.

8. Hold can 150 mm (5.9 in) to 254 mm (10 in) from the surface and spray a full wet coat with a steady back and forth motion. Be sure all areas of the surface are covered. Observe for a uniform gloss/coverage across the surface while the adhesion promoter is still wet.

9. Allow the adhesion promoter to dry 2-3 minutes and reapply a second wet coat. Allow to dry 2-3 minutes.

10. Proceed with the refinish process and follow the Ford-approved paint system procedures. Steps may vary between paint manufacturers.

Plastics Refinishing — Interior

Printable View (83 KB)

Material

Item	Specification
Plastic Bonding Adhesive TA-9	—
Motorcraft Adhesion Promoter PM-19A316-AA	—
Motorcraft Interior Spray Paint PM-19M547-XXXXH (XXXX=Color Code)	—

1. **CAUTION: Do not attempt any refinishing procedure on supplemental restraint system (SRS) deployment doors or covers.**

   CAUTION: The use of adhesion promoter is only required for rigid plastics. Do not use adhesion promoter or equivalent prior to color coating soft plastic.

   NOTE: Care must be used if applying heat to parts, thermoplastics soften and tend to loose their shape when heated.

   The first step to any repair or refinish procedure is to identify the type of plastic. Is it rigid or flexible, grained or smooth? This will determine how it should be cleaned and prepared for refinishing. Refer to Plastics Identification in this section.
   - Clean part with warm water/mild detergent and gray scuff pad, then with plastic cleaner to remove wax, silicone and other contaminants.

2. **NOTE:** As with most refinishing procedures, surface preparation is critical to a correct repair. Surfaces must be clean, dry and free of contaminants that could cause loss of adhesion. A test sample should be painted prior to refinishing the repair or replacement part for correct color match.

   Use interior trim spray paint only when the product and surface temperatures are 15°C to 33°C (60°F to 92°F). Blushing may occur in high humidity conditions, to alleviate this apply paint in a spray booth or controlled climate. You may also use a hair dryer or fan to create air movement to speed the paint curing process.
   - Shake can vigorously for 2 full minutes prior to use.
   - Apply to a small inconspicuous area to verify color match.

3. **NOTE:** If applying refinish materials to components on the vehicle, mask off adjacent areas to protect from overspray.

   Hold can vertically 305 mm (12 in) from surface to be painted. Apply in light mist coats using even strokes from side to side. Stop spraying at the end of strokes.

4. Apply 2 to 3 mist coats, allowing approximately 10 minutes between coats. Heavy coats will result in patchiness and runs and may trap solvents, resulting in incorrect curing.

Adhesion Promoter

NOTE: Correct surface preparation must be carried out before any adhesion promoter or paint product is applied. Thoroughly clean surface to be coated. Remove any grease, dirt, polish, moisture, etc. with a plastics wax and grease remover by wiping in one direction, To make sure of correct adhesion, it is essential that all silicone, conditioners and existing paint be removed prior to application. If applying refinish materials to components on the vehicle, mask off adjacent areas to protect from overspray.

1. For best results, use only when the product and surface temperatures are between 15°C and 33° C (60°F to 92°F). In cases of high humidity apply the adhesion promoter in a spray booth or controlled climate. You may also use a hair dryer or fan to create air movement to speed the adhesion promoter curing process.

2. Shake can vigorously for one full minute before use and repeat for 10 seconds after each full minute of use.
    - Test spray on a hidden area before proceeding.

3. Hold can 150 mm (5.9 in) to 254 mm (10 in) from the surface and spray a full wet coat with a steady back and forth motion. Be sure all areas of the surface are covered. Observe for a uniform gloss/coverage across the surface while the adhesion promoter is still wet.

4. Allow the adhesion promoter to dry 2-3 minutes and reapply a second wet coat. Allow to dry 2-3 minutes.

5. Apply the color coat as soon as possible after second coat of adhesion promoter dries, within 10 minutes if possible.

Plastics Repair

Printable View (118 KB)

Material

Item	Specification
Plastic Bonding Adhesive TA-9	—
Motorcraft Adhesion Promoter PM-19A316-AA	—

1. In deciding whether to repair or install a new component, follow these guidelines.
   - Is a part readily available?
   - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
   - Will repair provide for the fastest, highest quality repair?

2. **CAUTION: Never apply solvents such as lacquer thinner or reducer at any stage of plastic repair. Solvents, cleaners and water are absorbed by many types of plastics and by the glass fibers used for reinforcements. If this occurs the plastic may swell in the area of repair and cause the repair to fail. Remove cleaners and water quickly and use air and heat to speed up drying.**

   CAUTION: During the repair of most plastics and particularly polyolefins, an adhesion promoter must be applied to the substrate to allow repair materials and paint to bond correctly. Reapplication is required every time you grind or sand through the sealer or primered layers.

   NOTE: When possible, it is recommended to carry out as much of the plastic repair as possible on the vehicle. Parts mounted on the vehicle are held in correct alignment throughout the repair. Attempting to repair the part off the vehicle may cause misalignment. This could lead to failure of the repair.

   Select the correct repair method by identifying the type of plastic being repaired. Refer to Plastics Identification in this section to determine the type of plastic being repaired.

3. **NOTE:** Always refer to the manufacturer's label directions for the type repair materials, fillers and bonding agents being used as they are material specific.

   Determine whether a reinforcement piece is needed as a backer on large repairs.
   - Construct a reinforcement piece from a scrap piece of the type of plastic being repaired and follow manufacturer's label directions for the type of system being used.
   - When repairing sheet-molded compound (SMC), a reinforcement piece can be constructed using several layers of glass cloth saturated with resin or structural adhesive. Nylon screening is also acceptable. The weave of the cloth or screening should be loose enough to allow the resin to thoroughly penetrate. Reinforcement should cover the entire area of damage and extend outward beyond the damage or joint area.

SMC Body Panel Repair

NOTE: The following procedure applies to repair of structural cracks and large gouges, if damage is

cosmetic use of reinforcing cloth may not be necessary.

1. Panels to be repaired should be dry and at room temperature 18°C (65°F) to 24°C (75°F) prior to carrying out any repairs. Both sides of the panel must be thoroughly cleaned before sanding or grinding.

2. Cover the break in the SMC (front and back) with masking tape. This protects the damaged area from absorbing the prep cleaner and eliminates wicking of the cleaner through the fibers into the SMC.

3. Remove all waxes, silicones, dirt and road oils from the area surrounding both sides of the damaged area with a plastics wax and grease remover.
    - Remove the tape and sand the back of the repair area with an angle grinder, dual action (D/A) sander or by hand using 80-grit sandpaper. Remove all dust with vacuum and tack cloth.

4. Create a reinforcing patch using a piece of scrap SMC that conforms well to the back of the damaged area or form a patch from fiberglass cloth.
    - Cut a section of cloth large enough to cover the repair, plus 25.4 mm (1 in) around the repair area.
    - Cut a section of plastic film backing approximately 25.4 mm (1 in) larger than the cloth. Lay the plastic on a smooth, flat surface where it will be used to create a pyramid patch.

5. Follow manufacturer's directions and apply plastic repair adhesive to the plastic film backing and smooth with plastic spreader to recommended thickness. Place the pre-cut fiberglass cloth on the adhesive-coated plastic film. Cover the cloth with a coat of repair adhesive and spread to the recommended thickness.

6. Apply the prepared patch to the backside of the panel and compress. Follow manufacturer's instructions for adhesive cure. Remove plastic film after adhesive cures and sand as necessary to remove roughness.

7. Remove masking tape from the front side of damaged area and grind down to the backing patch. Use an angle grinder with a 30- to 40-grit wheel. Make a gradual taper in the area, this will prevent bull's-eyes or read-through in the finished repair. Sand prepared area with a dual-action (D/A) sander or hand-sand with 80-grit sandpaper.

8. Build a pyramid patch using fiberglass cloth or equivalent and plastic repair adhesive. Following manufacturer's directions, apply patch to damaged area.

9. Rough-grind area to remove excess adhesive. Sand repair area with 80-grit sandpaper, making sure to cut slightly below the SMC finished surface. This will allow for a finish coat of plastic body repair material.

10. Apply a finish coat of plastic repair filler material per manufacturer's directions.

11. Finish-sand, prime and topcoat using Ford-approved paint systems.

Thermoplastic Compounds

1. In deciding whether to repair or install a new component follow these guidelines.
    - Is a part readily available?
    - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
    - Will repair provide for the fastest, highest quality repair?

2. Identify the plastic compound. Refer to Plastics Identification in this section.

3. **NOTE:** The following steps are to be used as a guideline. Depending on what brand of adhesives,

patch material etc., are used, procedures may vary slightly.

Thoroughly clean the damaged area with wax and grease remover.

4. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.

5. Apply a plastics adhesion promoter per label directions to the repair area.

6. For small repairs, a plastic adhesive filler can be applied to damaged area. Follow manufacturer's directions and build layers to form a thickness above the damaged area. This will allow area to be sanded smooth.

7. To repair large holes or cracks, measure and cut a piece of fiberglass cloth or equivalent 25.4 mm (1 in) larger than crack or hole.
    - Apply plastic repair adhesive to damaged area and immediately apply into plastic adhesive for reinforcement. Apply additional plastic repair adhesive for strength and shape as required.

8. Contour and shape the repair as necessary with D/A sander. Avoid sanding through the repair.

9. Finish-sand the area and carry out any required paint operations using Ford-approved paint systems.

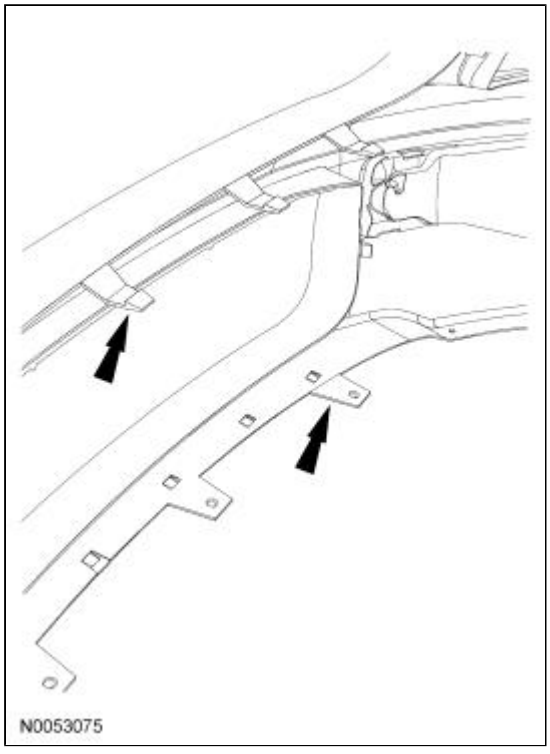
Tab Repair — Bumper

1. **NOTE:** Inspect the bumper cover to determine if part can be repaired to an acceptable level of quality of appearance, fit and durability. Will labor and material cost of the repair meet or exceed the cost of a new replacement bumper cover. If the bumper cover is determined to be repairable, proceed to the following steps.

   NOTE: The following steps are to be used as a guideline. Depending on what brand of adhesives, patch material etc., are used, procedures may vary slightly.

   Remove the affected bumper. Refer to Section 501-19 .

2. Clean the broken tab(s) with a plastics wax and grease remover.



3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.

4. Apply a plastics adhesion promoter per label directions to the repair area.

5. Measure and cut a patch of fiberglass cloth or equivalent large enough to form the front of the tab, then slope back in a wedge shape approximately 51 mm (2 in) from original tab.

6. Prepare the repair adhesive per manufacturer's instructions and apply to the affected area.
    - Immediately apply the plastic repair material to form the tab shape.

7. Allow appropriate cure time and shape the repair tab using a small angle sander. Use extreme care to not sand through the exterior surface.

8. Perform any required paint repair operations to the bumper cover using Ford-approved paint systems.

9. Reassemble and install the bumper cover. Refer to Section 501-19 .

Frame Members

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Special Tool(s)

ST2956-A	Pro 230 MIG Welder 208-00030

Material

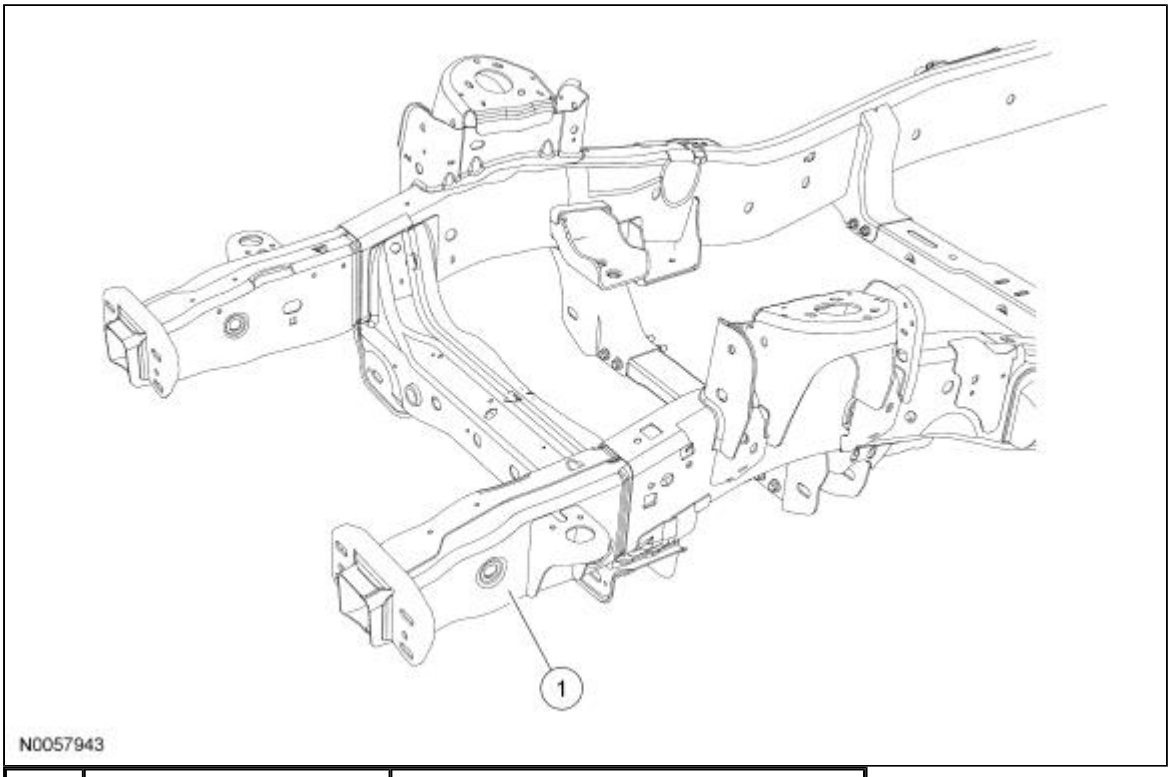
Item	Specification
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Motorcraft Metal Surface Prep ZC-31	—
Low Temperature Anti-Corrosion Coating PM-12-A	—
High Temperature Anti-Corrosion Coating PM-13-A	—

Front Frame Rail

CAUTION: The following is step by step procedure for carrying out front frame horn replacement on 2007 and beyond Expedition/Navigator models. Then Expedition/Navigator is a body on frame vehicle which is designed with energy absorbing features in the front frame horns to manage crash energy. The horn section of the frame MUST NOT be straightened if any holes or surfaces show evidence of collapse or buckling. If any evidence of damage exists BEHIND the first frame crossmember in terms of buckling, cracking, etc. then the ENTIRE frame must be installed new.

NOTE: Prior to beginning this procedure, the vehicle must be restored to its correct overall dimensions. Refer to Body in this section for dimensional information.

NOTE: The replacement front frame horns are production parts designed with a taper to insert into the mid-rail section to assist in alignment and welding operations. Tow hooks are not included with the replacement frame kit.



Item	Part Number	Description
1	5D059 LH/ 5D058 RH	Frame rail sectioning/instruction kit

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

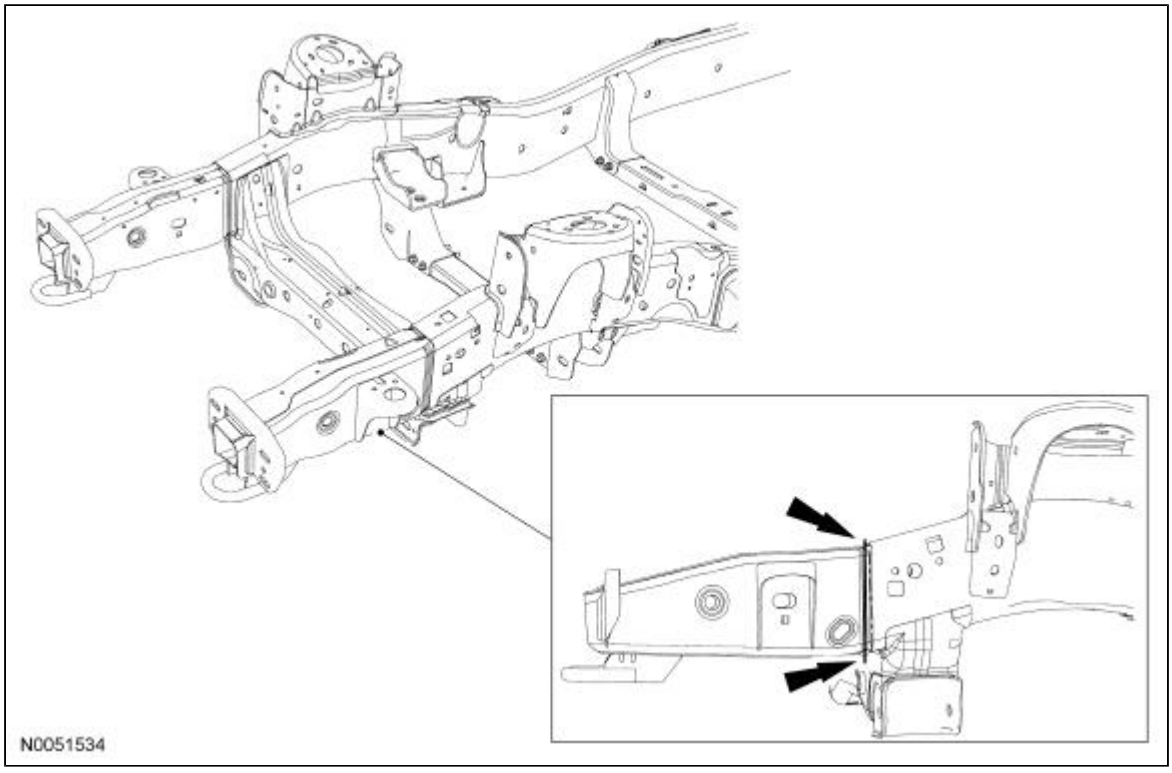
NOTE: Observe prescribed welding procedures when carrying out repairs to the frame assembly. For additional information, refer to Welding Precautions — Steel in this section.

1. Position the vehicle on a frame rack following the manufacturer's recommendations. Measure the vehicle to determine body and frame alignment. Refer to Body in this section for dimensional information.

2. Remove the front bumper. For additional information, refer to Section 501-19 .
   - If equipped, remove tow hooks.

3. Unbolt the front end sheet metal and body mount bolts. If necessary, raise the body off the frame assembly. Refer to Section 502-02 .

4. Locate the vertical weld line of the front frame horn to center mid-rail.



5. **CAUTION: DO NOT cut directly along the weld line. Leave enough material on the forward side of the weld line to allow the edge to be ground back exactly to the weld line. This is required to assure a proper fit up between the frame and the replacement section.**

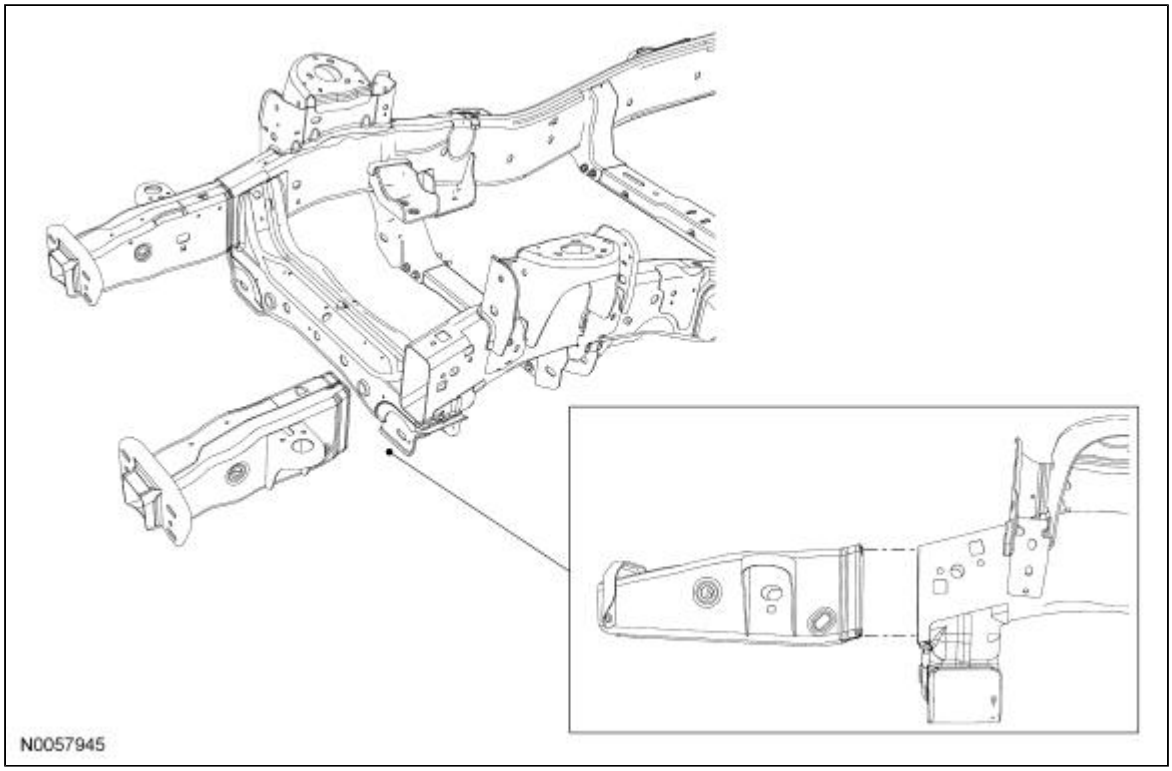
   Using a plasma cutter, reciprocating saw or die-grinder, remove the damaged front frame horn section.

6. **CAUTION: Do not thin out the frame rail. The material must maintain a minimum thickness of 3.4 mm (0.13 in) after grinding. This is required to maintain correct energy management in the event of a collision.**

   Grind off the excess welding material that remains in front of the weld line on the frame mid-rail.

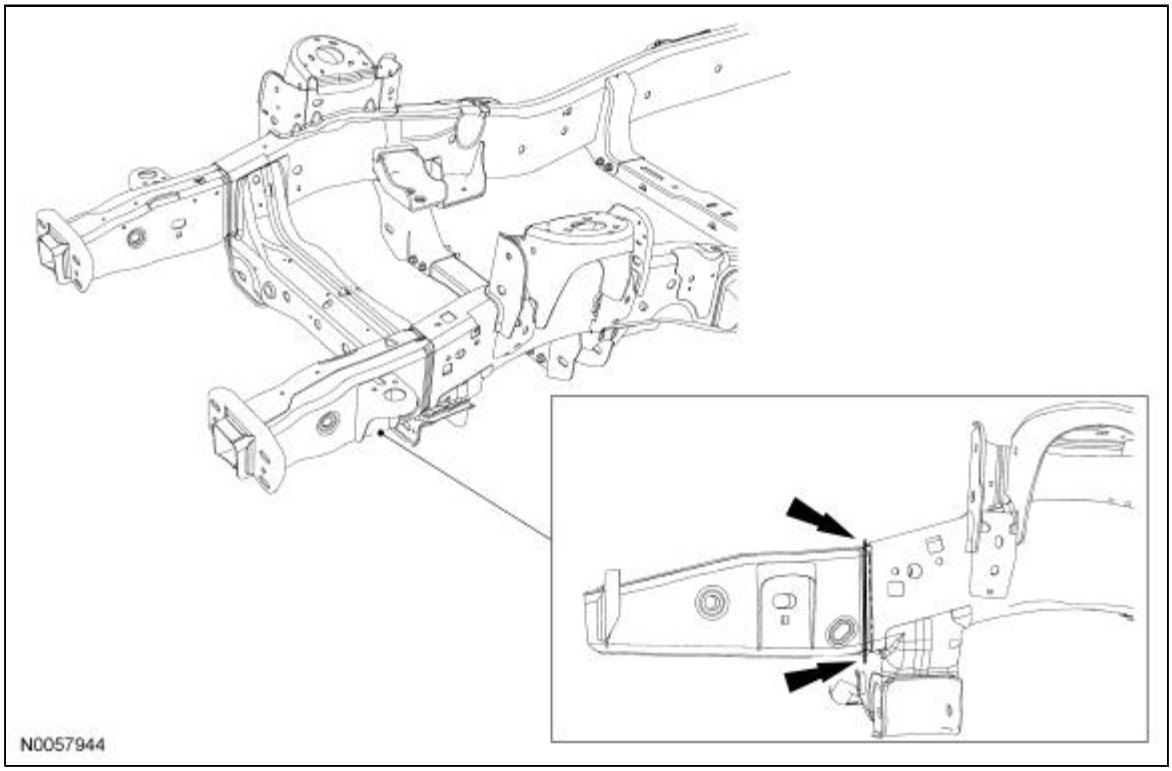
7. Remove the remaining portion of the front frame horn (ring-like piece) from inside the mid-rail with pliers or similar tool.

8. Using a wire brush or sandpaper, remove the E-coat 15 mm (0.59 in) to 20 mm (0.78 in) wide from the inner and outer surfaces of the existing mid-rail. Clean the surfaces with a wire brush and metal surface cleaner.
   - Apply a zinc rich weld-through primer to the exposed inner and outer mating surfaces.



9. Using a wire brush or sandpaper, remove the E-coat 15 mm (0.59 in) to 20 mm (0.78 in) wide from the inner and outer surfaces of the replacement frame horn section. Clean the surfaces with a wire brush and metal surface cleaner.
    - Apply a zinc rich weld-through primer to the exposed inner and outer mating surfaces.

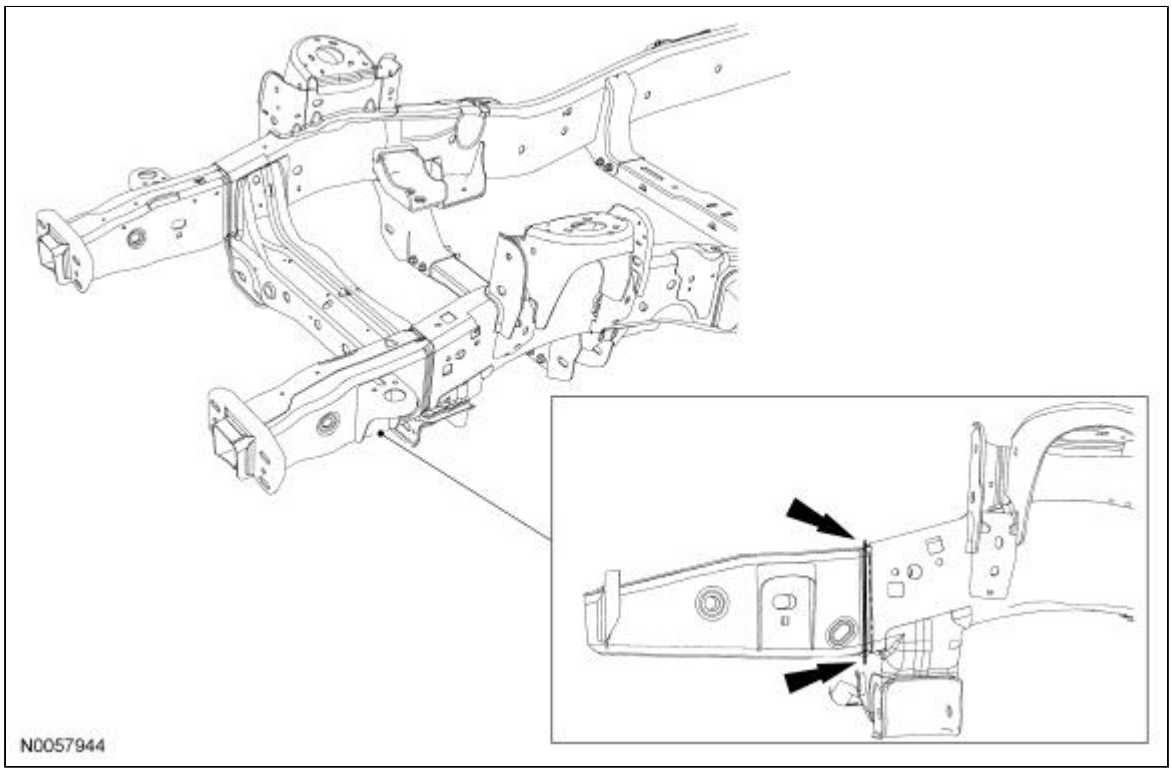
10. Install the front section inside the frame mid-rail. Support the replacement frame horn in position. Verify that the front end sheet metal (FESM) mount bracket lines up with sheet metal hole. The holes should line up so that the FESM mount can be replaced and the FESM mount bolt can be installed.



11. Make sure that the frame and service replacement part have attained a minimum room temperature of 10°C (50°F) before beginning the weld procedure. A MIG welder capable of producing 185-250 amps must be used. Use ER70S-3 or ER70S-6 weld wire 0.035 to 0.045 inch diameter that is compatible with SAE 1010 steel. Shielding gas must be 100% CO2 or 75% CO2 and 25% Argon.

12. Tack weld the frame horn replacement section into the existing frame at 4 small points centered on the flats between the corners. This will hold the section in place to check the fit up prior to completely welding up the section.
    - Measure the frame to make sure factory dimensions are maintained.

13. Make sure the frame section replacement is correctly aligned.
    - Carry out the remainder of the welding procedure.
    - After welding is complete, grind off any excess weld material.



14. Use a dye penetrant to determine if any cracks or large voids exist in the weld joint after the welding process has been completed.
    - If any cracks or other defects exist, grind out the defect and repair it until the imperfection is corrected.

15. Clean the repaired area(s) and any exposed metal surfaces. Restore corrosion protection to the exposed surfaces of the repaired area(s) using anti-corrosion coating PM-12-A or PM-13-A on exposed interior and exterior surfaces.

16. Install the components removed during the repair procedure and torque fasteners to correct specification.

Inner Body Reinforcing Panels

Printable View (239 KB)

Special Tool(s)

ST2956-A	Pro 230 MIG Welder 208-00030
ST2738-A	Heat Treatment Induction Resistance Spot Welder 254-00001

Material

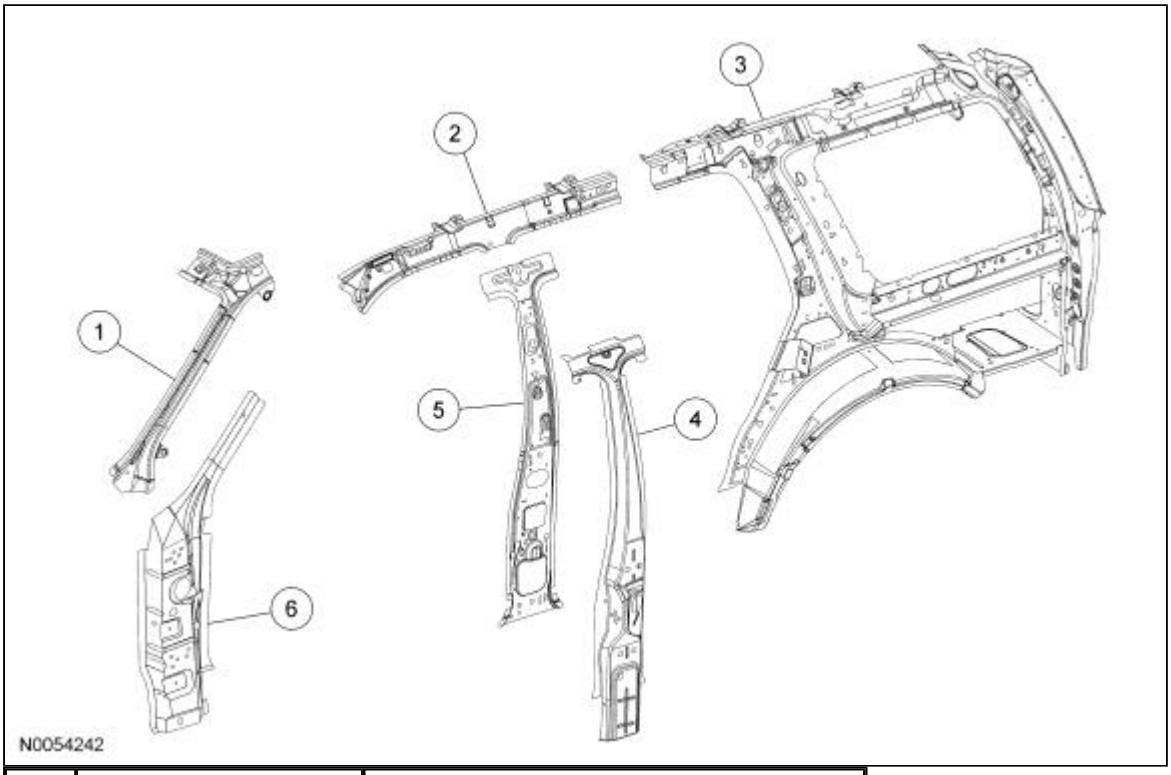
Item	Specification
Metal Bonding Adhesive TA-1	—
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Seam Sealer TA-2	—
Motorcraft Metal Surface Prep ZC-31	—

Exploded View

WARNING: On vehicles equipped with safety canopy options, the safety canopy module and related components must be removed prior to carrying out any section repairs near the roof line or sail panel areas of the vehicle. For additional information, refer to Section 501-20B .

CAUTION: Body side section repairs should not be carried out in areas of laser welds, door hinge or striker anchoring points or near restraints anchoring points. Do not cut or grind body side components within 50 mm (1.96 in) of restraint anchoring points. For additional restraints anchoring location information, refer to Section 501-20A .

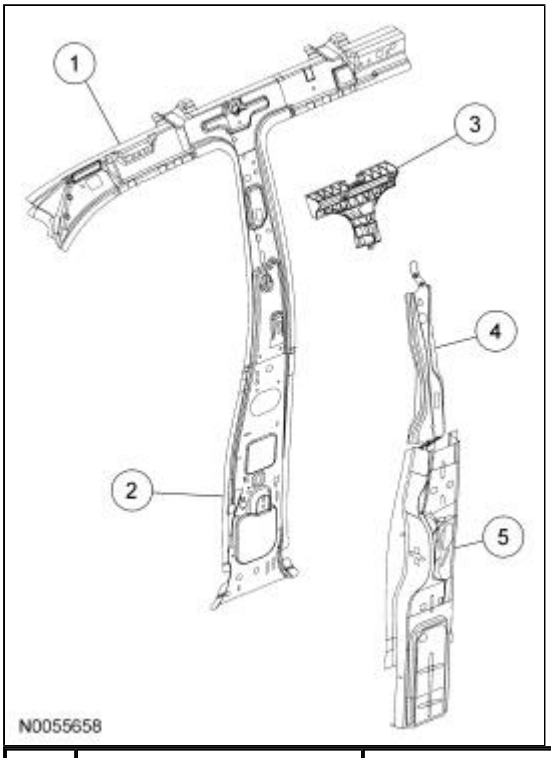
NOTE: A nylon epoxy reinforcement part No. 24383 LH/ 24382 RH, is contained in the upper B-pillar reinforcement in the 2007 design. Reinforcement is not used in 2007.5 design. The following illustration shows the 2007.5 design.



Item	Part Number	Description
1	02501 LH/ 02500 RH	A-pillar upper reinforcement — mild steel
2	513A31 LH/ 513A30 RH	Roof side rail assembly — mild steel
3	27865 LH/ 27864 RH	Body side inner panel — mild steel
4	27841 LH/ 27840 RH	B-pillar reinforcement — high-strength steel
5	24301 LH/ 24300 RH	B-pillar inner — high-strength steel
6	22843 LH/ 22842 RH	A-pillar reinforcement — mild steel

B-Pillar Inner — 2007 Design

NOTE: All 2007 models contain a nylon epoxy reinforcement (No. 3), in the upper B-pillar. Lincoln Navigator and Expedition/Navigator extended wheelbase models contain an additional reinforcement, (No. 4). Expedition standard wheelbase does not use this reinforcement (No. 4), in the B-pillar.



Item	Part Number	Description
1	513A31 LH/ 513A30 RH	Roof side rail assembly — mild steel
2	24301 LH/ 24300 RH	B-pillar inner — high-strength steel
3	24383 LH/ 24382 RH	Reinforcement — nylon/epoxy
4	24587 LH/ 24586 RH	B-pillar reinforcement — high-strength steel
5	27841 LH/ 27840 RH	B-pillar reinforcement — mild steel

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: Factory spot welds may be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

Observe prescribed welding procedures when carrying out any body side section repair. For additional information, refer to Welding Precautions — Steel in this section.

NOTE: When necessary to carry out weld-bonding procedures, refer to Weld-Bonding in this section.

1. Remove the outer body sheet metal from the affected area prior to carrying out any reinforcing panel replacement. For additional information, refer to Sectioning Guidelines in this section.

Printable View (66 KB)

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery cable nut	9	—	80
Body mount bolts to frame	55	41	—
Camshaft position (CMP) sensor bolts	10	—	89
Condenser-to-manifold and tube assembly nut	25	18	—
Frame mounted heat shield bolts	20	15	—
Front end sheet metal body mount bolts	80	59	—
Front skid plate bolts	40	30	—
Ground wire nut	12	9	—
No. 1 body mount bolt	103	76	—
No. 2 and 3 body mount bolts	80	59	—
No. 4 body mount nut	55	41	—
Parking brake cable-to-frame bolt	15	11	—
Rear storage compartment body mount nuts	80	59	—
Spare tire winch bolts	20	15	—
Spare tire heat shield bolts	25	18	—
Steering shaft bolt	25	18	—
Tow hook bolts	70	52	—
Trailer hitch lower mounting bolts	275	203	—
Trailer hitch side mounting bolts	175	129	—
Transfer case skid plate bolts	25	18	—
Transmission mount nuts	103	76	—
Transmission crossmember bolts	90	66	—

Frame and Body Mounting

Printable View (428 KB)

The frame is made up of 2 steel boxed side rails and crossmembers, which are welded to the 2 side rails. The transmission crossmember is bolted to the side rails. The side welded rails and crossmembers are not replaced separately.

The service kits available for the frame are the following:

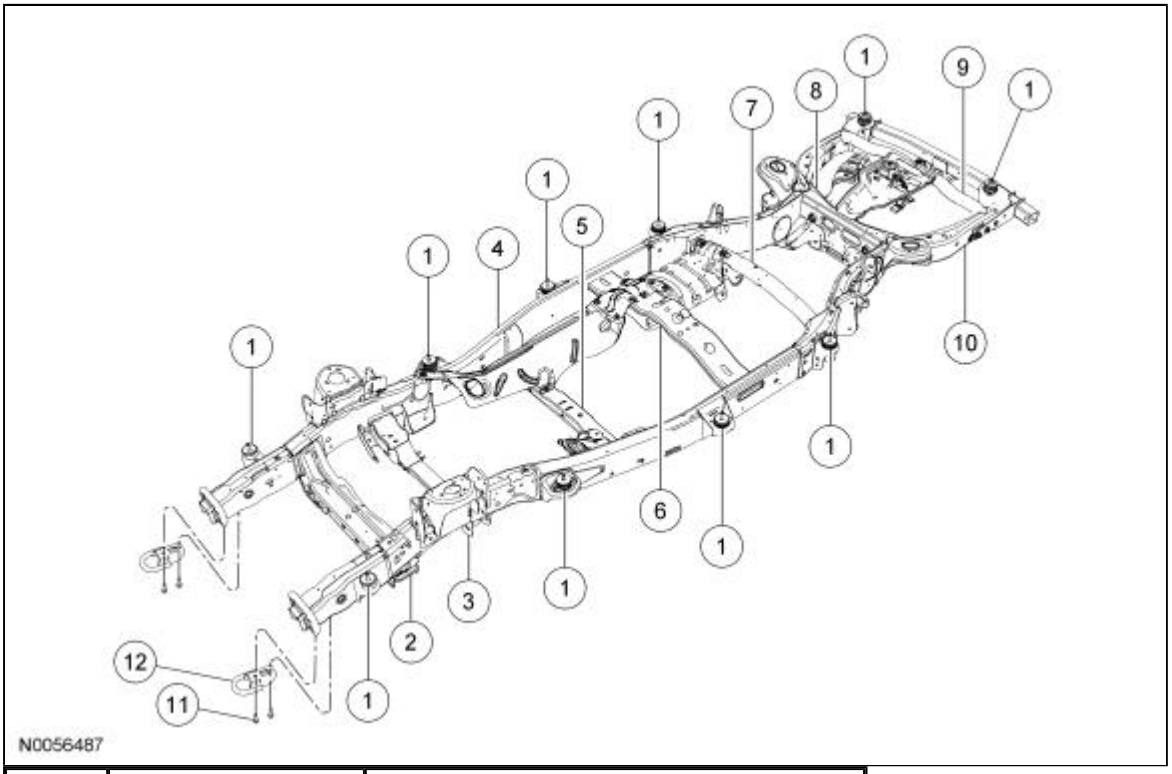
- RH front horn replacement kit
- LH front horn replacement kit
- Front bumper bracket replacement kit
- 1B crossmember replacement kit
- Transmission crossmember replacement kit

Refer to the instructions included in the kits for installation instructions.

Frame Mounted Heat Shields

All frame mounted heat shields, except the spare tire heat shield, are tightened to 20 Nm (15 lb-ft). The spare tire heat shield is tightened to 25 Nm (18 lb-ft).

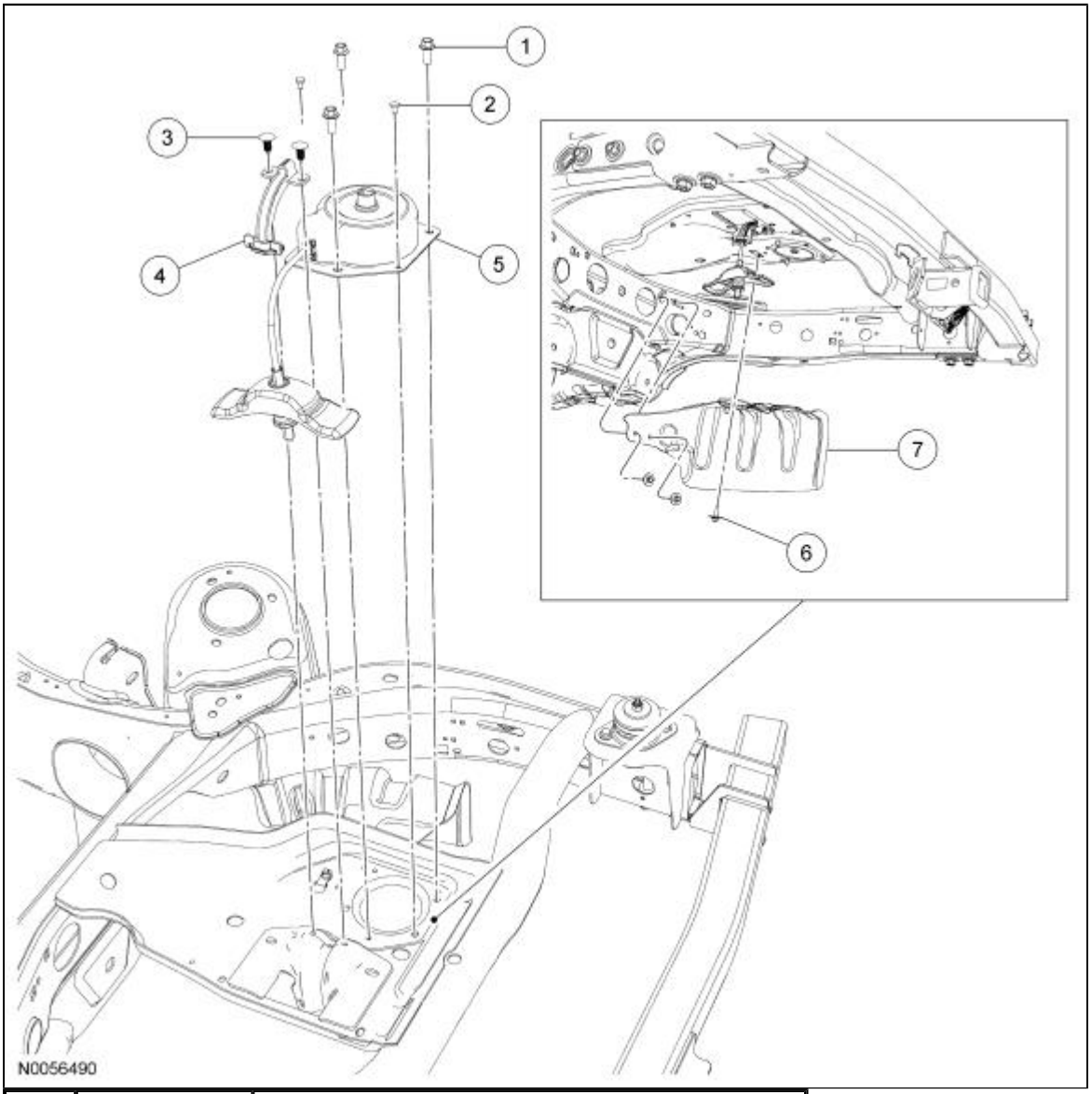
Frame Components



Item	Part Number	Description
1	—	Body to frame mounts
2	—	Front crossmember No. 1
3	—	1B crossmember

4	—	RH frame rail
5	—	Transmission crossmember
6	—	Crossmember No. 3
7	—	Crossmember No. 4
8	—	Crossmember No. 5
9	—	Crossmember No. 6
10	—	LH frame rail
11	—	Tow hook bolt (4 required)
12	—	Tow hook (2 required)

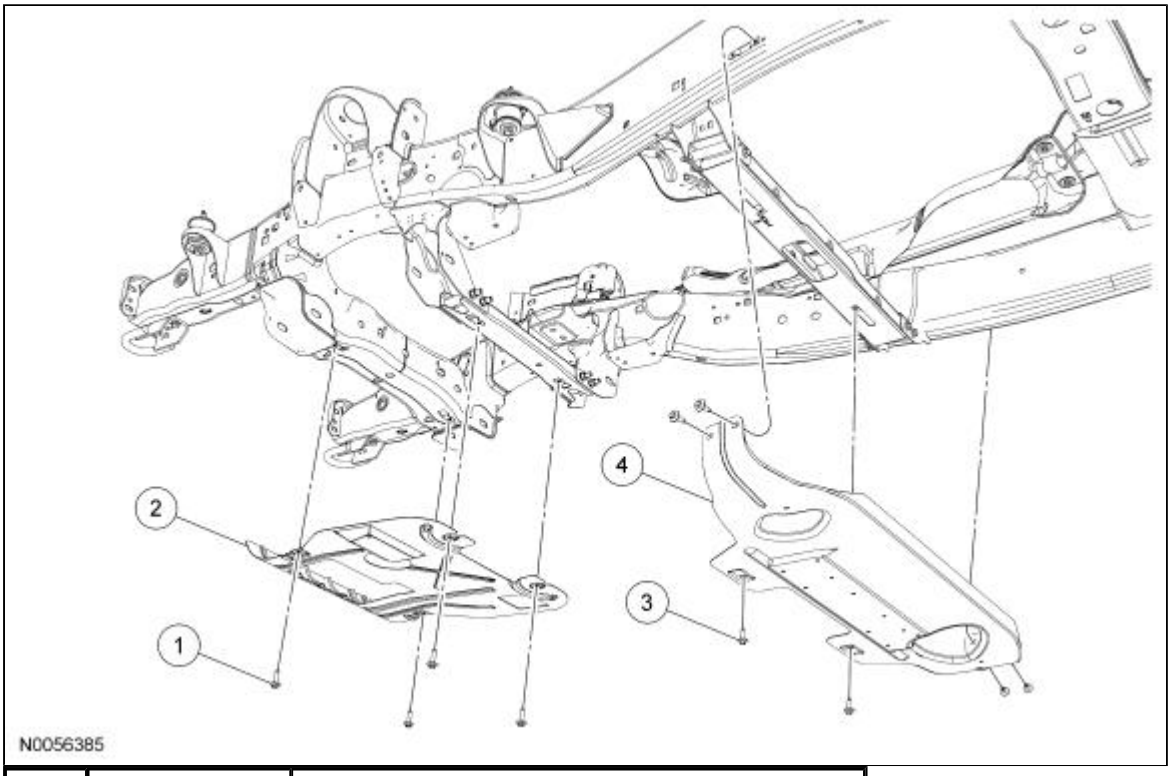
Spare Tire Winch



Item	Part Number	Description
1	W505263	Spare tire winch bolt (3 required)
2	—	Spare tire winch rivet (2 required)
3	—	Spare tire winch pushpin retainer (2 required)

4	—	Spare tire winch cable guide
5	1A131	Spare tire winch assembly
6	W712588	Spare tire heat shield bolt (3 required)
7	1A484	Spare tire heat shield

Skid Plates

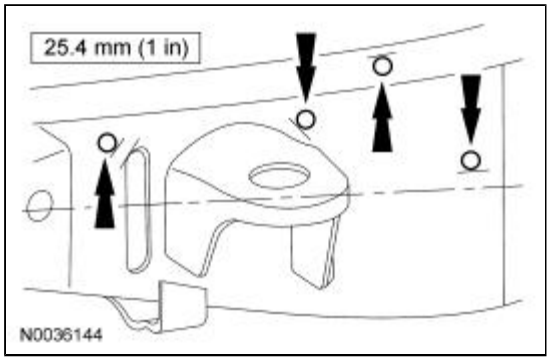


Item	Part Number	Description
1	—	Front skid plate bolt (4 required)
2	—	Front skid plate
3	—	Transfer case skid plate bolt (4 required)
4	—	Transfer case skid plate

Drilling Precautions

Printable View (78 KB)

1. If a hole must be drilled in the frame, make sure the hole meets the following requirements:
   - The hole is at least the specified distance from the edge of the nearest hole.
   - The edge of the drilled hole is at least the specified distance from the edge of the flange.
   - The drilled hole is at least the specified distance from any other existing bracket or component of the frame.



Welding Precautions

Printable View (63 KB)

1. If welding must be done on a frame, make sure the following requirements are met:
    - If the frame is attached to the vehicle, the battery ground cable must be disconnected before using any electrical welding equipment. For additional information, refer to Section 414-01 .
    - Do not use gas welding equipment.
    - Use a temperature-indicating crayon to make sure that the temperature does not exceed 750°C (1,400°F).
    - Install new spot-welded components by spot welding where possible. If spot welding is not possible, use puddle welding.

Frame Straightening

Printable View (79 KB)

1. **WARNING: Straightening of front frame rail convolute is prohibited. Failure to follow these instructions may result in personal injury.**

   When straightening the frame, make sure the following requirements are met:

   - **CAUTION: Reposition and/or shield any fuel lines, brake lines or wiring harness or component in the heated area.**

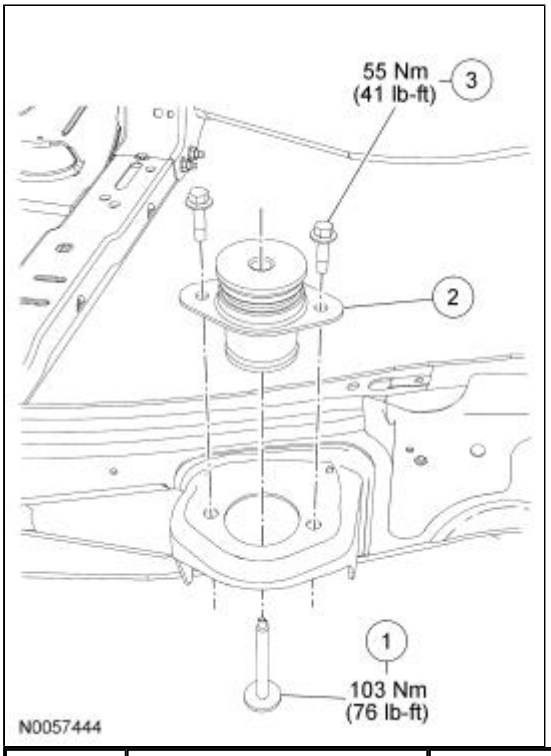
     If heat is needed to straighten a frame member, keep the temperature below 650°C (1,200°F) (a dull red glow). A temperature sensitive thermal melt crayon should be used to monitor heat buildup.
   - Heat should be kept to a minimum area so that the hardness of the metal will not be affected.
   - Straightening should only be attempted on frames that fail to meet specifications of the diagonal checking method or where damage is apparent.
   - Straightening should be limited to parts which are not severely bent.
   - Reposition and/or shield any fuel lines, brake lines or wiring harnesses or components in heated area.

Body Support — Number 1

Printable View (121 KB)

Removal and Installation

No. 1 Body Support Mount



Item	Part Number	Description
1	78001B39	Body mount bolt
2	7800192	Body support mount
3	W506433	Bolt (2 required)

1. Remove the body mount bolt.
   - To install, tighten to 103 Nm (76 lb-ft).

2. Loosen the remaining body mount bolts.

3. Raise the vehicle body enough to remove the body mount bolts and body mount.
   - To install, tighten to 55 Nm (41 lb-ft).

4. **NOTE:** No lubricants of any kind are to be used during body mount installation.

   NOTE: Do not reuse body mount fasteners. New fasteners must be installed for each fastener that has been removed or loosened.

   To install, reverse the removal procedure.

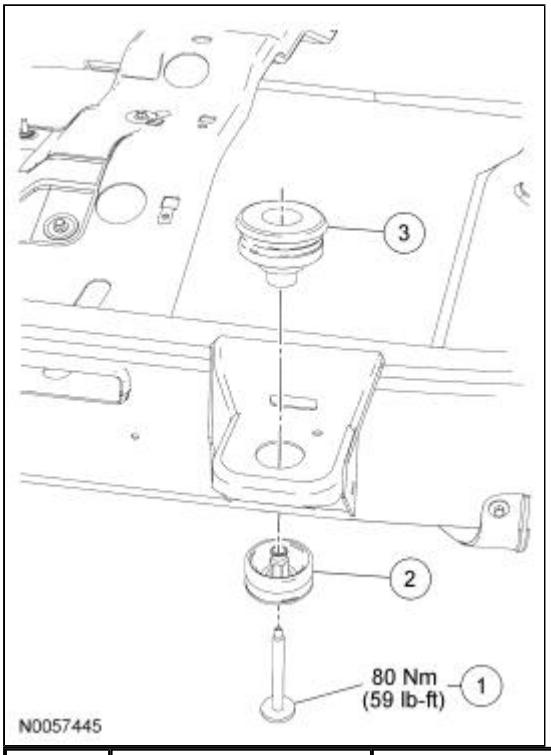
Body Support — Number 2 and Number 3

Printable View (115 KB)

Removal and Installation

No. 2 Body Support Mount

NOTE: No. 2 body mount is shown, body mount No. 3 similar.



Item	Part Number	Description
1	78001B39	Body support mount bolt
2	7800193	Lower body support mount
3	7800192	Upper body support mount

Upper and lower body support mount

1. Remove the body mount bolt and lower body mount.
    - To install, tighten to 80 Nm (59 lb-ft).

Upper body mount

2. Loosen the remaining body mount bolts.

3. Raise the vehicle body enough to remove the upper body mount.

Upper and lower body mount

4. **NOTE:** No lubricants of any kind are to be used during body mount installation.

NOTE: Do not reuse body mount fasteners. New fasteners must be installed for each fastener that has been removed or loosened.

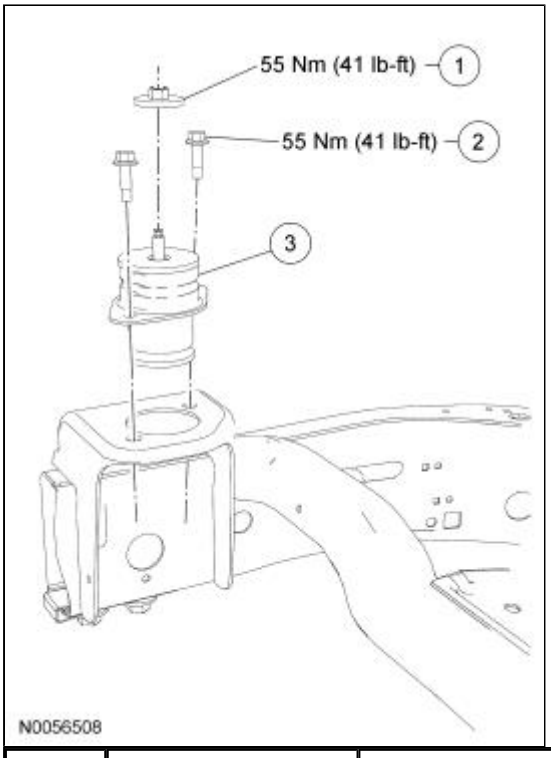
To install, reverse the removal procedure.

Body Support — Number 4

Printable View (147 KB)

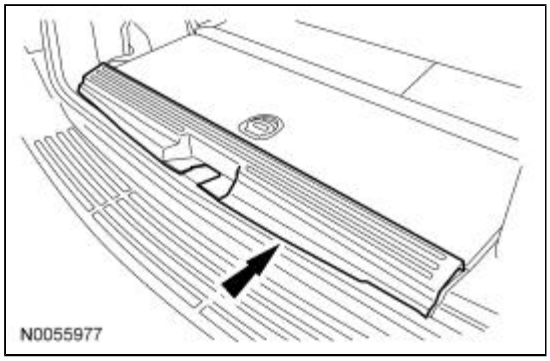
Removal and Installation

No. 4 Body Mount

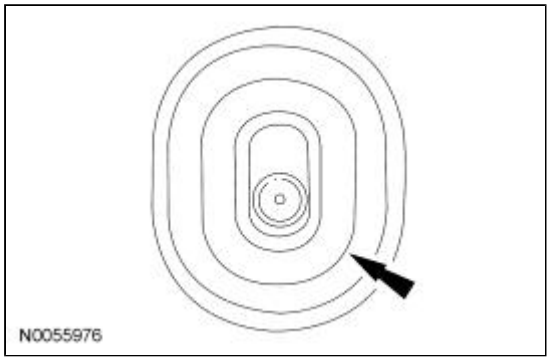


Item	Part Number	Description
1	W708109	Body mount nut and washer
2	W506433	Body mount bolt (2 required)
3	7800192	Body mount

1. Remove the liftgate scuff plate.



2. Remove the body mount bolt cover.



3. Remove the body mount nut.
    - To install, tighten to 55 Nm (41 lb-ft).

4. Loosen the remaining body mount bolts.

5. Raise the vehicle body enough to remove the body mount bolts.
    - To install, tighten to 55 Nm (41 lb-ft).

6. **NOTE:** No lubricants of any kind are to be used during body mount installation.

   NOTE: Do not reuse body mount fasteners. New fasteners must be installed for each fastener that has been removed or loosened.

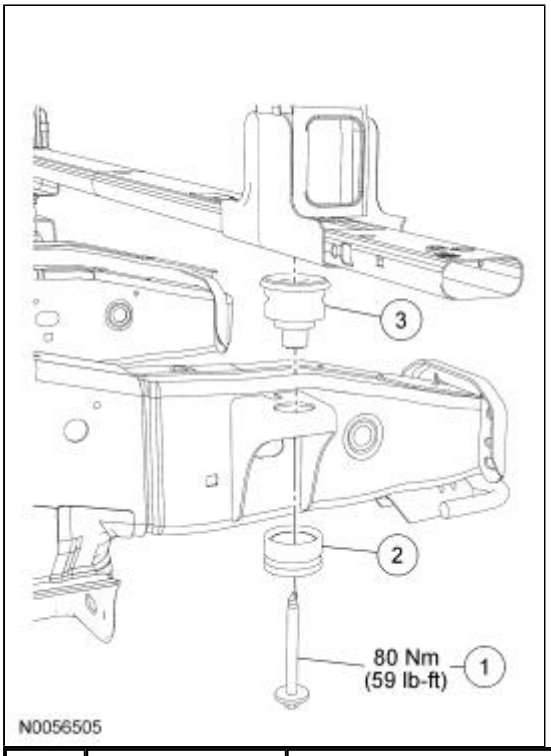
   To install, reverse the removal procedure.

Body Support — Front End Sheet Metal

Printable View (122 KB)

Removal and Installation

Front End Sheet Metal Body Mount



Item	Part Number	Description
1	78001B39	Radiator front end sheet metal mount bolt
2	7800193	Lower front end sheet metal body mount
3	7800192	Upper front end sheet metal body mount

Upper and lower body mount

1. Remove the lower front end sheet metal body mount.
    1. Remove the lower front end sheet metal body mount bolt.
    2. Remove the lower front end sheet metal body mount.
        - To install, tighten to 80 Nm (59 lb-ft).

Upper body mount

2. Loosen the remaining body mount bolts.

3. Raise the vehicle body enough to remove the upper front end sheet metal body mount.

Upper and lower body mount

4. **NOTE:** No lubricants of any kind are to be used during body mount installation.

NOTE: Do not reuse body mount fasteners. New fasteners must be installed for each fastener that has been removed or loosened.

To install, reverse the removal procedure.

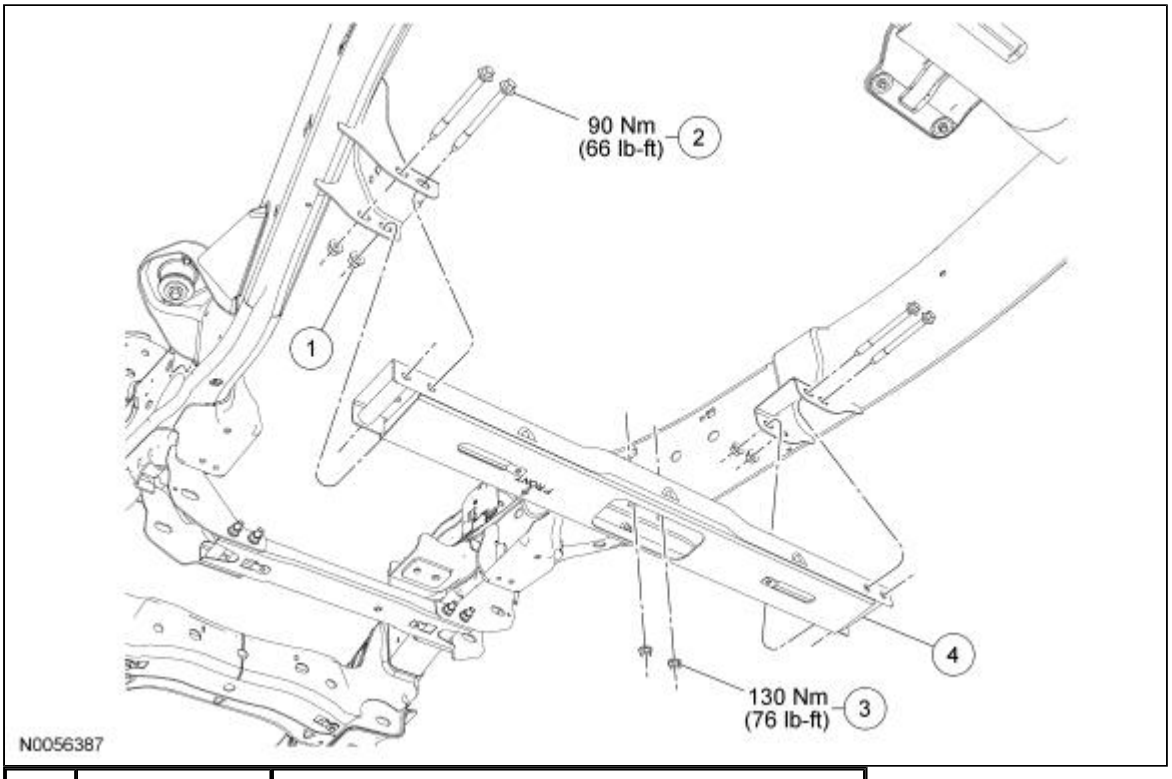
Transmission Support Crossmember

Printable View (235 KB)

Removal and Installation

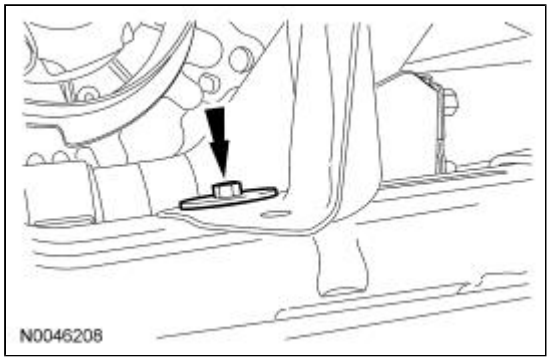
Transmission Support Crossmember - Exploded View

NOTE: Transmission not shown for clarity.

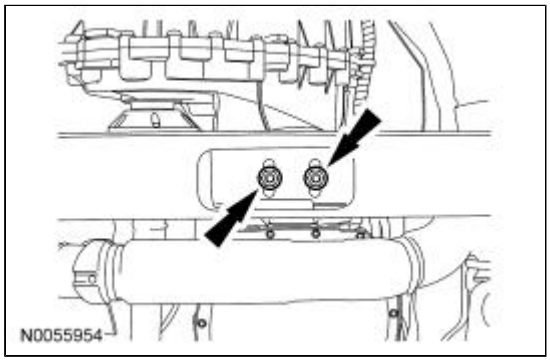


Item	Part Number	Description
1	W520114-S427	Transmission support crossmember nut (4 required)
2	W705049-S426	Transmission support crossmember bolt (4 required)
3	N621945-S301	Transmission mount nut (2 required)
4	5059	Transmission support crossmember

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If equipped, remove the skid plate fasteners and skid plate.
3. Remove the LH and RH exhaust heat shield-to-crossmember fasteners.



4. Remove the 2 transmission mount nuts.
    - To install, tighten to 103 Nm (76 lb-ft).

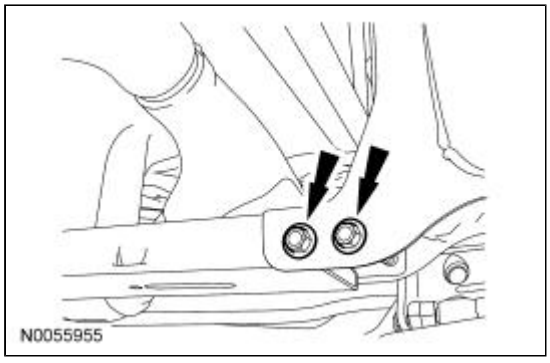


5. Support the transmission.

6. **NOTE:** Mark the transmission crossmember next to the edge of the frame bracket to make sure the crossmember is installed in the same position it was removed from.

   NOTE: The crossmember nuts are installed on the crossmember bolts facing the front of the vehicle.

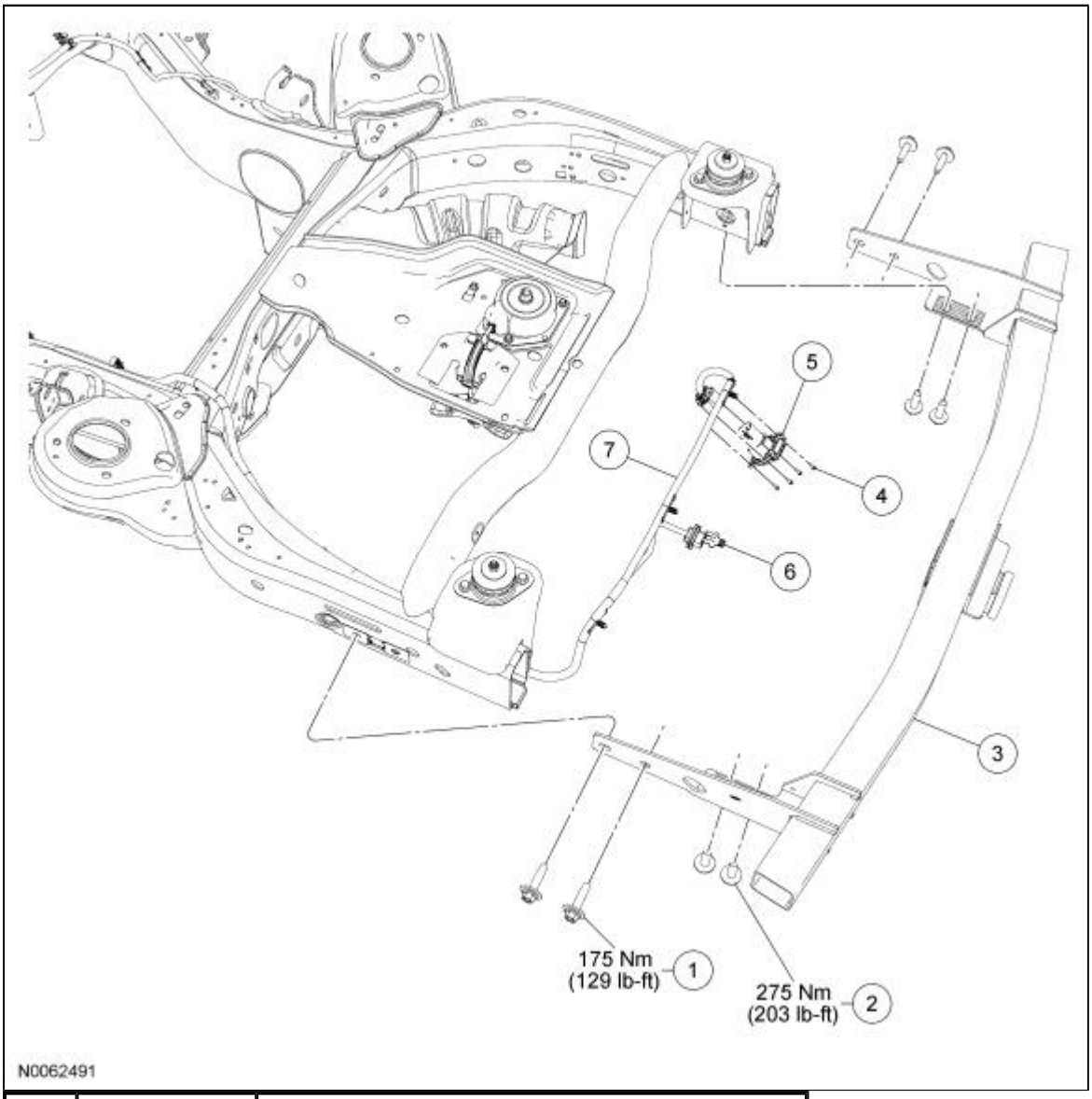
   Remove the 4 transmission crossmember bolts (2 each side) and the transmission crossmember.
    - To install, tighten to 90 Nm (66 lb-ft).



7. To install, reverse the removal procedure.

Trailer Hitch

Printable View (363 KB)



Item	Part Number	Description
1	W708795	Trailer hitch side mounting bolt (4 required)
2	W711408	Trailer hitch lower mounting bolt (4 required)
3	17775	Trailer hitch
4	N611038	Trailer hitch lighting plug bolt (4 required)
5	14489	Trailer hitch lighting socket
6	—	Trailer hitch electrical connector
7	—	Trailer hitch wiring harness

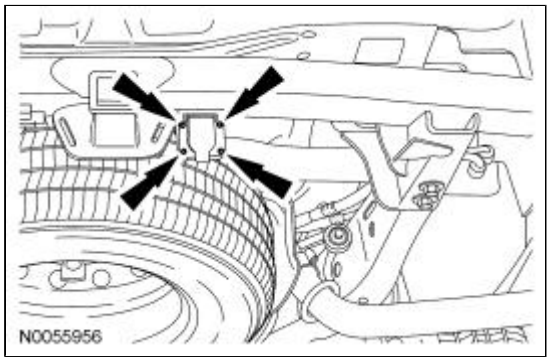
Removal and Installation

WARNING: Do not permanently remove the trailer hitch. Always reinstall the hitch before delivery of the vehicle to the customer. Failure to follow this warning could increase the risk of injury in a rear end collision.

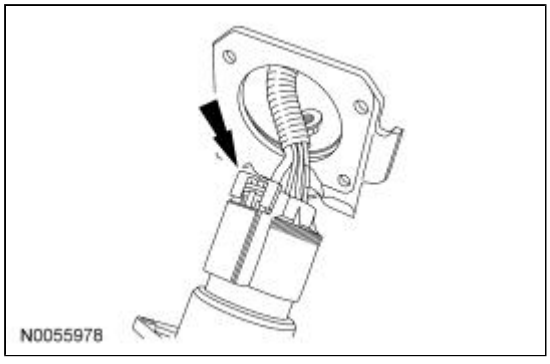
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the trailer hitch rear bumper cover trim panel, if equipped.

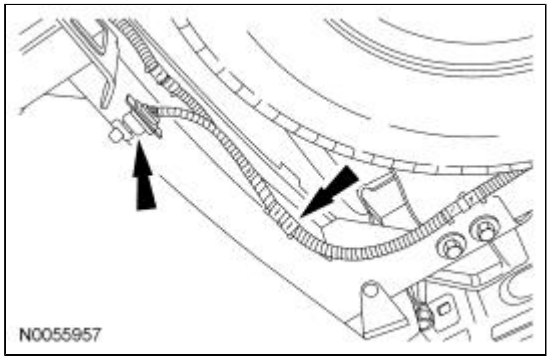
3. Remove the 4 trailer lighting plug cover bolts.



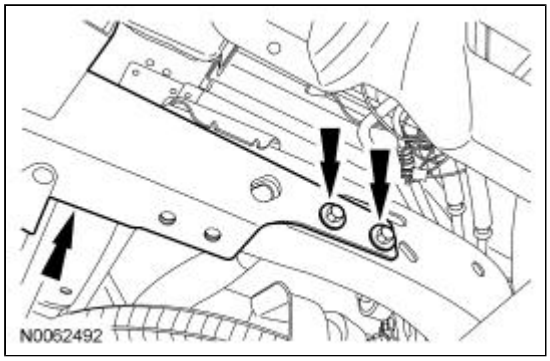
4. Remove the trailer lighting plug.
   - Position the plug away from the trailer hitch.
   - Disconnect the electrical connector.
   - Remove the trailer lighting plug.



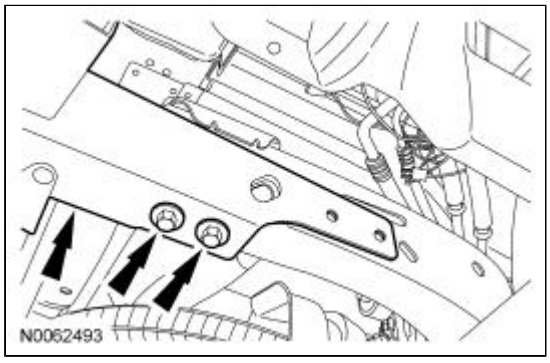
5. Remove the electrical connector from the trailer hitch and unclip the harness from the retainers on the frame.



6. Remove the 4 (2 each side) trailer hitch side mounting bolts.
   - To install, tighten to 175 Nm (129 lb-ft).



7. Remove the 4 (2 each side) trailer hitch lower mounting bolts and remove the trailer hitch.
    - To install, tighten to 275 Nm (203 lb-ft).



8. To install, reverse the removal procedure.

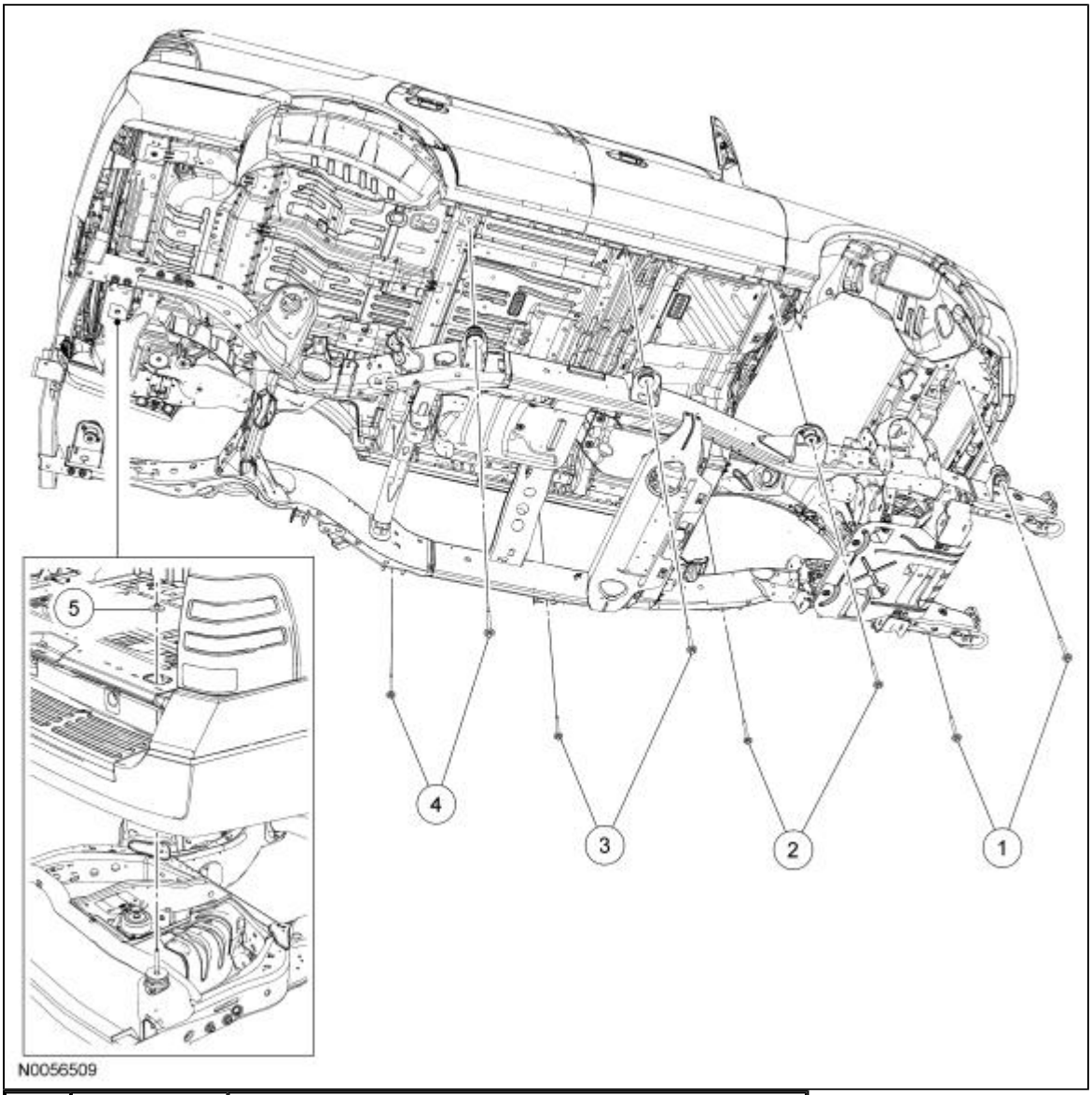
Body

Printable View (1733 KB)

Special Tool(s)

ST2591-A	Disconnect Tool, Transmission Cooler Lines 307-441
ST2670-A	Disconnect Tool, Transmission Cooler Lines 307-459

Body Off Mounting Locations



Item	Part Number	Description
1	—	Front end sheet metal (FESM) mounting bolt (2 required)
2	—	Body mount No. 1 mounting bolt (2 required)
3	—	Body mount No. 2 mounting bolt (2 required)
4	—	Body mount No. 3 mounting bolt (2 required)
5	—	Body mount No. 4 mounting bolt (2 required)

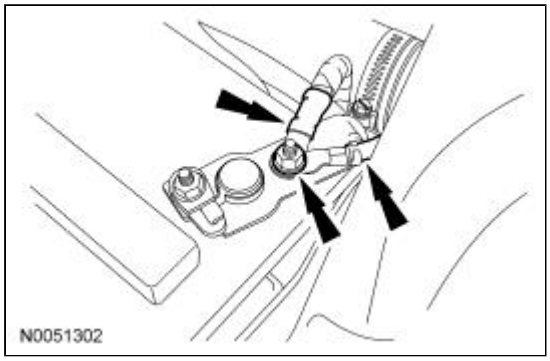
1. **NOTE:** A 2-post hoist must be used to lift the body from the chassis.

   Open the tail gate.

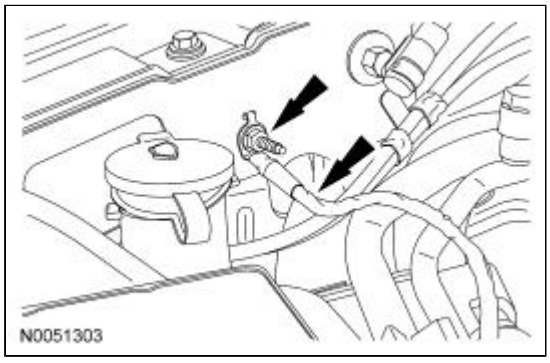
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Disconnect the battery cables. For additional information, refer to Section 414-01 .

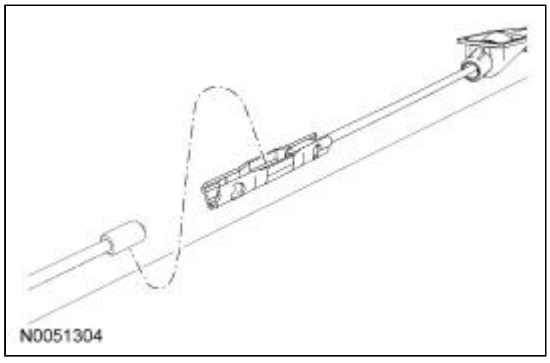
4. Remove the nut and separate the leads from the battery positive cable and position aside.
   - To install, tighten to 9 Nm (80 lb-in).



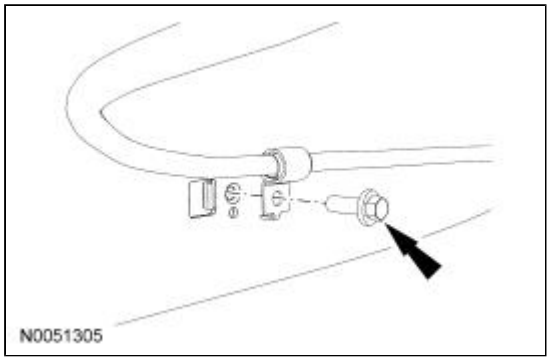
5. Remove the nut and the ground wire from the right fender.
    - To install, tighten to 12 Nm (9 lb-ft).



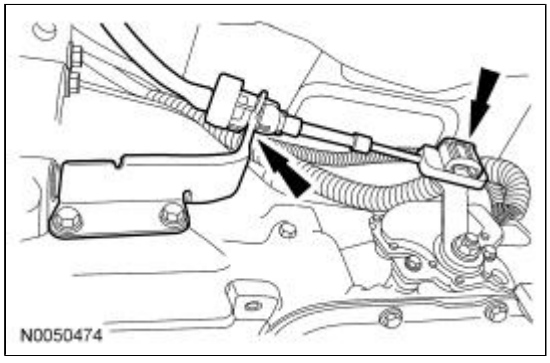
6. Remove the ground wire from the clip on the battery tray.
7. Recover the refrigerant. For additional information, refer to Section 412-00 .
8. Drain the engine coolant. For additional information, refer to Section 303-03 .
9. Remove the front bumper cover. For additional information, refer to Section 501-19 .
10. Remove the rear bumper cover. For additional information, refer to Section 501-19 .
11. Raise the vehicle.
12. Remove the running boards, if equipped. For additional information, refer to Section 501-08 .
13. Release the parking brake tension and disconnect the parking brake cable at the intermediate connection.



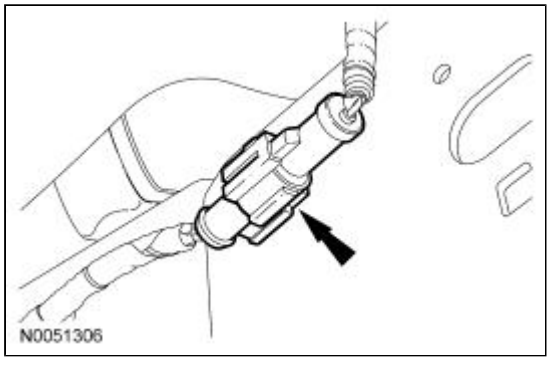
14. Remove the parking brake cable-to-frame bolt.
    - To install, tighten to 15 Nm (11 lb-ft).



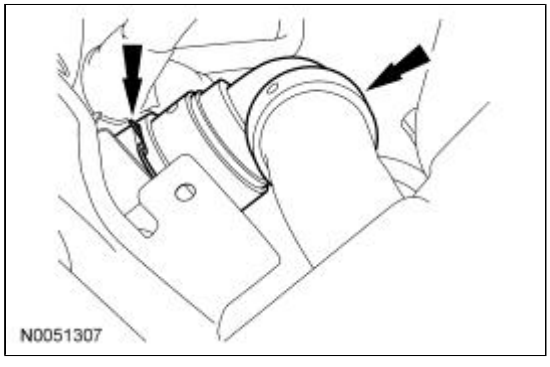
15. Disconnect the automatic transmission cable from the manual valve and retainer clip.



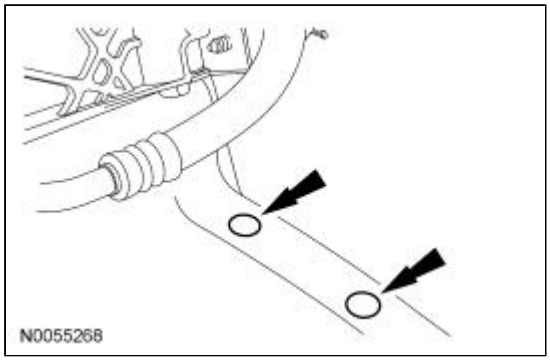
16. Disconnect the steering gear electrical connector and remove the connector from the frame.



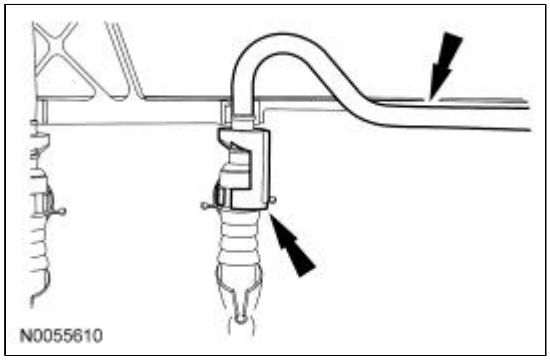
17. Remove the retaining ring and disconnect the lower radiator hose from the radiator.



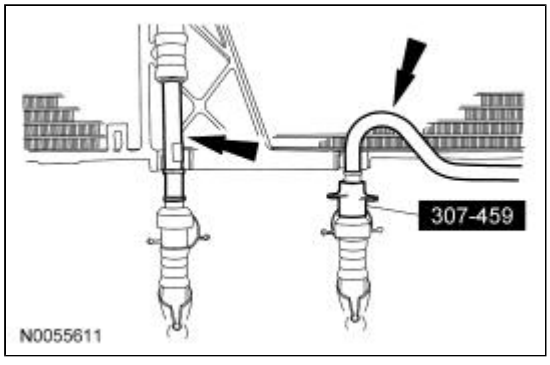
18. Remove the 4 pushpins (2 each side) from the frame-to- radiator air deflector.



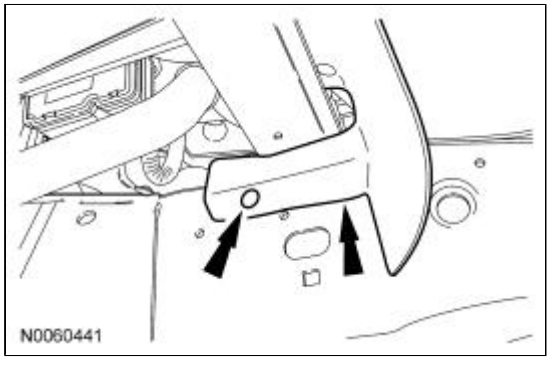
19. Remove the safety clips from the transmission cooler lines.



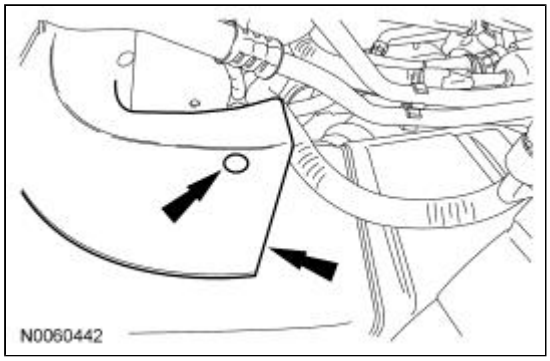
20. Using the special tool, disconnect the transmission cooler lines from the auxiliary cooler.



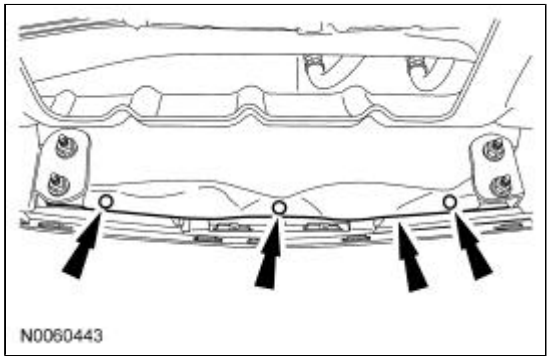
21. Remove the retainer from the splash shield on the front LH frame.



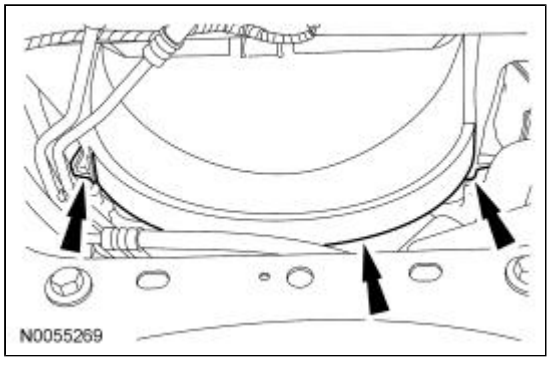
22. Remove the retainer from the splash shield on the front RH frame.



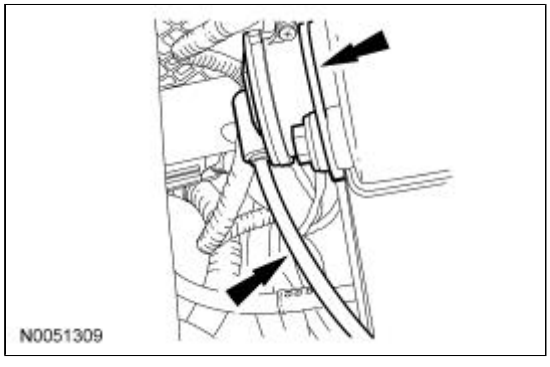
23. Remove the 3 retainers from the splash shield on the lower condenser.



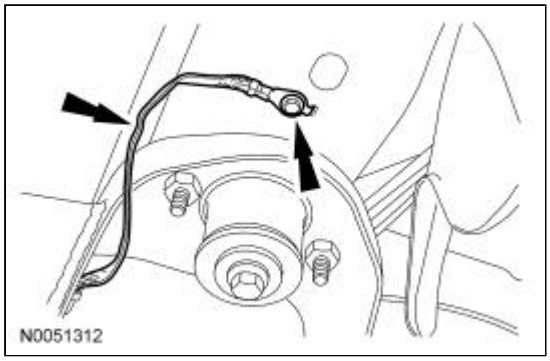
24. Release the fan shroud from the retainers and open the fan shroud.



25. If equipped, disconnect the air hose from the air suspension compressor.



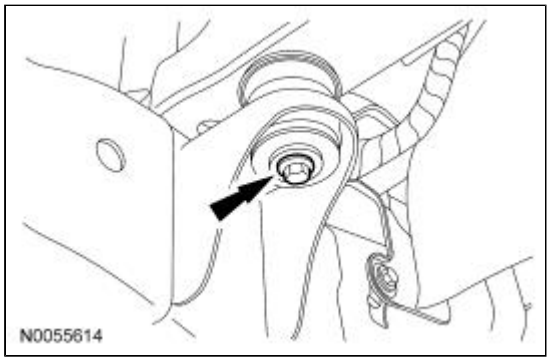
26. Remove the bolt and the ground wire from the body.



NOTE: Right front body bolt shown, all other bolts similar.

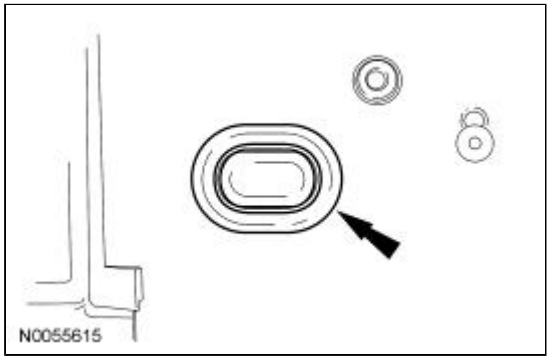
27. **NOTE:** Front end sheet metal body support bolt shown, all other bolts similar.

    Remove the 6 body mount bolts and 2 front end sheet metal body support bolts.
    - Discard the body bolts.
    - To install, tighten the front end sheet metal, body mount No. 2 and No. 3 to 80 Nm (59 lb-ft).
    - To install, tighten No. 1 body mount to 103 Nm (76 lb-ft).

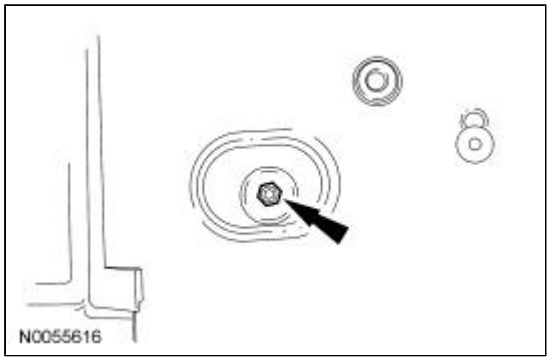


28. Lower the vehicle and chock the wheels to prevent the chassis from moving.

29. Remove the 2 bolt covers from the rear storage compartment.

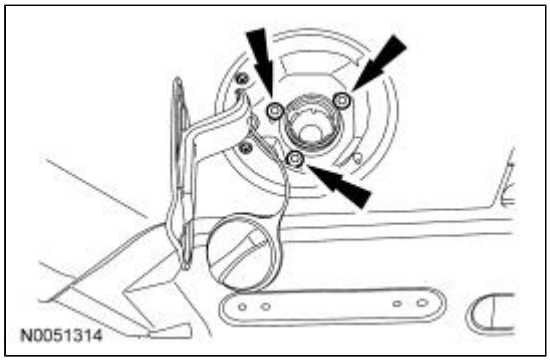


30. Remove the 2 rear body mount nuts from the rear storage compartment.
    - Discard the nuts.
    - To install, tighten to 80 Nm (59 lb-ft).



31. **CAUTION: The fuel tank filler pipe may become caught on the inside of the fender when lifting the vehicle. Make sure the fuel tank filler pipe is not binding when lifting the vehicle, or damage may occur.**

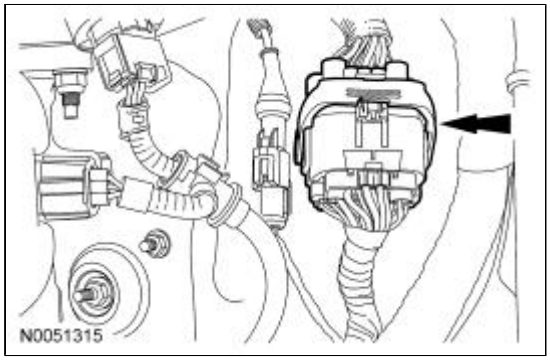
    Remove the 3 screws from the fuel tank filler pipe.



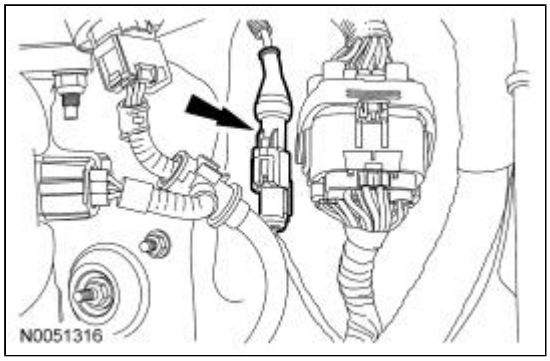
32. Remove the engine cover, if equipped.

33. Remove the air cleaner intake pipe. For additional information, refer to Section 303-12 .

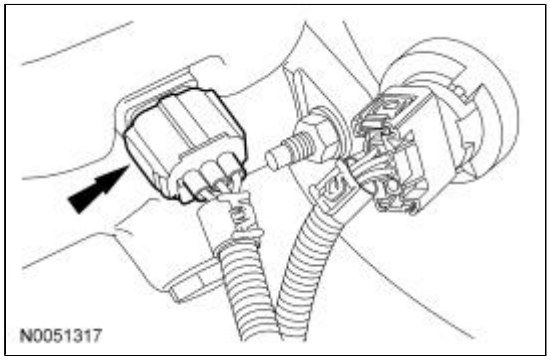
34. Disconnect the fuel bundle wiring harness connector and remove from the splash shield.



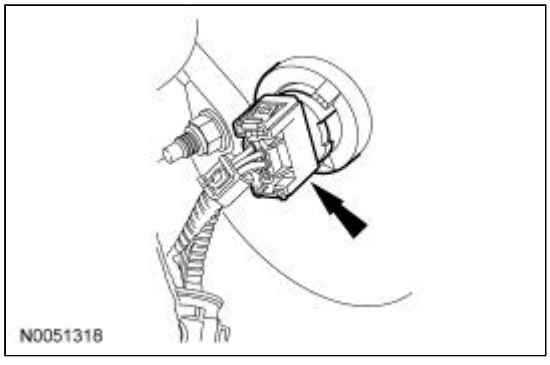
35. Disconnect the left anti-lock brake system (ABS) wheel speed sensor (WSS) connector.



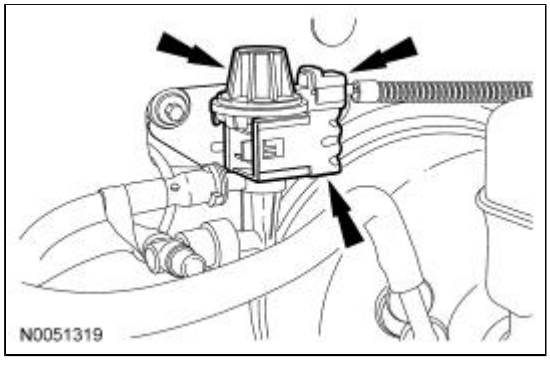
36. Disconnect the master cylinder electrical connector.



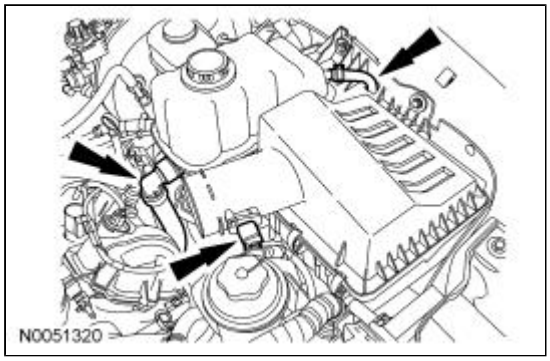
37. Disconnect the brake booster electrical connector.



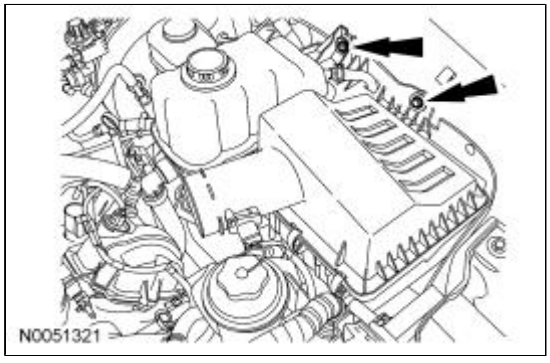
38. Disconnect the canister purge valve electrical connector and remove it from the bracket, position the canister aside.



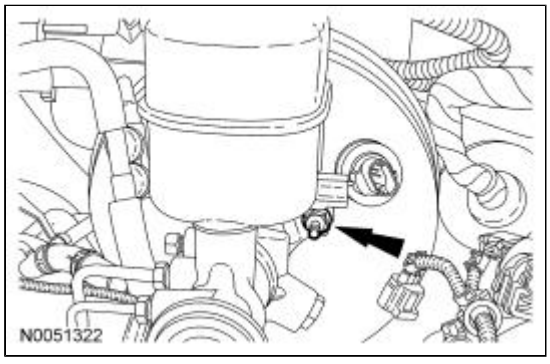
39. Disconnect the electrical connector and the 2 hoses from the degas bottle/air cleaner module.
    - Unclip the RH hose from the retainers on the side of the degas bottle/air cleaner module.



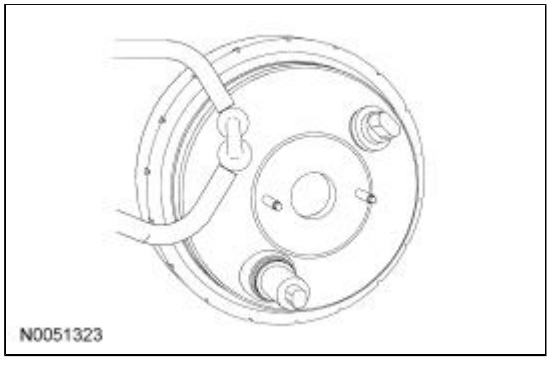
40. Remove the 2 bolts from the degas bottle/air cleaner module and remove the module.



41. Remove the 2 master cylinder nuts (1 each side) from the brake booster and secure the master cylinder to the engine.



42. Disconnect the brake booster vacuum supply hose and secure the hose to the engine.

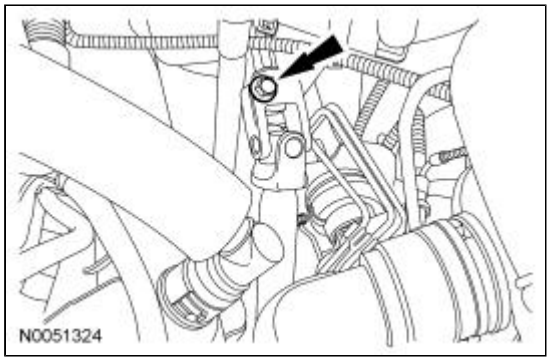


43. **NOTE:** Make sure that the vehicle wheels are straight.

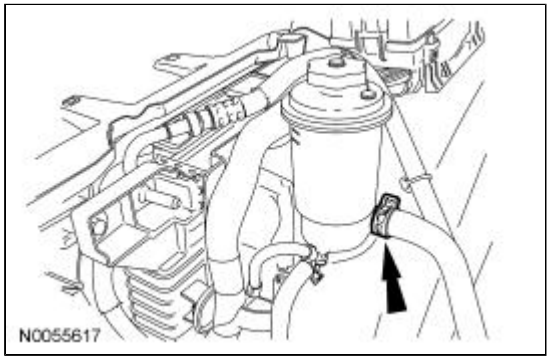
    Place the vehicle in PARK and remove the key.

44. **CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

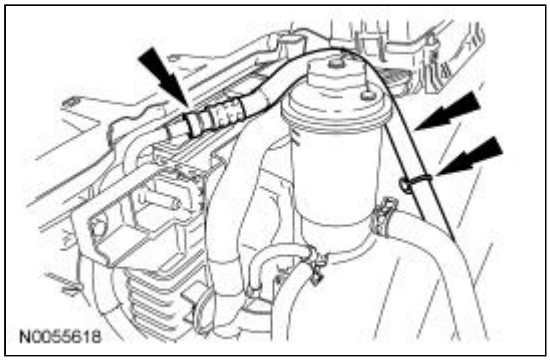
    Remove the steering shaft bolt at the joint between the intermediate and lower shafts and separate the shafts.
    - To install, refer to 25 Nm (18 lb-ft).



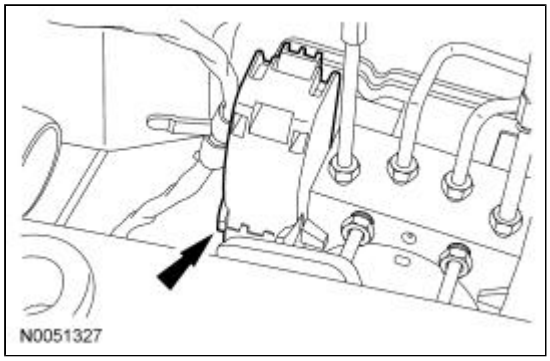
45. Disconnect the power steering reservoir-to-power steering pump hose.



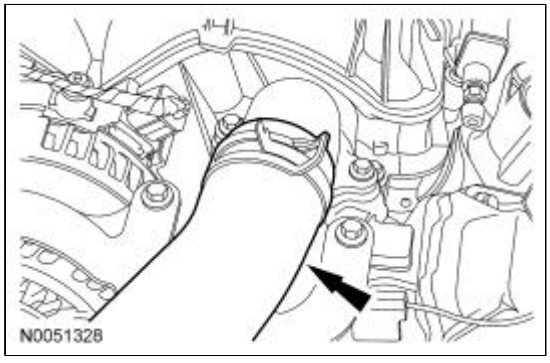
46. Disconnect the power steering pump-to-power steering cooler line quick connect.
    - Disconnect the hose from the retainer on the fan shroud.



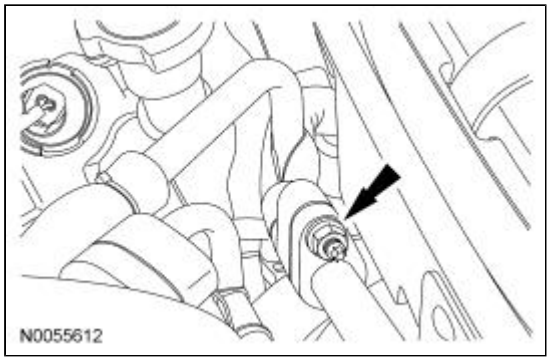
47. Disconnect the ABS module connector.



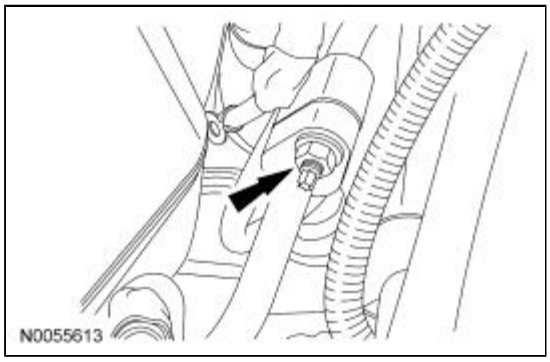
48. Disconnect the upper radiator hose from the engine.



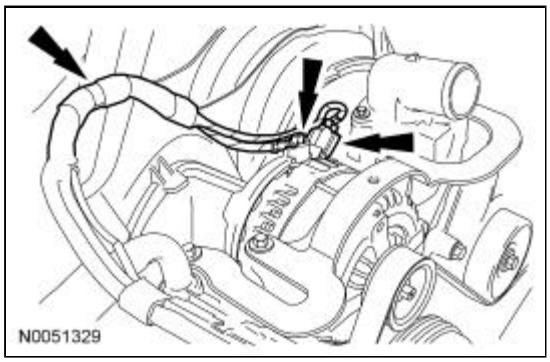
49. Remove the nut from the condenser-to-manifold and tube assembly and position aside.
    - Install new O-rings before installing the manifold and tube assembly.
        - To install, tighten to 25 Nm (18 lb-ft).



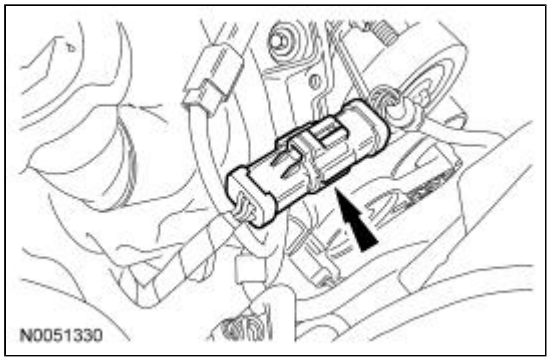
50. Remove the nut from the accumulator-to-manifold and tube assembly and position aside.
    - Install new O-rings before installing the manifold and tube assembly.
        - To install, tighten to 25 Nm (18 lb-ft).



51. Remove the nut and disconnect the electrical connector from the generator wiring harness and remove from the retainer.

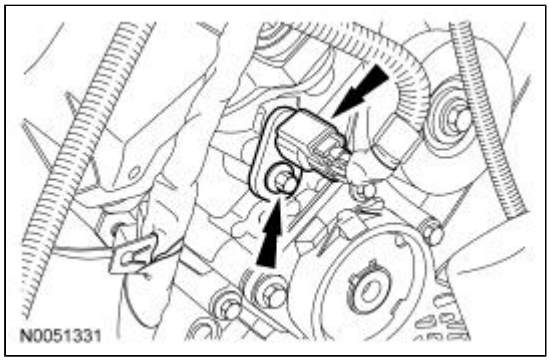


52. Disconnect the electrical connector from the electrical thermal connector on the front of the engine.

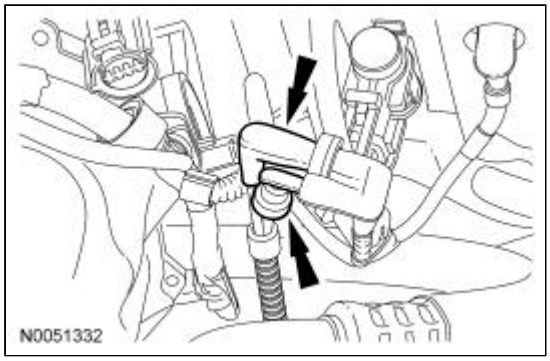


53. **NOTE:** RH shown, LH similar.

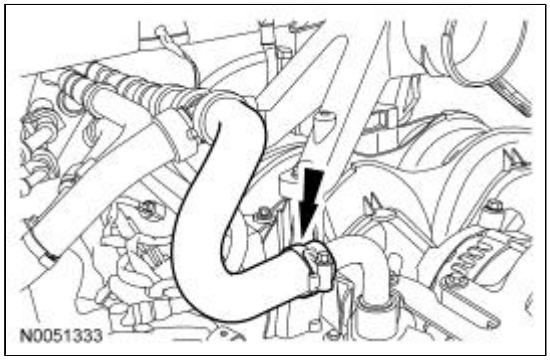
    Remove the bolts and the camshaft position (CMP) sensors (1 each side). Discard the O-ring seals.
    - To install, tighten to 10 Nm (89 lb-in).
    - Lubricate the O-ring seal with clean engine oil prior to installation.



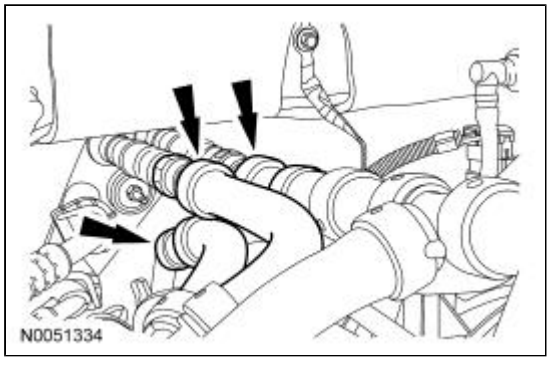
54. If equipped, disconnect the right vacuum lines for the four wheel drive (4WD) hub actuators.



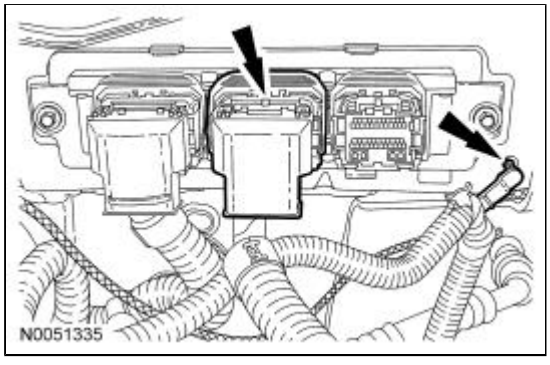
55. Disconnect the heater hose from the engine.



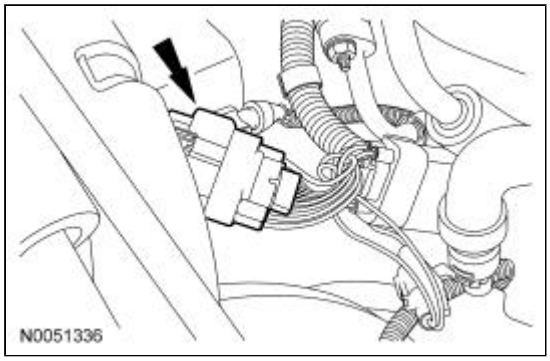
56. Disconnect the 3 heater hose quick disconnect fittings.



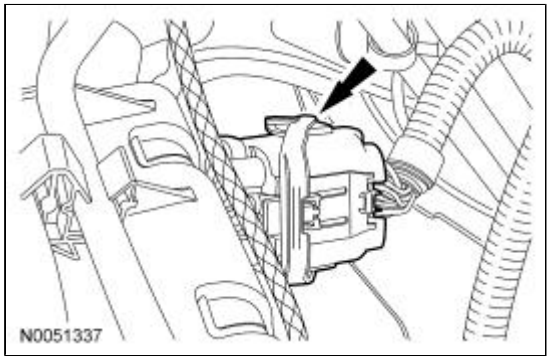
57. Disconnect the engine electrical connector from the powertrain control module (PCM) and remove the retainer from the bulkhead.



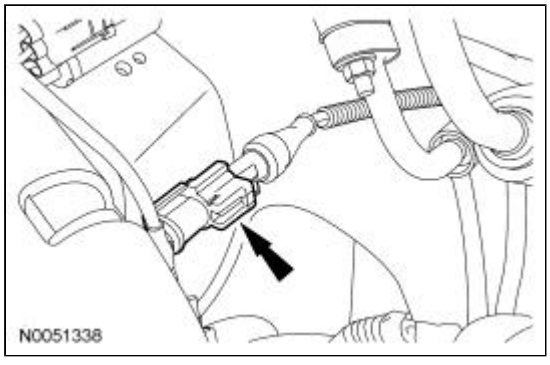
58. Disconnect the engine electrical connector from the wiring harness and position aside.



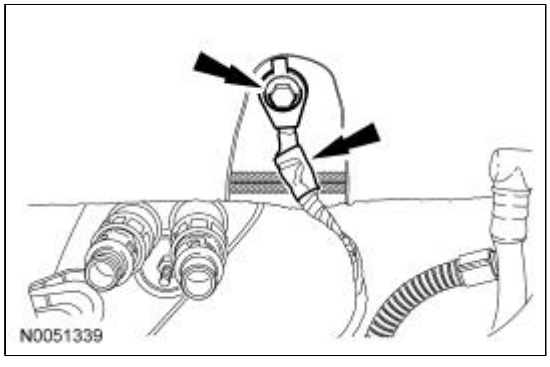
59. Disconnect the transmission electrical connector from the harness and the clip on the A/C line.



60. Disconnect the right side ABS wheel speed sensor (WSS) connector.



61. Remove the bolt and the ground wire from the front of the bulkhead.



62. **NOTE:** Marking the position of the tires will aid in aligning the cab to the chassis.

    Mark the position of the tires on the floor.

63. **NOTE:** A 2-post hoist must be used to lift the body from the chassis.

    Position the hoist lift pads, equally side-to-side, below the pinch welds at the furthest most possible front and rear positions.

64. **WARNING: The cab will become unstable once it is lifted from the frame. It will be necessary to secure the cab to the hoist with the appropriate straps so that the cab does not come off of the hoist. Failure to follow these instructions may result in personal injury.**

    CAUTION: An assistant will be necessary to make sure all the connections are disconnected and nothing interferes with the raising of the body while it is lifted.

    With the aid of an assistant lift the body from the chassis.

65. To install, reverse the removal procedure.
    - Align the tires to the marks on the floor.
    - Top off the fluids.

GENERAL INFORMATION

INTRODUCTION

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires, and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Components shown with a dashed line instead of a solid line indicate not all circuits are shown in this particular diagram (circuits shown in system diagrams are typically applicable to that system only). The remaining circuits connected to that component will be shown in the appropriate system that they apply to.

Today, the wiring diagram necessary to support a given repair procedure is included within that article or a link is provided to the appropriate SYSTEM WIRING DIAGRAM article. For example, the wiring diagram for a Ford EEC-IV system may be included in ENGINE PERFORMANCE and WIRING DIAGRAMS articles for Ford Motor Co. The wiring diagram for a cruise control system may be included in ACCESSORIES & EQUIPMENT section for the specific vehicle manufacturer, and the wiring diagram for an anti-lock brake system may be included in BRAKES and WIRING DIAGRAMS for the specific manufacturer.

WIRING DIAGRAMS contains all wiring diagrams not included in STARTING & CHARGING SYSTEMS and ACCESSORIES & EQUIPMENT. This includes: Data Link Connectors, Ground Distribution, Power Distribution, Engine Performance, Electric Cooling Fans, Anti-Lock Brakes, Electronic Suspension and Electronic Steering wiring diagrams. The Data Link Connectors wiring diagrams show the circuits by which the various on-board computers exchange information, and the diagnostic connectors used for diagnosis and their location. The Ground Distribution wiring diagrams show all vehicle ground points, their location, and the components common to those ground points. The Power Distribution wiring diagrams show the power feed circuits and the components common to those power feeds.

Wiring diagrams used to support the information in ACCESSORIES & EQUIPMENT are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Component locations are identified on the wiring diagrams. Any wires that do not connect directly to a component are identified on the diagram to indicate where they go.

WIRING DIAGRAM COLOR ABBREVIATIONS

COLOR ABBREVIATIONS

Color	Normal	Optional

Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbols are used on all wiring diagrams. The list below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

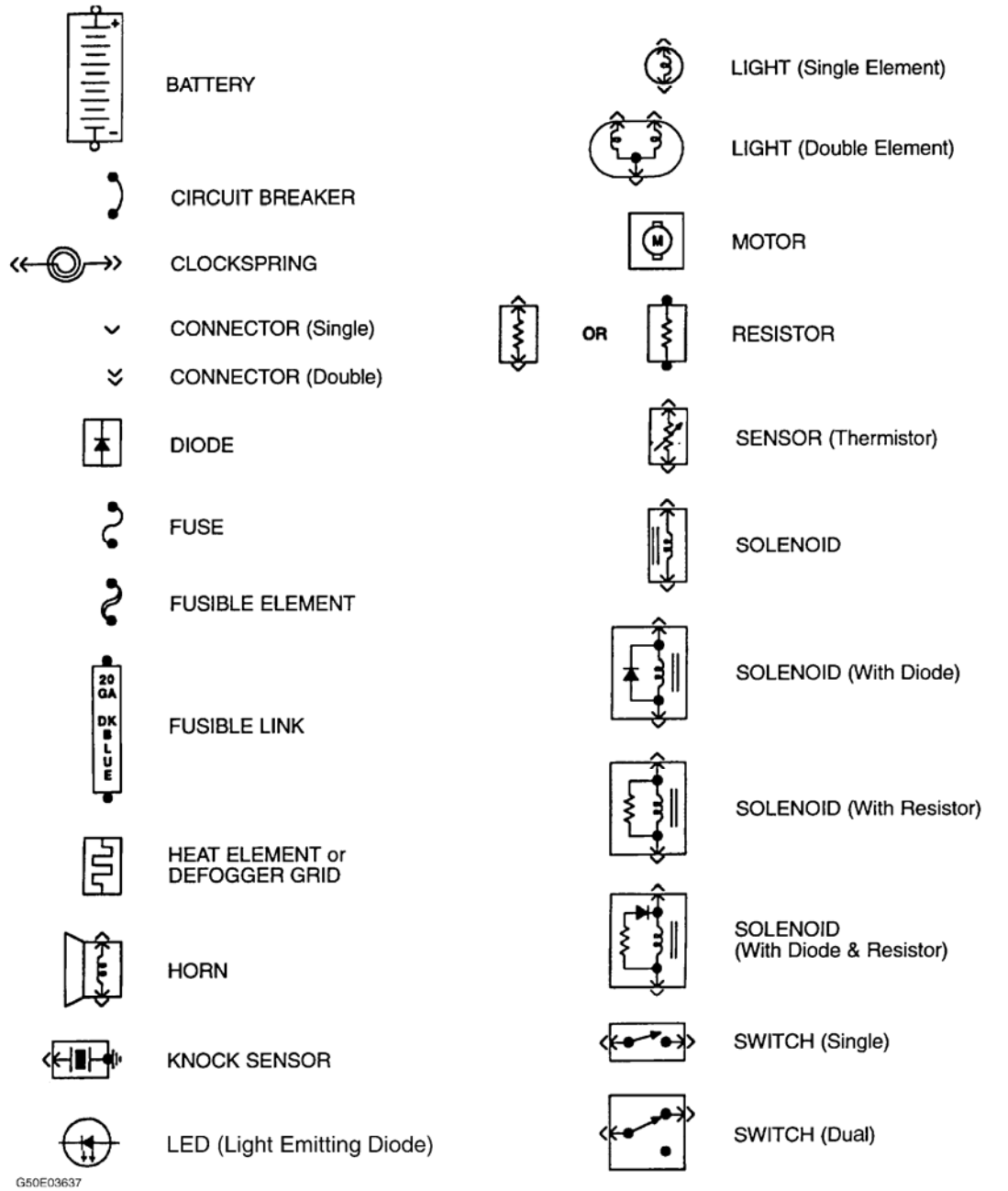
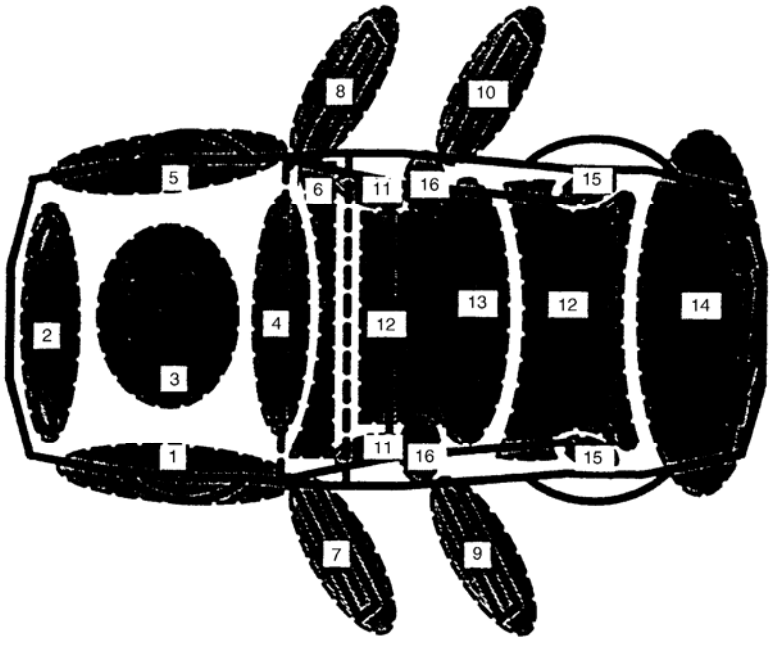


Fig. 1: Identifying Standard Wiring Diagram Symbols

WIRING DIAGRAM GROUND NUMBER LOCATIONS

NOTE: **The following illustration depicts standardized ground numbers and locations to be used in conjunction with wiring diagrams applying to 2001 and prior model years only. See Fig. 2 . Wiring diagrams applying to newer model years depict manufacturer-specified ground numbers and locations. Do not utilize the illustration with 2002 and newer**

model year wiring diagrams.



1) Left Fender
G100 ..... Front Of Fender
G102 ..... On Shock Tower
G104 ..... Rear Of Fender

2) Front of Vehicle
G106 ..... Behind Left Headlight
G107 ..... Behind Right Headlight
G108 ..... Left Radiator Support
G109 ..... Right Radiator Support

3) Engine
G110 ..... Left Front Of Engine
G111 ..... Left Front Behind Battery
G112 ..... Left Side Of Engine
G114 ..... Left Rear Of Engine
G115 ..... Rear Of Engine
G117 ..... Right Rear Of Engine
G119 ..... Right Front Of Engine
G120 ..... Right Side Of Engine
G125 ..... Front Of Engine
G127 ..... Left Underside Of Hood
G128 ..... Right Underside Of Hood
G129 ..... Top Center Of Transaxle

4) Safety Wall
G116 ..... Left Side Of Safety Wall
G121 ..... Center Of Safety Wall
G123 ..... Right Side Of Safety Wall

5) Right Fender
G101 ..... Front Of Fender
G103 ..... On Shock Tower
G105 ..... Rear Of Fender

6) Instrument Panel
G200 ..... Left Kick Panel
G201 ..... Right Side Of I/P
G202 ..... Left Side Of I/P
G203 ..... Right Kick Panel
G204 ... Left Rear Of Steering Support
G205 .. Right Rear Of Steering Support
G206 ..... Center Of I/P
G207 ..... Top Of Steering Column

7) Left Front Door
G500 ..... Left Front Door

8) Right Front Door
G600 ..... Right Front Door

9) Left Rear Door
G700 ..... Left Rear Door

10) Right Rear Door
G800 ..... Right Rear Door

11) "A" Pillars
G900 ..... Left "A" Pillar
G901 ..... Right "A" Pillar

12) Passenger Compartment
G300 ..... Below Left Front Seat
G301 ..... Below Right Front Seat
G302 ..... Below Center Console
G303 ..... Below Right Rear Seat
G304 ..... Below Left Rear Seat
G306 ..... Below Center Of Rear Seat
G307 ..... Below Right Rear Window
G309 ..... Left Front Door Sill
G310 ..... Behind Right Rear Seat
G311 ..... Center Of Rear Shelf
G312 ..... Behind Left Rear Seat

13) Roof
G902 ..... Left Front Of Roof
G903 ..... Right Front Of Roof
G906 ..... Left Rear Of Roof
G907 ..... Right Rear Of Roof
G908 ..... Center Front Of Roof
G909 ..... Center Rear Of Roof

14) Rear Of Vehicle
G400 ..... Left Front Side Of Trunk
G401 ..... Right Front Side Of Trunk
G402 ..... Left Rear Wheelwell
G403 ..... Right Rear Wheelwell
G404 ..... Left Rear Side Of Trunk
G405 ..... Right Rear Side Of Trunk
G406 ..... Center Rear Of Trunk Lid
G407 ..... Center Rear Of Trunk
G408 ..... Center Front Of Trunk
G409 ..... Rear Of Cargo Bed

15) "C" Pillars
G904 ..... Left "C" Pillar
G905 ..... Right "C" Pillar

16) "B" Pillars
G305 ..... Right "B" Pillar
G308 ..... Left "B" Pillar

G00027307

Fig. 2: Ground Numbers & Locations (2001 & Prior Model Years)

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes; Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System; Starters
Autolamp Control Relay	Headlight Systems; Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance; Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights; Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer; Anti-Theft System; Daytime Running Lights; Engine Performance; Headlight Systems; Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels
Brake On/Off (BOO) Switch	Cruise Control Systems; Engine Performance; Shift Interlock Systems
Buzzer Module	Warning Systems

Camshaft Position (CMP) Sensor	Engine Performance
Central Control Module	Anti-Theft System
Clockspring	Air Bag Restraint System; Cruise Control Systems; Steering Column Switches
Clutch Pedal Position Switch	Starters
Clutch Start Switch	Starters
Combination Meter	Analog Instrument Panels
Constant Control Relay Module (CCRM)	Engine Performance; Electric Cooling Fans
Convenience Center	Power Distribution; Illumination/Interior Lights
Convertible Top Motor	Power Convertible Top
Convertible Top Switch	Power Convertible Top
Crankshaft Position (CKP) Sensor	Engine Performance
Cruise Control Module	Cruise Control Systems
Cruise Control Switch	Cruise Control Systems
Condenser Fan Relay(s)	Electric Cooling Fans
Data Link Connector (DLC)	Engine Performance
Daytime Running Lights Module	Daytime Running Lights; Exterior Lights
Defogger Relay	Rear Window Defogger
Diagnostic Energy Reserve Module (DERM)	Air Bag Restraint System
Discriminating Sensor (Air Bag)	Air Bag Restraint System
Distributor	Engine Performance
Door Lock Actuators	Power Door Locks; Remote Keyless Entry
Door Lock Relay(s)	Power Door Locks
Electrochromic Mirror	Power Mirrors
Electronic Level Control (ELC) Height Sensor	Electronic Suspension
Electronic Level Control (ELC) Module	Electronic Suspension
Engine Coolant Temperature (ECT) Sending Unit	Analog Instrument Panels
Engine Coolant Temperature (ECT) Sensor	Engine Performance
Engine Control Module	Engine Performance; Generators & Regulators; Starters
ETACS ECU	Warning Systems; Power Windows; Remote Keyless Entry
Evaporative (EVAP) Emissions Canister	Engine Performance
EVAP Canister Purge Solenoid	Engine Performance
EVAP Canister Vent Solenoid	Engine Performance
Exhaust Gas Recirculation (EGR) Valve	Engine Performance
Fuel Tank Vacuum Sensor	Engine Performance
Fog Lights	Headlight Systems; Daytime Running Lights
Fog Light Relay	Headlight Systems; Daytime Running Lights
Fuel Door Release Solenoid	Power Fuel Door Release
Fuel Gauge Sending Unit	Analog Instrument Panels
Fuel Injectors	Engine Performance
Fuel Pump	Engine Performance
Fuel Pump Relay	Engine Performance; Power Distribution

Fuse/Relay Block	Power Distribution
Fusible Links	Power Distribution; Generators & Regulators; Starters
Generator	Generators & Regulators; Engine Performance; Power Distribution
Generic Electronic Module (GEM)	Body Control Modules; Electronic Suspension
Glow Plug Relay	Engine Performance
Glow Plugs	Engine Performance
Grounds	Ground Distribution
Headlight Door Module	Headlight Doors
Headlight Relay	Headlight Systems; Daytime Running Lights
Headlights	Headlight Systems; Daytime Running Lights
Heated Oxygen Sensor(s) (HO2S)	Engine Performance
Heated Windshield Control Module	Heated Windshields
Height Sensor	Electronic Suspension
Horns	Steering Column Switches
Horn Relay	Steering Column Switches
Idle Air Control (IAC) Motor/Valve	Engine Performance
Ignition Coil(s)	Engine Performance
Ignition Key Lock Cylinder	Anti-Theft System
Ignition Module	Engine Performance
Ignition Switch	Power Distribution; Engine Performance; Generators & Regulators; Starters
Illuminated Entry Module	Illumination/Interior Lights
Illumination Lights	Illumination/Interior Lights
Impact Sensor	Air Bag Restraint System
Inertia Fuel Shutoff Switch	Engine Performance
Inhibit Relay	Starters
Instrument Cluster	Analog Instrument Panels
Intake Air Temperature (IAT) Sensor	Engine Performance
Interior Lights	Illumination/Interior Lights
Interlock Switch	Starters
Junction Block	Power Distribution
Keyless Entry Receiver	Remote Keyless Entry
Key Reminder Switch	Starters
Knock Sensor	Engine Performance
Lamp Control Module	Exterior Lights
License Plate Lamp	Exterior Lights
Lighting Control Module	Lighting Control Modules; Anti-Theft System; Daytime Running Lights; Headlight Systems
Lower Relay	Power Convertible Top
Malfunction Indicator Light (MIL)	Engine Performance; Instrument Panels
Manifold Absolute Pressure (MAP) Sensor	Engine Performance
Mass Airflow (MAF) Sensor	Engine Performance

Mega Fuse	Generators & Regulators
Memory Seat/Mirror Module	Memory Systems
Mirror Defogger	Rear Window Defogger
Moon Roof Motor	Power Moon Roof
Moon Roof Relay	Power Moon Roof
Multi-Function Control Module	Warning Systems
Neutral Safety Switch	Starters
Oil Level Switch	Engine Performance
Oil Pressure Switch/Sending Unit	Analog Instrument Panels; Engine Performance
Overhead Console	Overhead Console
Oxygen Sensor(s) (O2S)	Engine Performance
Parking Brake Switch	Analog Instrument Panels
Park Lights	Exterior Lights
Park/Neutral Position Switch	Starters; Engine Performance; Anti-Theft System; Body Control Module
Perimeter Lighting Control Relay	Exterior Lights
Power Amplifier	Power Antennas
Power Antenna Module	Power Antennas
Power Antenna Motor	Power Antennas
Power Distribution Center	Power Distribution; Generators & Regulators; Starters
Power Door Lock Motors	Power Door Locks
Power Mirror Motors	Power Mirrors; Memory Systems
Power Sliding Door Controller	Power Sliding Side Door
Power Seat Motors	Power Seats; Memory Systems
Power Steering Pressure Switch	Engine Performance
Power Top Motor	Power Convertible Top
Power Top Relay(s)	Power Convertible Top
Powertrain Control Module	Engine Performance; Analog Instrument Panels; Cruise Control Systems; Data Link Connectors; Generators & Regulators; Starters
Power Window Motors	Power Windows
Power Window Relay(s)	Power Windows
Radiator Fan Motor(s)	Electric Cooling Fans
Radiator Fan Relay(s)	Engine Performance; Electric Cooling Fans;
Rainsense Module	Wiper/Washer Systems
Raise Relay	Power Convertible Top
Remote Anti-Theft Personality (RAP) Module	Anti-Theft System; Starters; Warning Systems
Seat Belt Pretensioners	Air Bag Restraint System
Seat Belt Retractor Solenoid	Passive Restraints
Seat Belt Switch	Air Bag Restraint System; Passive Restraints
Shift Interlock Solenoid	Shift Interlock Systems
Shift Lock Actuator	Shift Interlock Systems
Side Marker Lights	Exterior Lights

SIR Coil Assembly (Clockspring)	Air Bag Restraint System
Slip Ring (Clockspring)	Air Bag Restraint System; Steering Column Switches
SRS Control Module	Air Bag Restraint System
Starter Motor	Starters
Starter Interrupt Relay	Starters
Starter Solenoid	Starters
Starter Relay	Starters
Steering Wheel Position Sensor	Anti-Lock Brakes
Stoplights	Exterior Lights
Stoplight Switch	Engine Performance; Cruise Control Systems; Anti-Lock Brakes
Sun Roof ECU	Power Sun Roof
Sun Roof Motor	Power Sun Roof
Sun Roof Position Sensor	Power Sun Roof
Taillights	Exterior Lights
Throttle Position (TP) Sensor	Engine Performance
Torque Converter Clutch Solenoid/Switch	Engine Performance
Traction Control Switch	Anti-Lock Brakes
Trailer Tow Connector	Exterior Lights
Trailer Tow Relay	Exterior Lights
Transmission/Transaxle	Engine Performance
Transmission Control Module (TCM)	Engine Performance; Starters
Transmission Range Sensor	Starters; Back-Up Lights; Engine Performance
Transmission Range Switch	Back-Up Lights; Engine Performance; Anti-Theft System
Turn Signal Flasher	Exterior Lights
Turn Signal Lights	Exterior Lights
Twilight Sentinel Switch	Headlight Systems; Daytime Running Lights
Vapor Canister Leak Detection Pump	Engine Performance
Vehicle Control Module (VCM)	Engine Performance
Vehicle Dynamic Module	Electronic Suspension
Vehicle Speed Control Servo	Cruise Control Systems
Vehicle Speed Sensor	Data Link Connectors; Analog Instrument Panels; Cruise Control Systems; Electronic Suspension
Voltage Regulator	Generators & Regulators
Water-In-Fuel Sensor	Engine Performance; Analog Instrument Panels
Wheel Speed Sensors	Anti-Lock Brakes
Window Timer Module	Power Convertible Top
Windshield Intermittent Wiper Relay	Wiper/Washer Systems
Windshield Washer Motor	Wiper/Washer Systems
Wiper Motor	Wiper/Washer Systems

AIR CONDITIONING

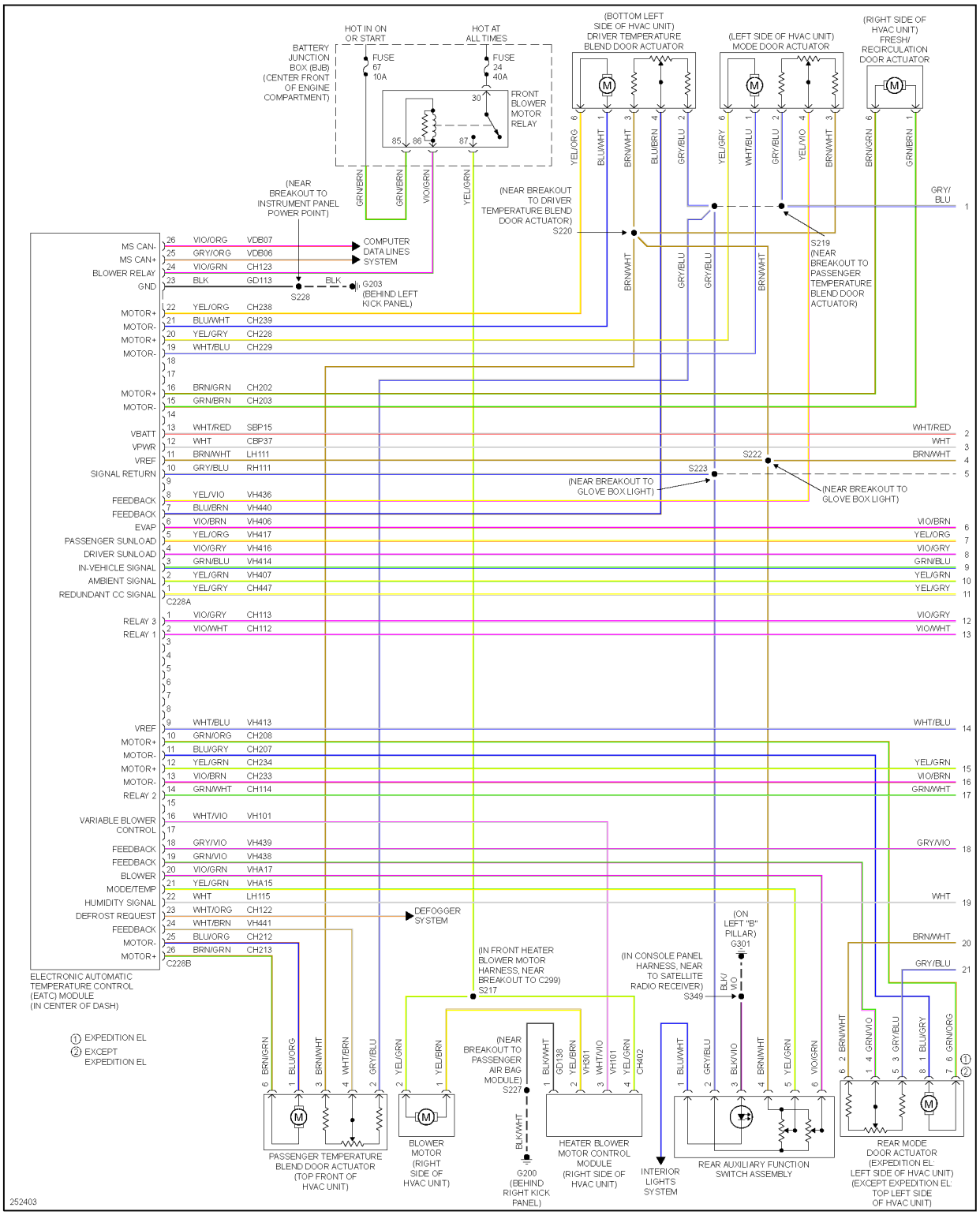


Fig. 1: Automatic A/C Circuit, W/ Auxiliary Climate Control (1 of 3)

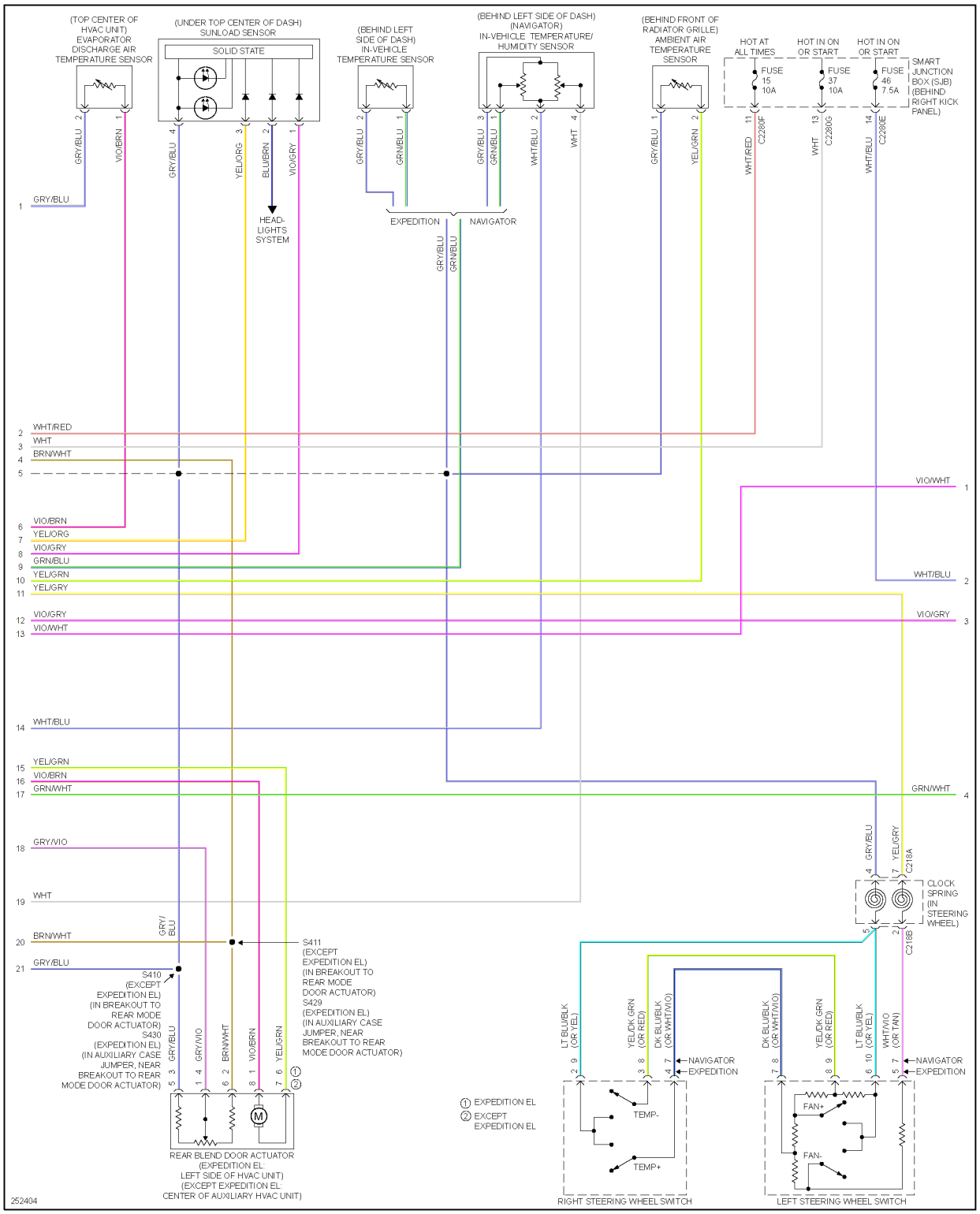


Fig. 2: Automatic A/C Circuit, W/ Auxiliary Climate Control (2 of 3)

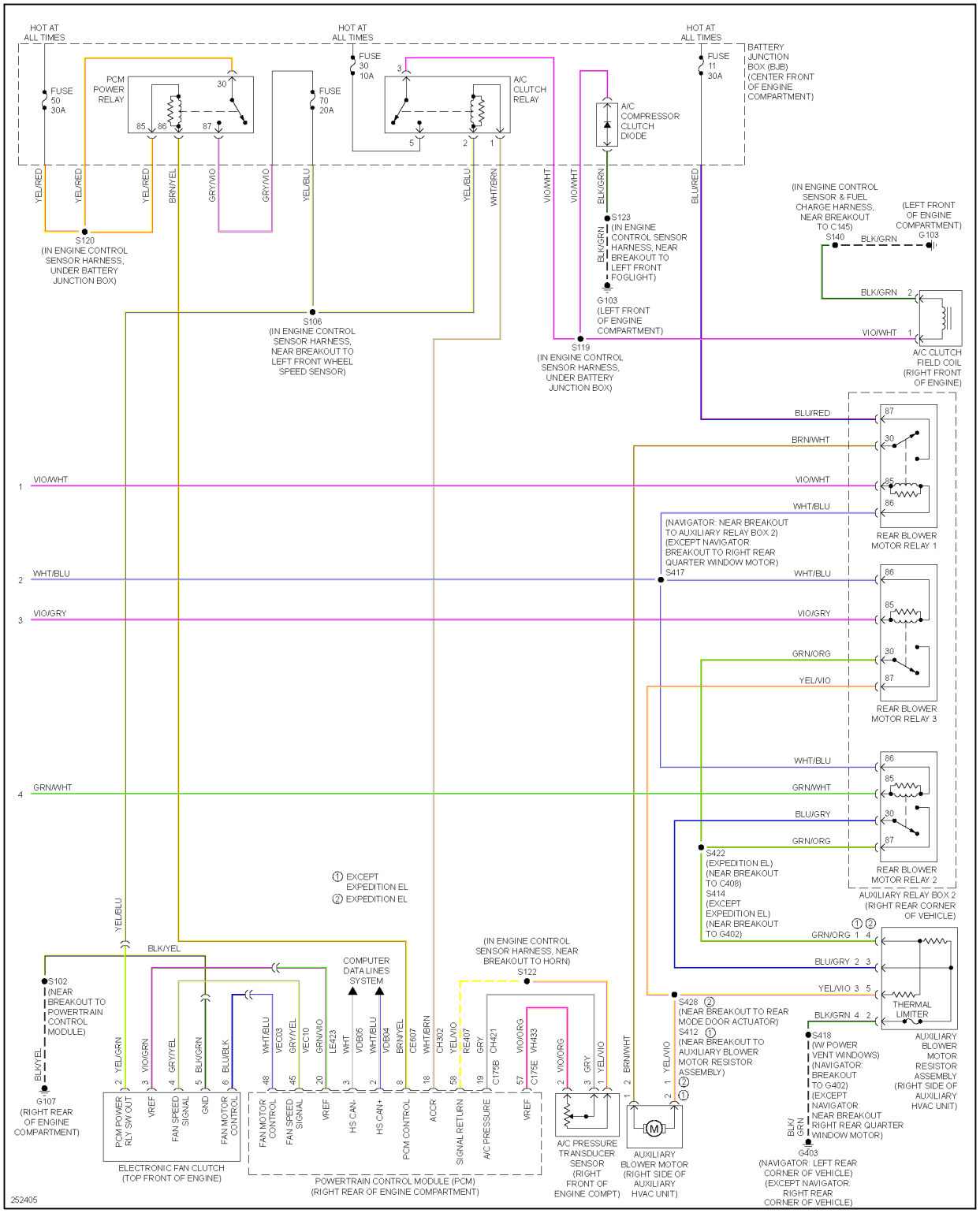


Fig. 3: Automatic A/C Circuit, W/ Auxiliary Climate Control (3 of 3)

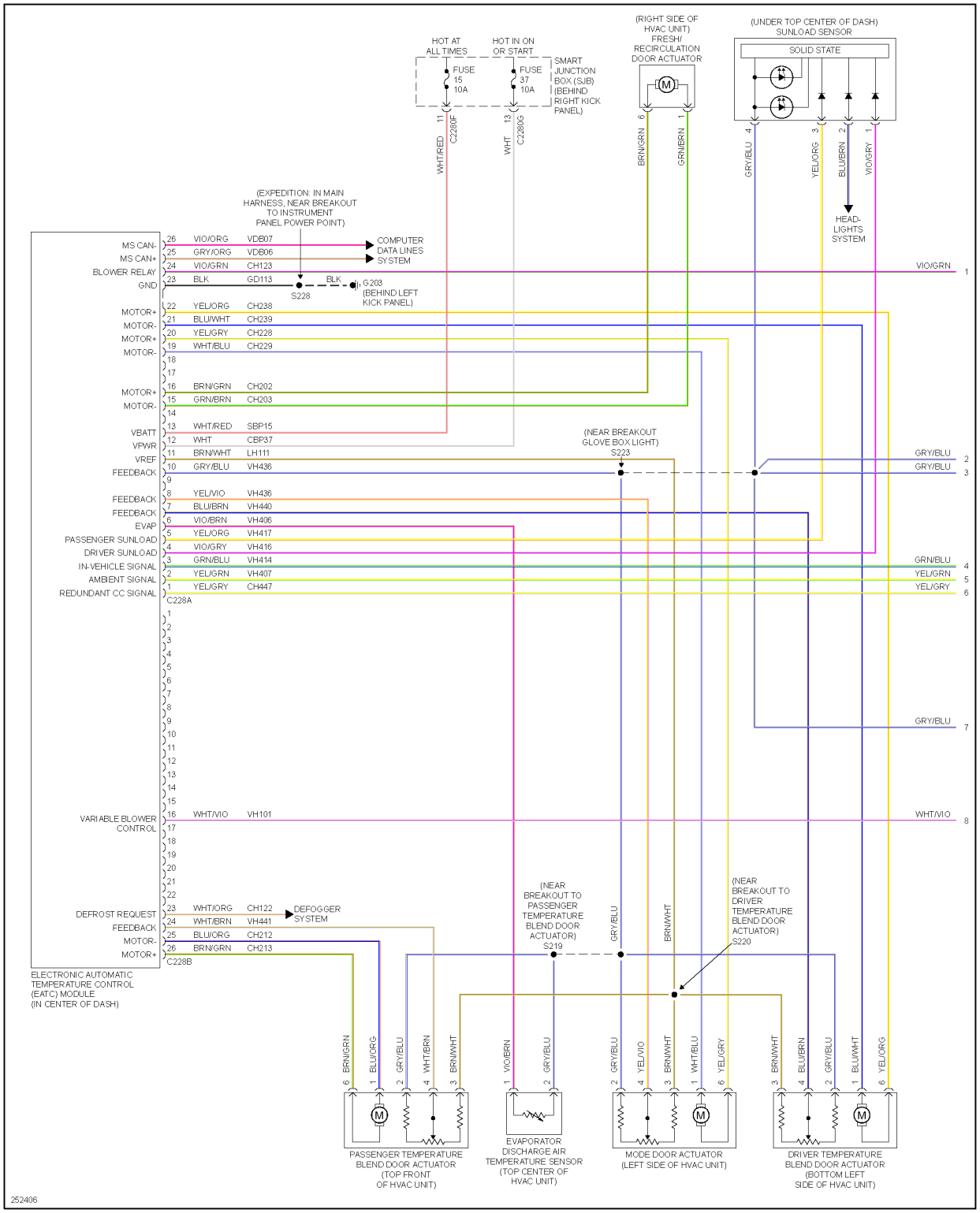


Fig. 4: Automatic A/C Circuit, W/O Auxiliary Climate Control (1 of 3)

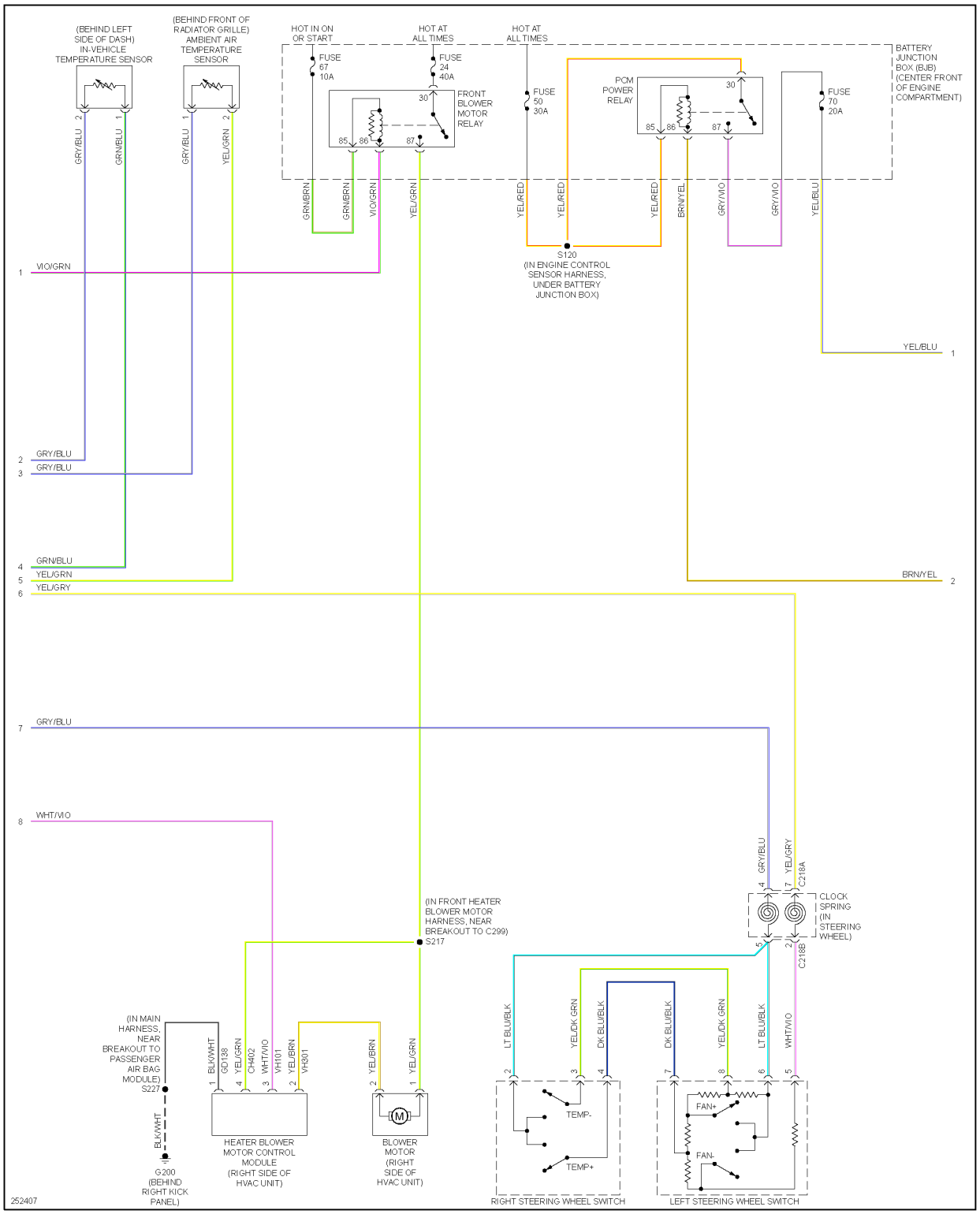


Fig. 5: Automatic A/C Circuit, W/O Auxiliary Climate Control (2 of 3)

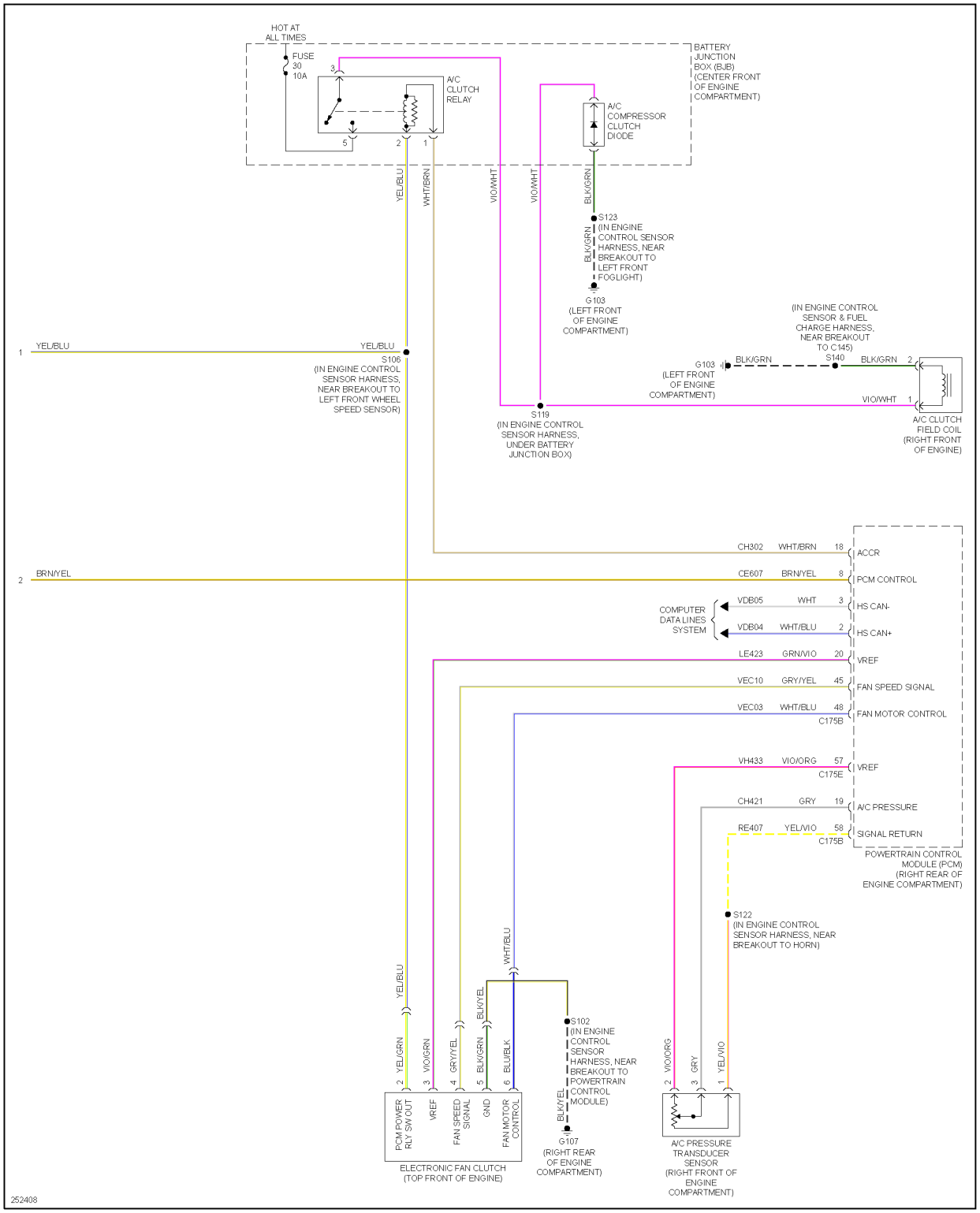


Fig. 6: Automatic A/C Circuit, W/O Auxiliary Climate Control (3 of 3)

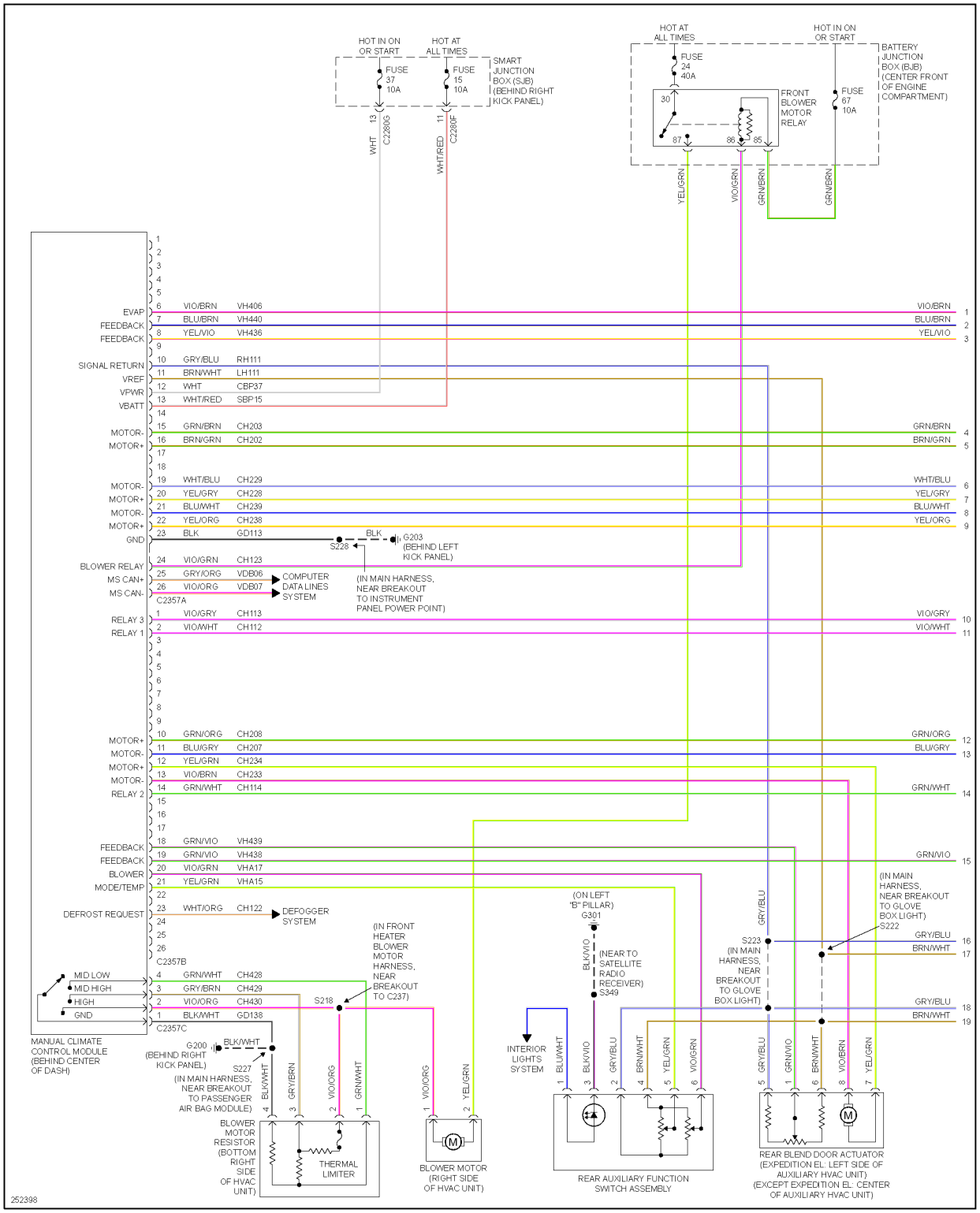


Fig. 7: Manual A/C Circuit, W/ Auxiliary Climate Control (1 of 3)

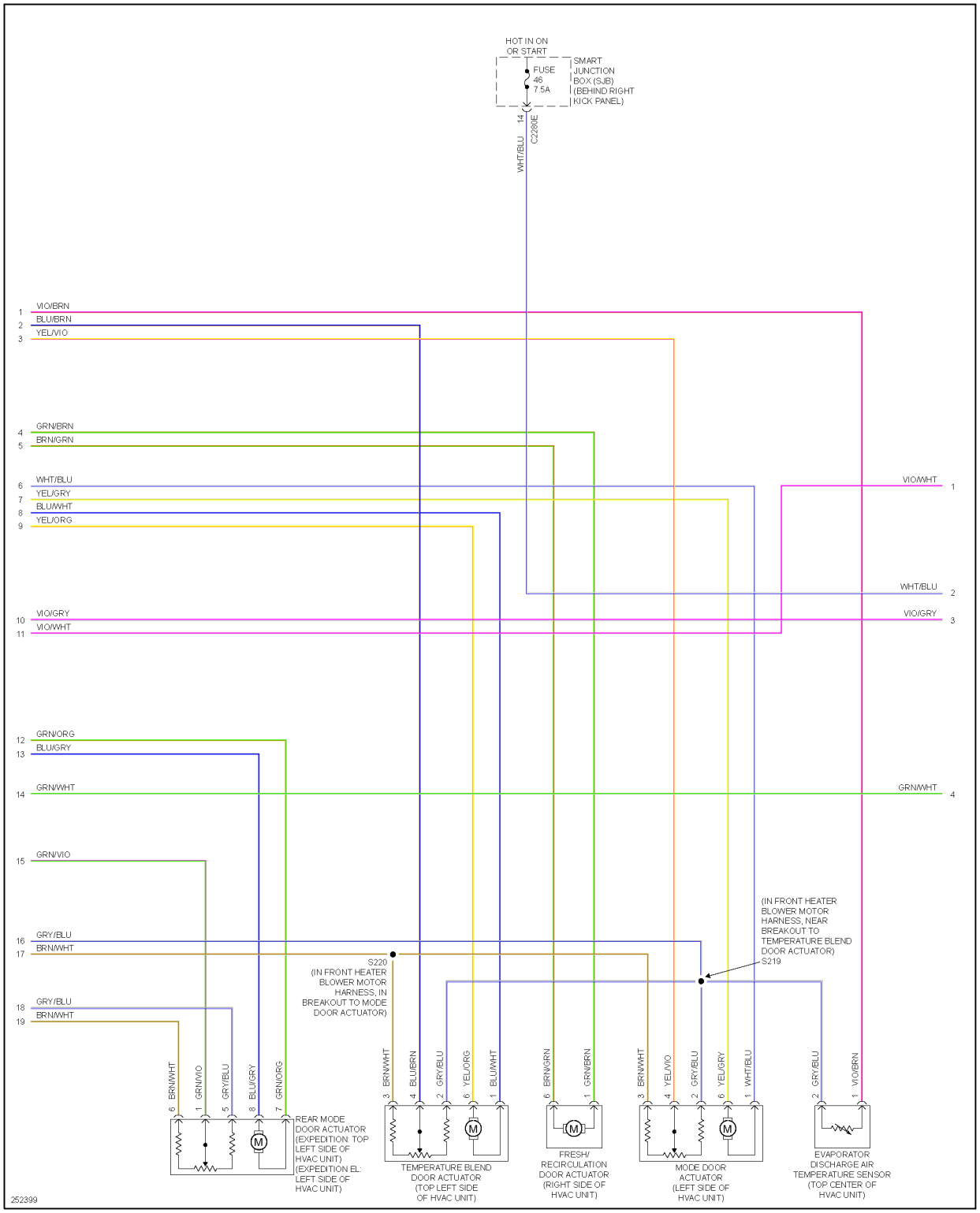


Fig. 8: Manual A/C Circuit, W/ Auxiliary Climate Control (2 of 3)

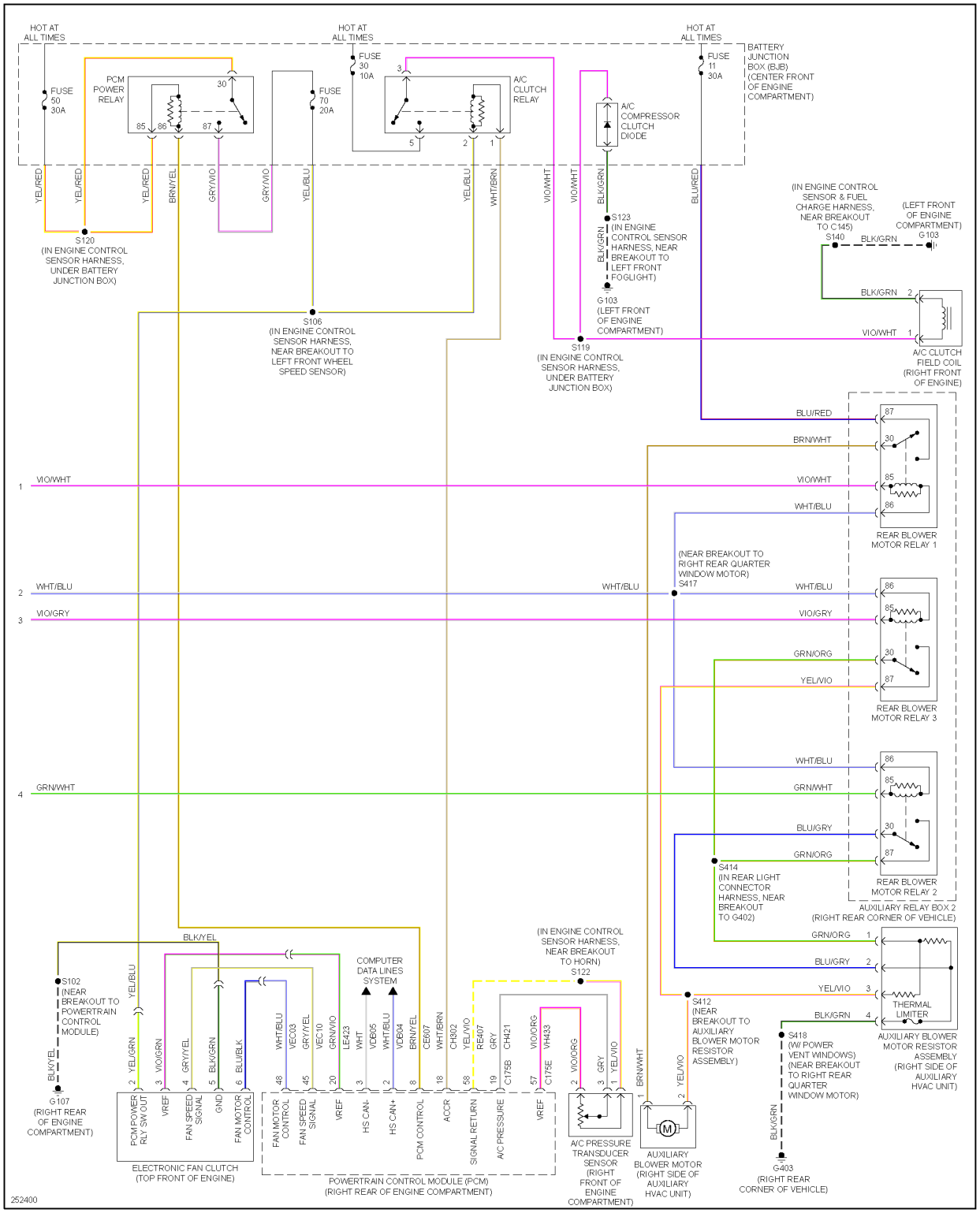


Fig. 9: Manual A/C Circuit, W/ Auxiliary Climate Control (3 of 3)

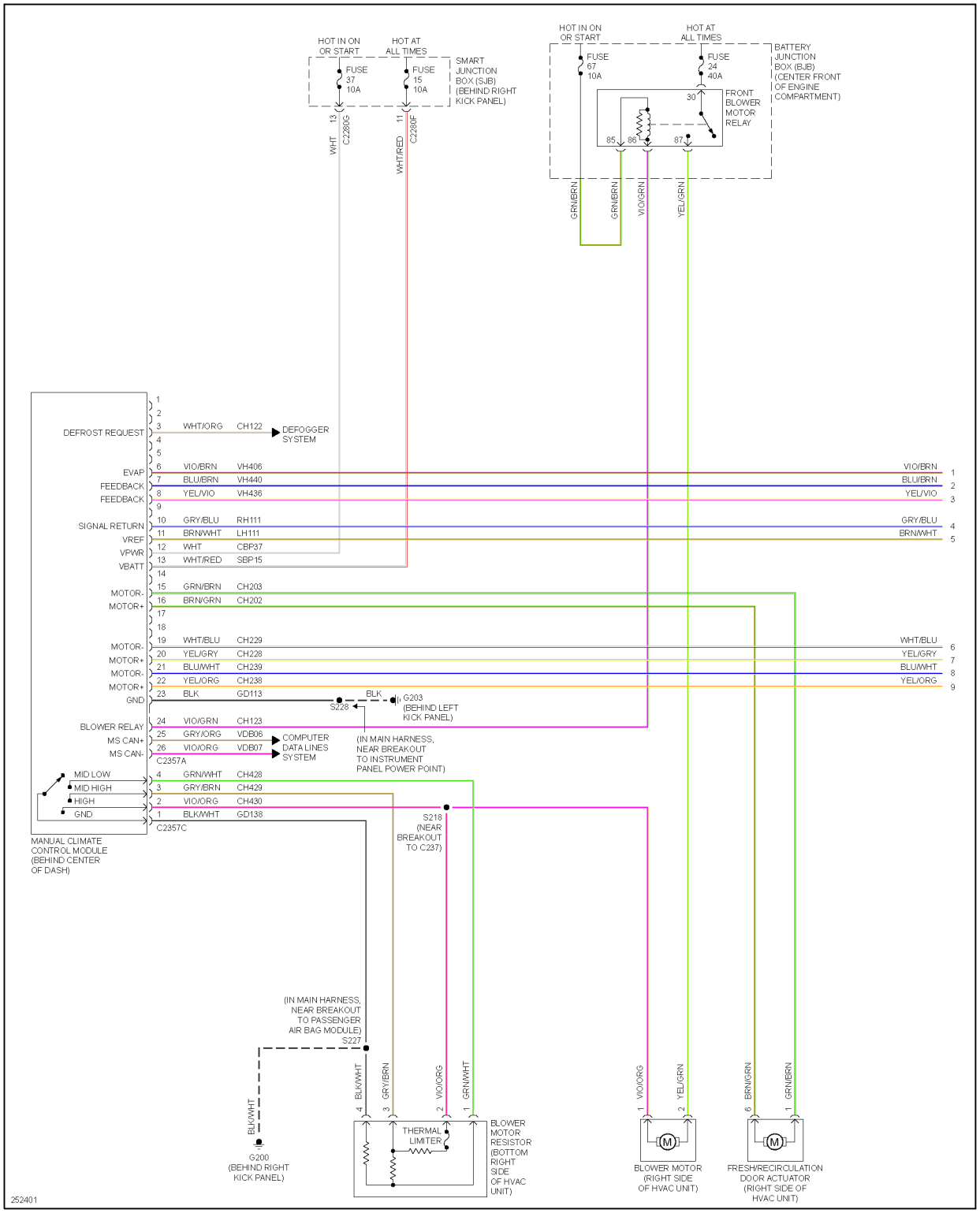


Fig. 10: Manual A/C Circuit, W/O Auxiliary Climate Control (1 of 2)

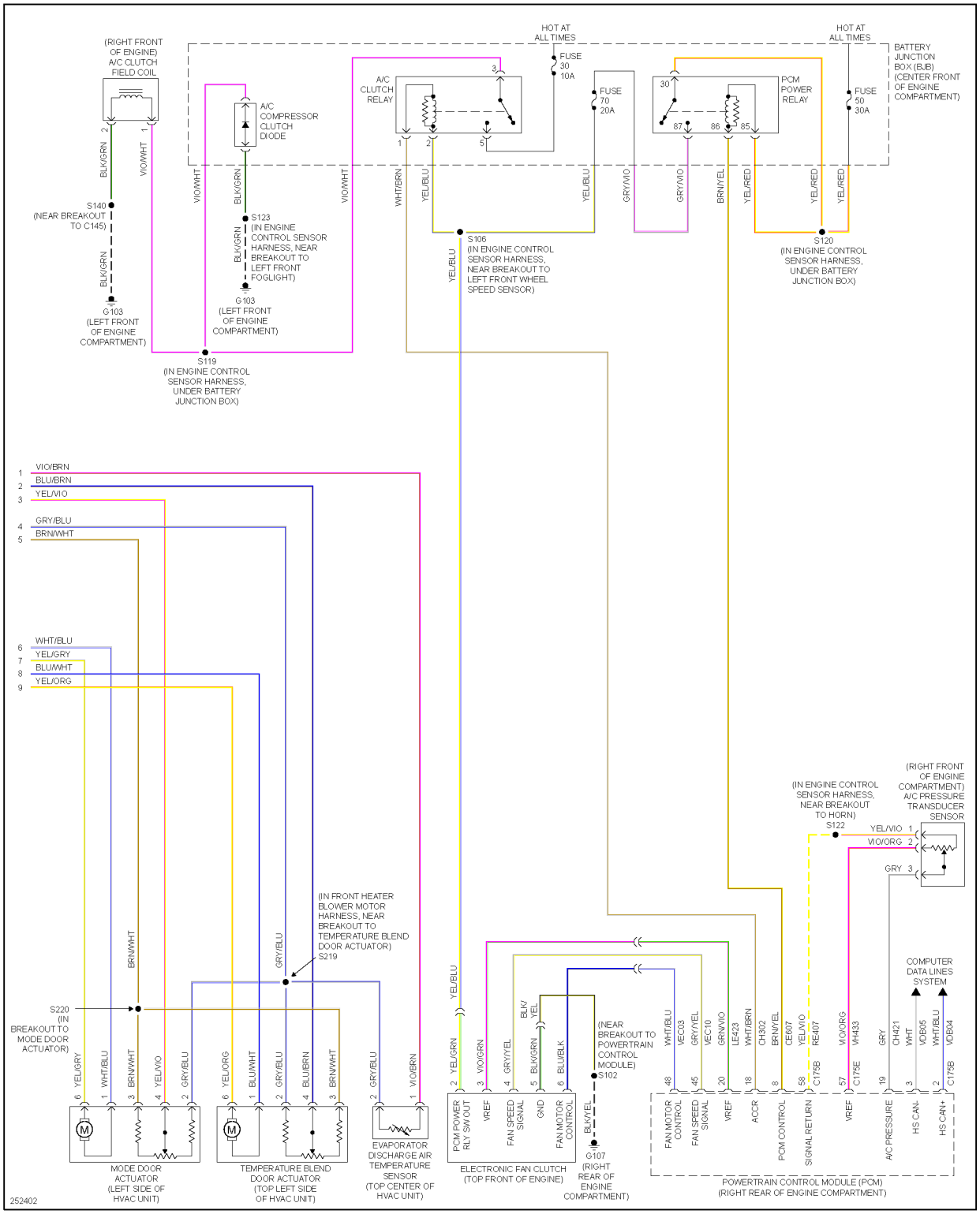


Fig. 11: Manual A/C Circuit, W/O Auxiliary Climate Control (2 of 2)

ANTI-LOCK BRAKES

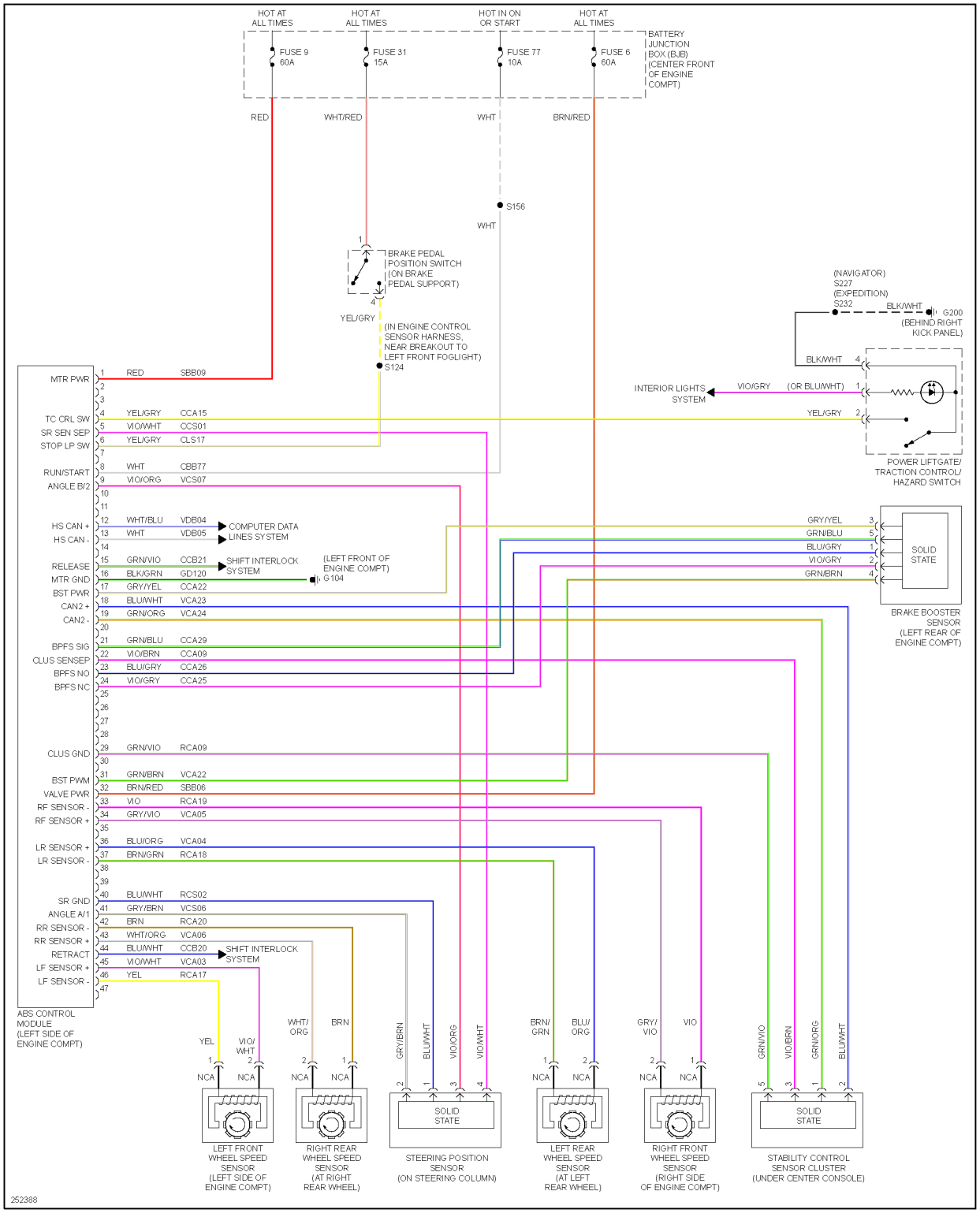


Fig. 12: Anti-lock Brakes Circuit

ANTI-THEFT

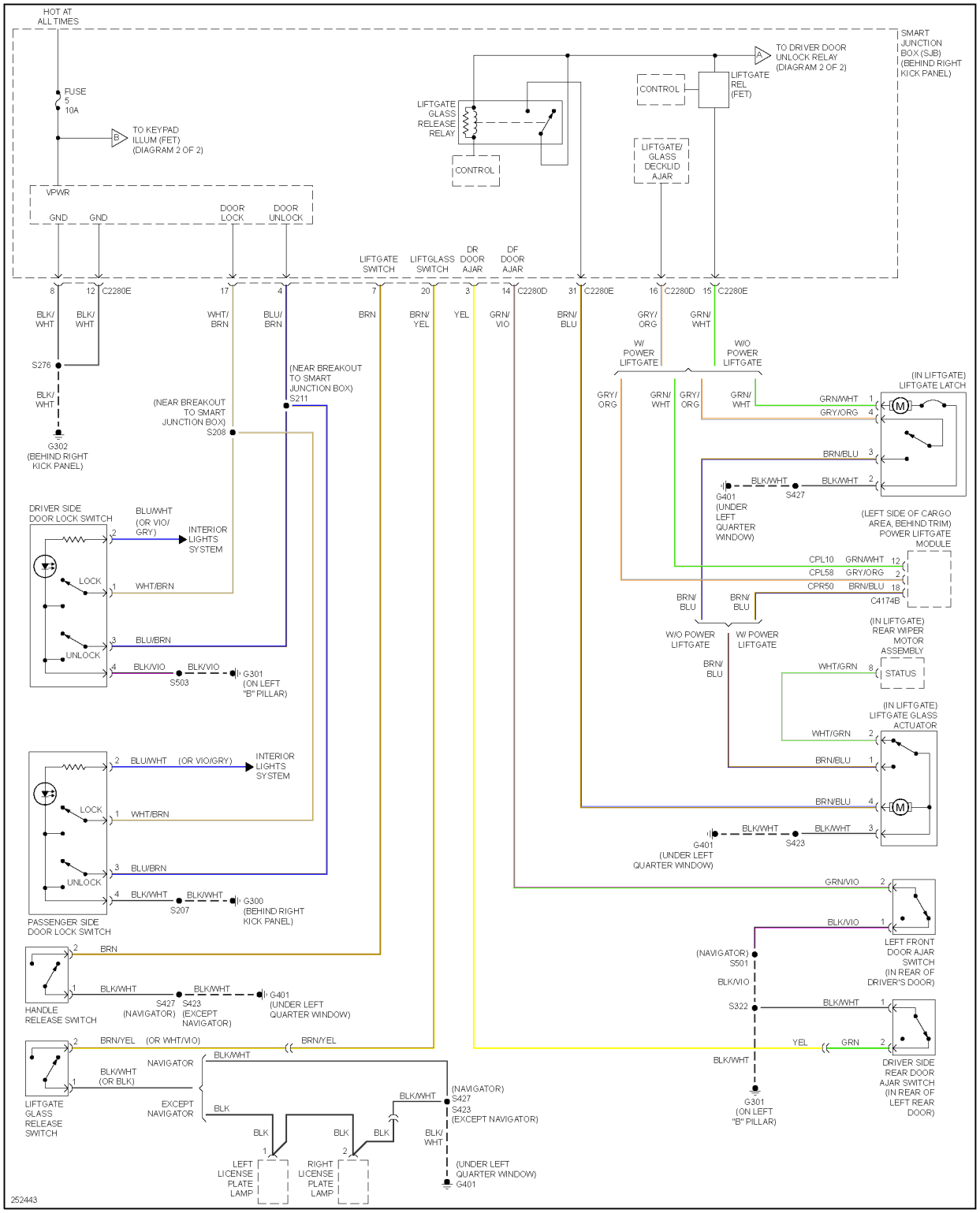


Fig. 13: Forced Entry Circuit (1 of 2)

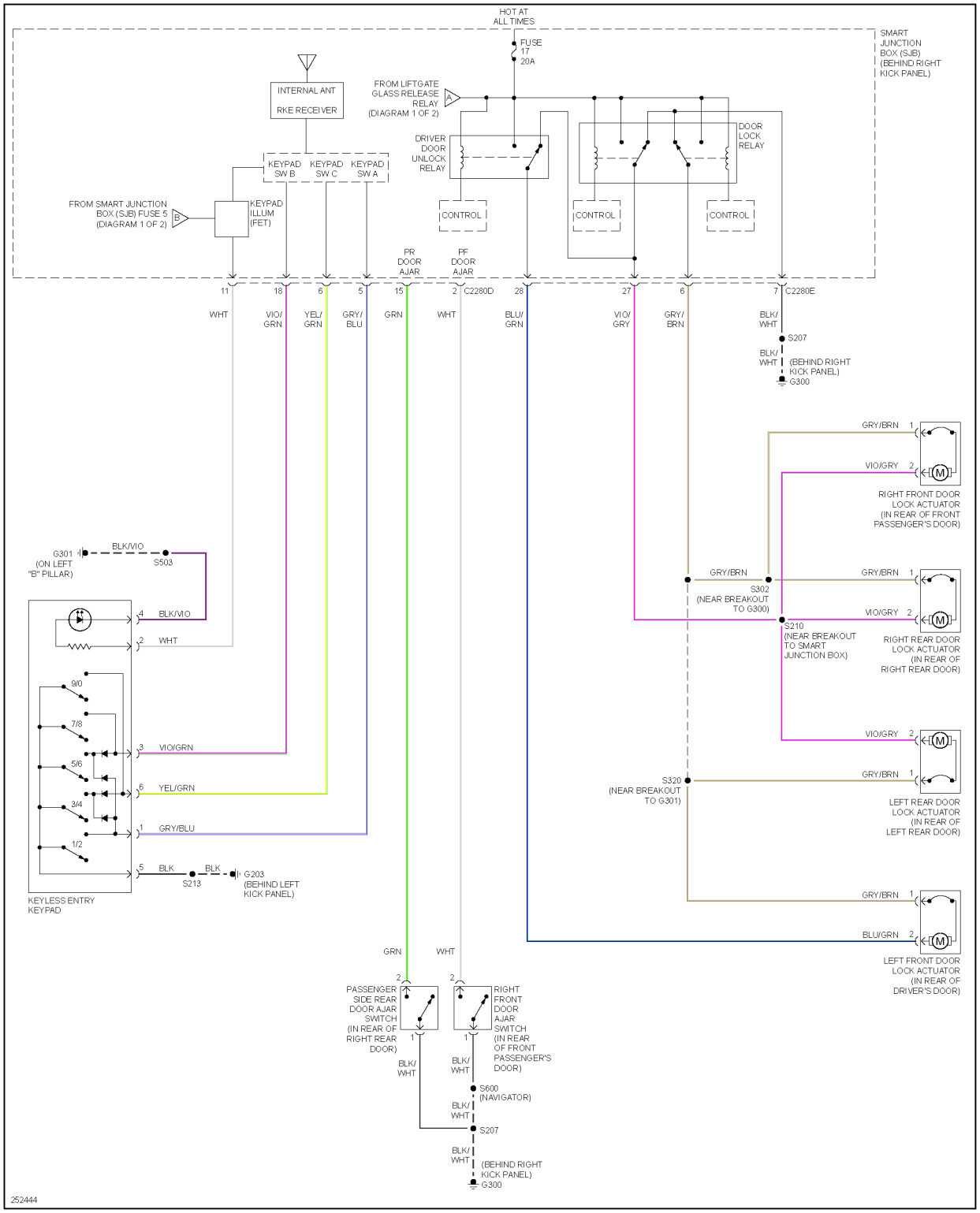


Fig. 14: Forced Entry Circuit (2 of 2)

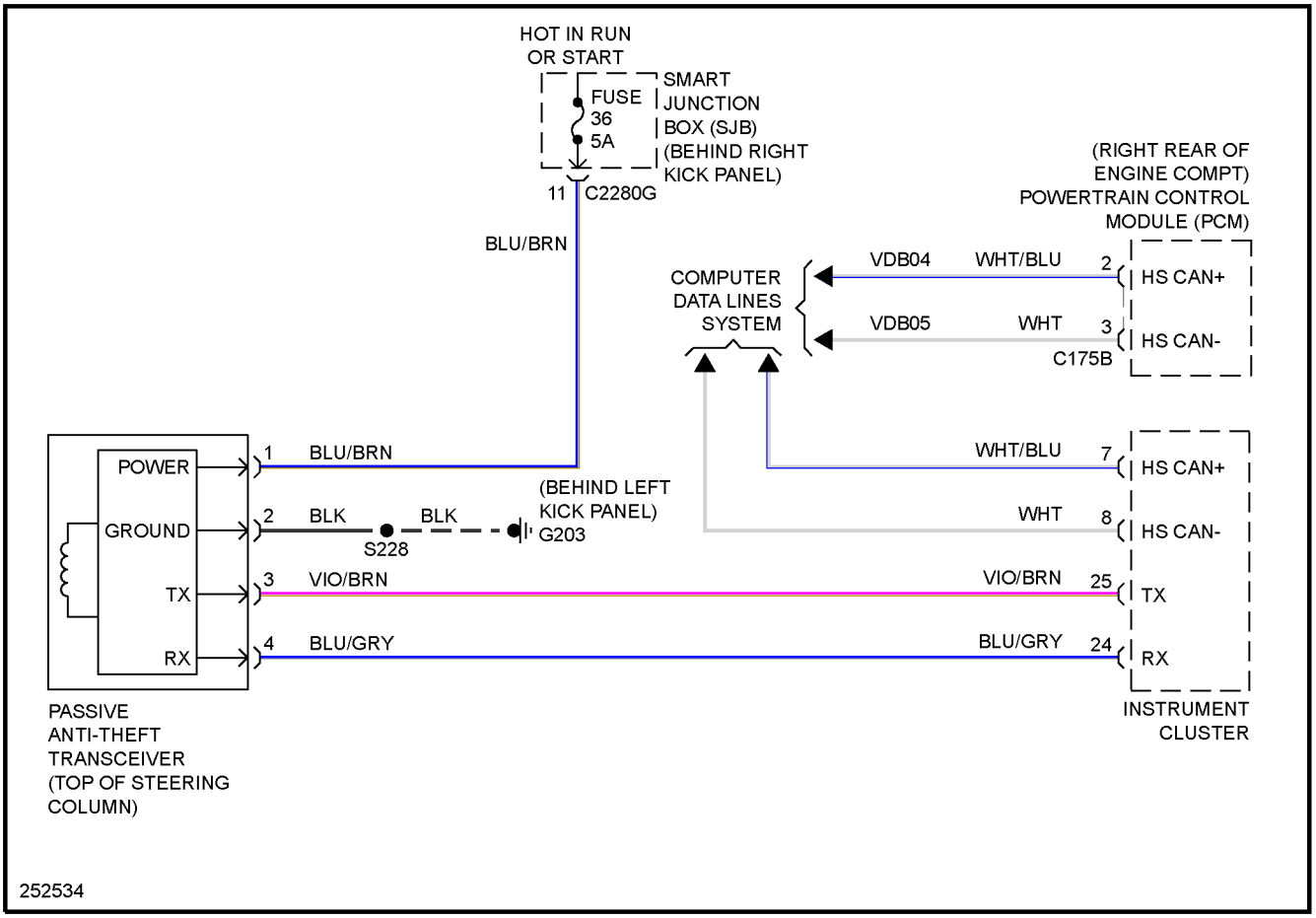


Fig. 15: Passive Anti-theft Circuit

BODY CONTROL MODULES

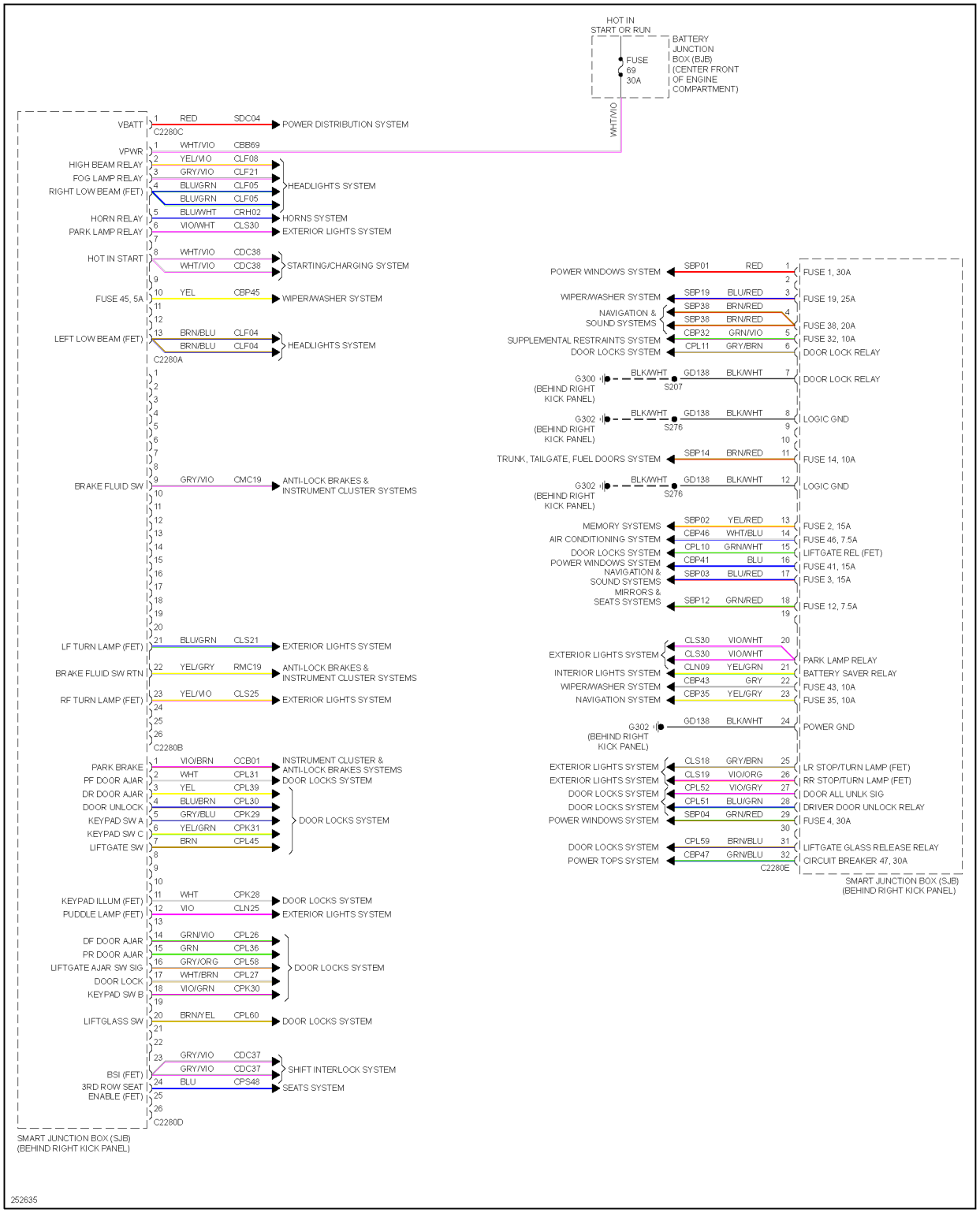


Fig. 16: Body Control Modules Circuit (1 of 2)

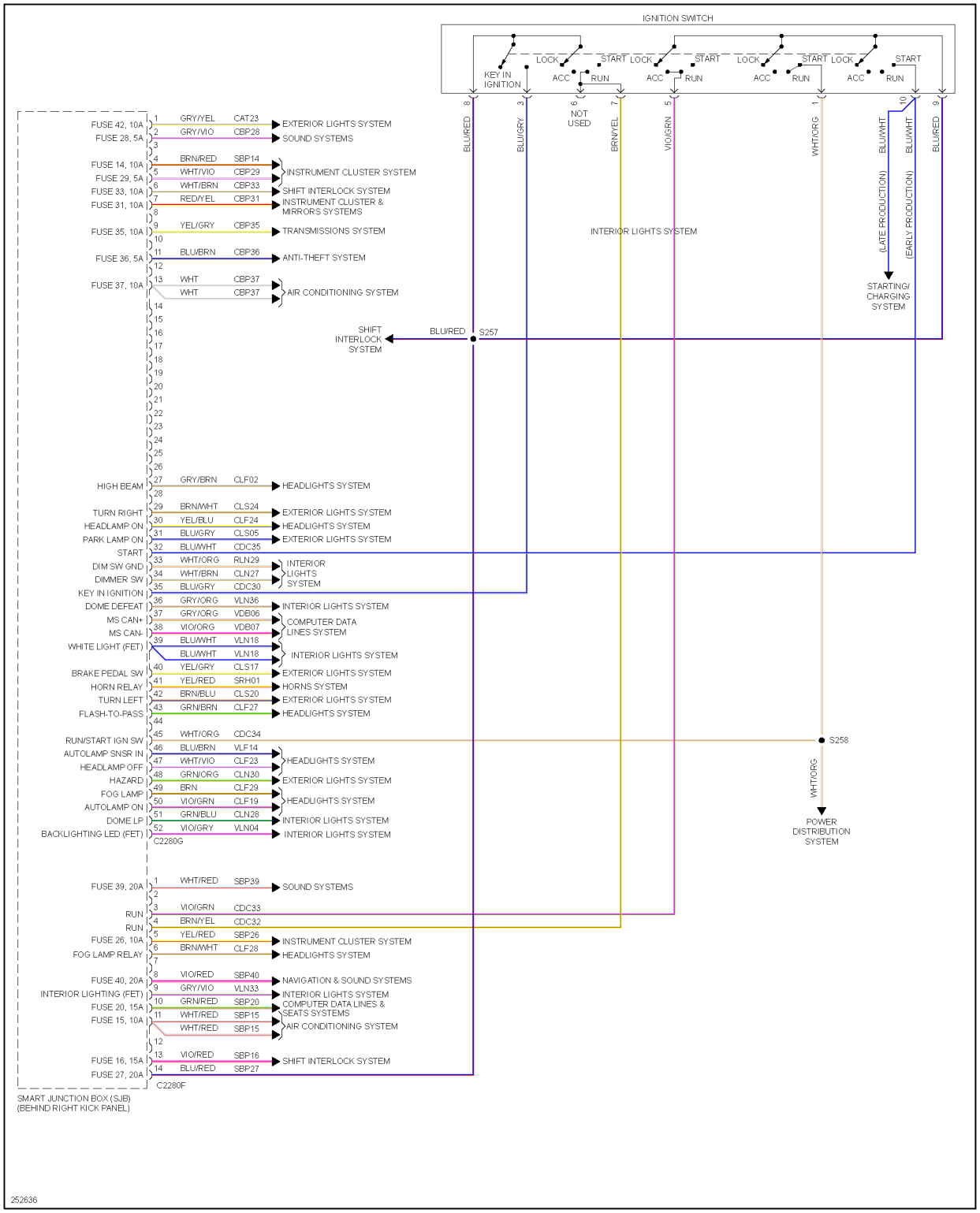


Fig. 17: Body Control Modules Circuit (2 of 2)

COMPUTER DATA LINES

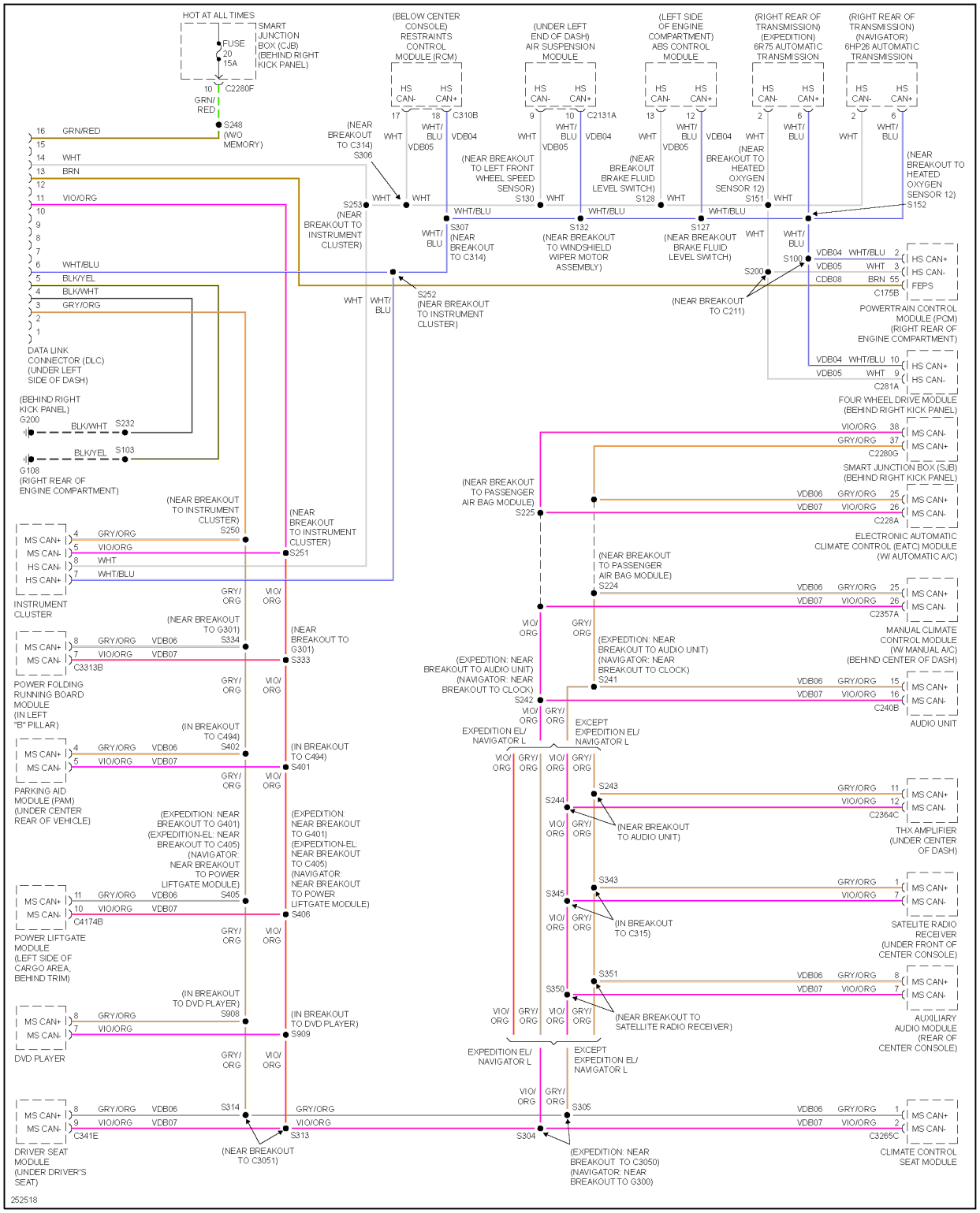


Fig. 18: Computer Data Lines Circuit

COOLING FAN

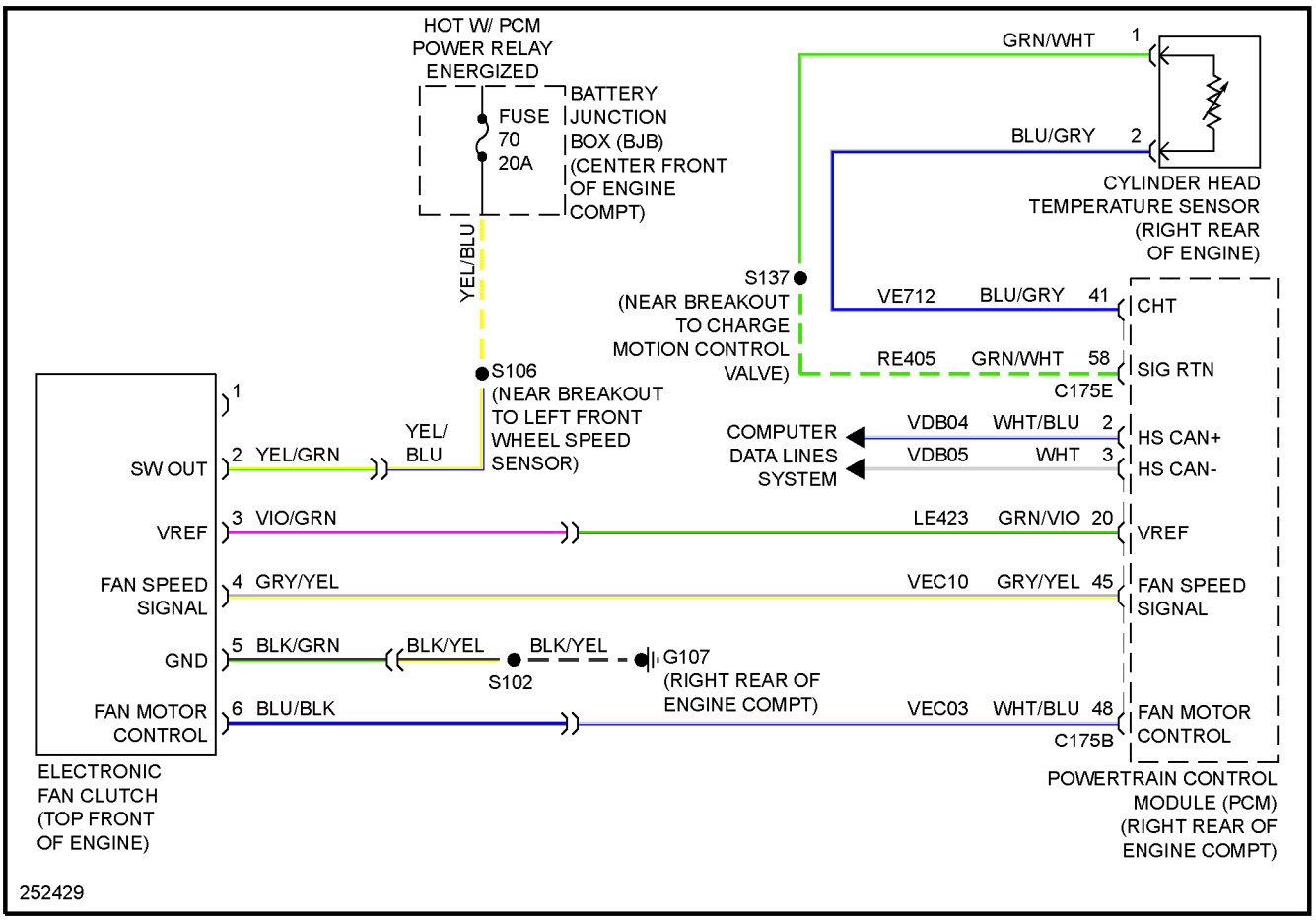


Fig. 19: Cooling Fan Circuit

CRUISE CONTROL

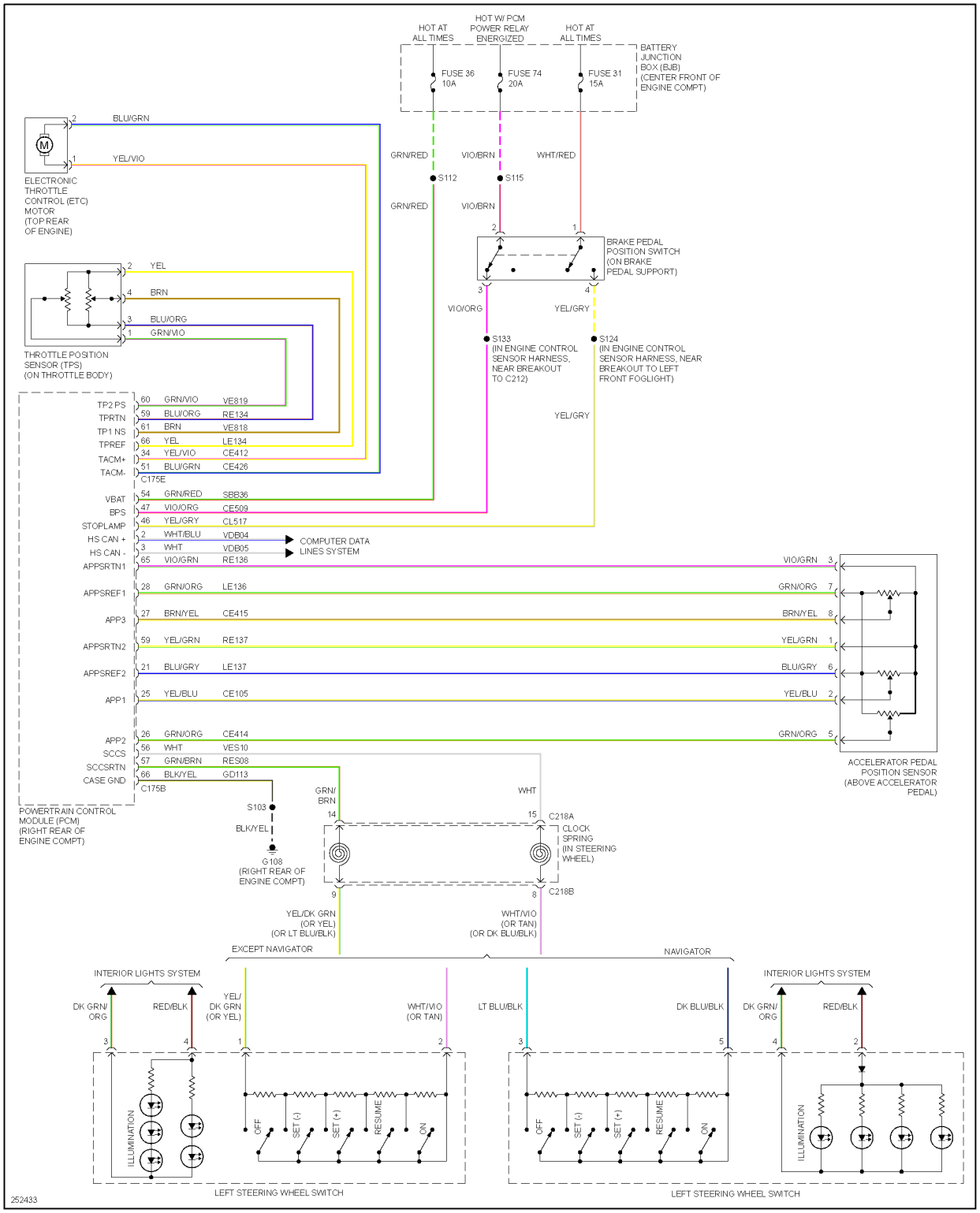


Fig. 20: Cruise Control Circuit

DEFOGGERS

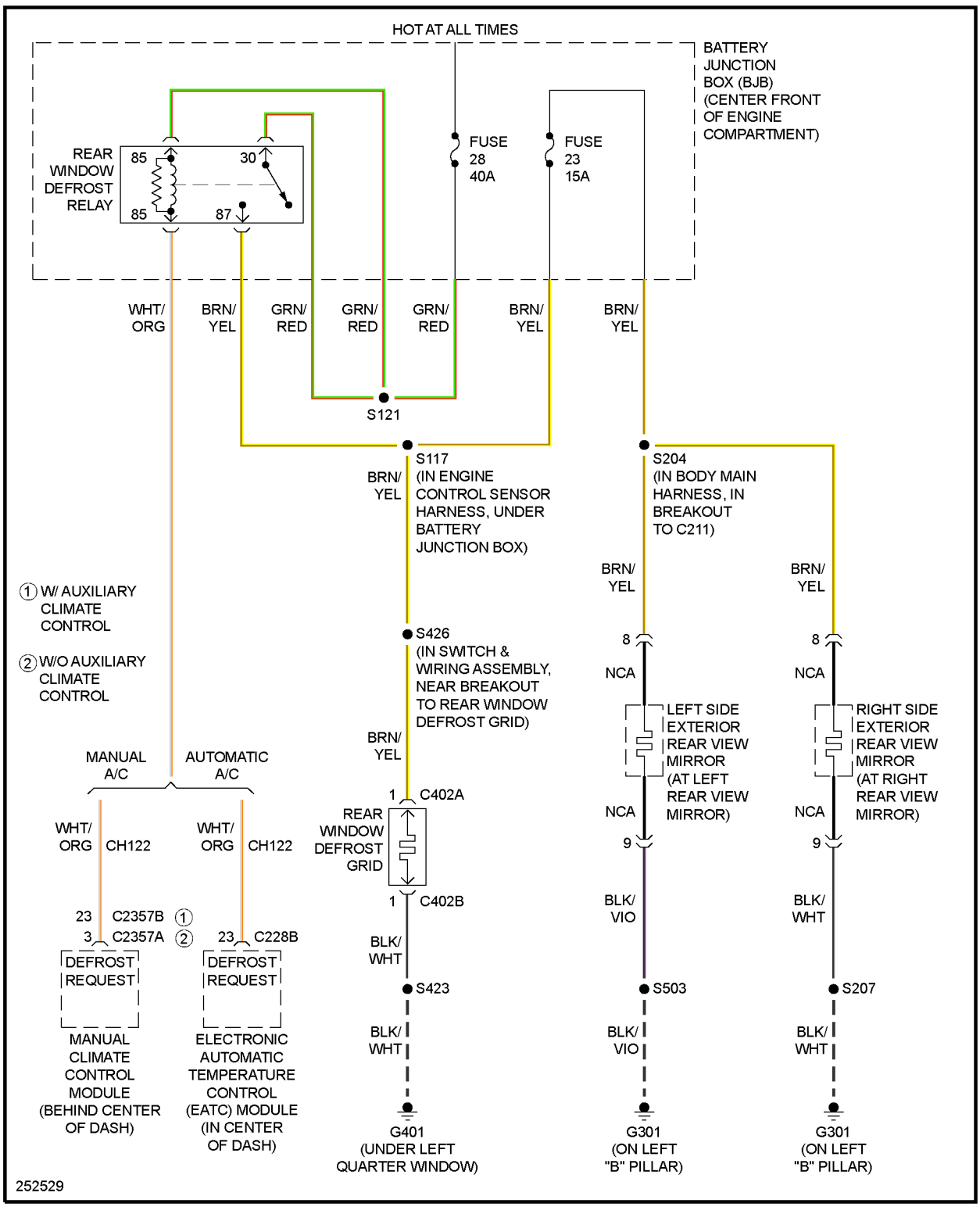


Fig. 21: Defoggers Circuit

ELECTRONIC SUSPENSION

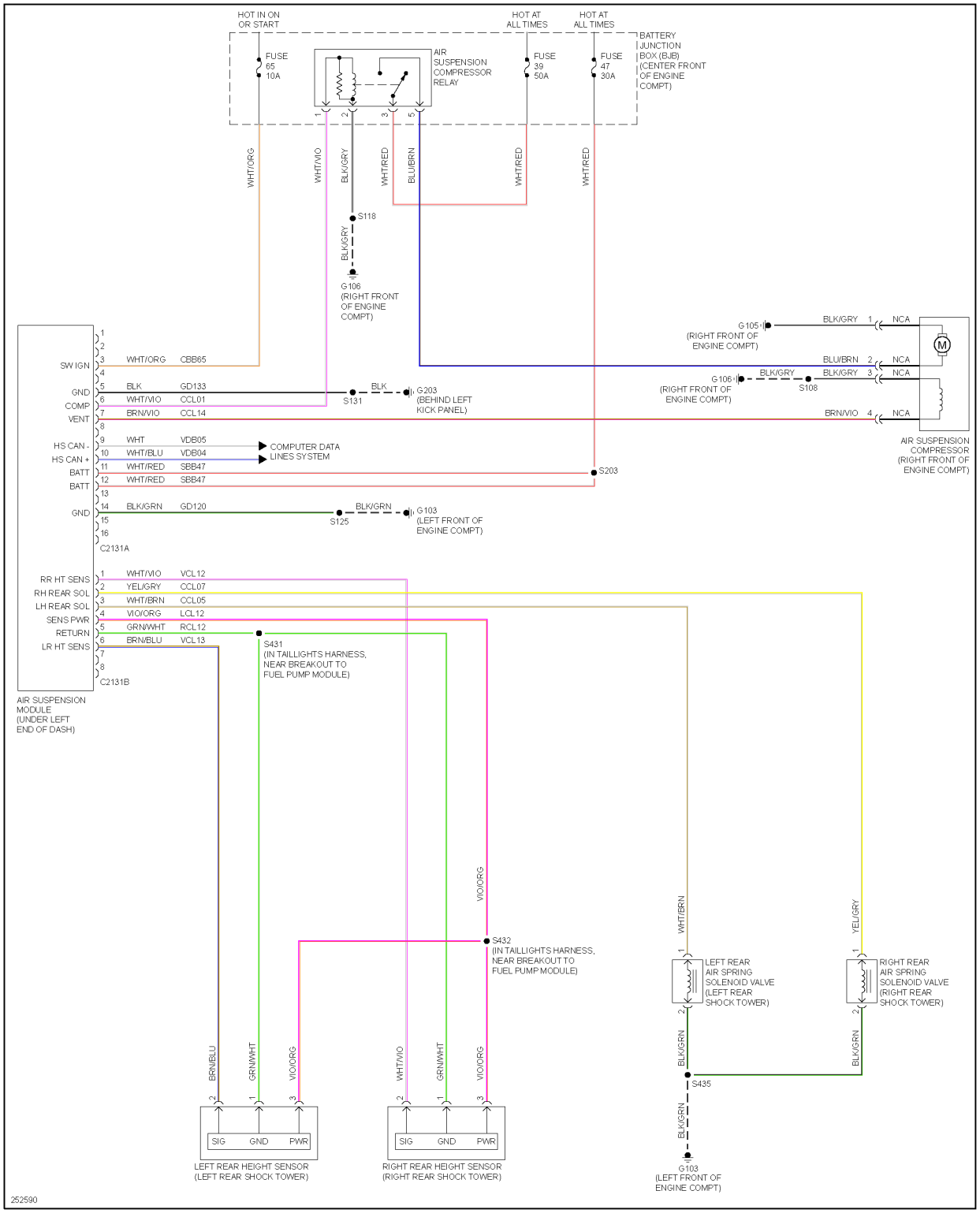


Fig. 22: Electronic Suspension Circuit

ENGINE PERFORMANCE

5.4L

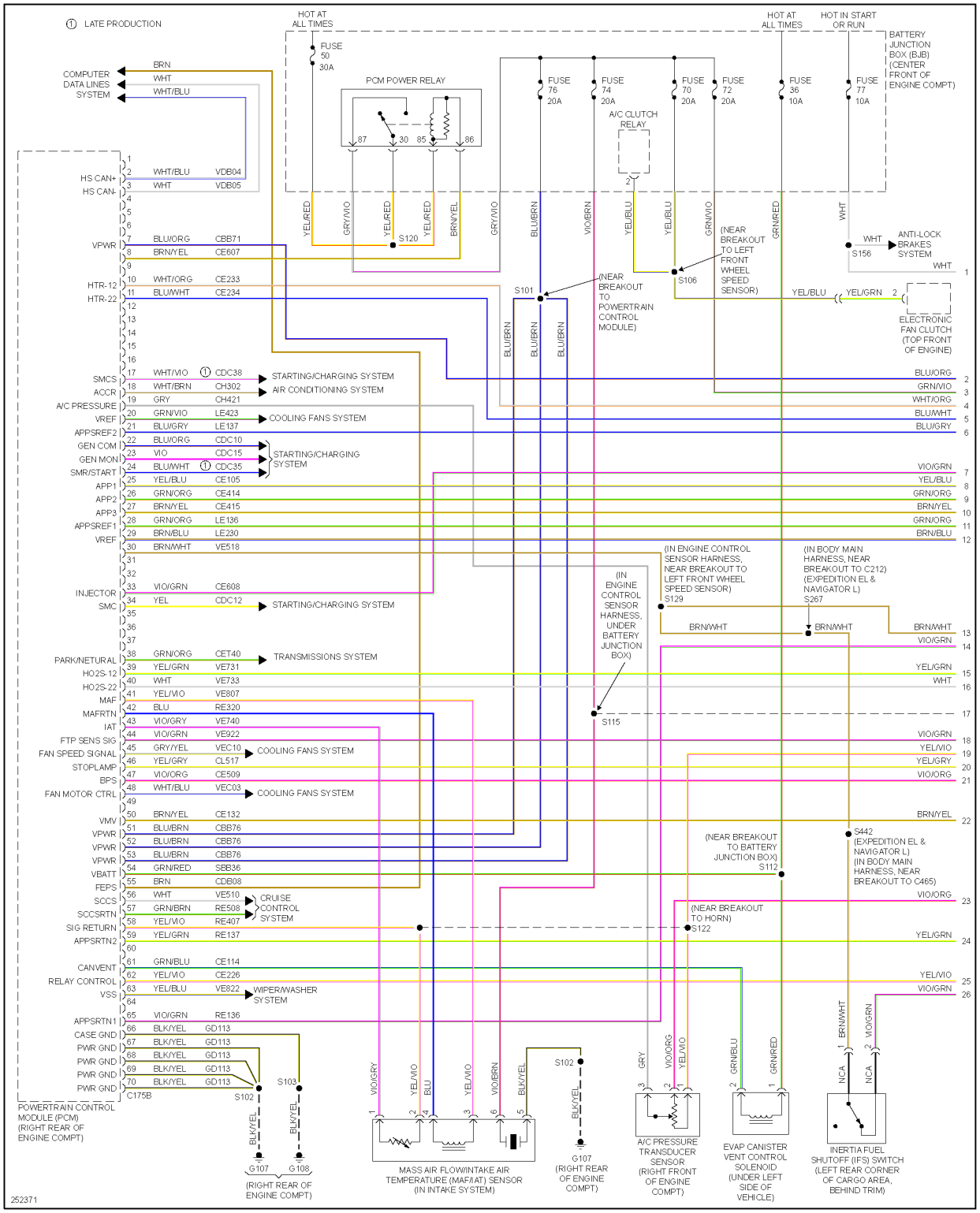


Fig. 23: 5.4L, Engine Performance Circuit (1 of 4)

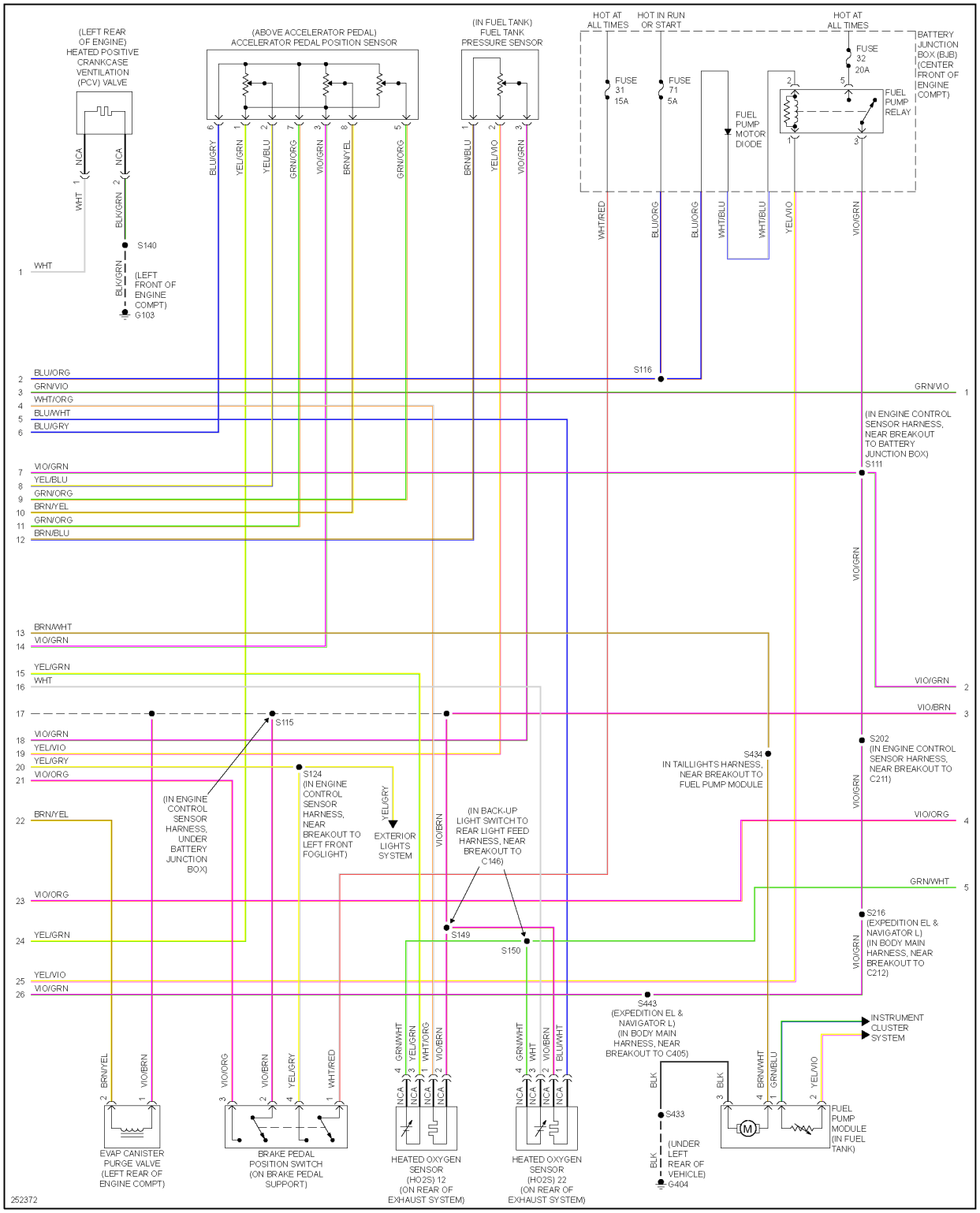


Fig. 24: 5.4L, Engine Performance Circuit (2 of 4)

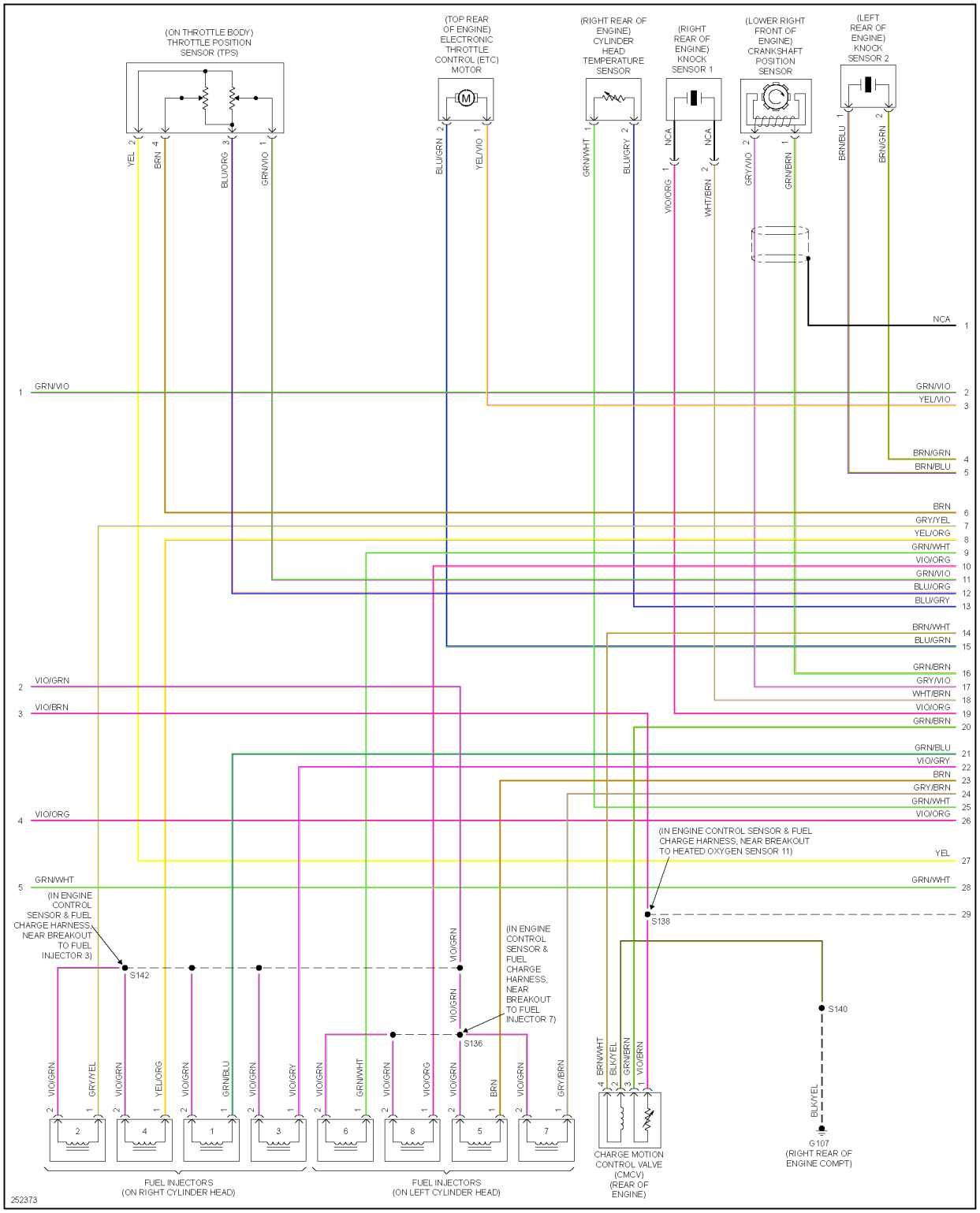


Fig. 25: 5.4L, Engine Performance Circuit (3 of 4)

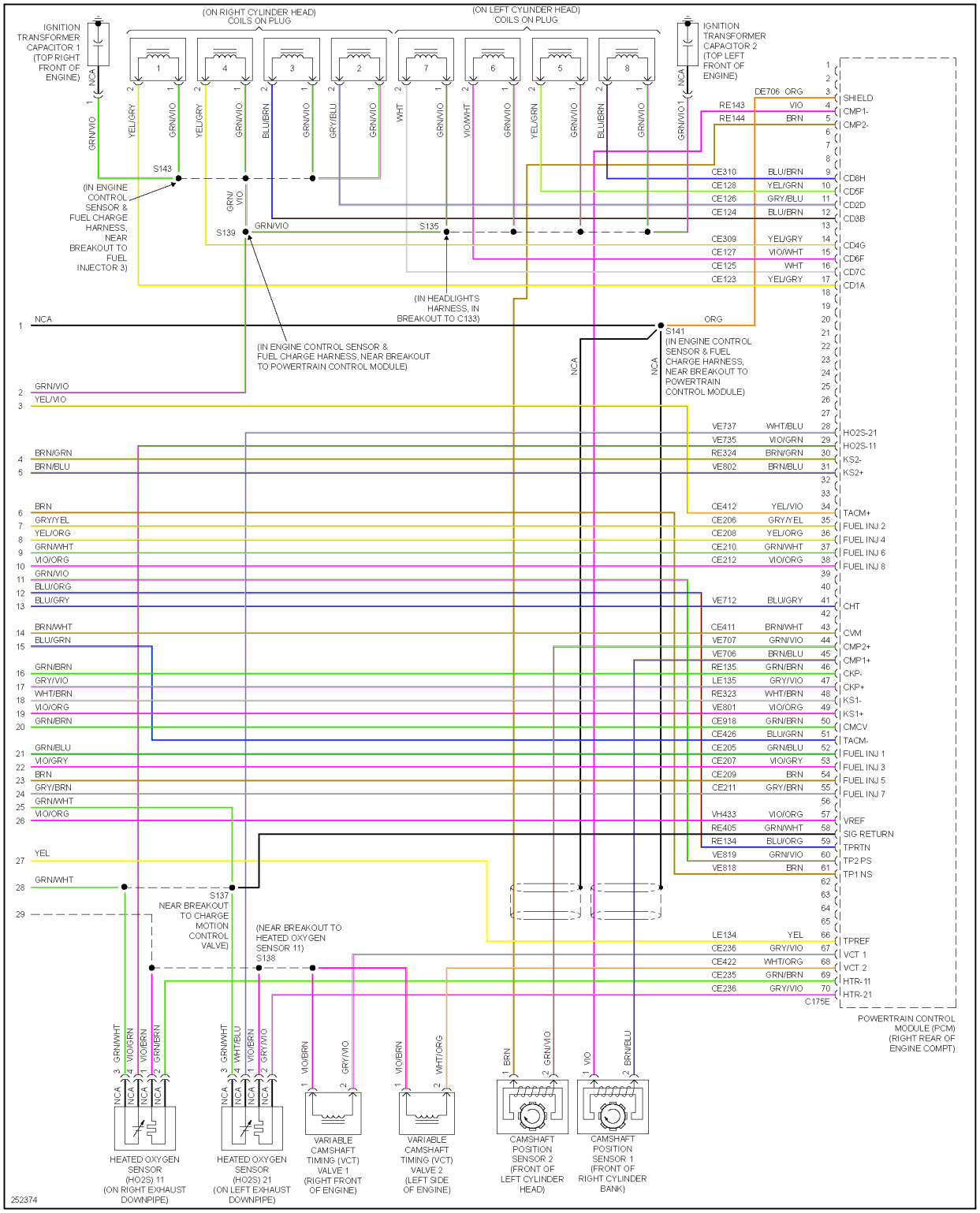


Fig. 26: 5.4L, Engine Performance Circuit (4 of 4)

EXTERIOR LIGHTS

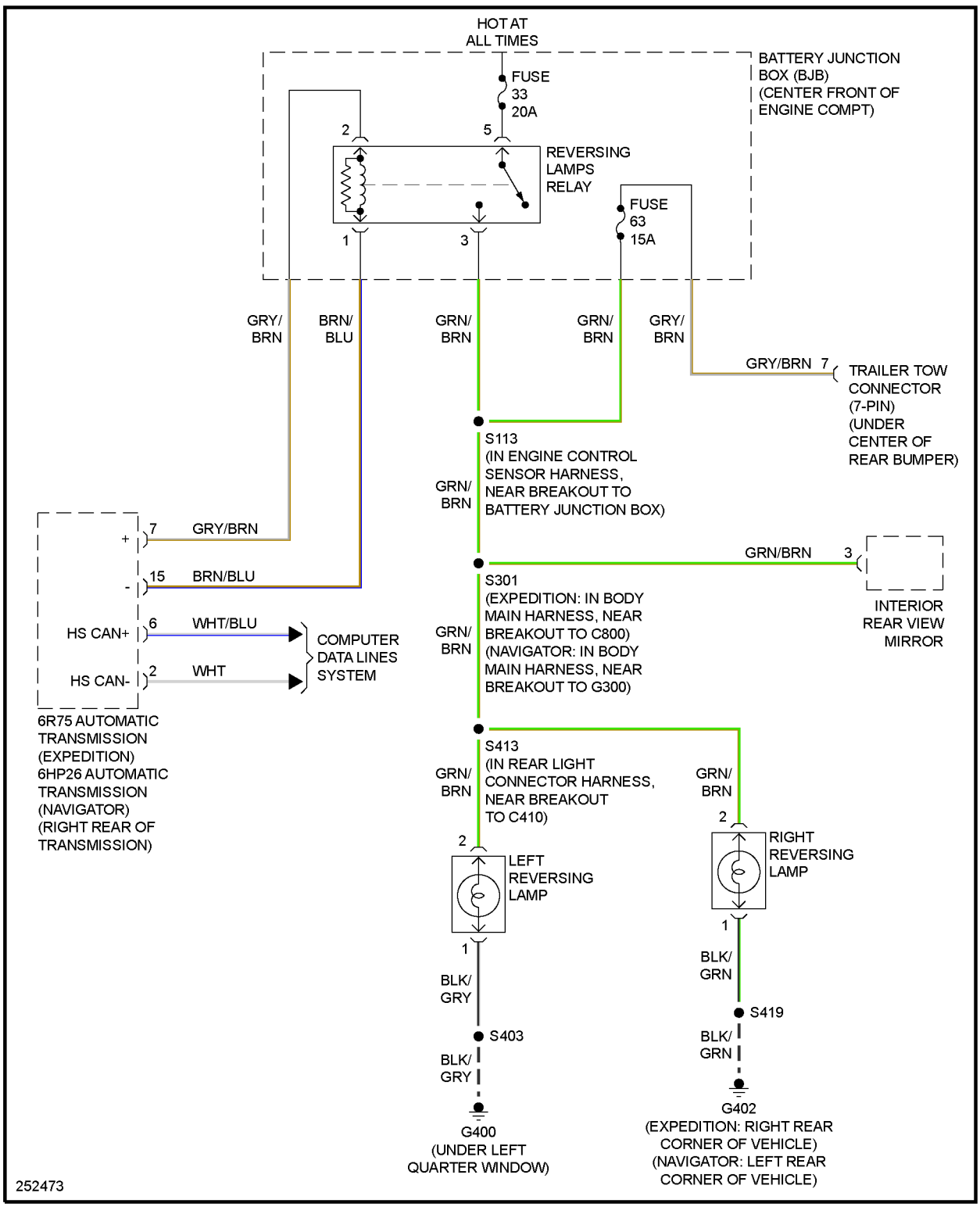


Fig. 27: Back-up Lamps Circuit

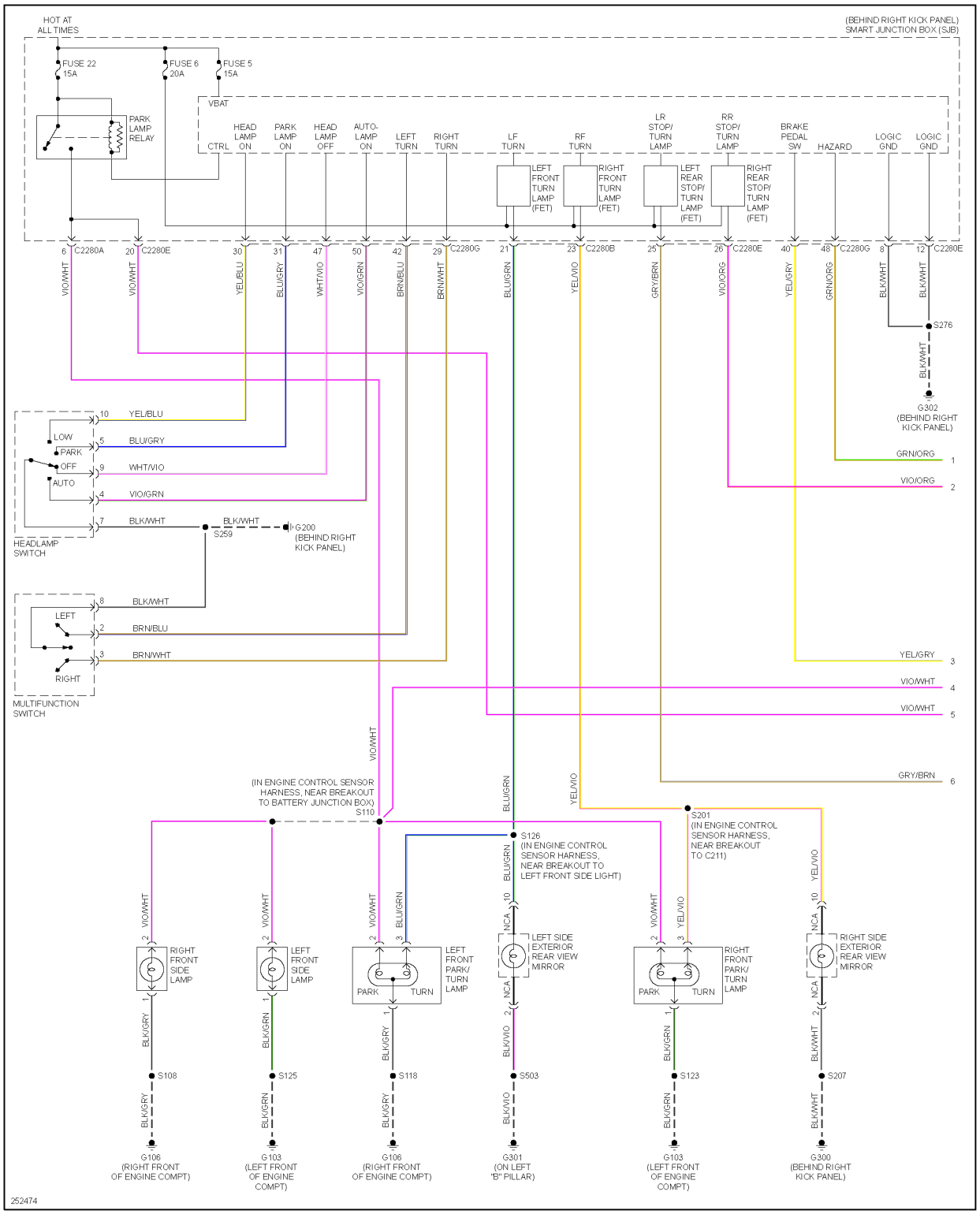


Fig. 28: Exterior Lamps Circuit (1 of 2)

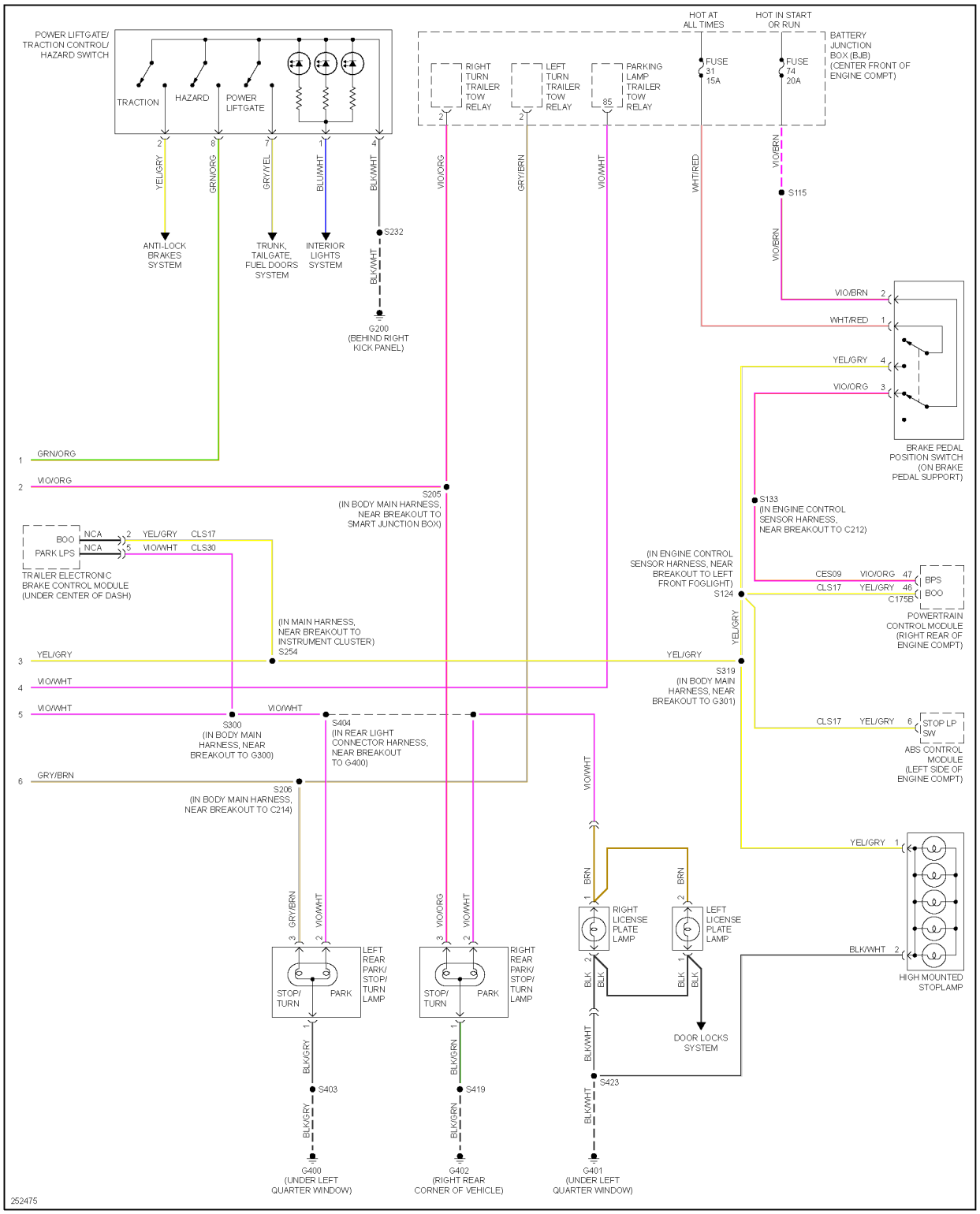


Fig. 29: Exterior Lamps Circuit (2 of 2)

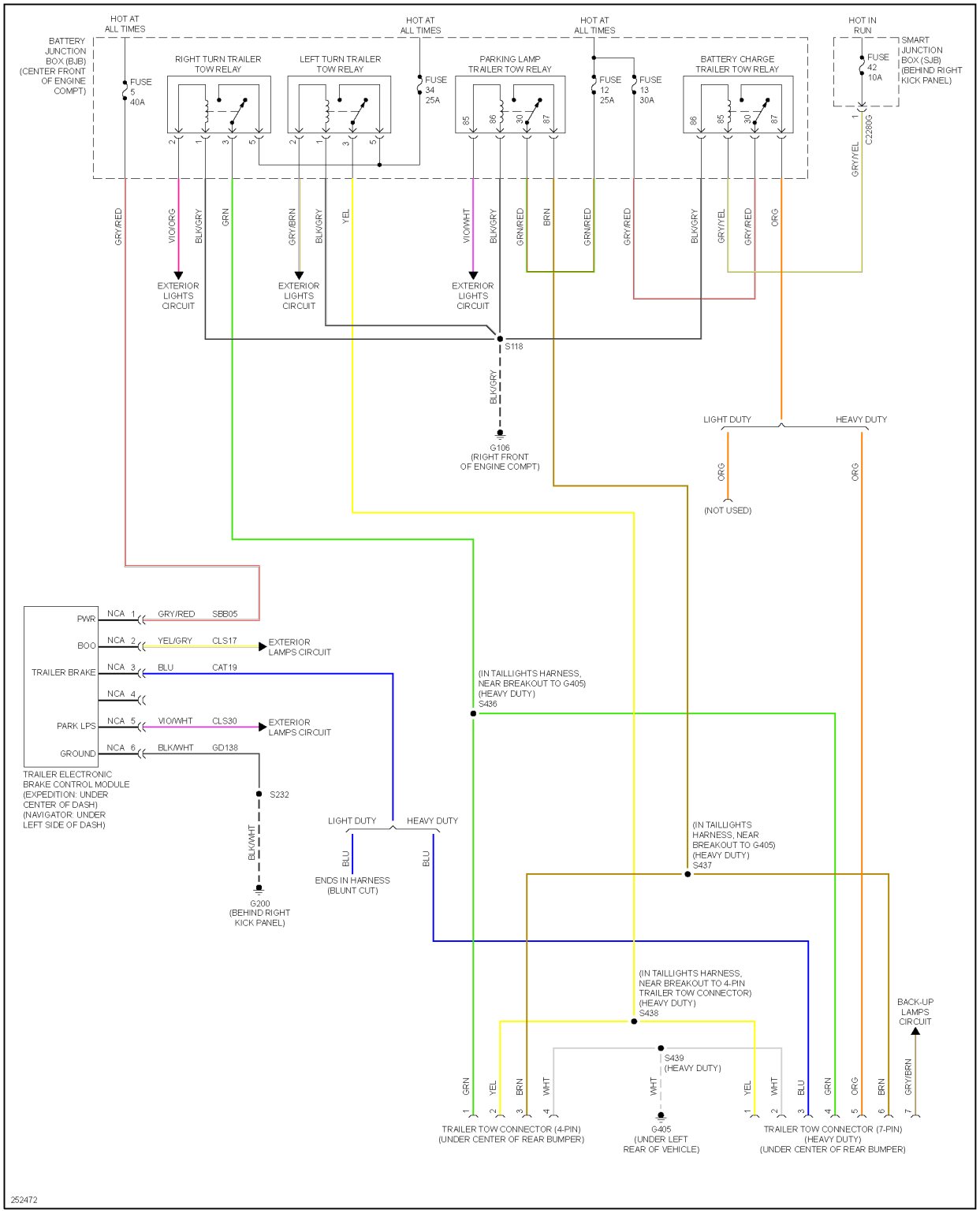


Fig. 30: Trailer/Camper Adapter Circuit

GROUND DISTRIBUTION

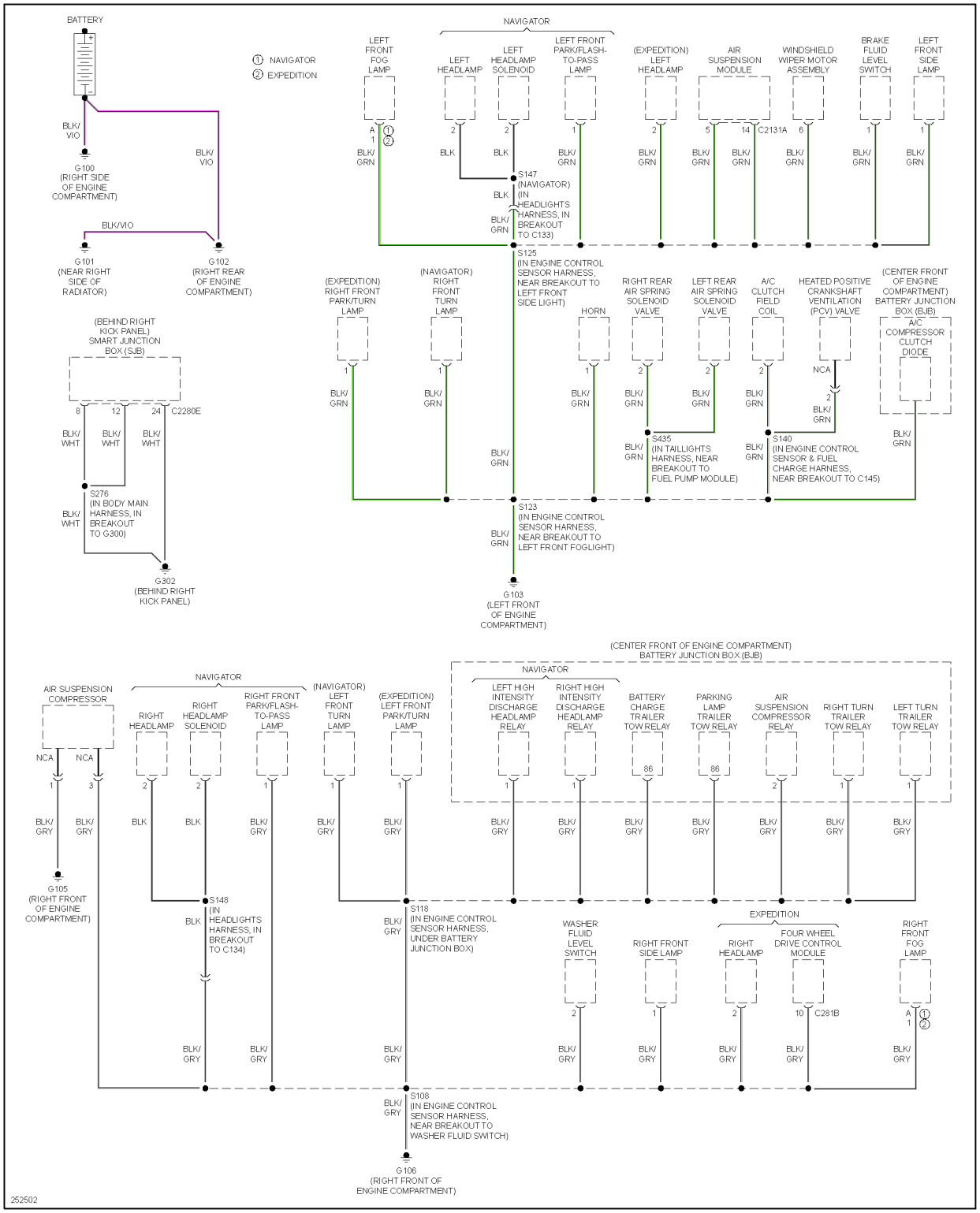


Fig. 31: Ground Distribution Circuit (1 of 5)

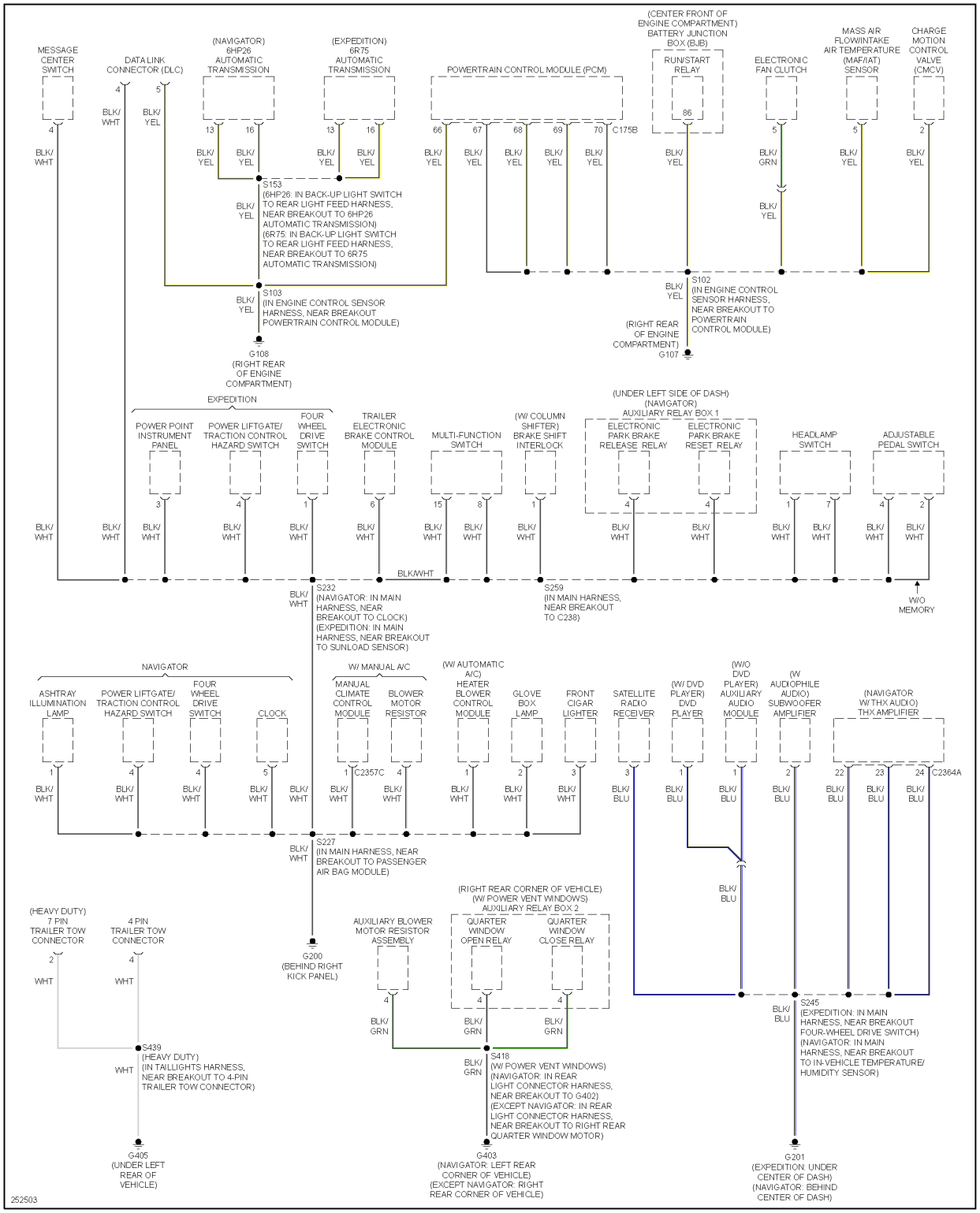


Fig. 32: Ground Distribution Circuit (2 of 5)

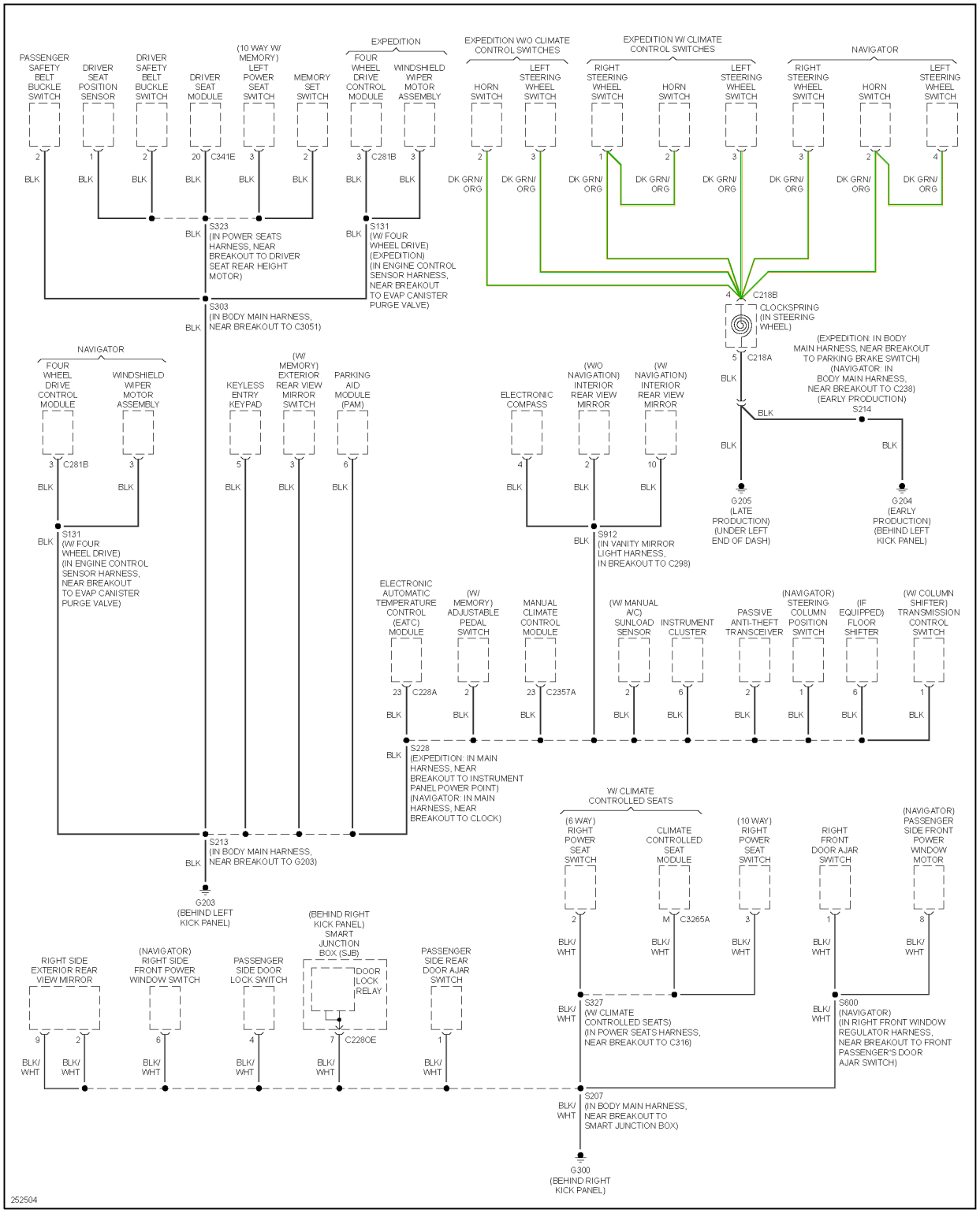


Fig. 33: Ground Distribution Circuit (3 of 5)

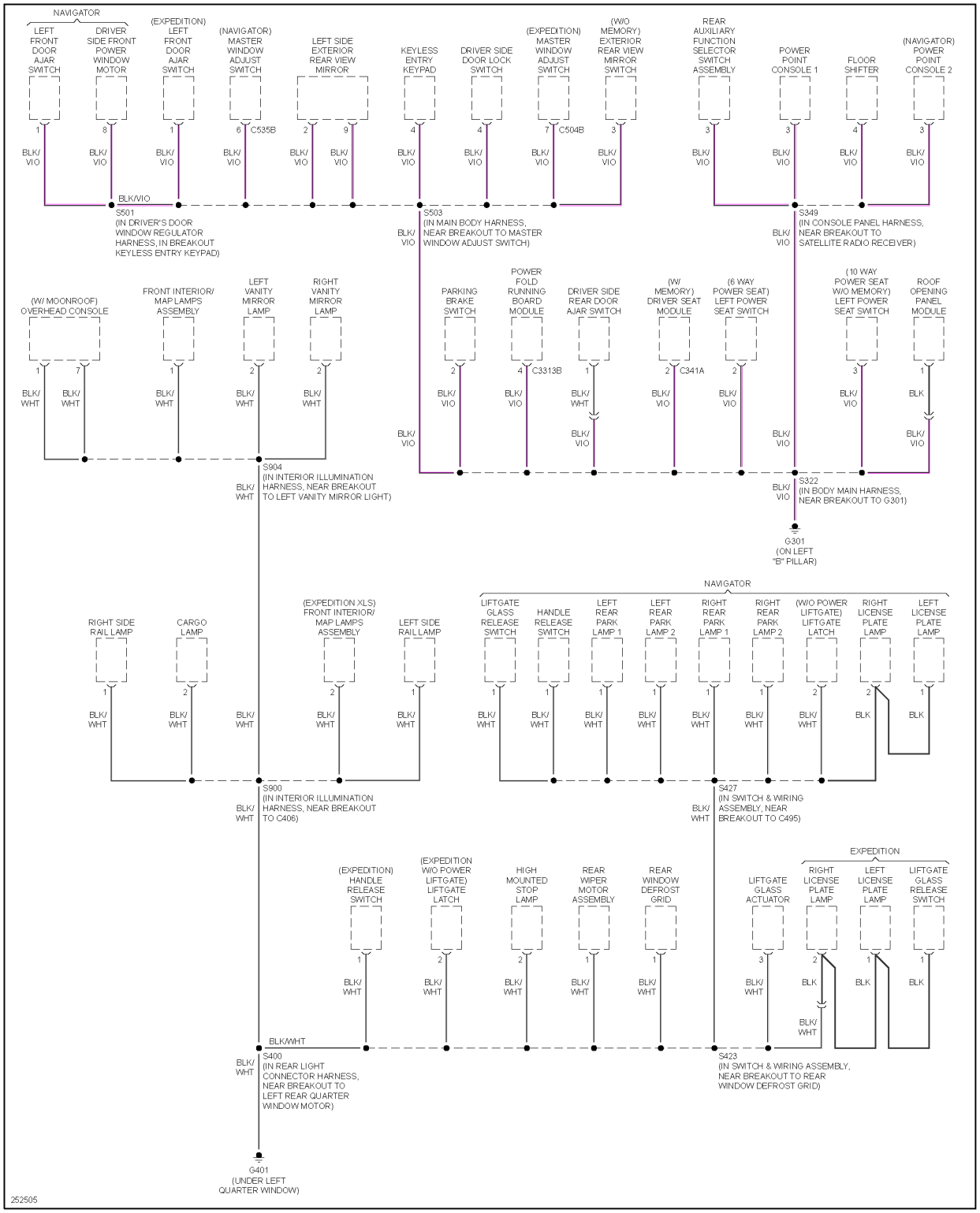


Fig. 34: Ground Distribution Circuit (4 of 5)

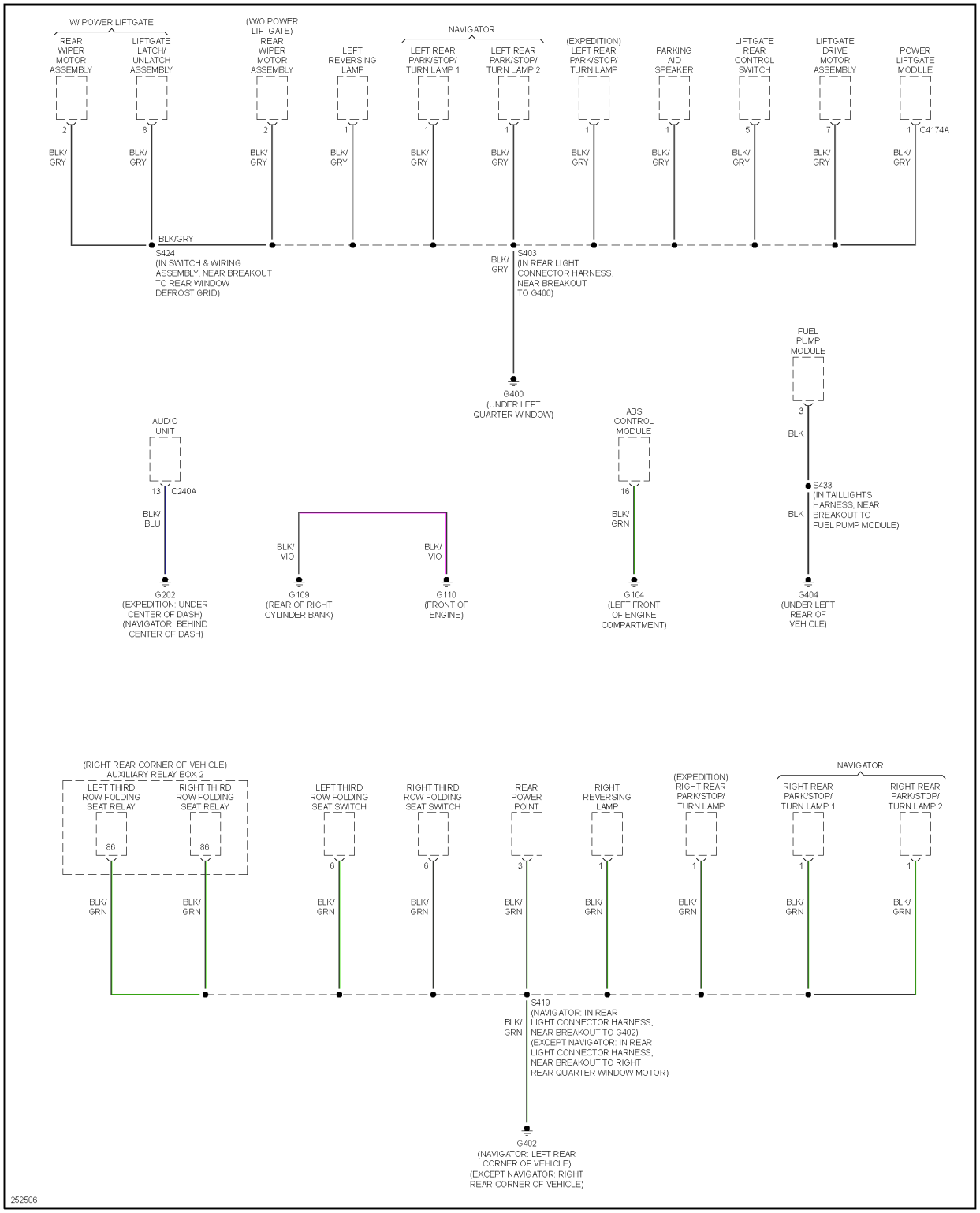


Fig. 35: Ground Distribution Circuit (5 of 5)

HEADLIGHTS

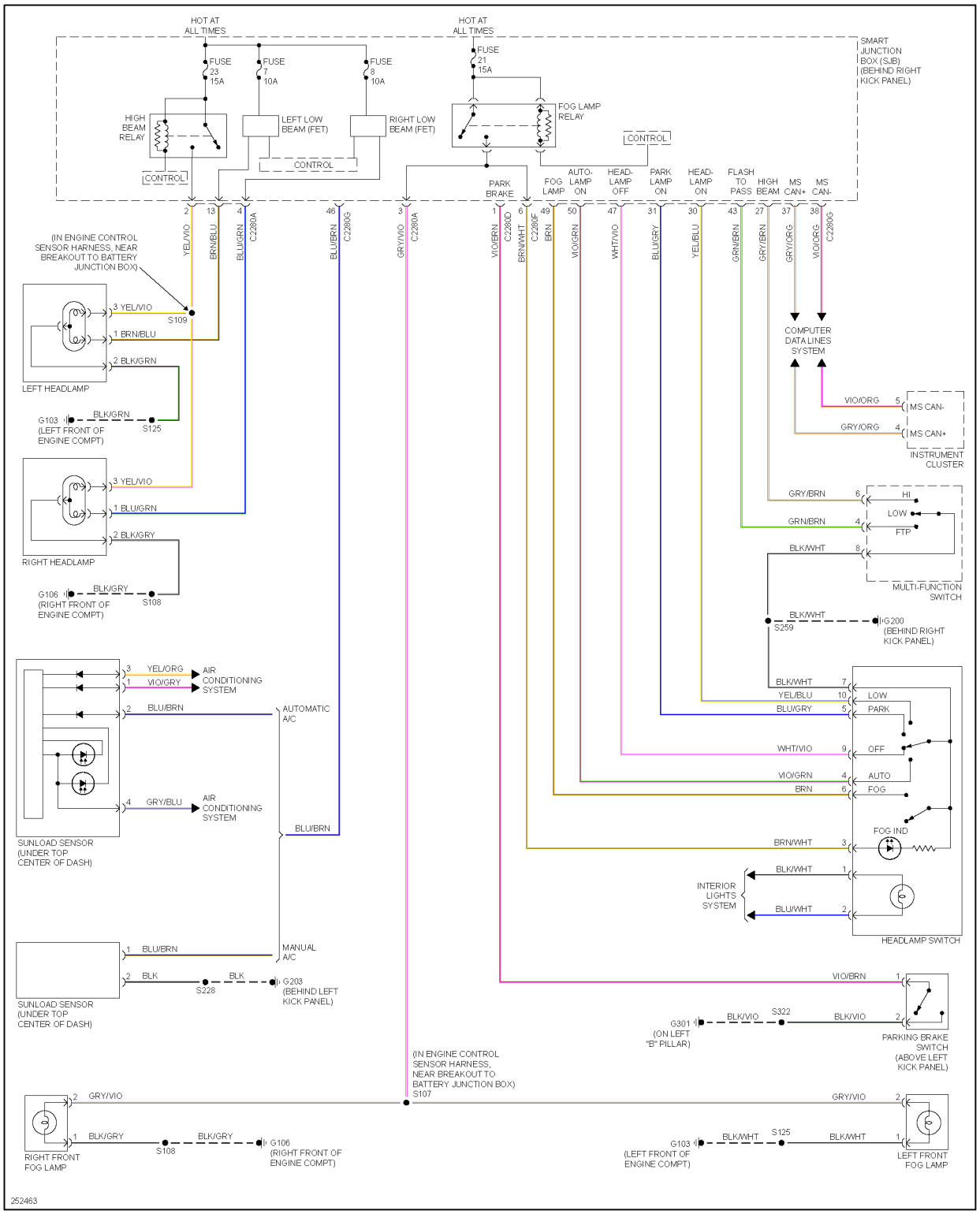


Fig. 36: Headlights Circuit

HORN

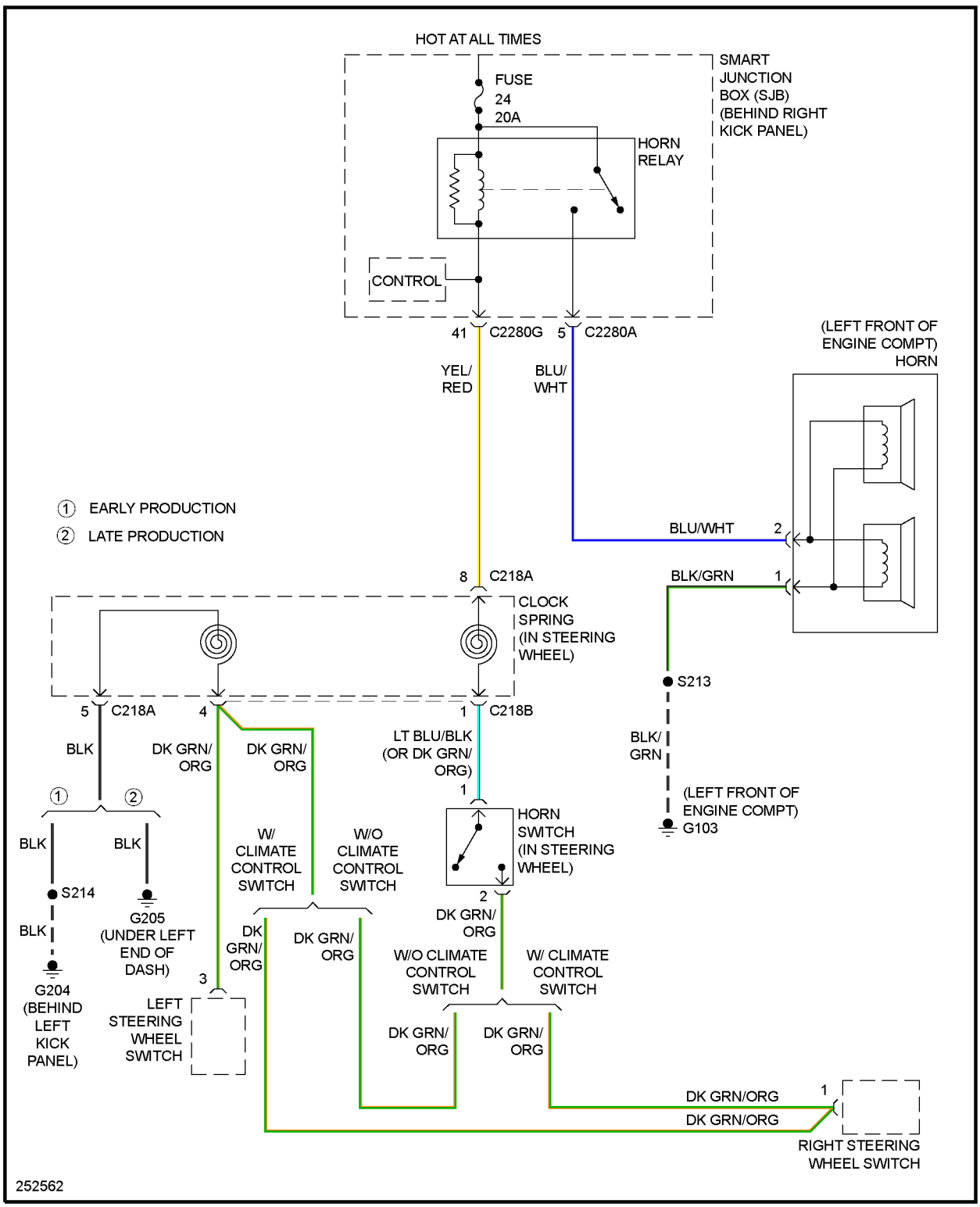


Fig. 37: Horn Circuit

INSTRUMENT CLUSTER

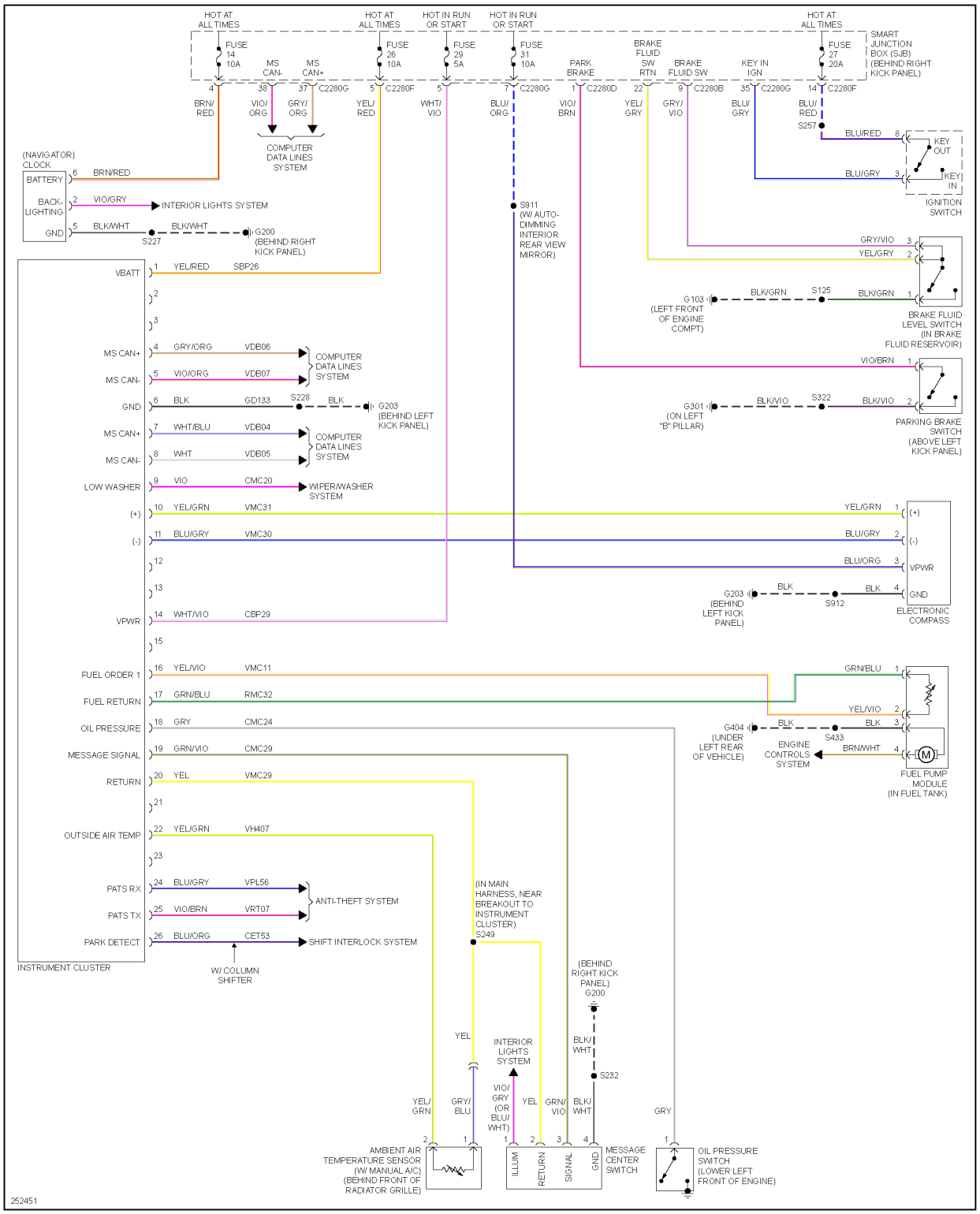


Fig. 38: Instrument Cluster Circuit

INTERIOR LIGHTS

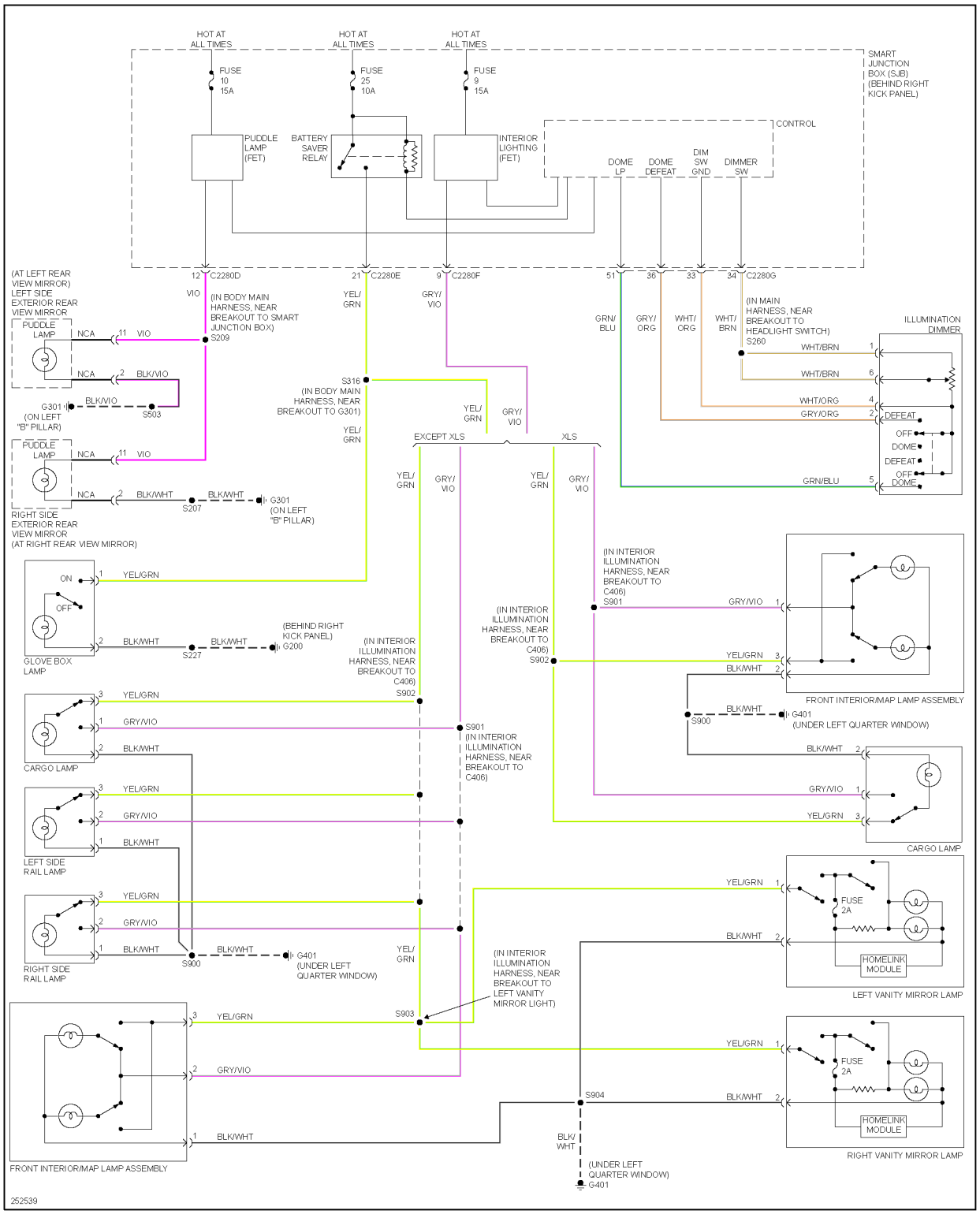


Fig. 39: Courtesy Lamps Circuit

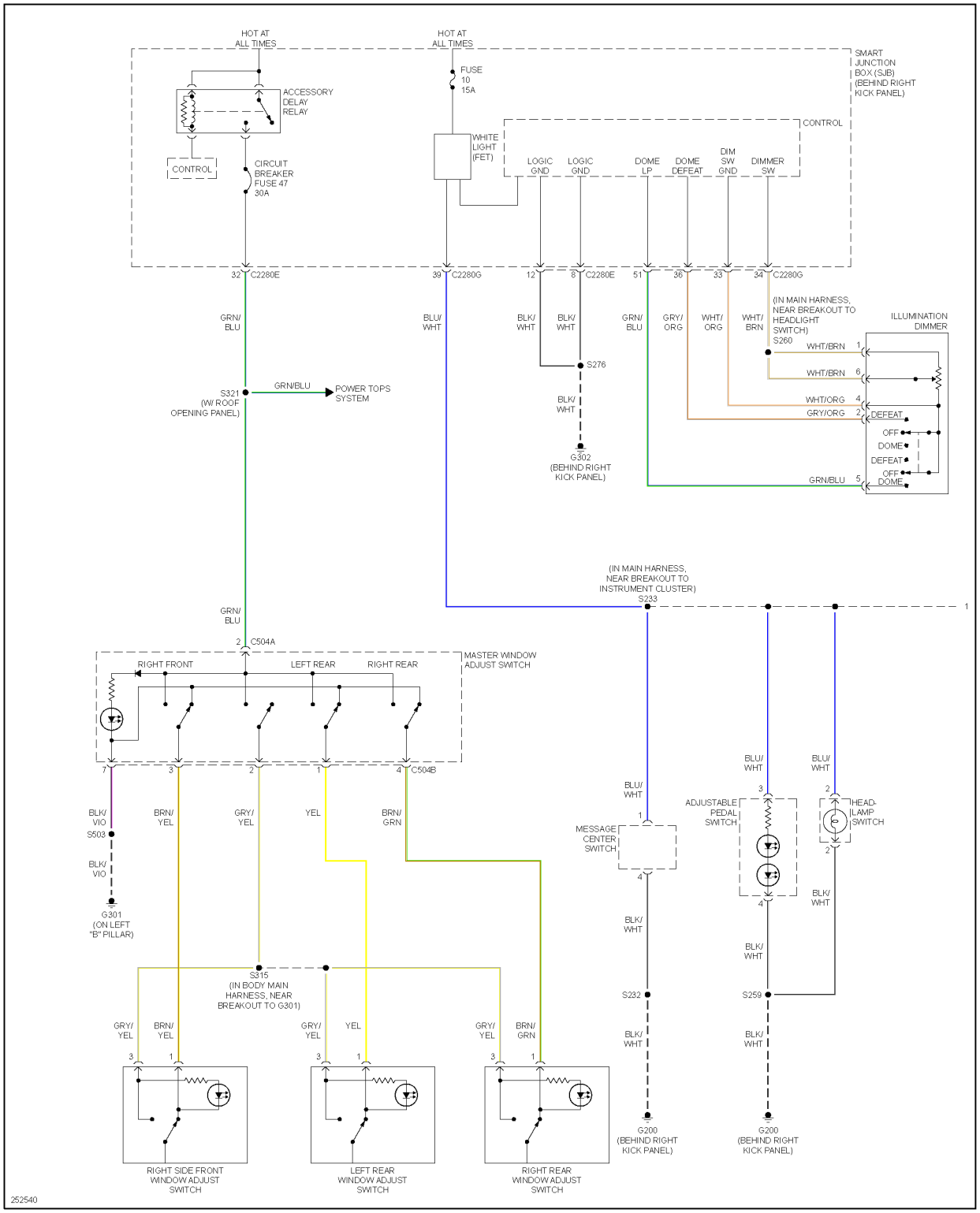


Fig. 40: Instrument Illumination Circuit (1 of 2)

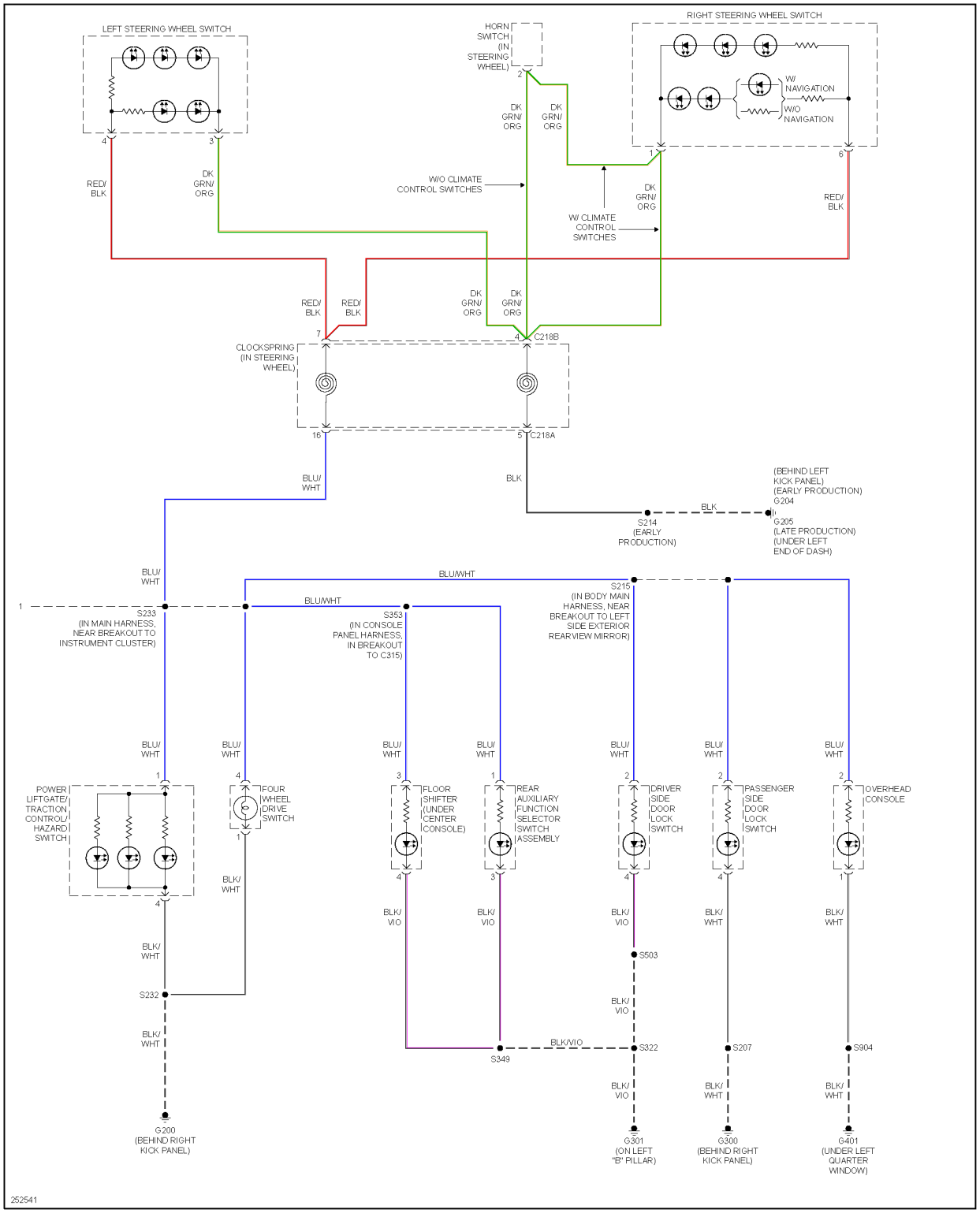


Fig. 41: Instrument Illumination Circuit (2 of 2)

MEMORY SYSTEMS

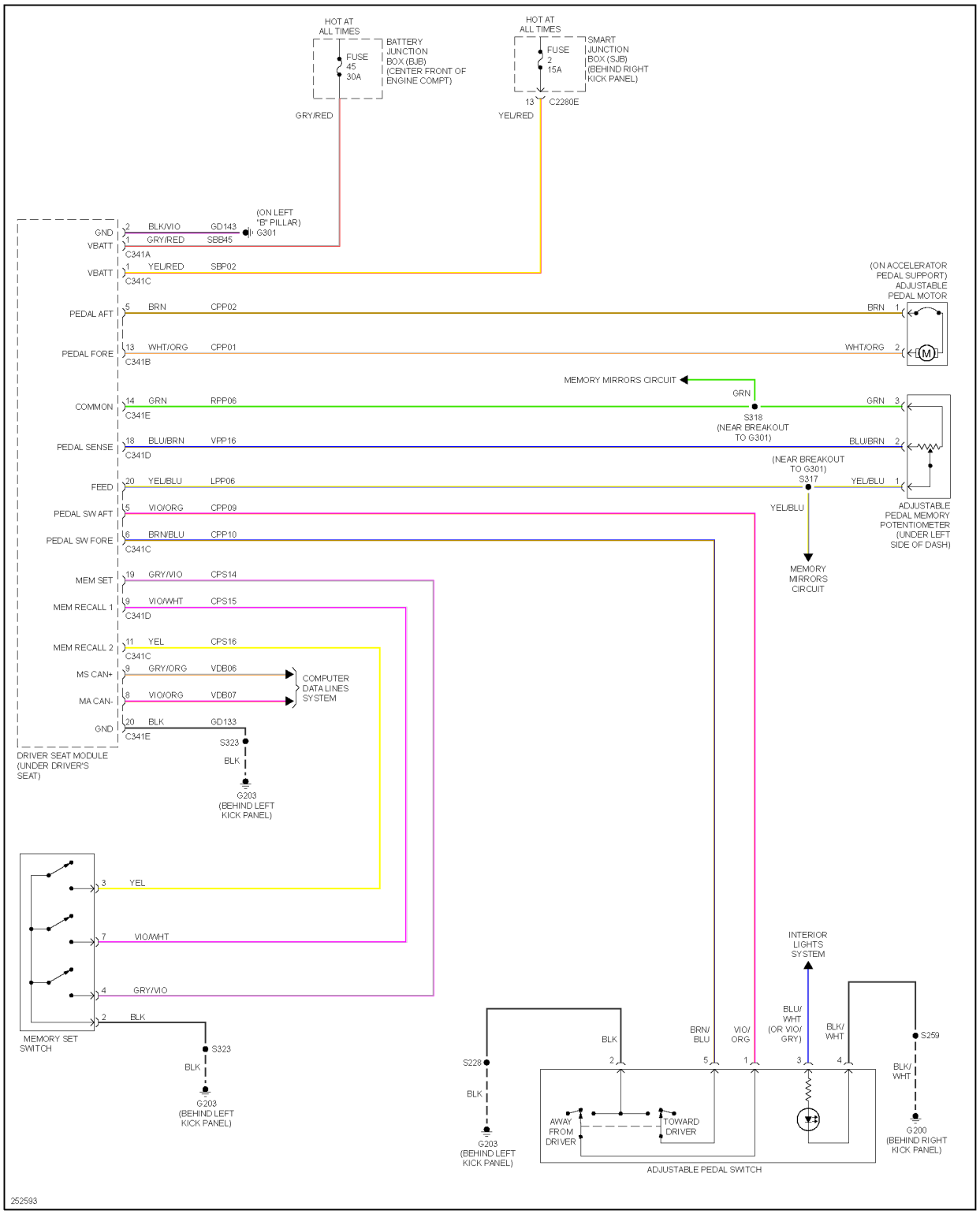


Fig. 42: Adjustable Pedal Circuit

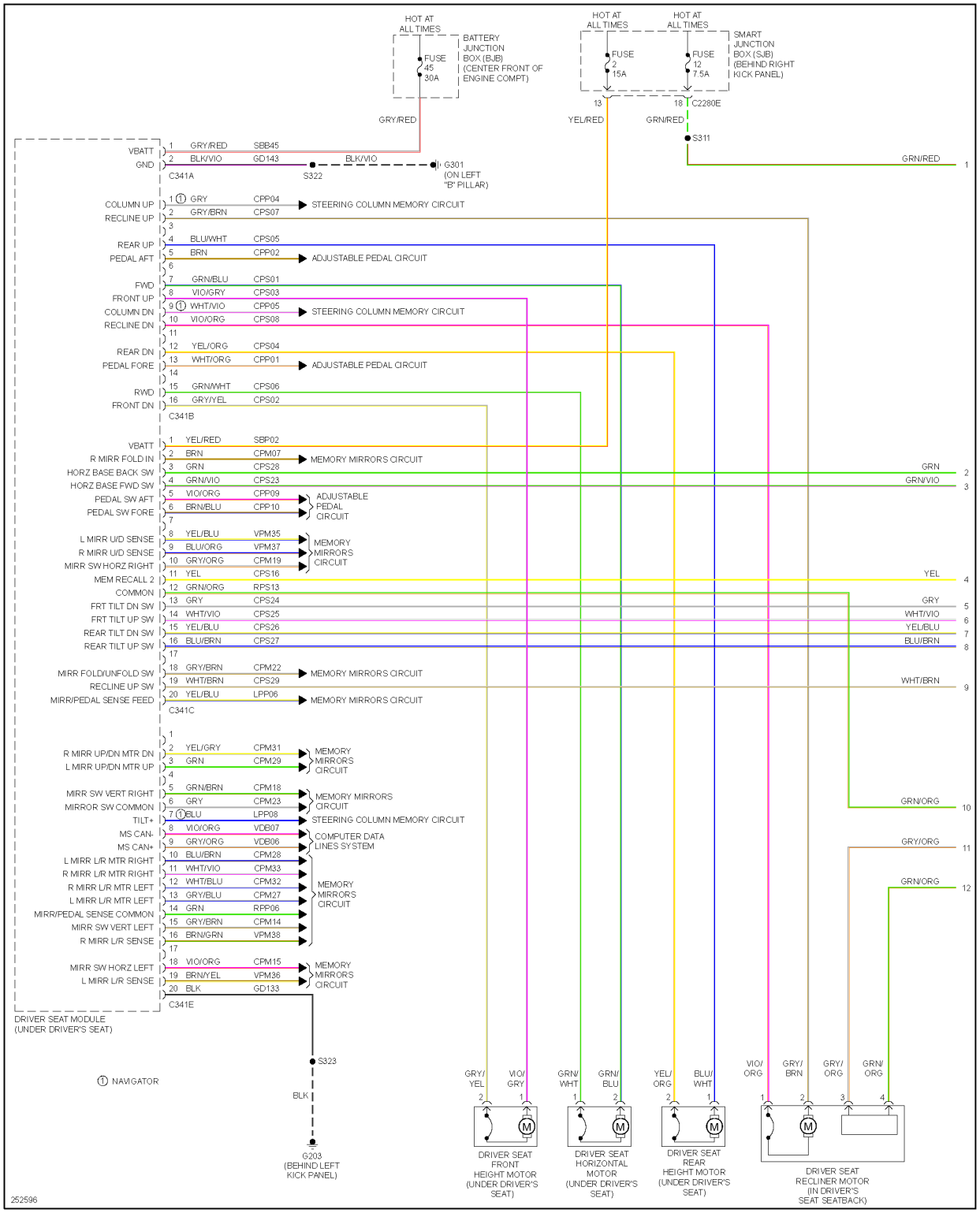


Fig. 43: Driver"s Memory Seat Circuit (1 of 2)

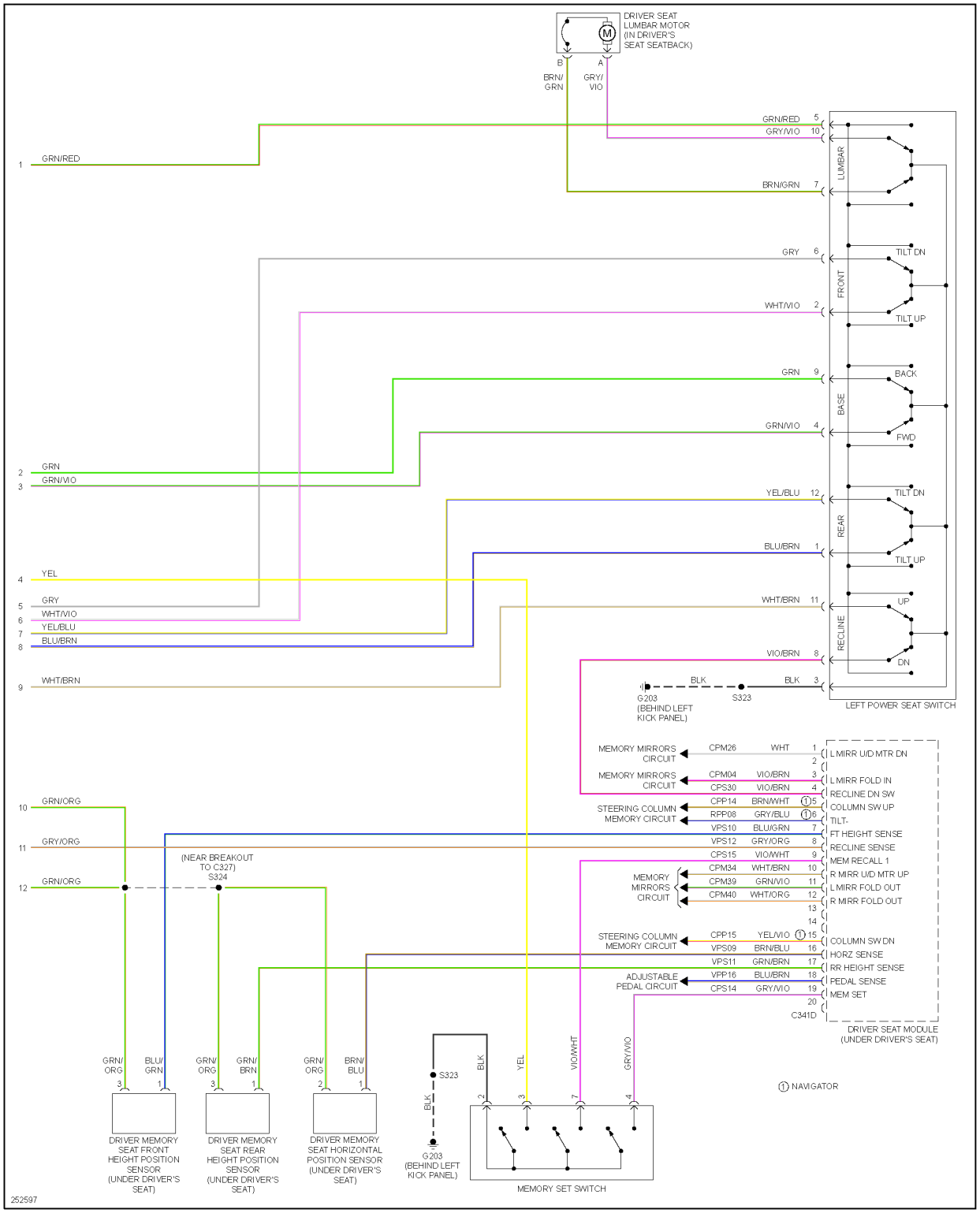


Fig. 44: Driver"s Memory Seat Circuit (2 of 2)

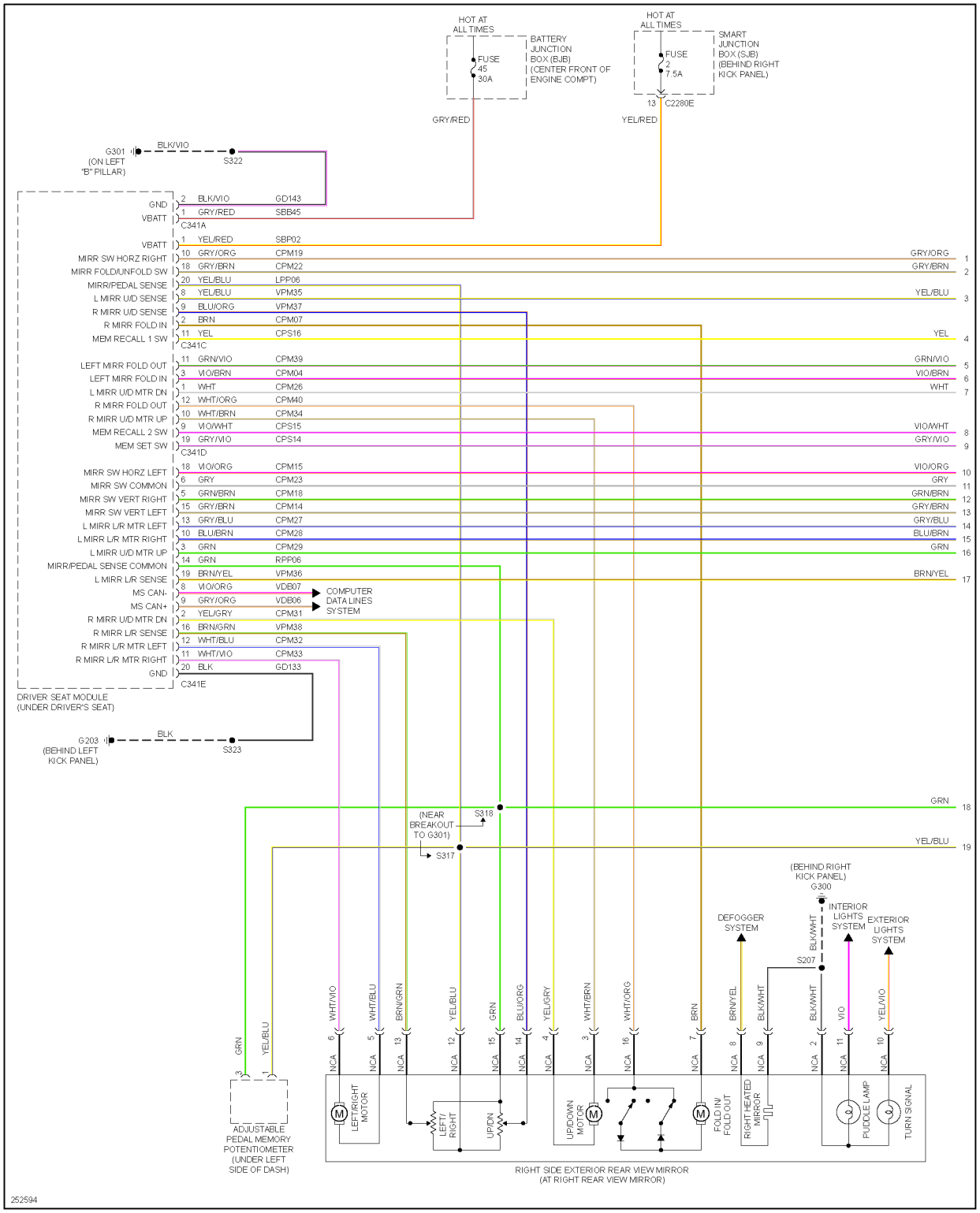


Fig. 45: Memory Mirrors Circuit (1 of 2)

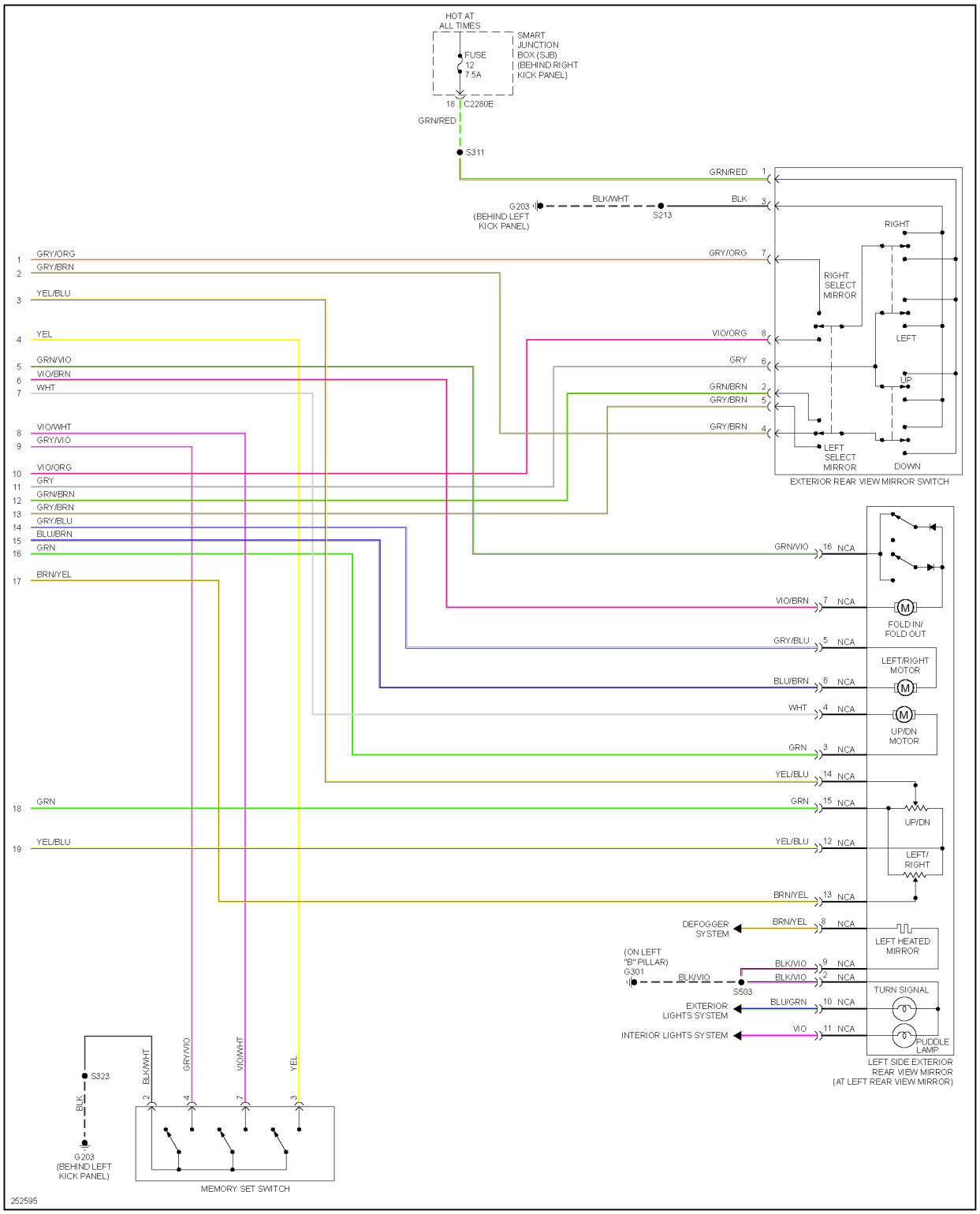


Fig. 46: Memory Mirrors Circuit (2 of 2)

NAVIGATION

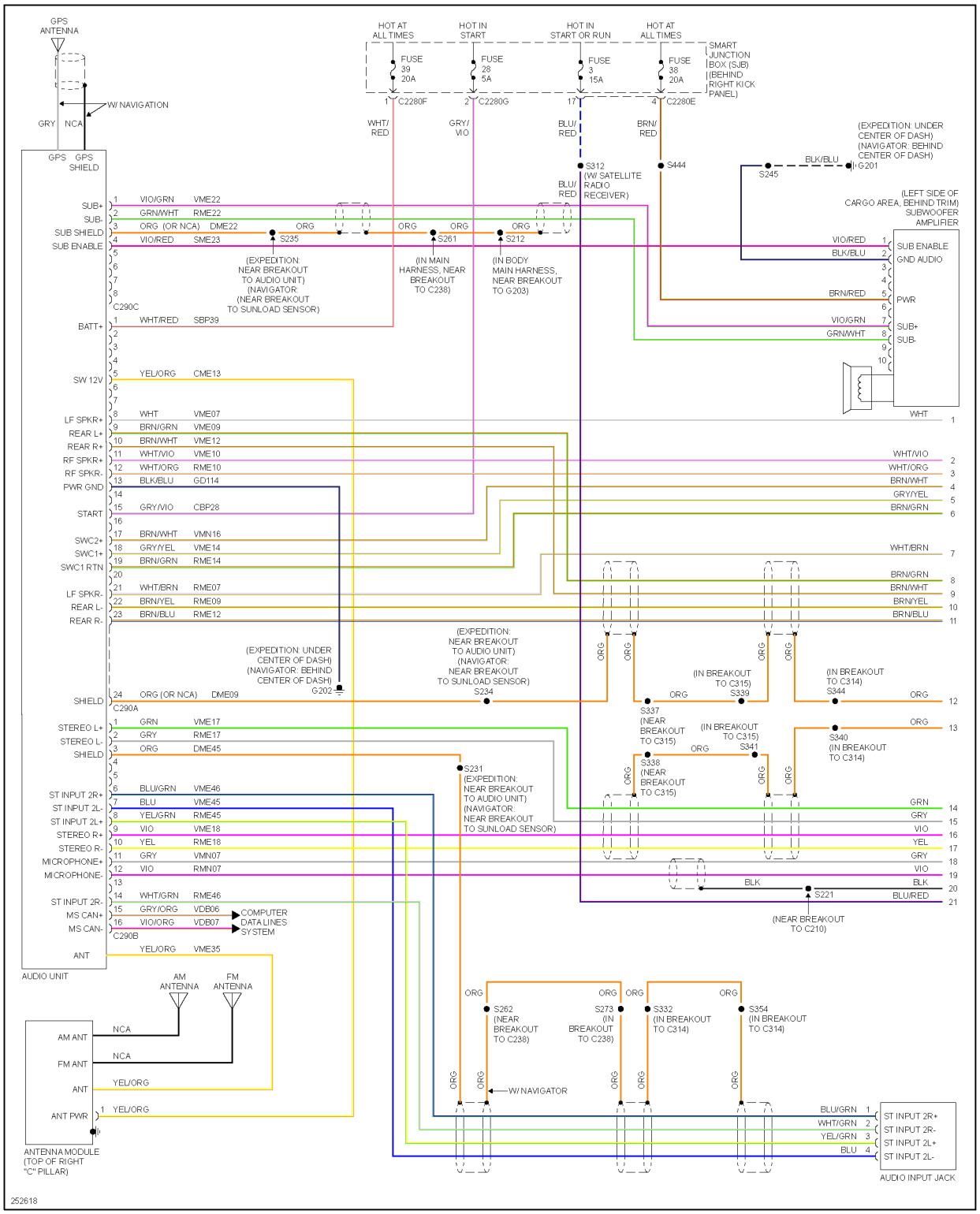


Fig. 47: Navigation Circuit, Audiophile Sound Radio Circuit W/ DVD (1 of 2)

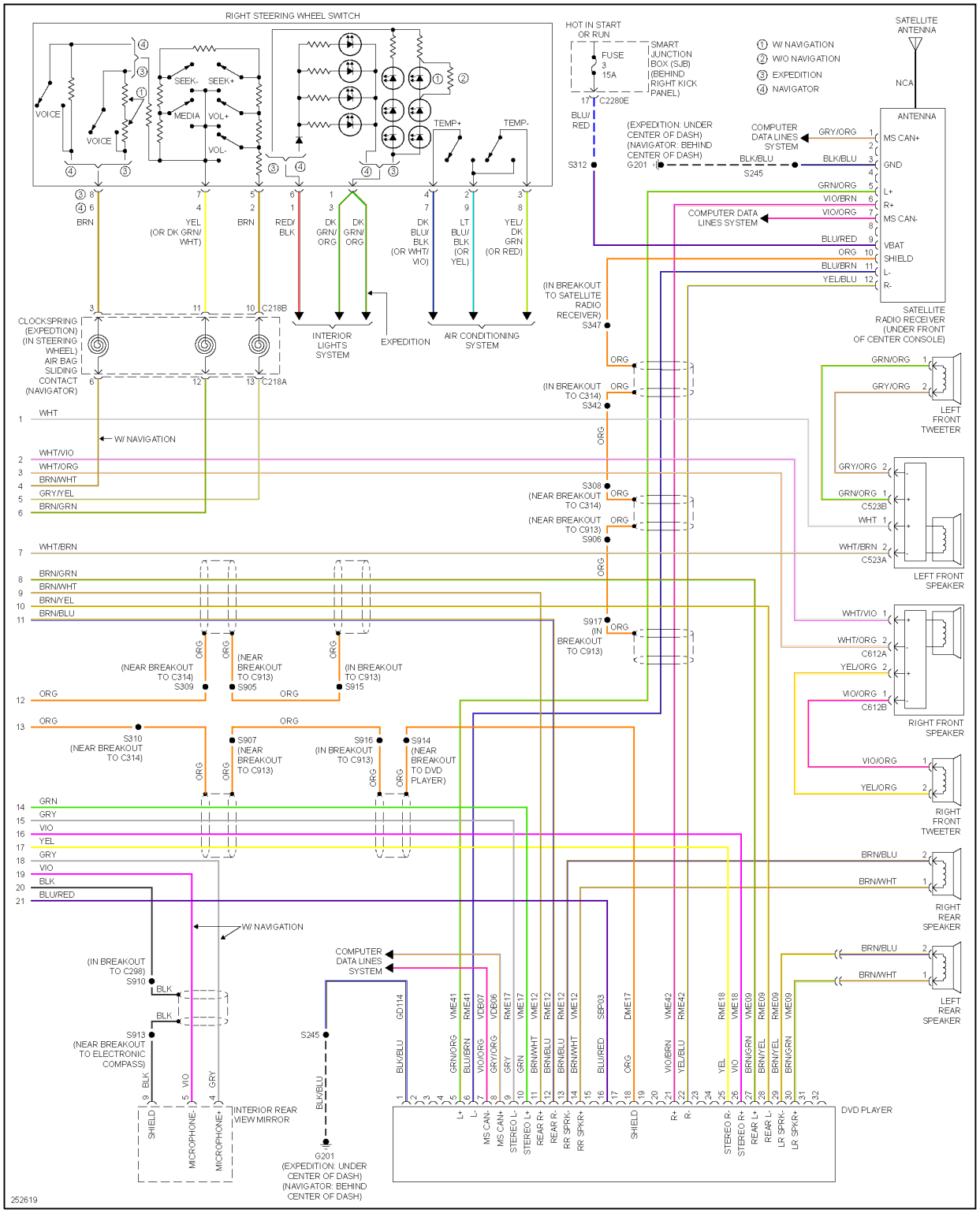


Fig. 48: Navigation Circuit, Audiophile Sound Radio Circuit W/ DVD (2 of 2)

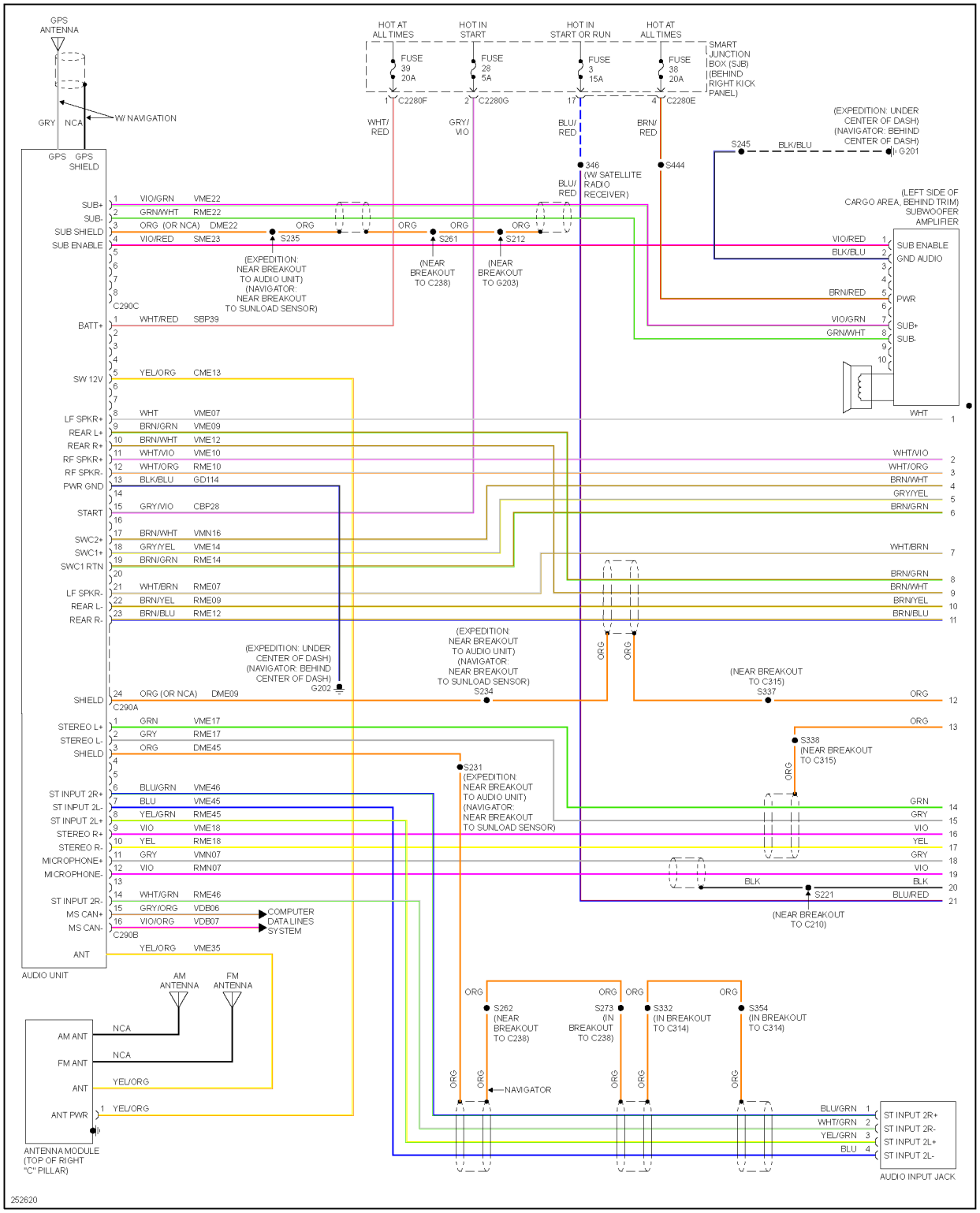


Fig. 49: Navigation Circuit, Audiophile Sound Radio Circuit W/O DVD (1 of 2)

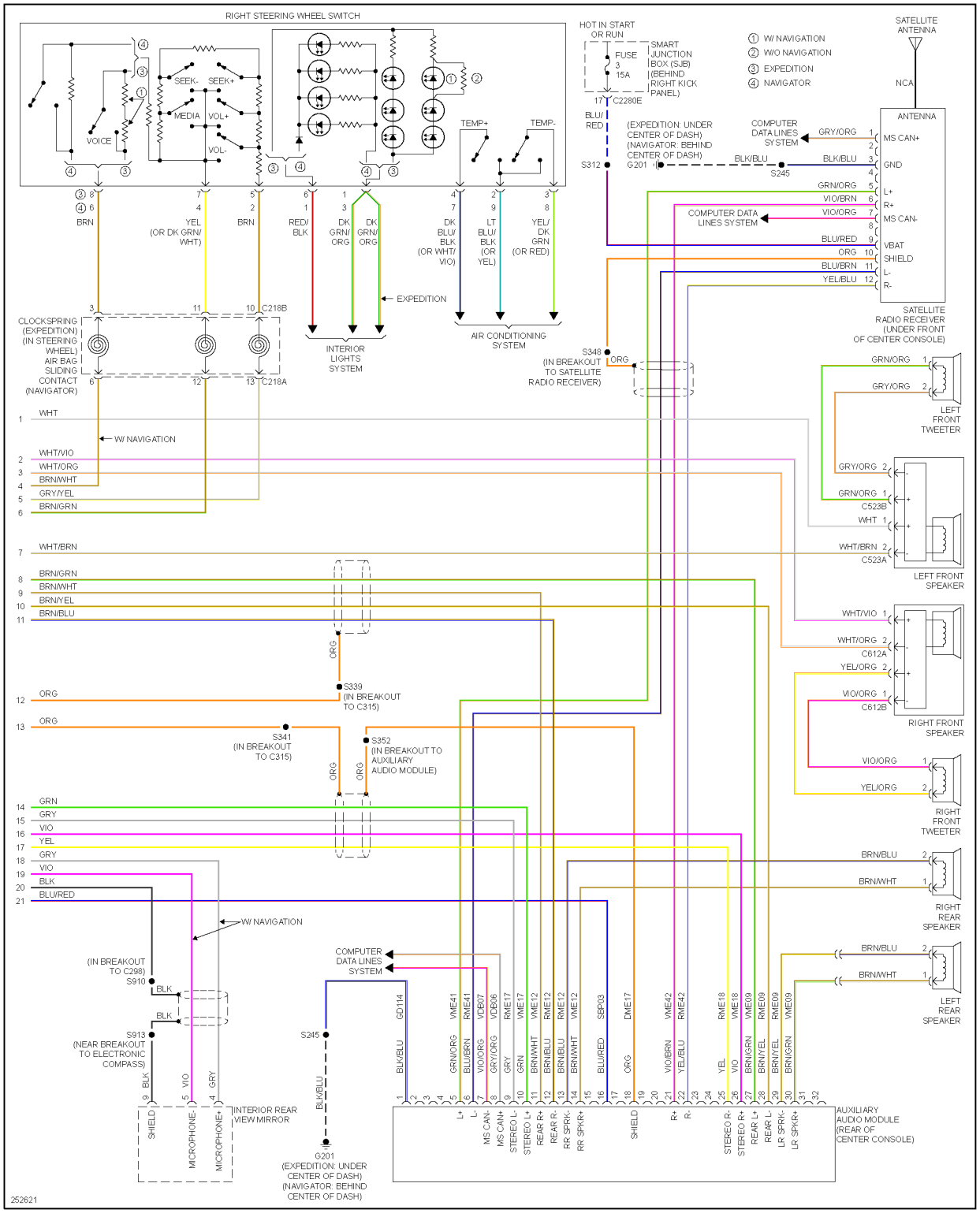


Fig. 50: Navigation Circuit, Audiophile Sound Radio Circuit W/O DVD (2 of 2)

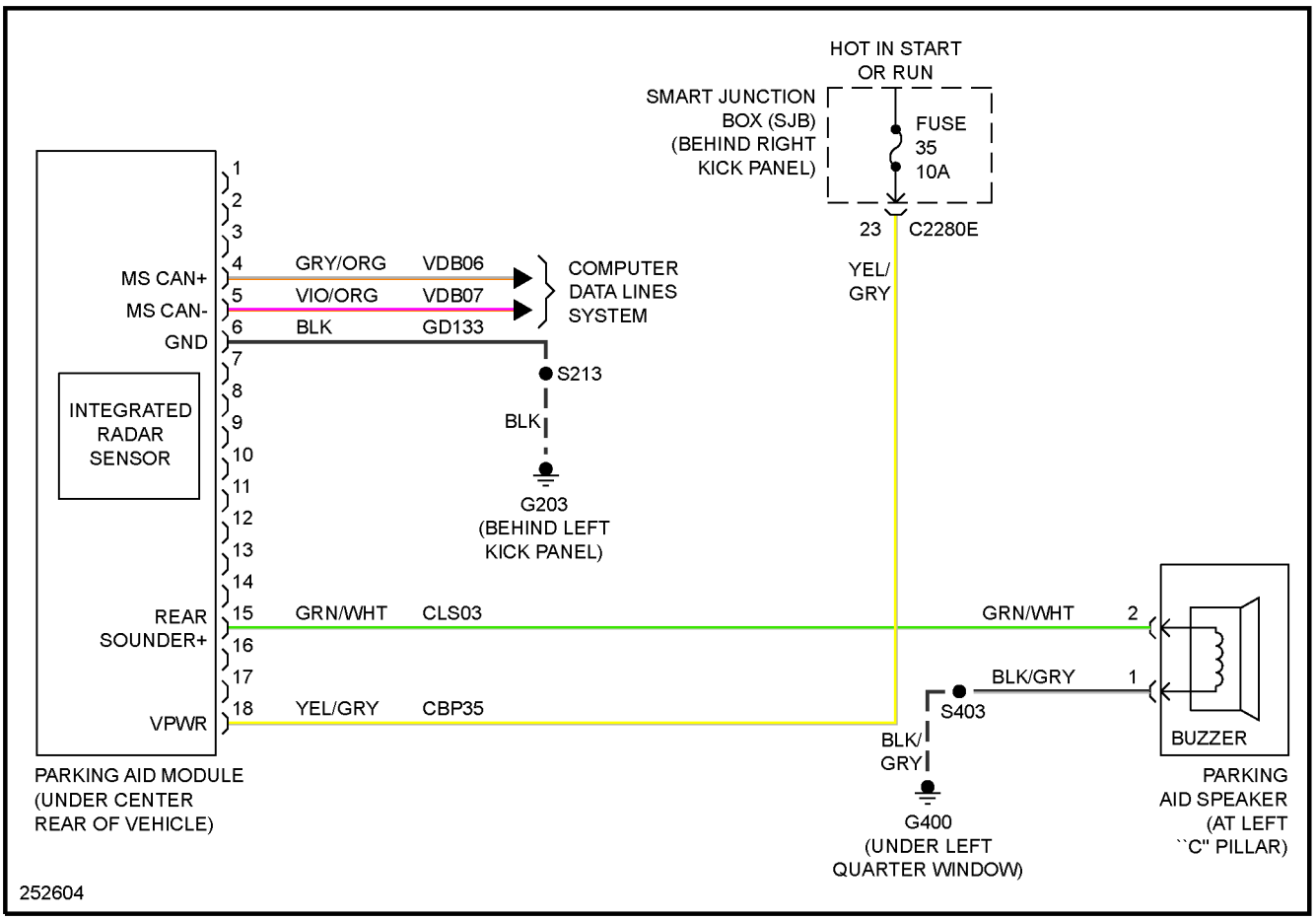


Fig. 51: Parking Assistant Circuit

POWER DISTRIBUTION

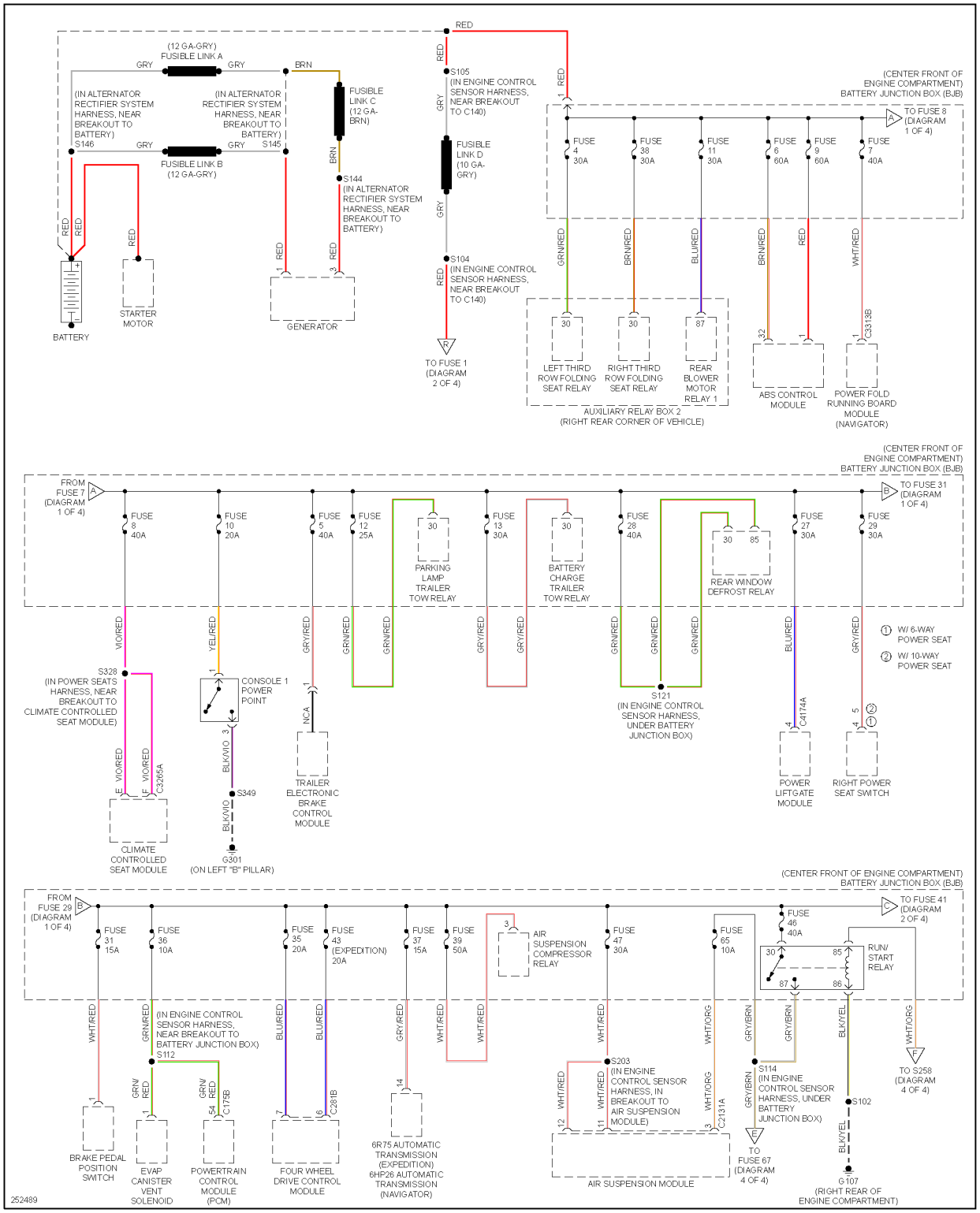


Fig. 52: Power Distribution Circuit (1 of 4)

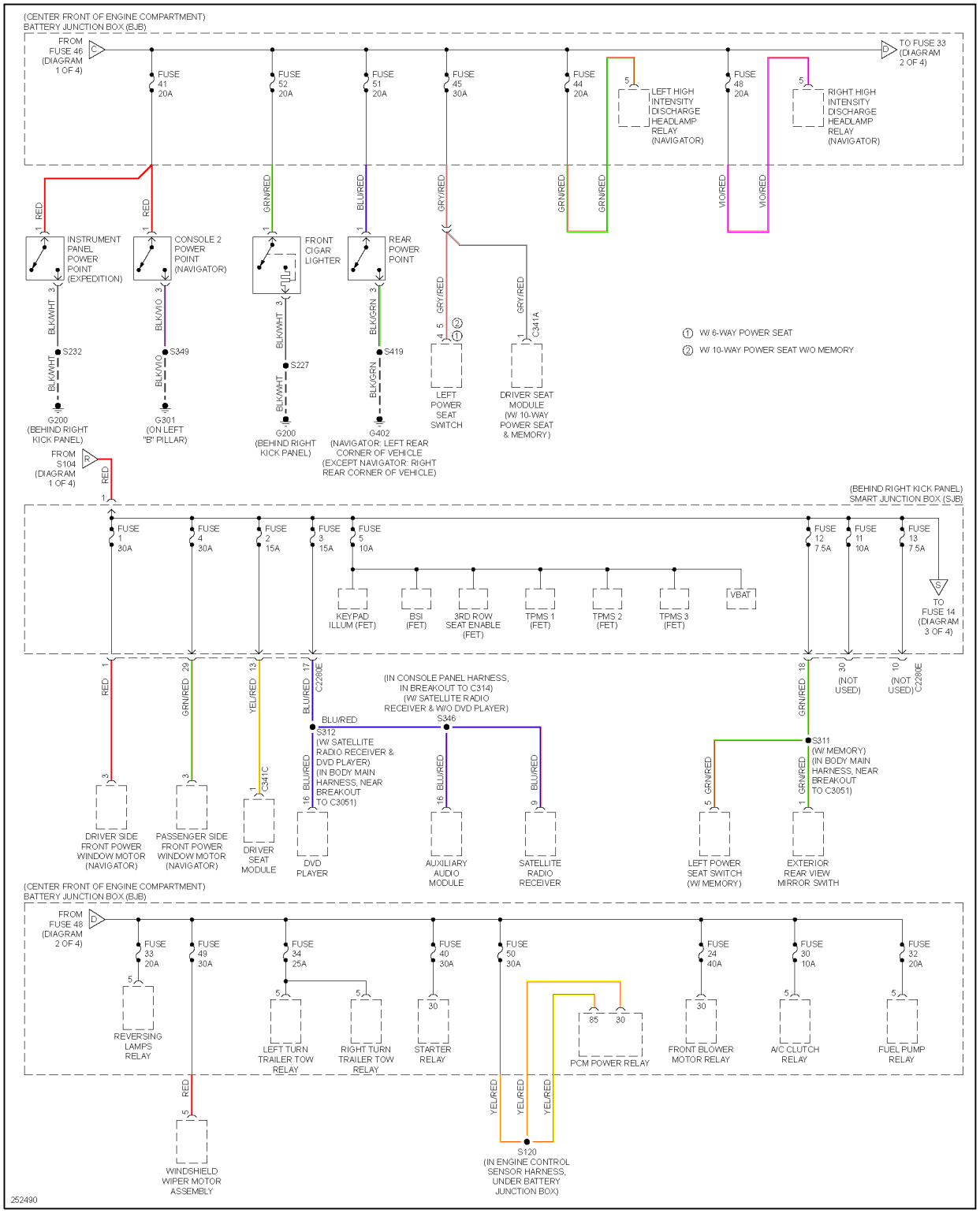


Fig. 53: Power Distribution Circuit (2 of 4)

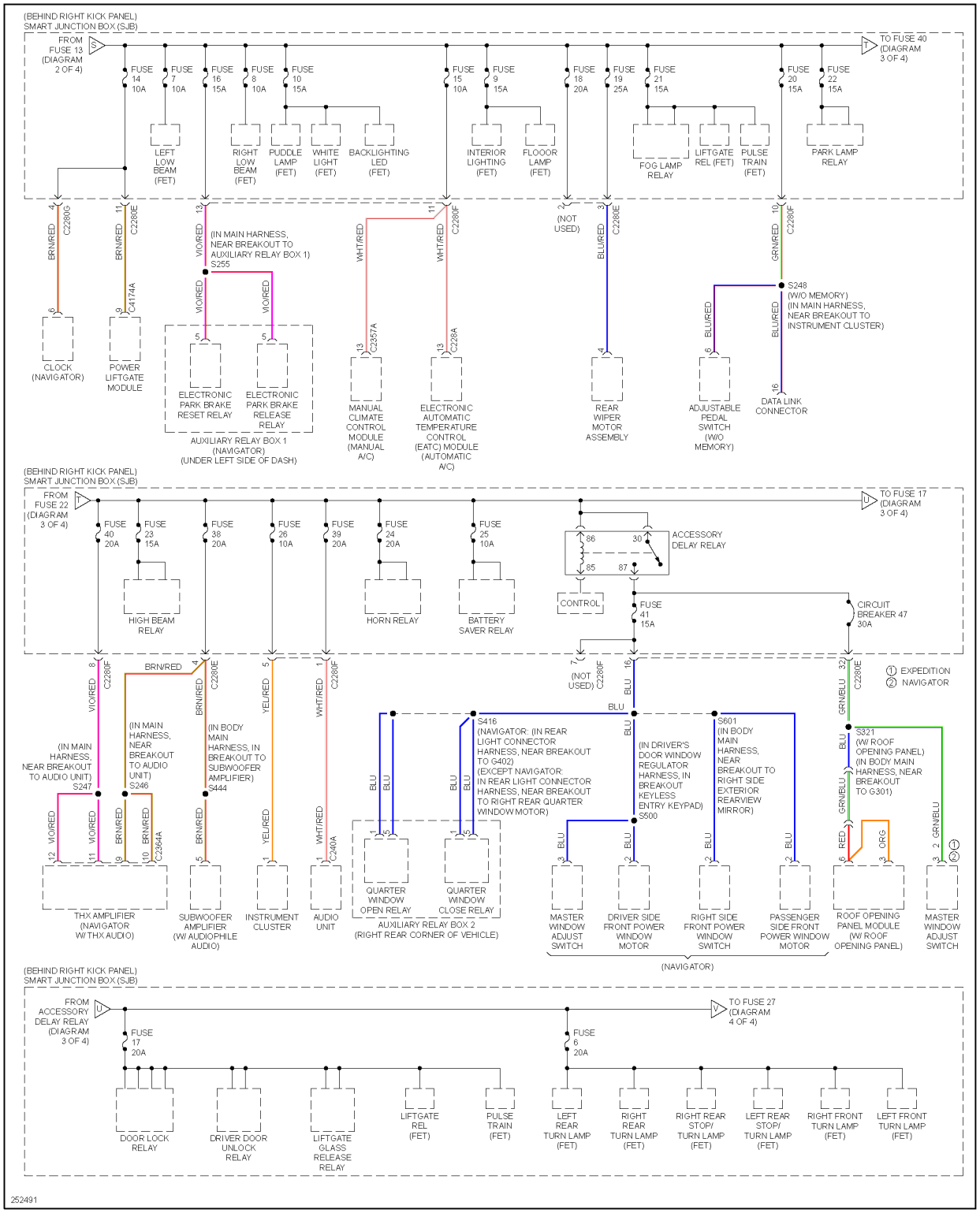


Fig. 54: Power Distribution Circuit (3 of 4)

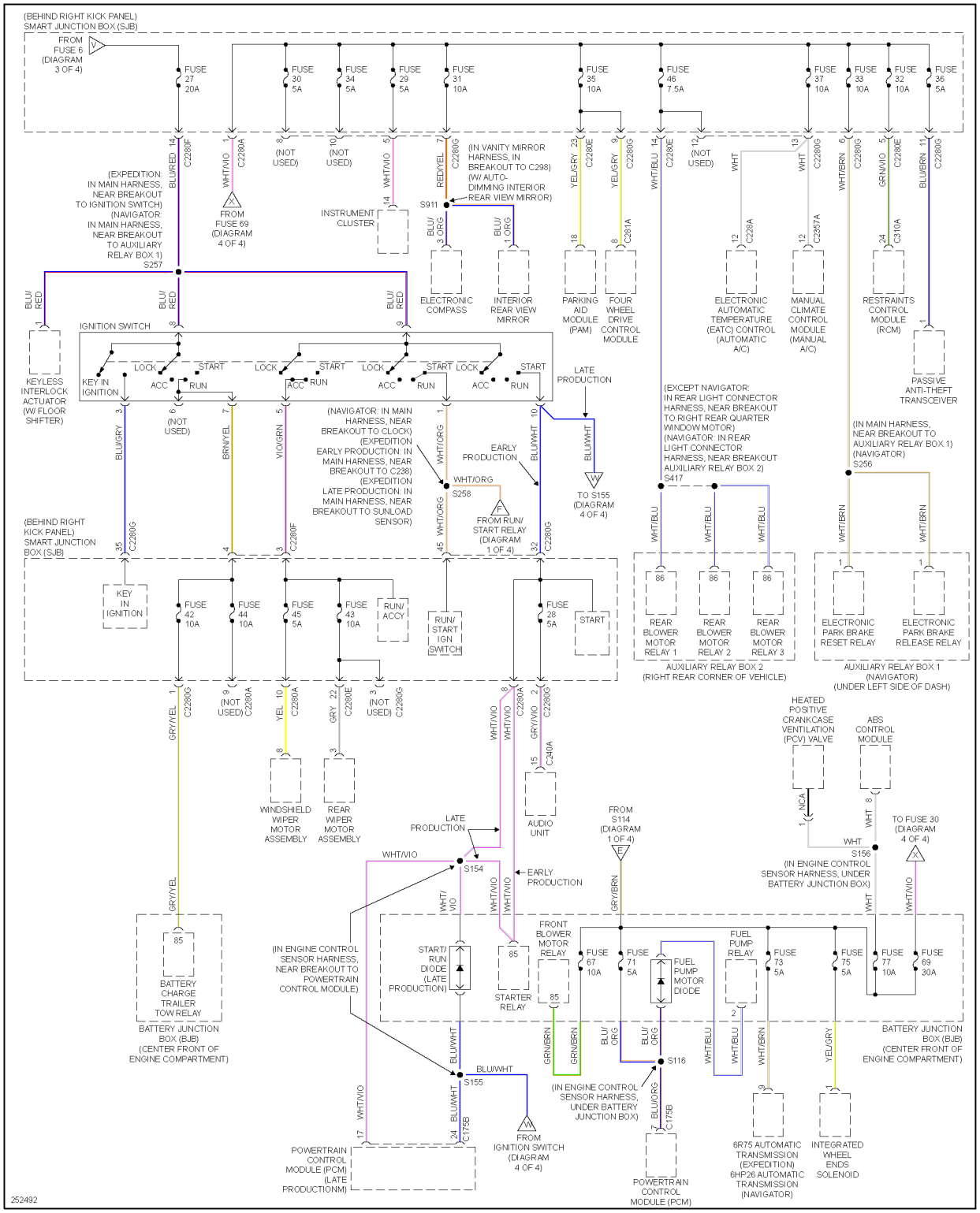


Fig. 55: Power Distribution Circuit (4 of 4)

POWER DOOR LOCKS

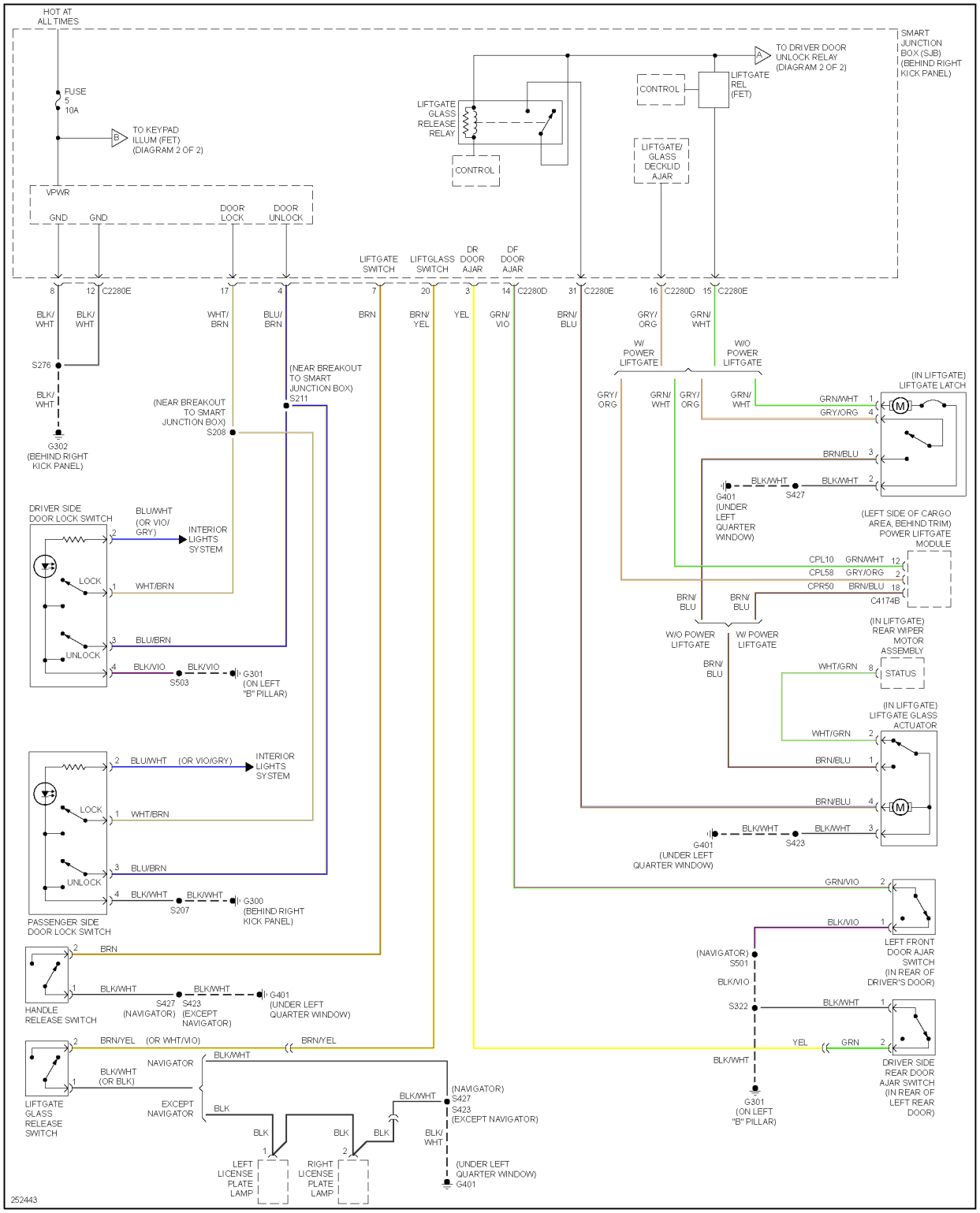


Fig. 56: Power Door Locks Circuit (1 of 2)

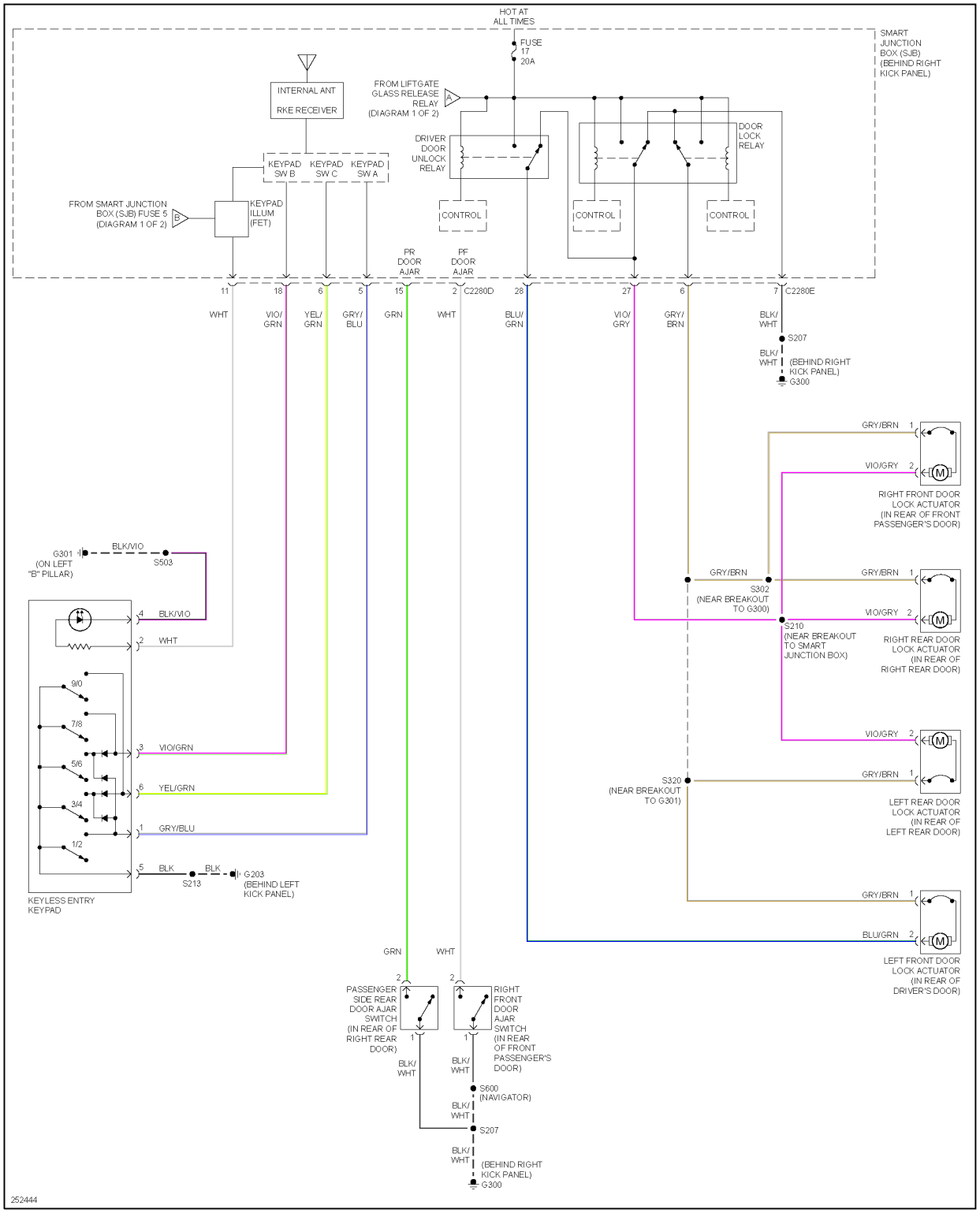


Fig. 57: Power Door Locks Circuit (2 of 2)

POWER MIRRORS

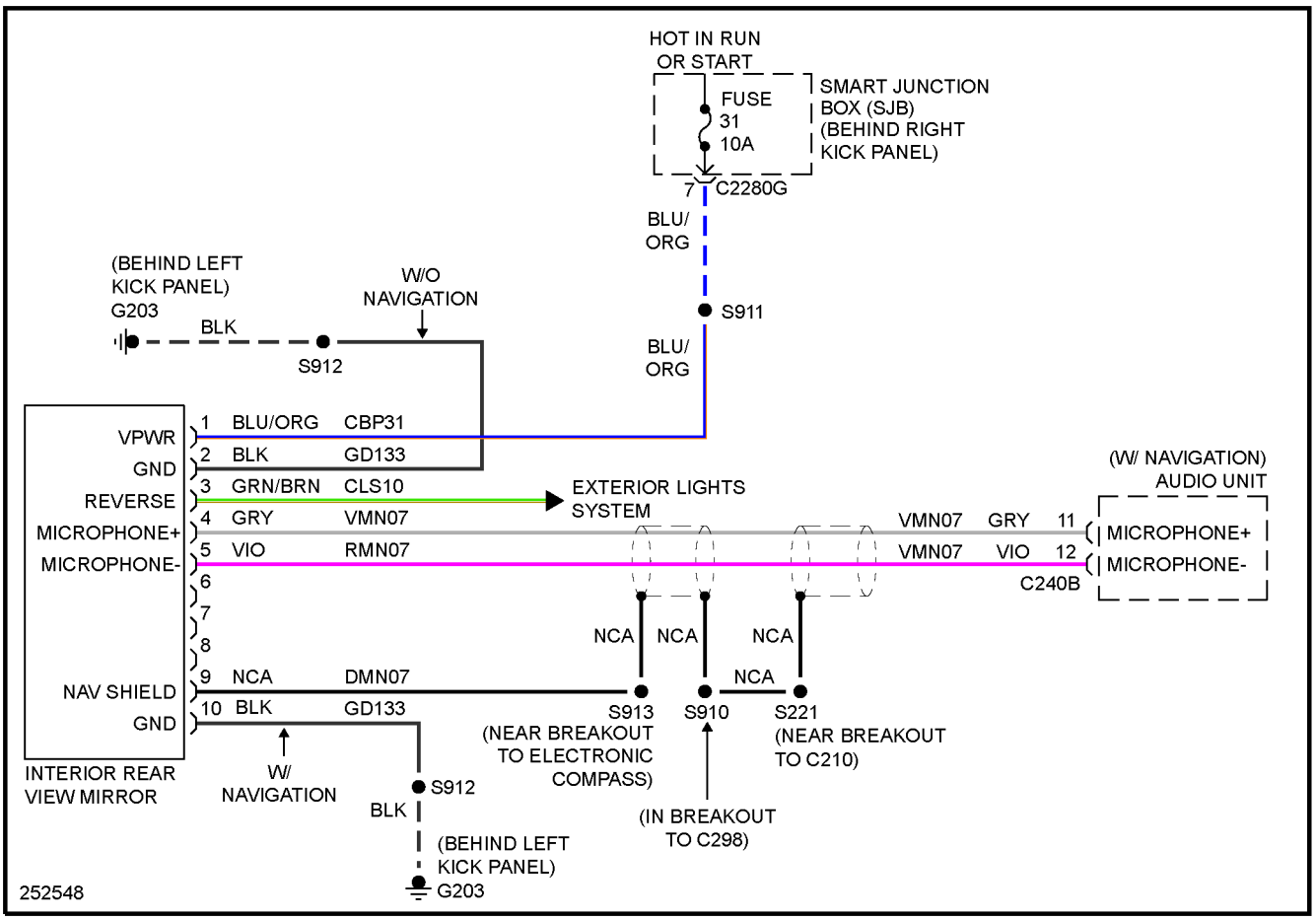


Fig. 58: Electronic Day/Night Mirror Circuit

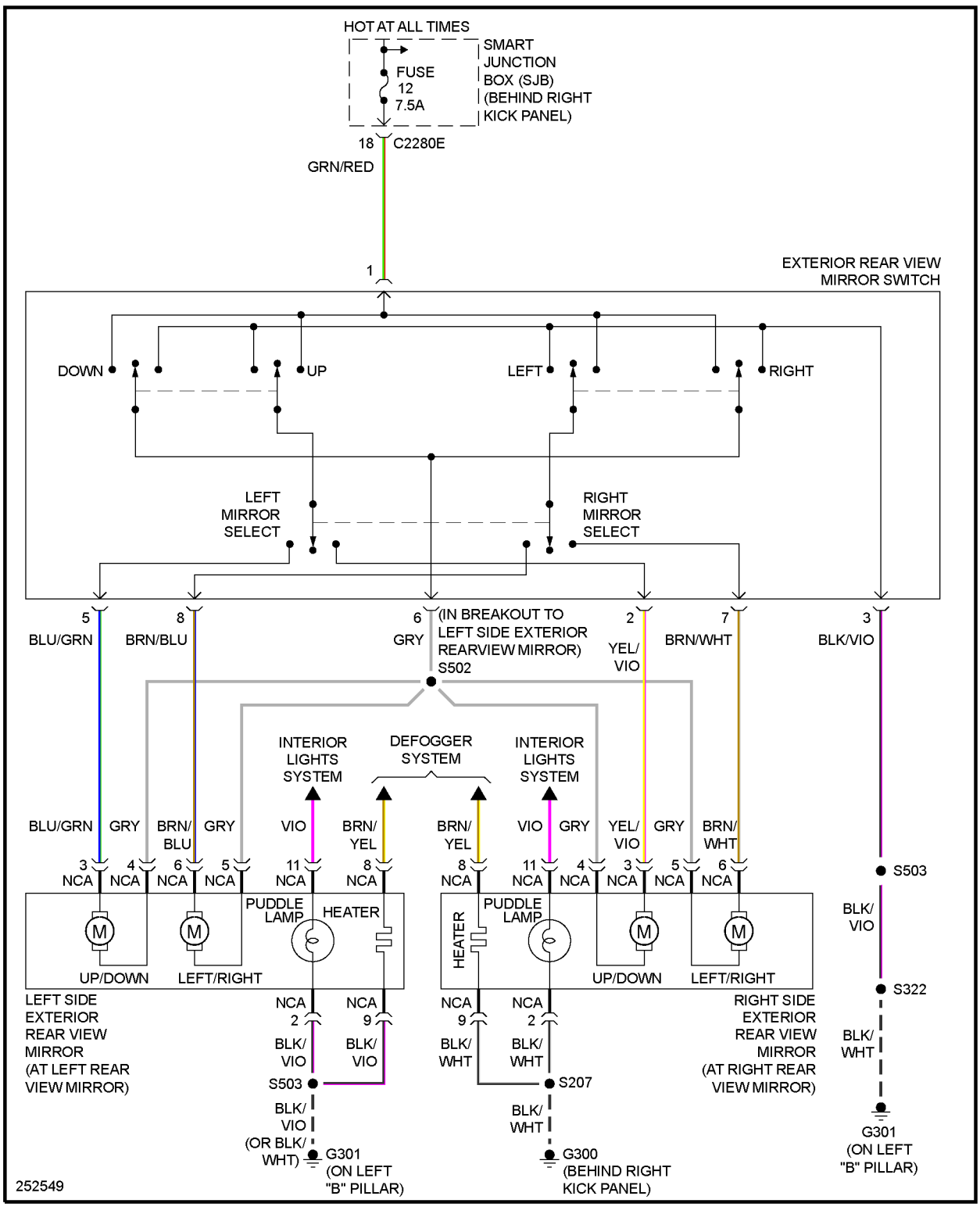


Fig. 59: Power Mirrors Circuit

POWER SEATS

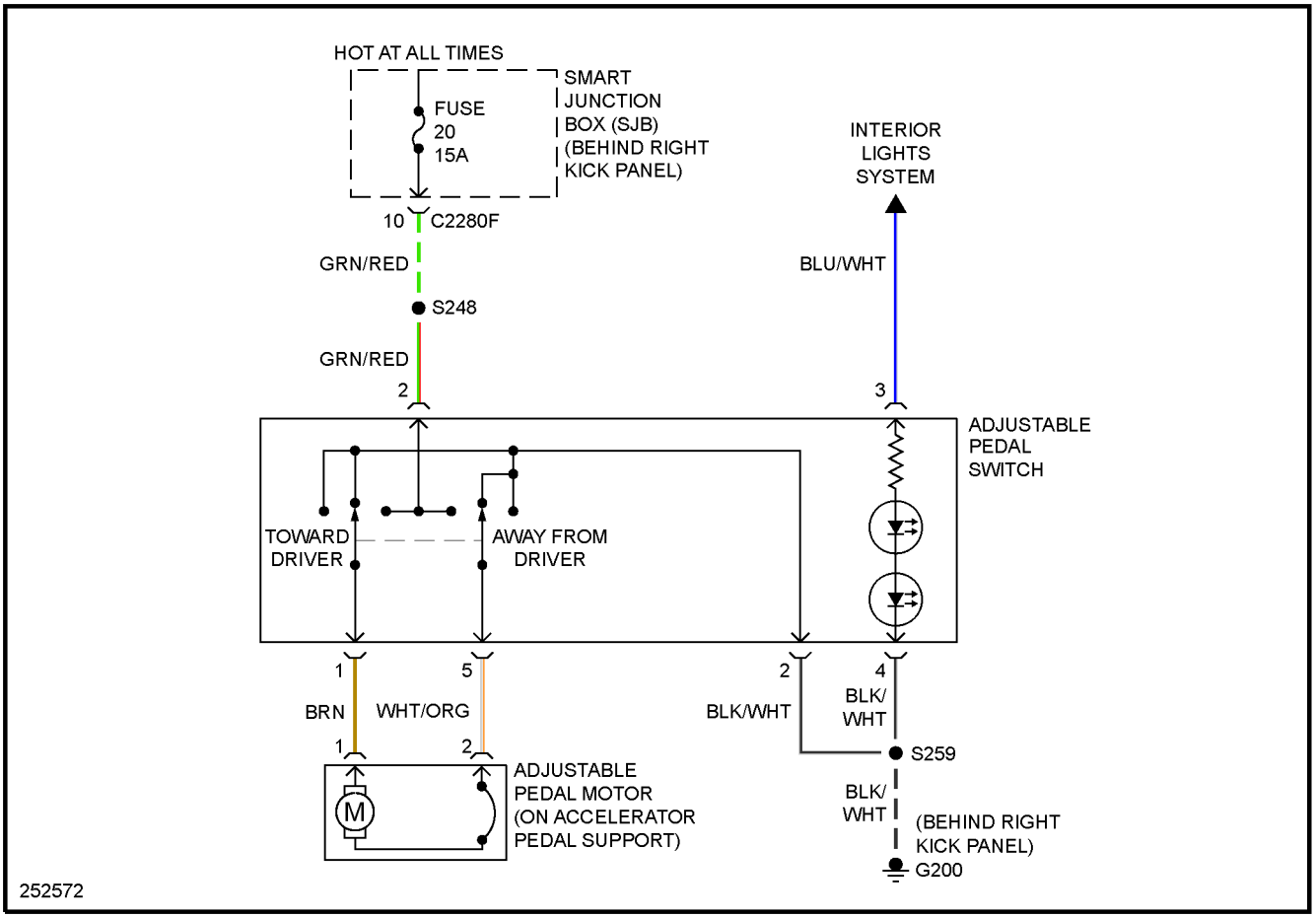


Fig. 60: Adjustable Pedal Circuit

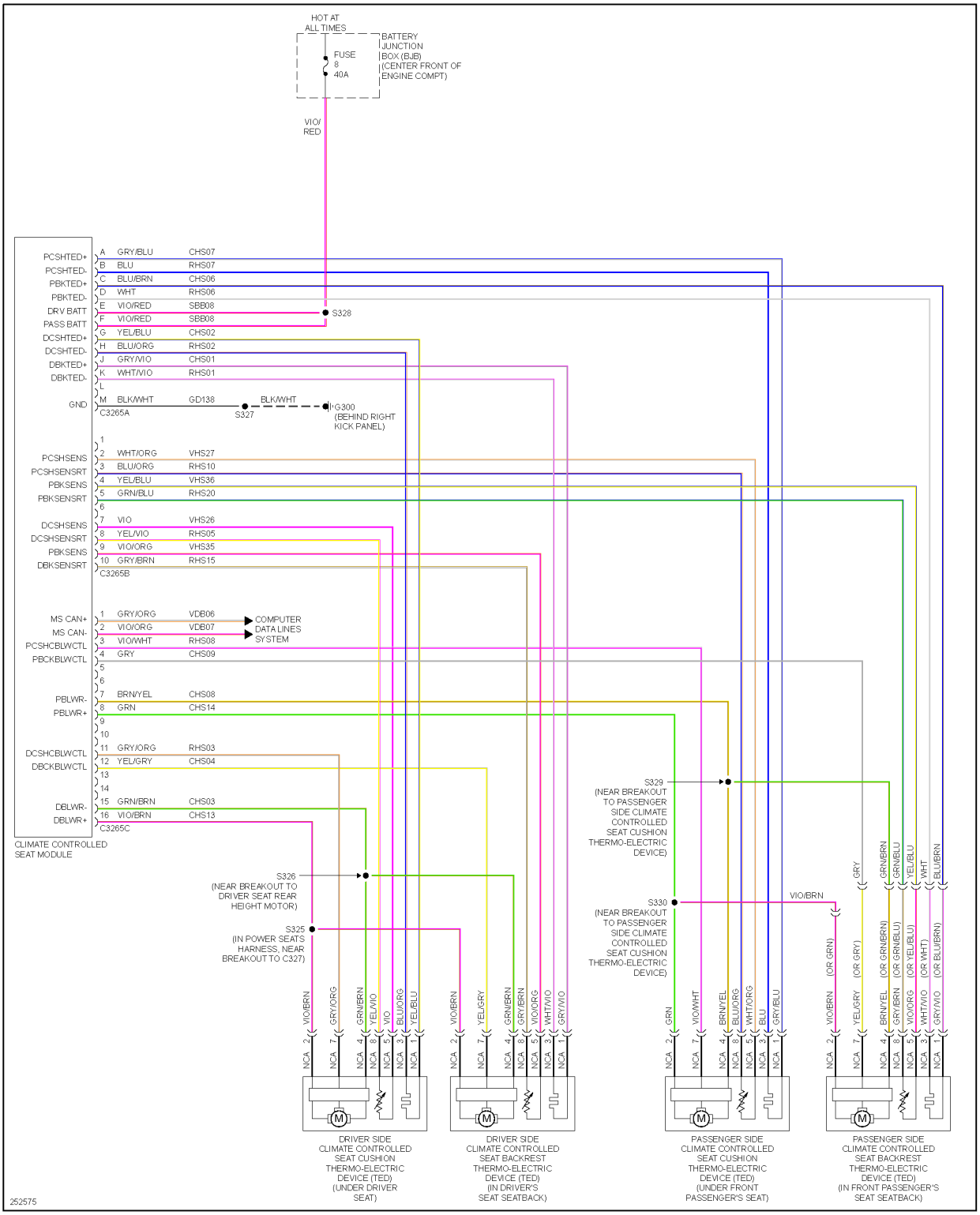


Fig. 61: Climate Control Seats Circuit

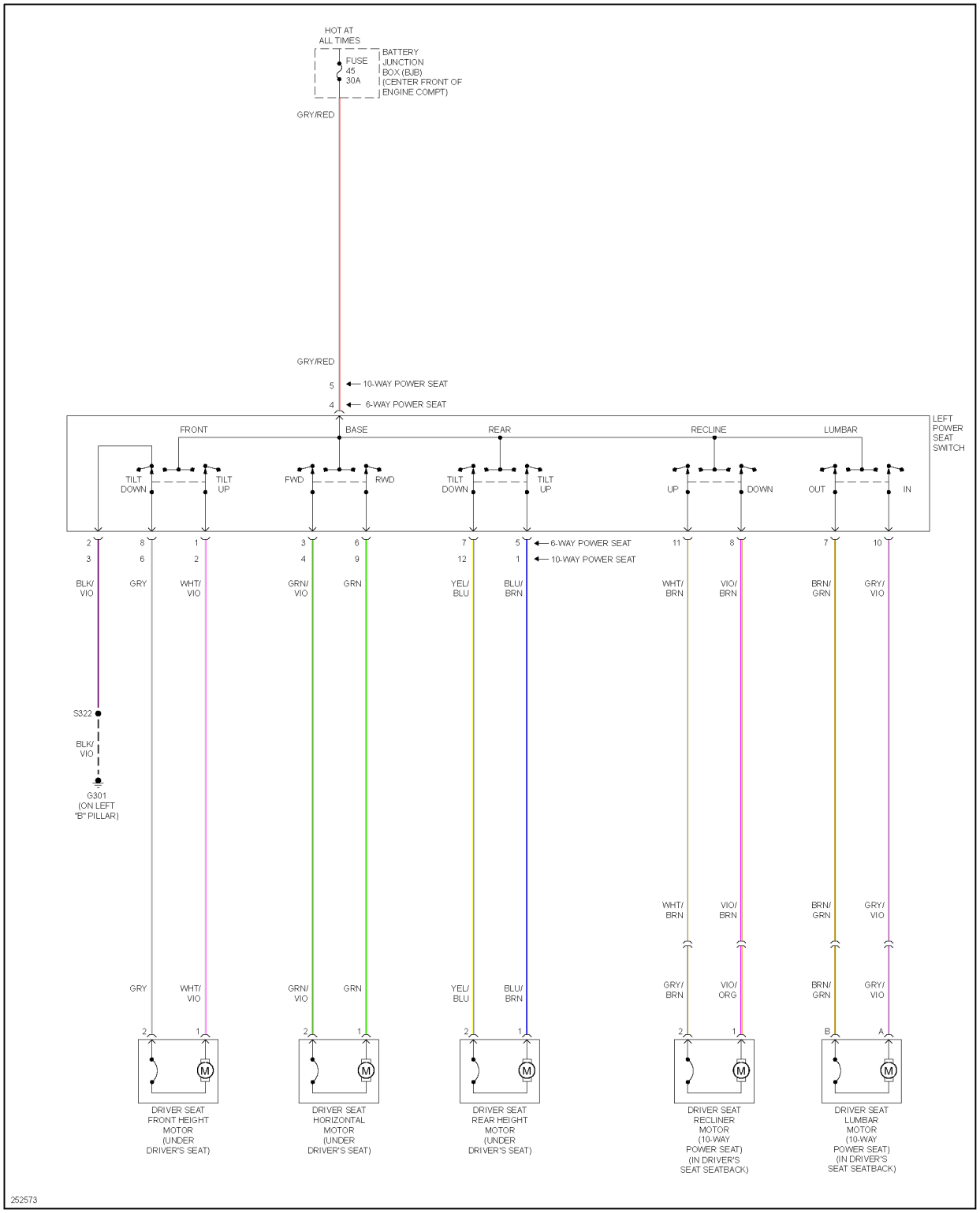


Fig. 62: Driver Power Seat Circuit

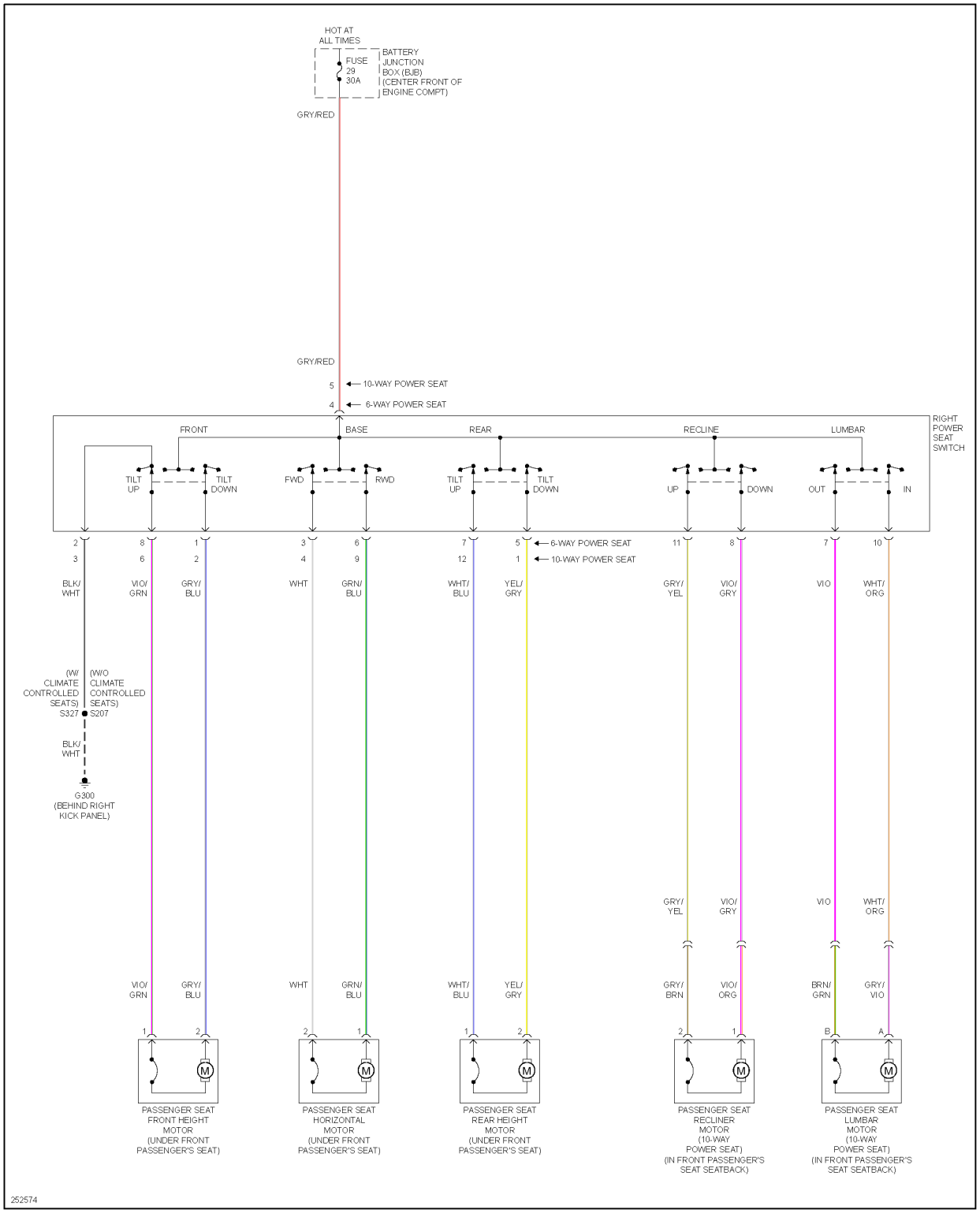


Fig. 63: Passenger Power Seat Circuit

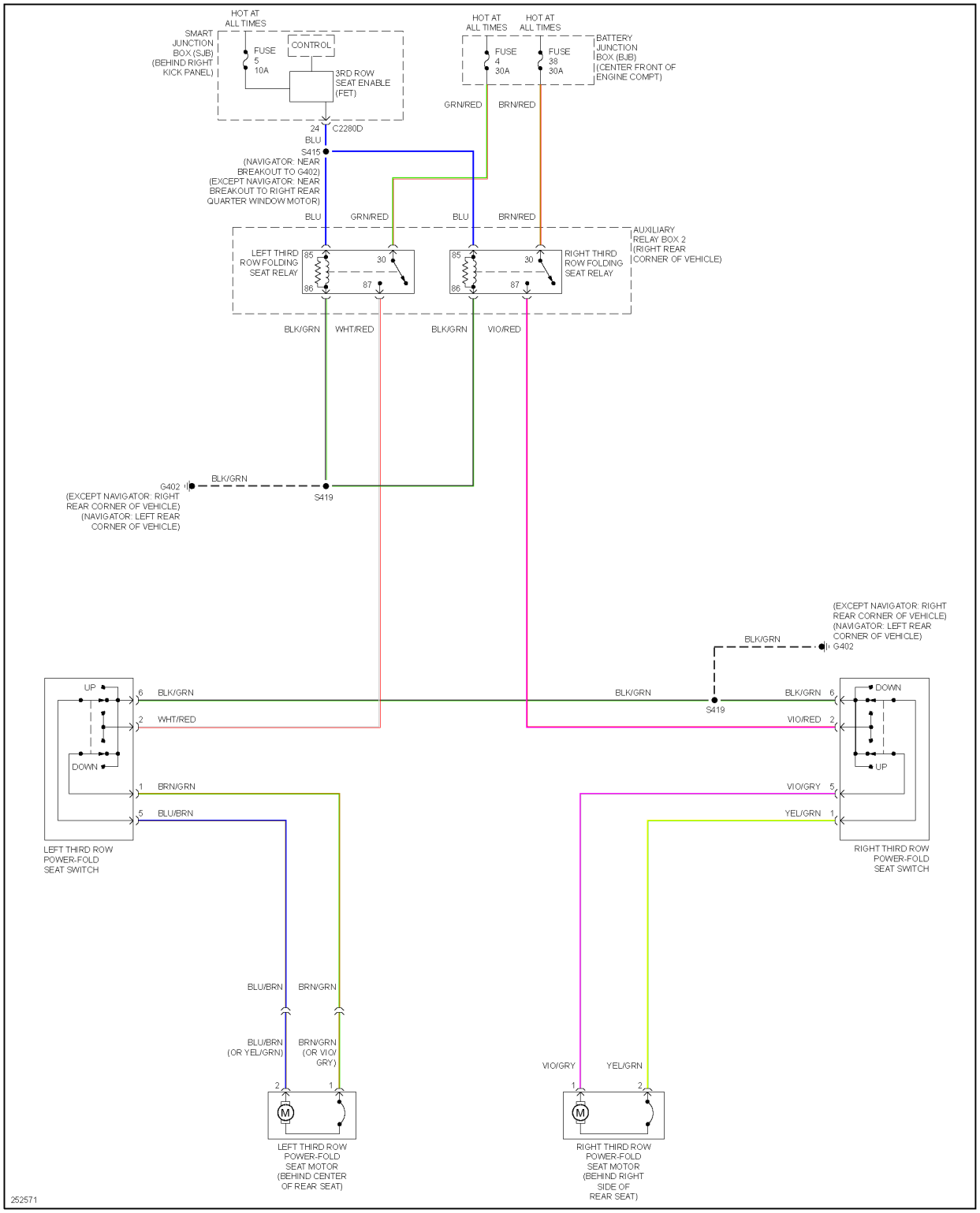


Fig. 64: Third Row Folding Seat Circuit

POWER TOP/SUNROOF

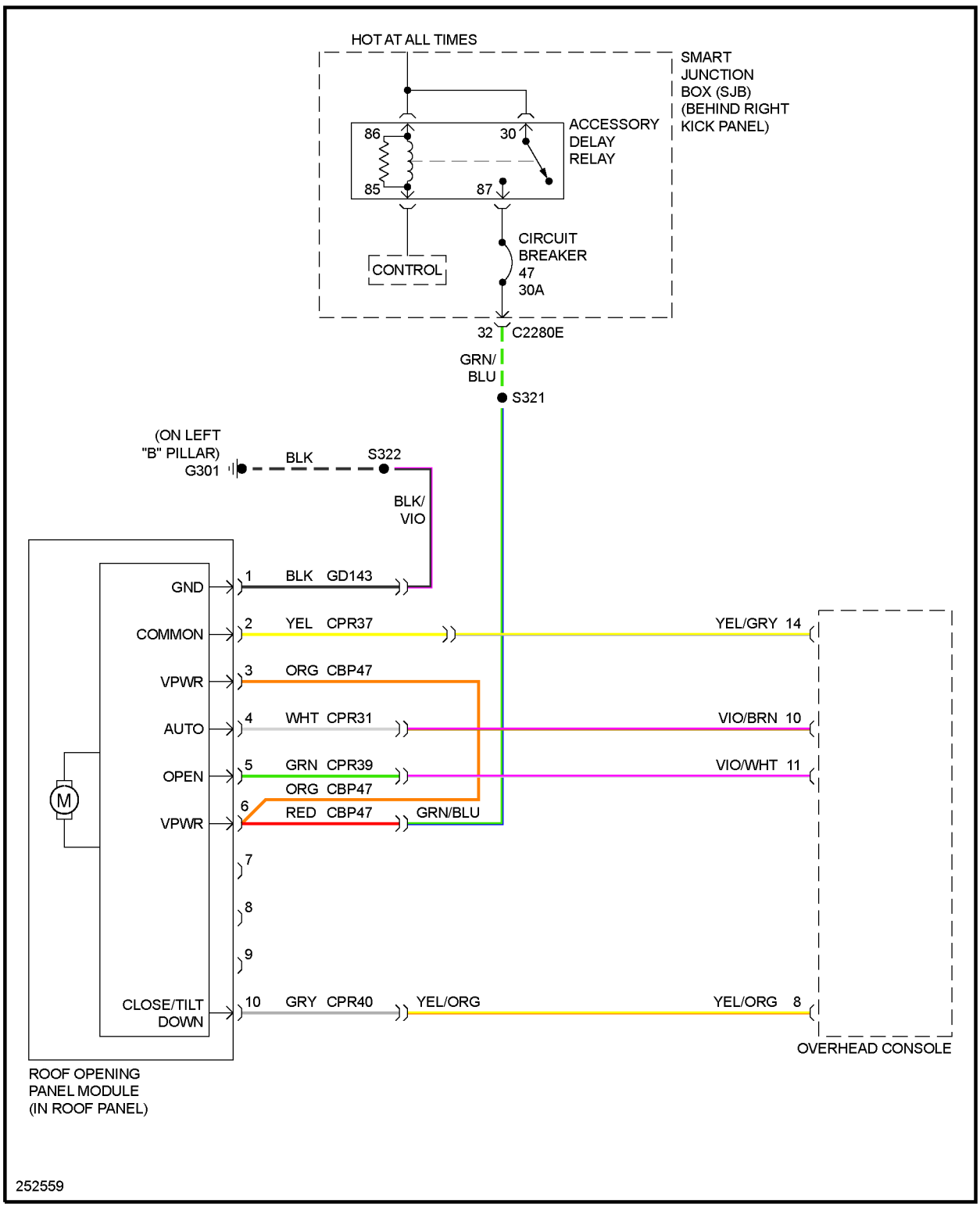


Fig. 65: Power Top/Sunroof Circuit

POWER WINDOWS

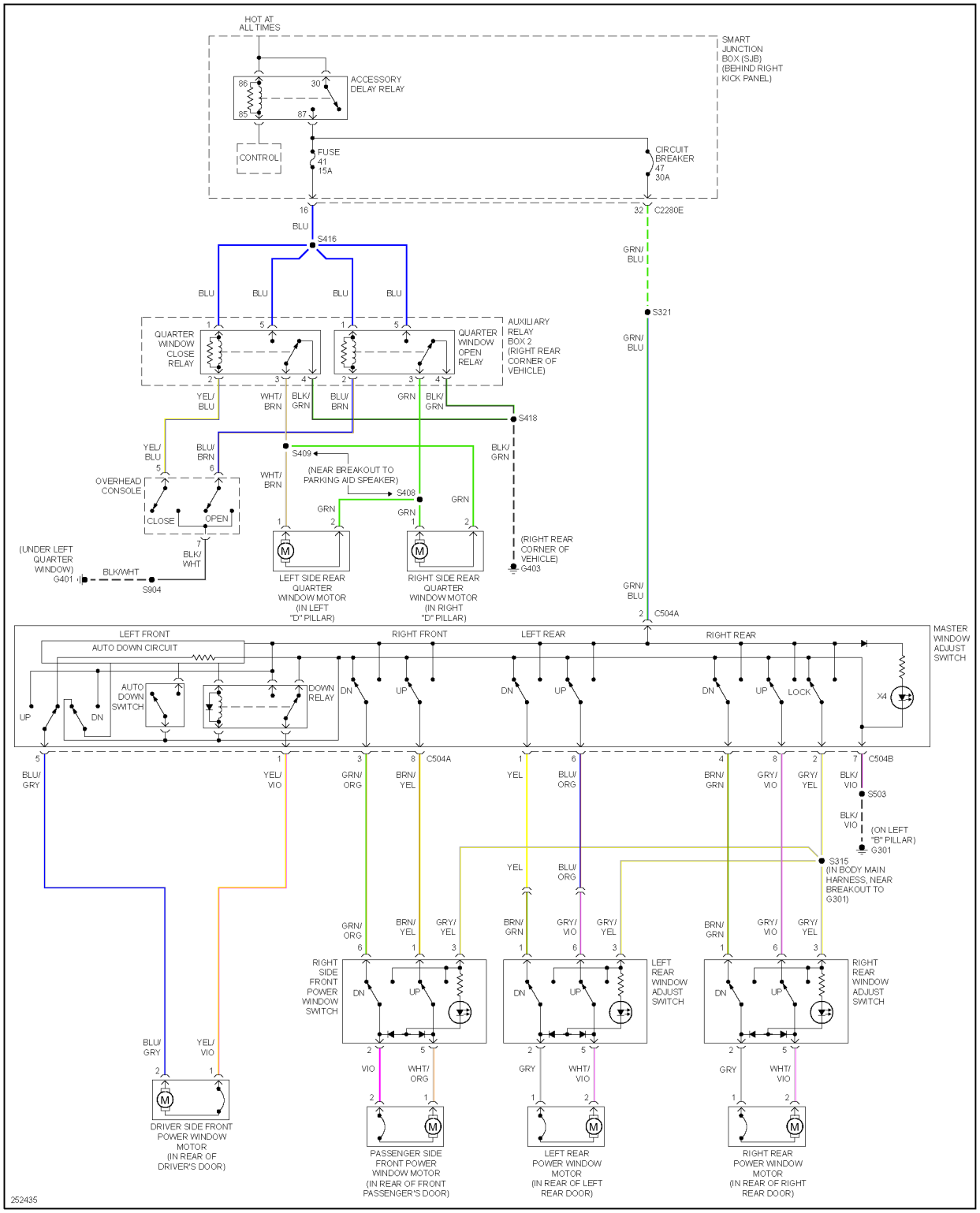


Fig. 66: Power Windows Circuit

RADIO

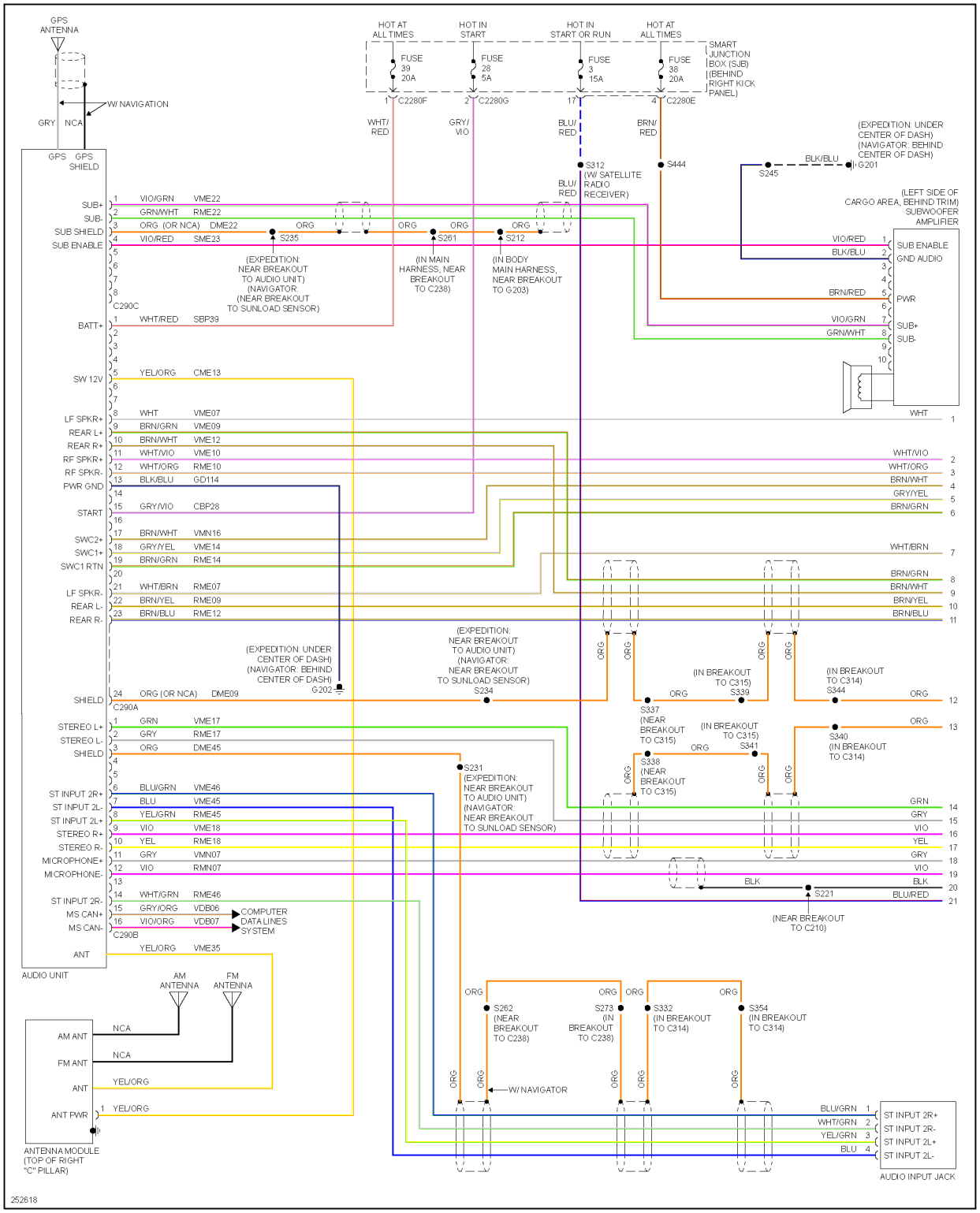


Fig. 67: Audiophile Sound Radio Circuit, W/ DVD (1 of 2)

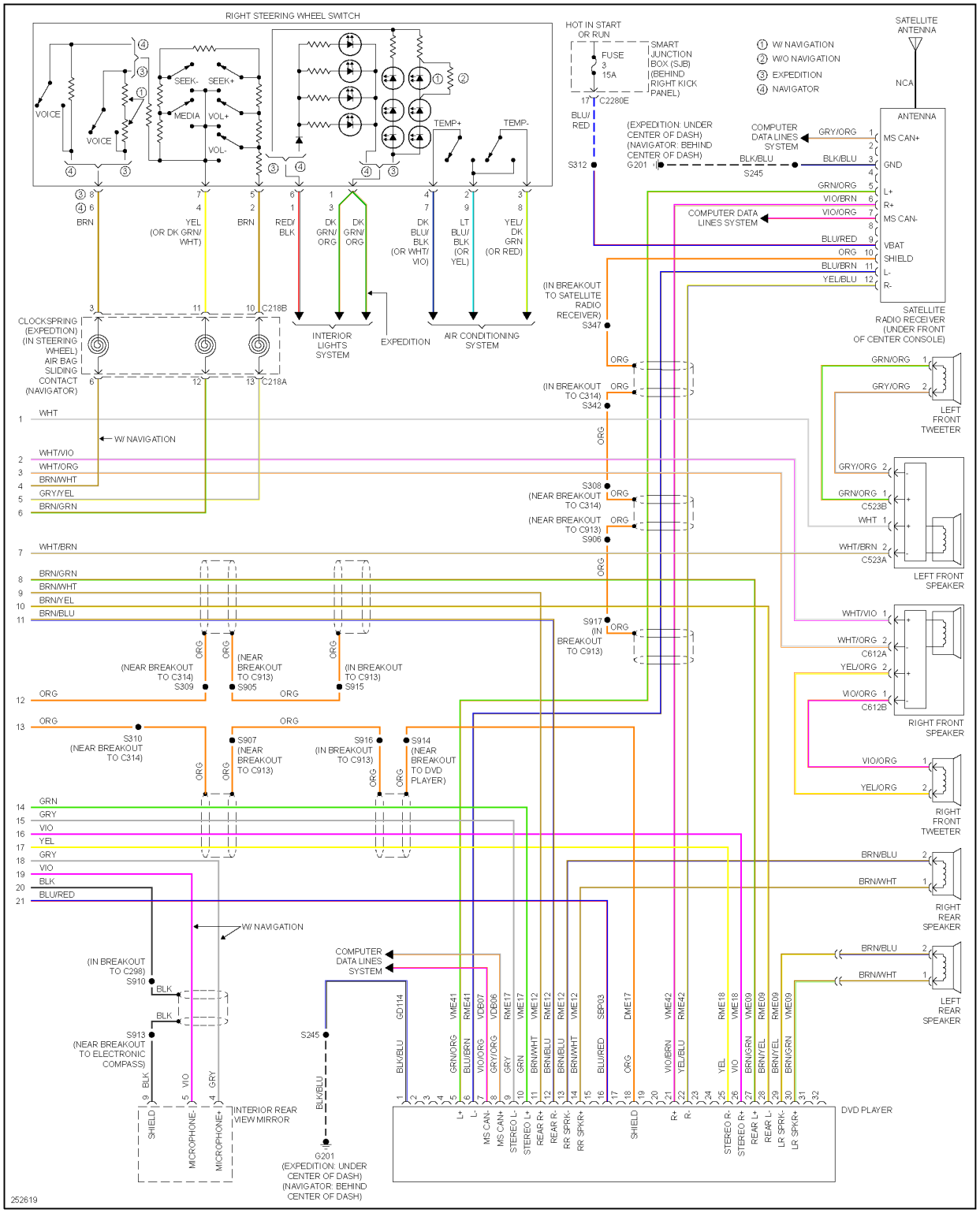


Fig. 68: Audiophile Sound Radio Circuit, W/ DVD (2 of 2)

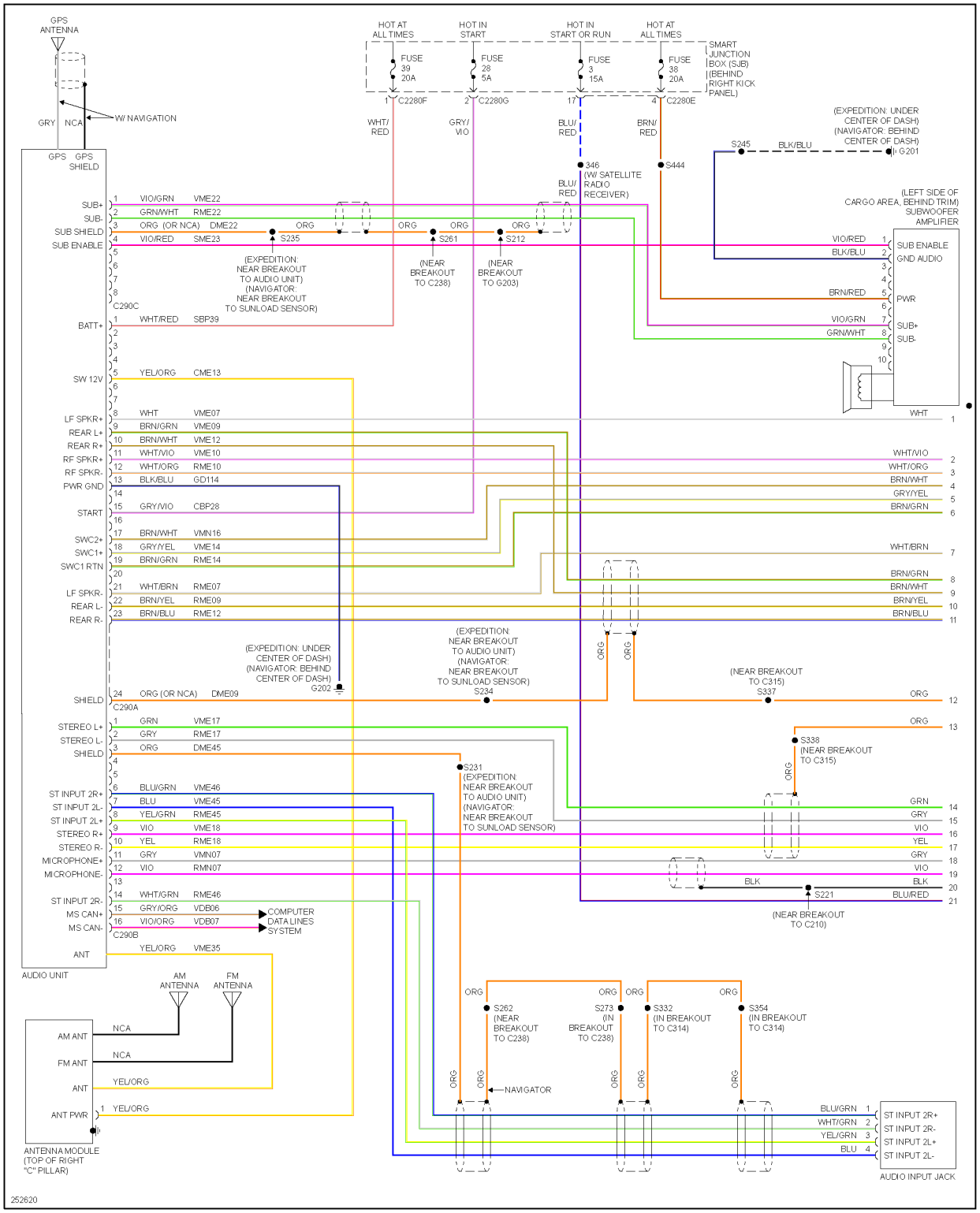


Fig. 69: Audiophile Sound Radio Circuit, W/O DVD (1 of 2)

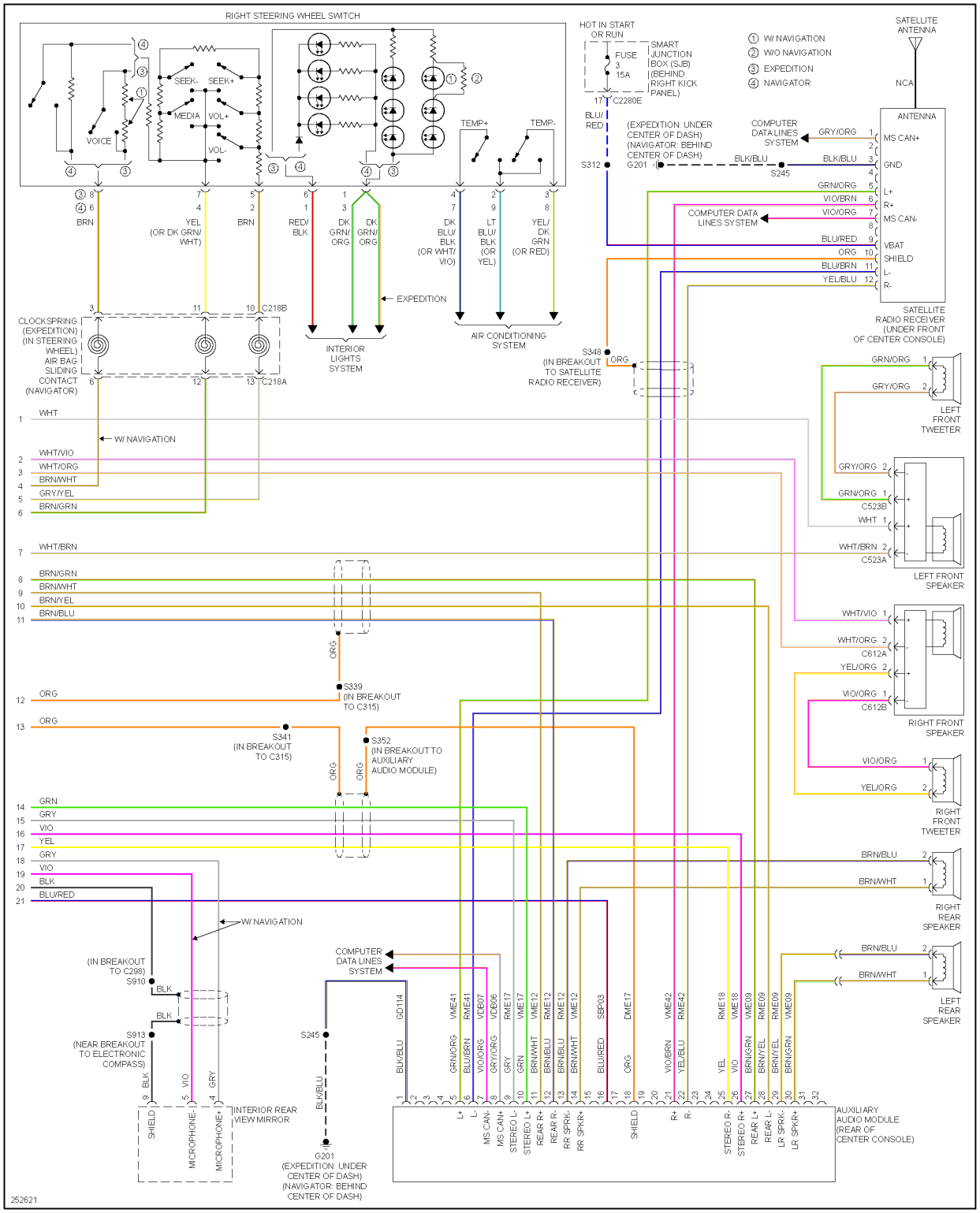


Fig. 70: Audiophile Sound Radio Circuit, W/O DVD (2 of 2)

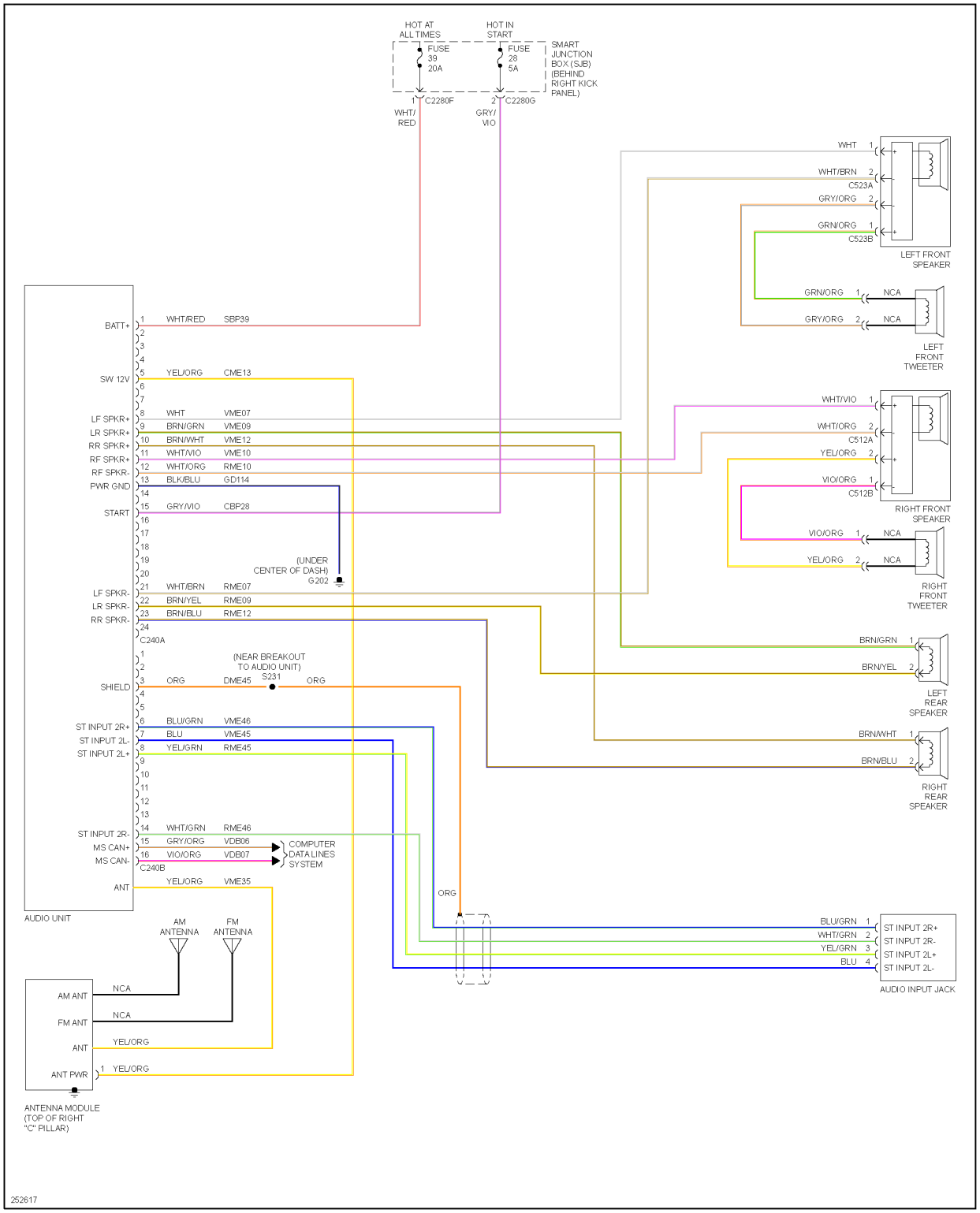


Fig. 71: Base Radio Circuit

SHIFT INTERLOCK

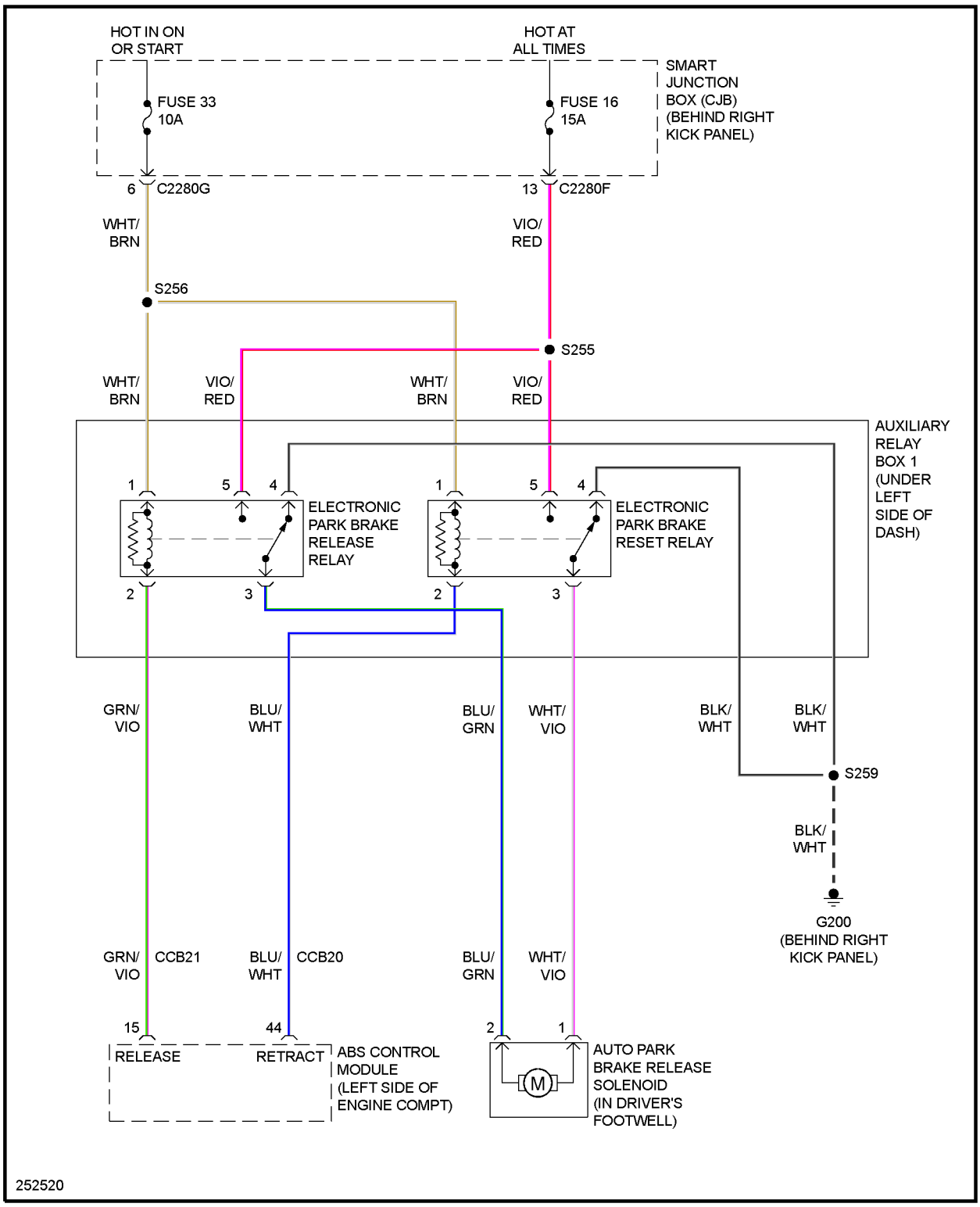


Fig. 72: Park Brake Release Circuit

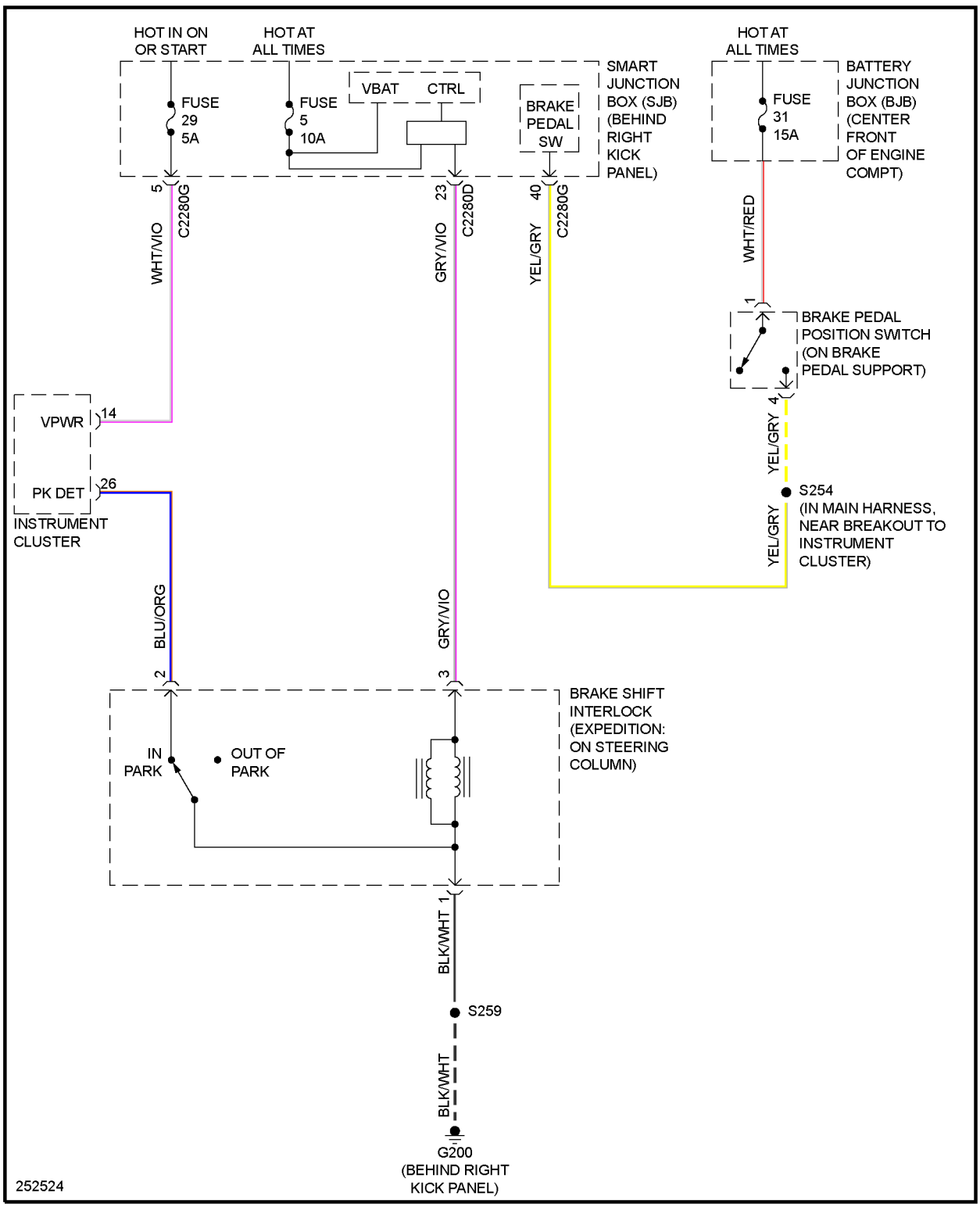


Fig. 73: Shift Interlock Circuit, W/ Column Shift

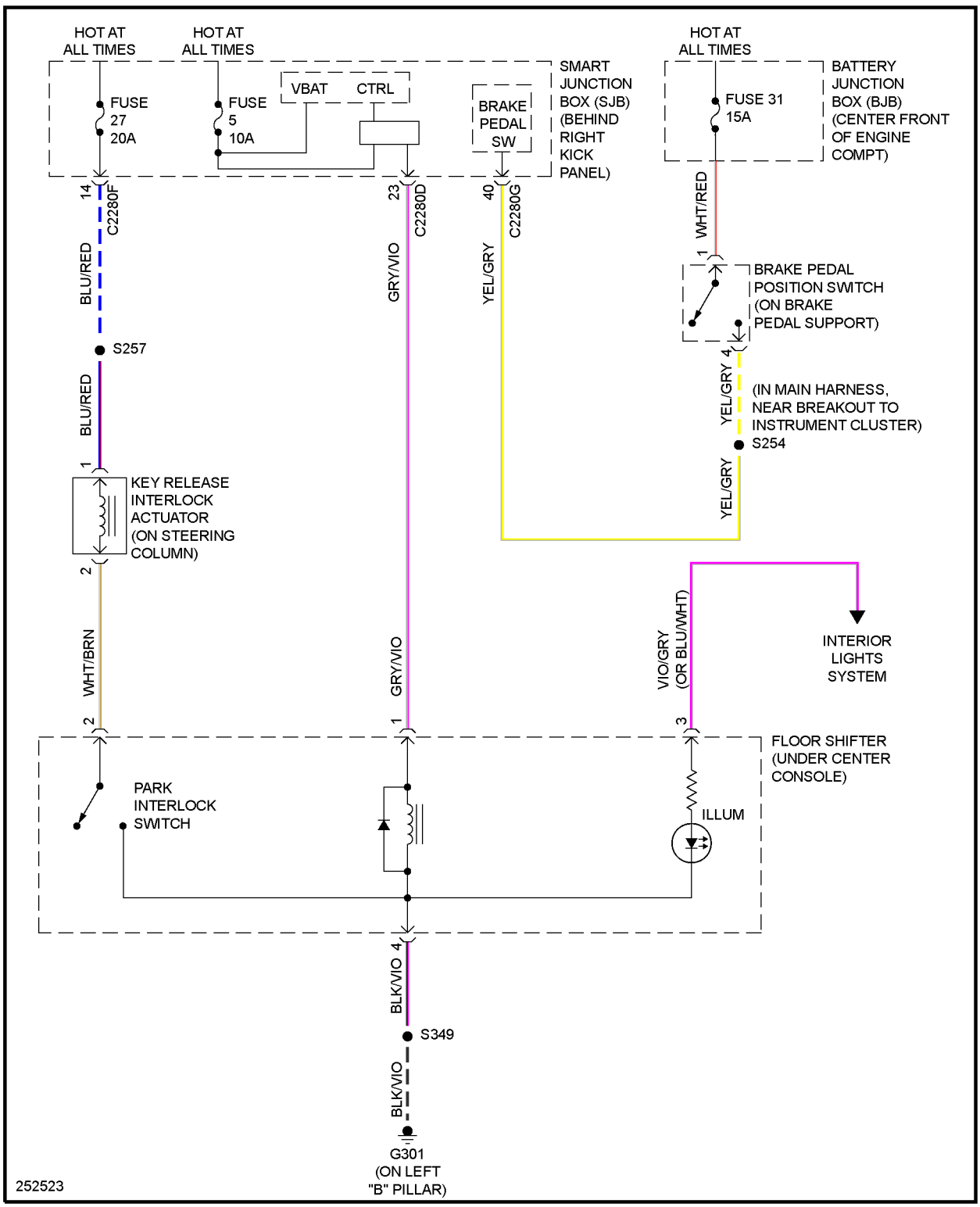


Fig. 74: Shift Interlock Circuit, W/ Floor Shift

STARTING/CHARGING

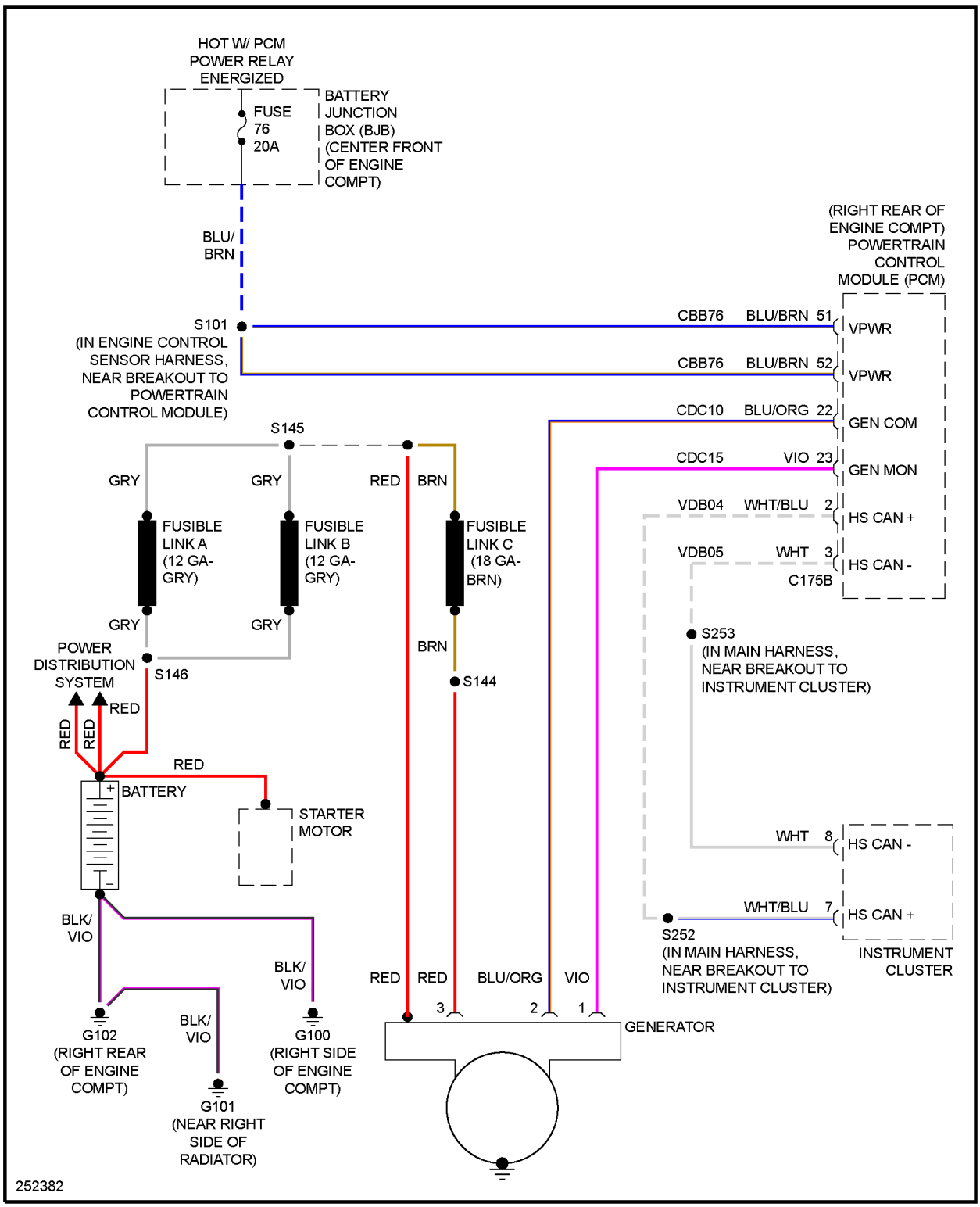


Fig. 75: Charging Circuit

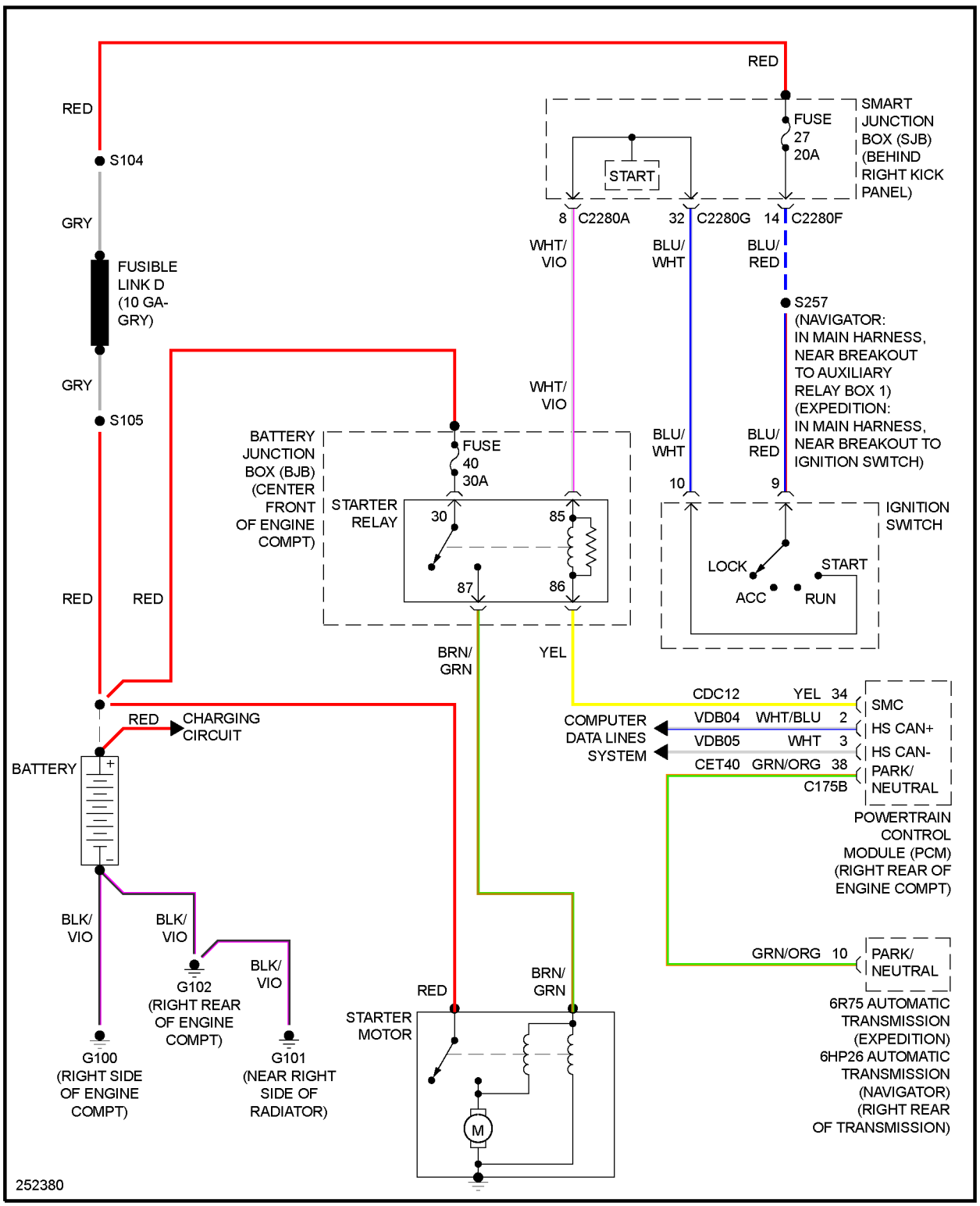


Fig. 76: Starting Circuit, Early Production

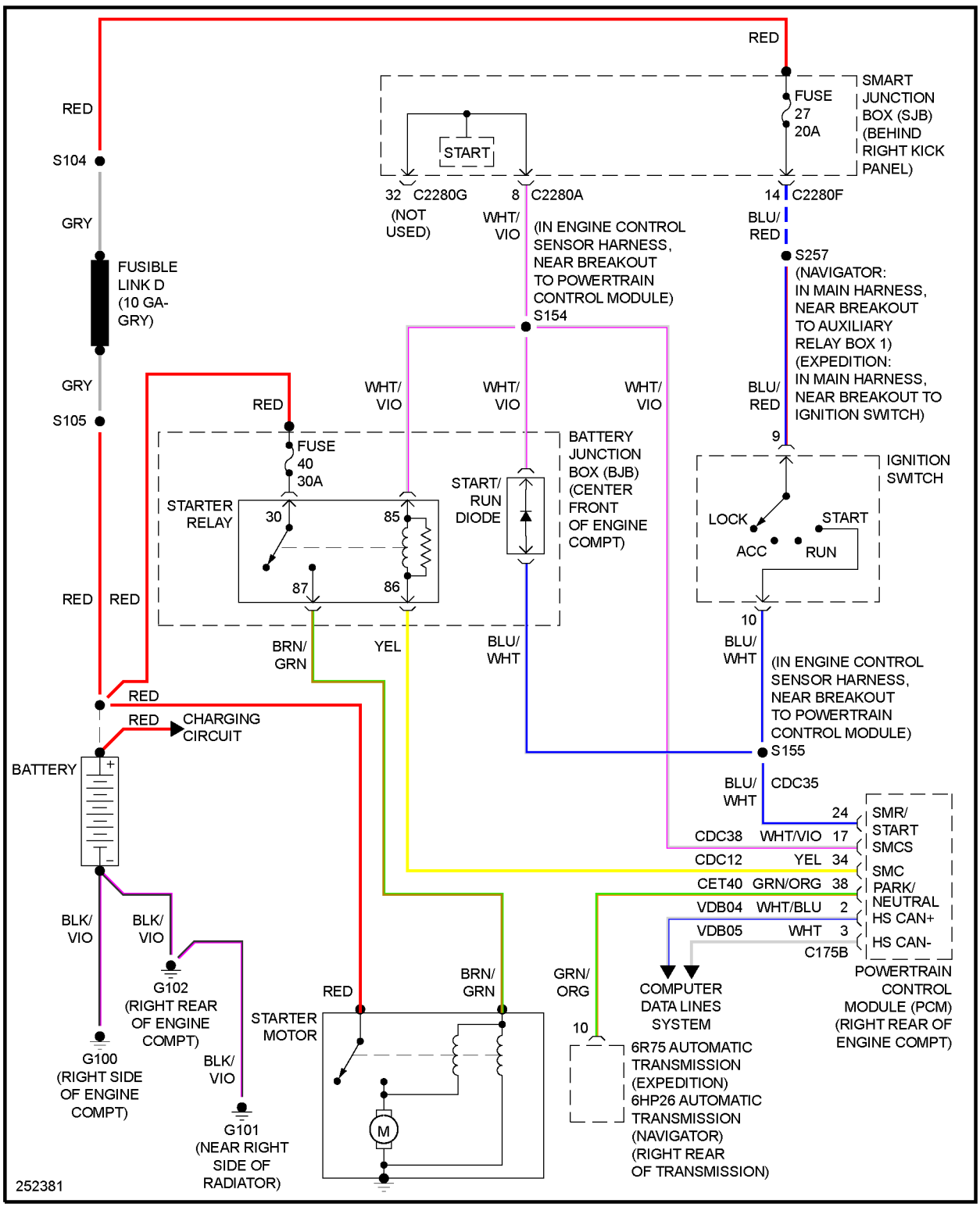


Fig. 77: Starting Circuit, Late Production

SUPPLEMENTAL RESTRAINTS

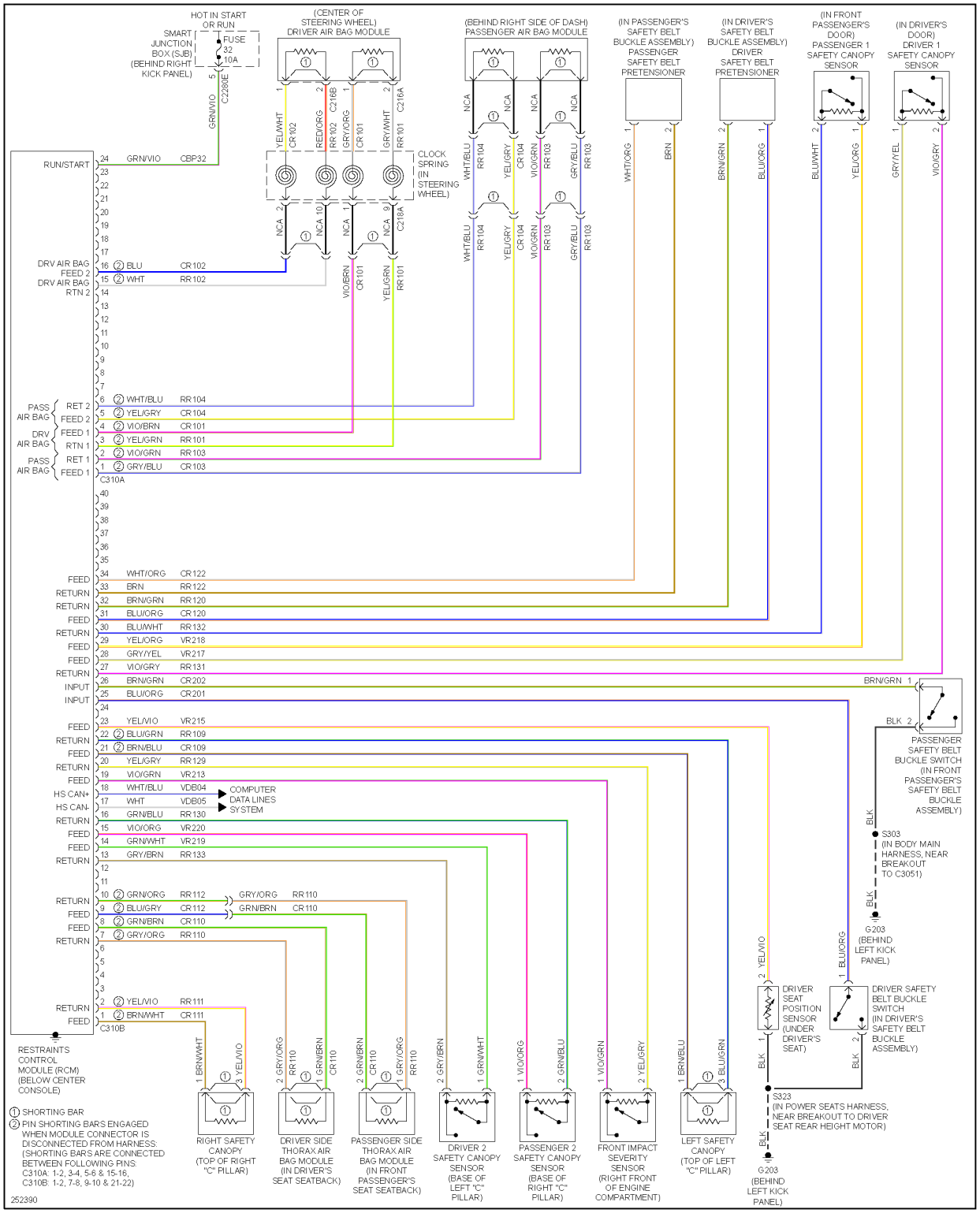


Fig. 78: Supplemental Restraints Circuit

TRANSMISSION

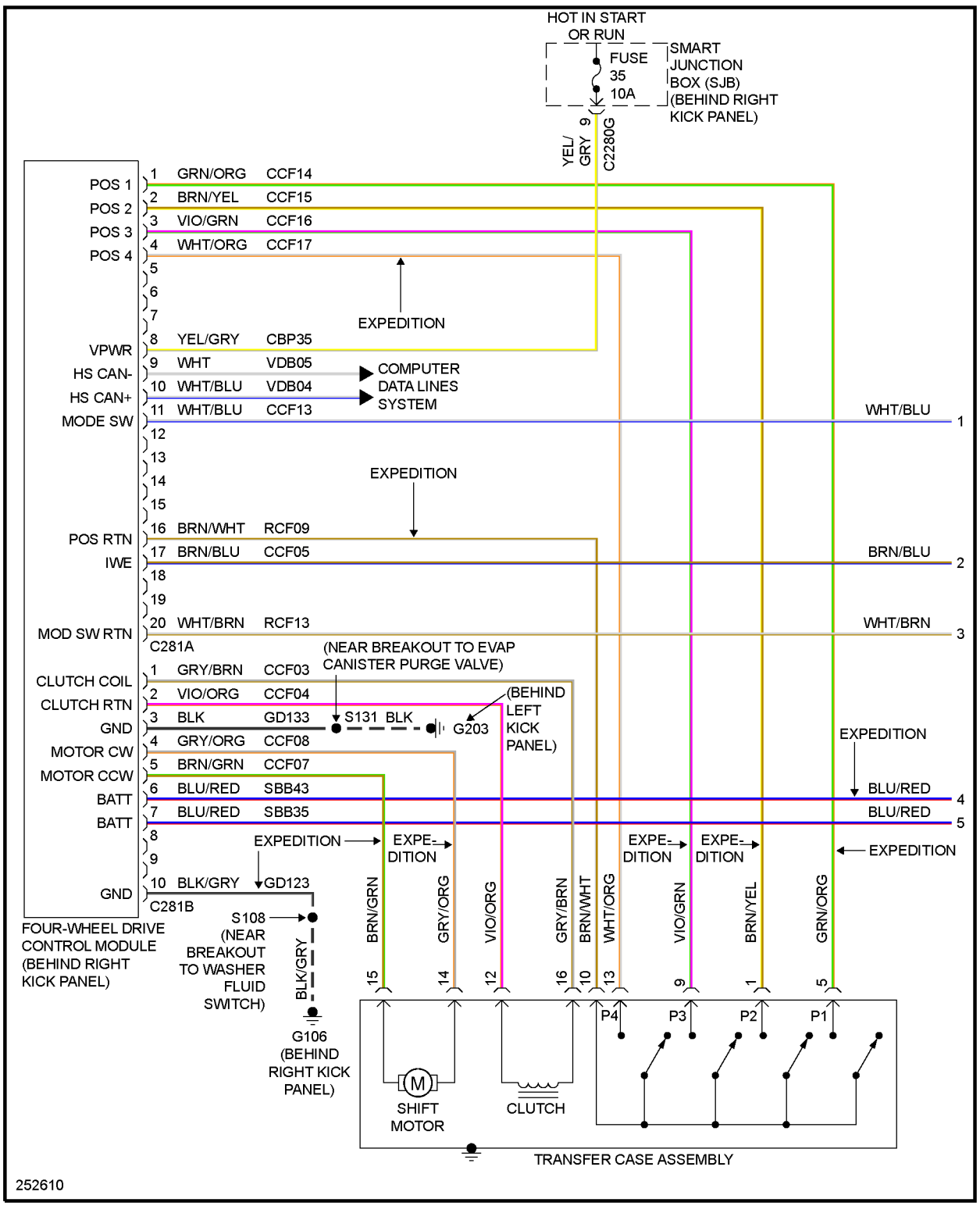


Fig. 79: 4WD Circuit (1 of 2)

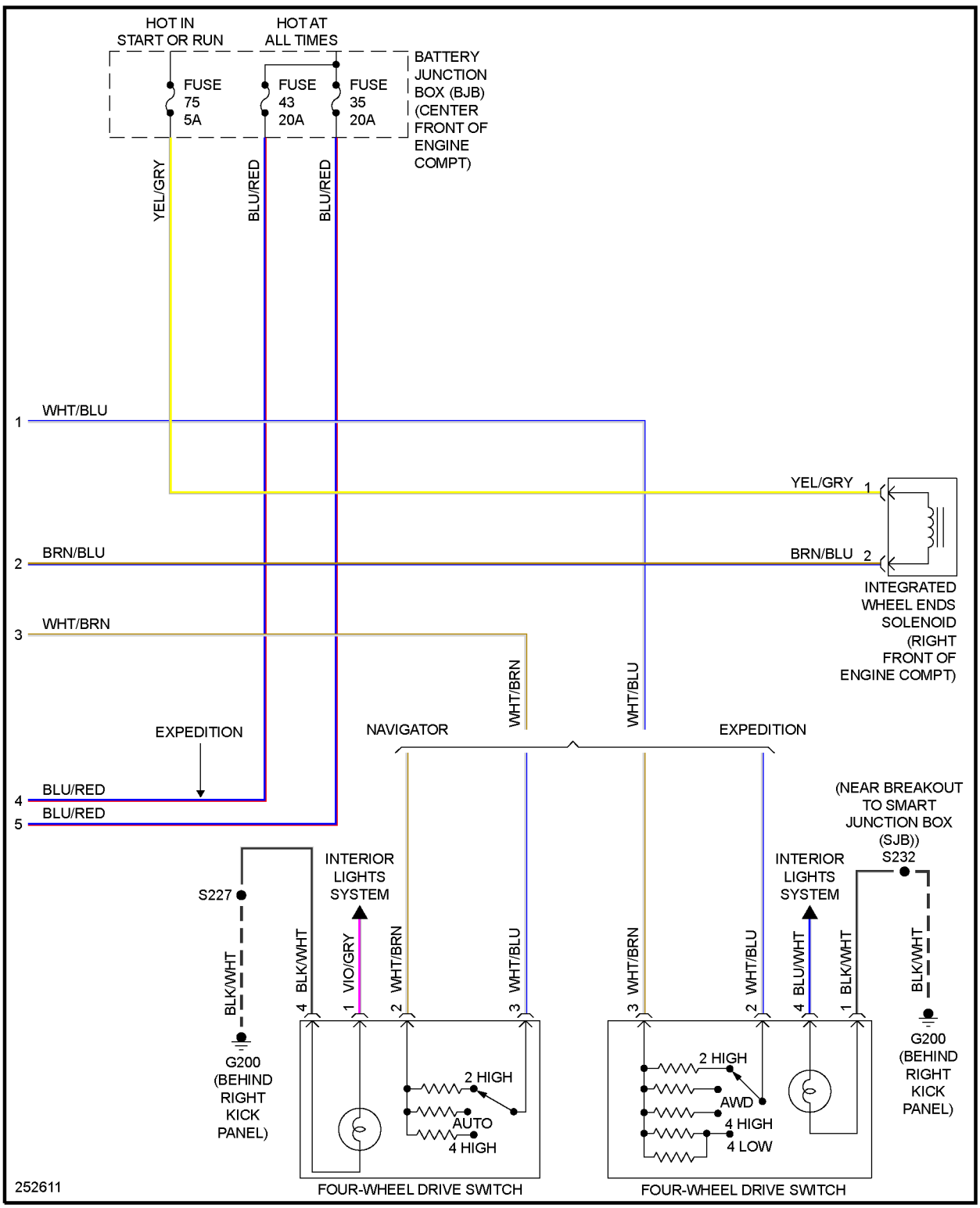


Fig. 80: 4WD Circuit (2 of 2)

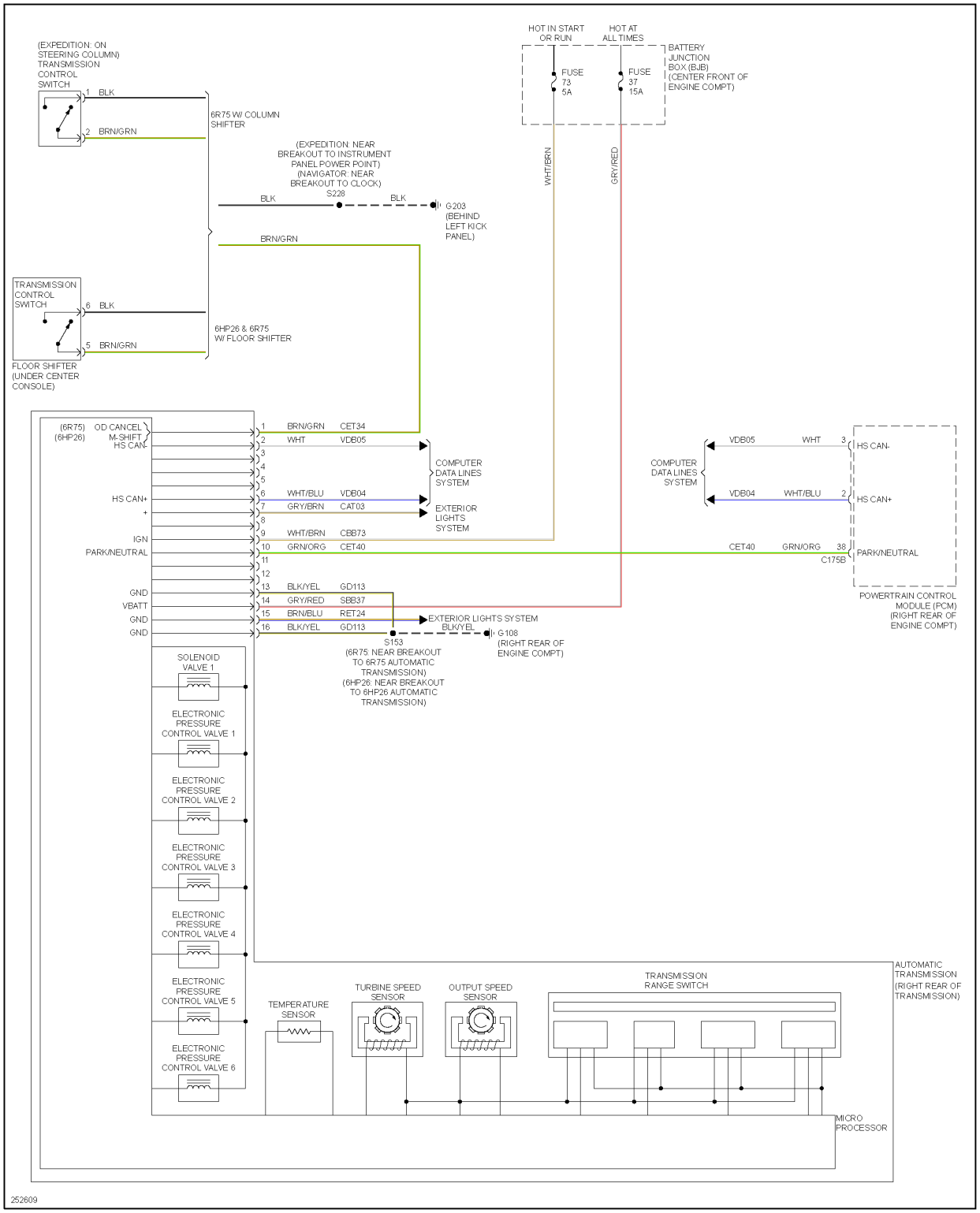


Fig. 81: A/T Circuit

TRUNK, TAILGATE, FUEL DOOR

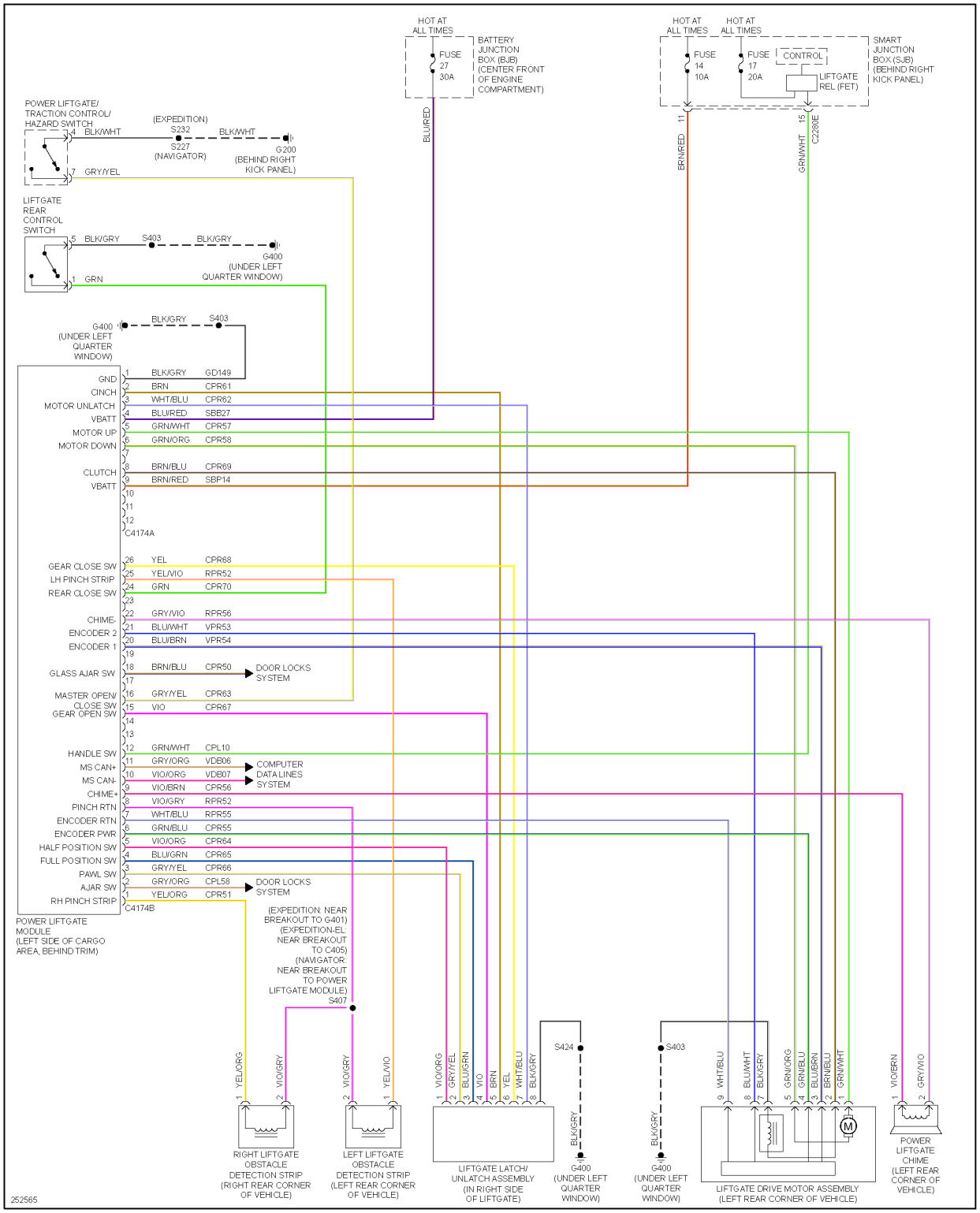


Fig. 82: Trunk Release Circuit

WARNING SYSTEMS

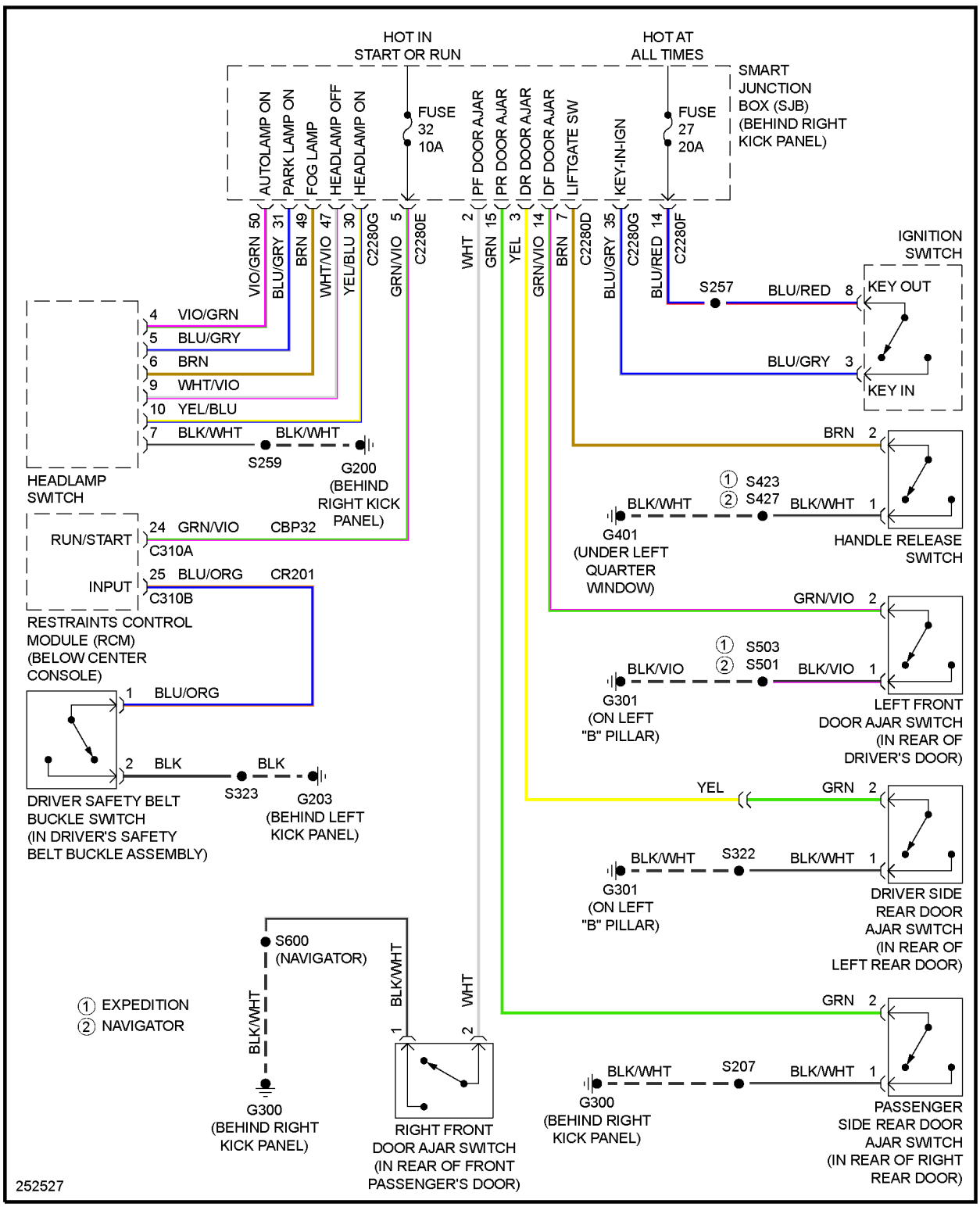


Fig. 83: Warning Systems Circuit

WIPER/WASHER

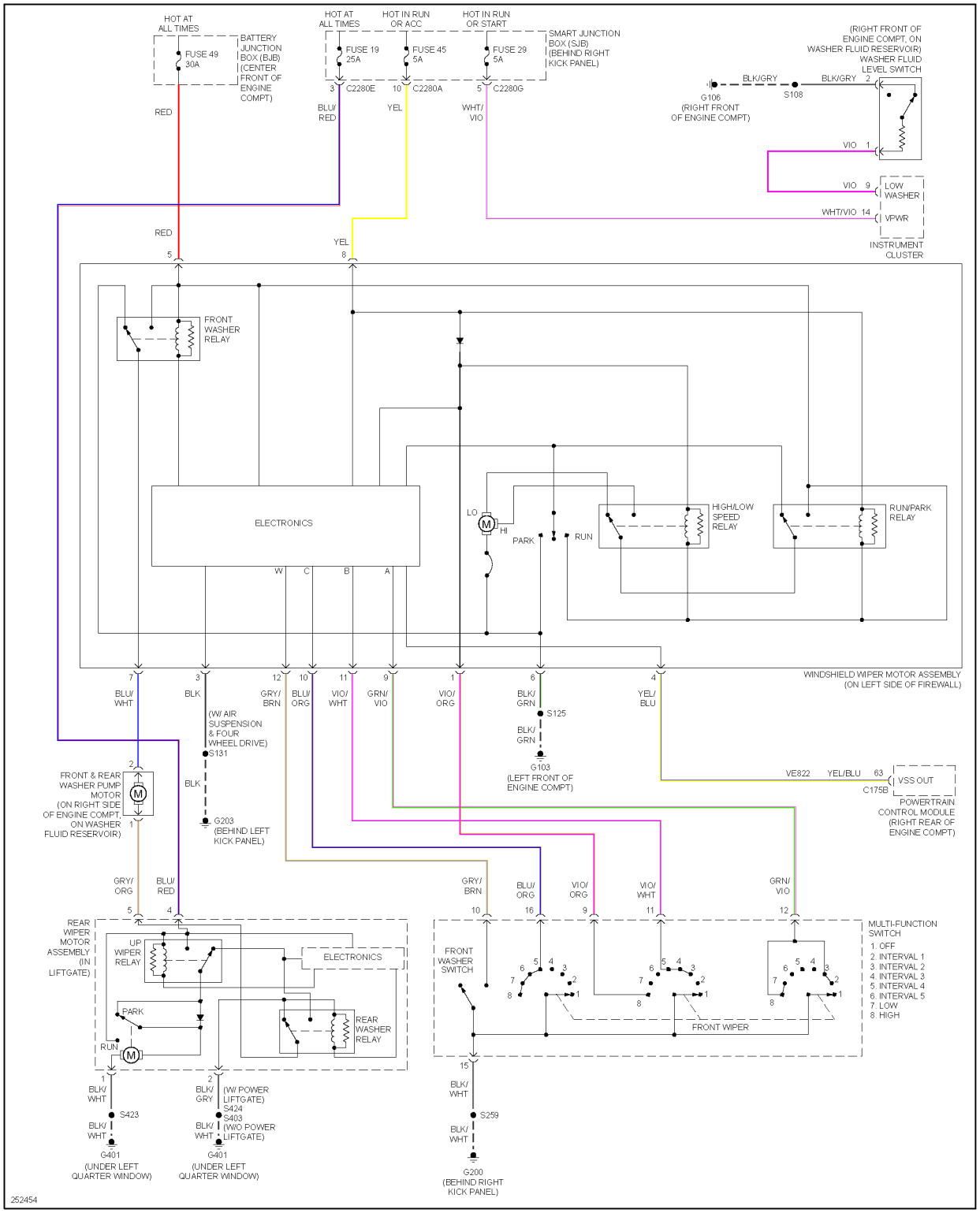


Fig. 84: Front Wiper/Washer Circuit

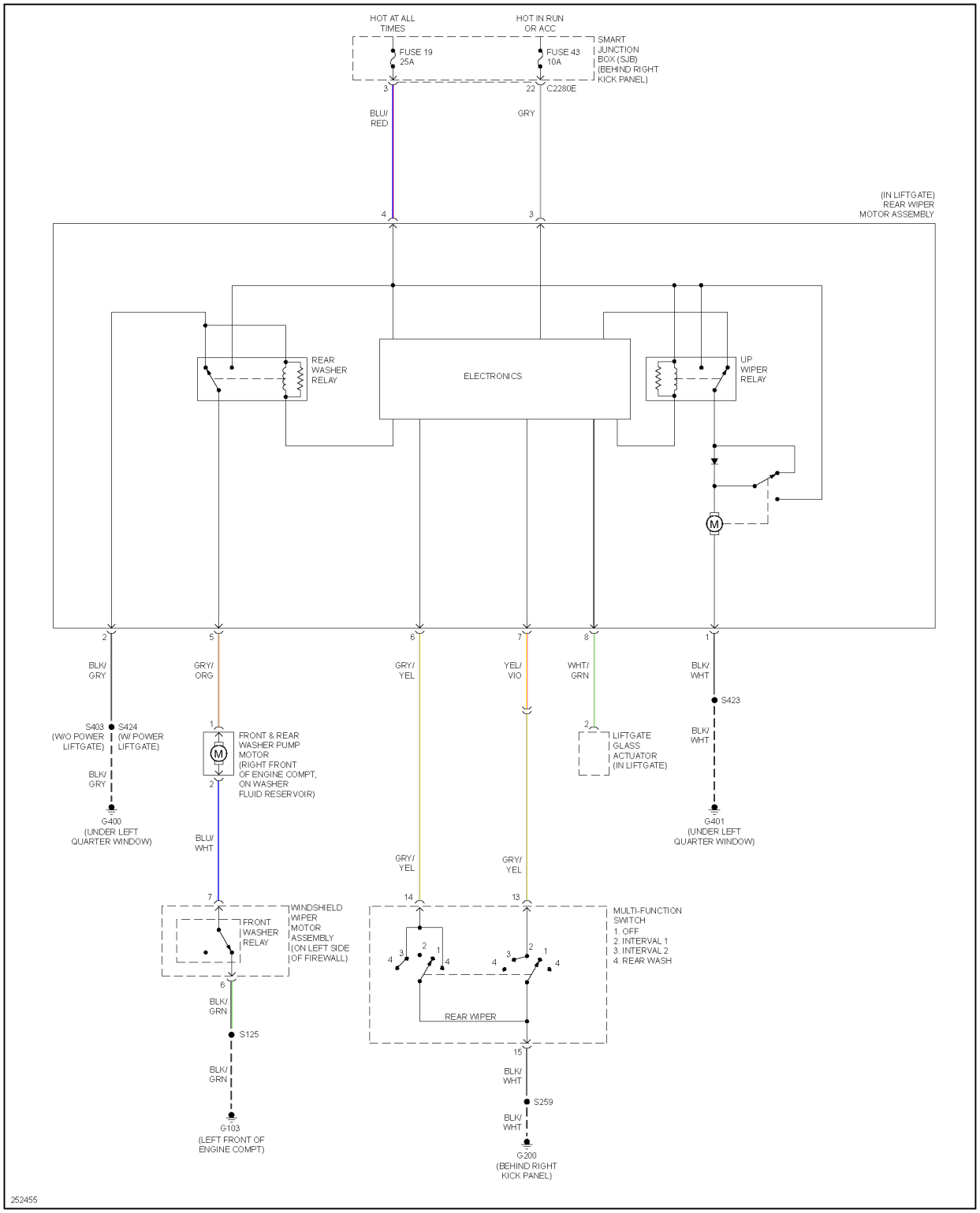


Fig. 85: Rear Washer/Wiper Circuit

2007 FORD MOTOR CO.

Expedition & Navigator

BUZZERS, RELAYS & TIMERS

BUZZERS, RELAYS & TIMERS LOCATION

Component	Location
Accessory Delay Relay	In smart junction box (SJB). See **Fig. 2**.
A/C Clutch Relay	In battery junction box (BJB). See **Fig. 1**.
Air Suspension Compressor Relay	In battery junction box (BJB). See **Fig. 1**.
Electronic Park Brake Release Relay	In auxiliary relay box 1. See **Fig. 3**.
Electronic Park Brake Reset Relay	In auxiliary relay box 1. See **Fig. 3**.
Front Blower Motor Relay	In battery junction box (BJB). See **Fig. 1**.
Fuel Pump Relay	In battery junction box (BJB). See **Fig. 1**.
High Intensity Discharge Headlamp Relay (Left)	In battery junction box (BJB). See **Fig. 1**.
High Intensity Discharge Headlamp Relay (Right)	In battery junction box (BJB). See **Fig. 1**.
PCM Power Relay	In battery junction box (BJB). See **Fig. 1**.
Quarter Window Close Relay	In auxiliary relay box 2. See **Fig. 4**.
Quarter Window Open Relay	In auxiliary relay box 2. See **Fig. 4**.
Rear Blower Motor Relay 1	In auxiliary relay box 2. See **Fig. 4**.
Rear Blower Motor Relay 2	In auxiliary relay box 2. See **Fig. 4**.
Rear Blower Motor Relay 3	In auxiliary relay box 2. See **Fig. 4**.
Rear Window Defrost Relay	In battery junction box (BJB). See **Fig. 1**.
Reversing Lamps Relay	In battery junction box (BJB). See **Fig. 1**.
Run/Start Relay	In battery junction box (BJB). See **Fig. 1**.
Starter Relay	In battery junction box (BJB). See **Fig. 1**.
Third Row Folding Seat Relay (Left)	In auxiliary relay box 2. See **Fig. 4**.
Third Row Folding Seat Relay (Right)	In auxiliary relay box 2. See **Fig. 4**.
Trailer Tow Relay (Battery Charge)	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Relay (Left Turn)	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Relay (Parking Lamp)	In battery junction box (BJB). See **Fig. 1**.
Trailer Tow Relay (Right Turn)	In battery junction box (BJB). See **Fig. 1**.

CIRCUIT PROTECTION DEVICES

CIRCUIT PROTECTION DEVICES LOCATION

Component	Location
A/C Clutch Diode	In battery junction box (BJB). See **Fig. 1**.
A/C Clutch Diode	In battery junction box (BJB). See **Fig. 1**.
Auxiliary Relay Box 1	Under left side of dash. See **Fig. 17**.
Auxiliary Relay Box 2 (Expedition)	Right rear corner of vehicle. See **Fig. 29**.
Auxiliary Relay Box 2 (Expedition-EL & Navigator-L)	Right rear corner of vehicle. See **Fig. 33**.
Auxiliary Relay Box 2 (Navigator)	Right rear corner of vehicle. See **Fig. 31**.

Battery Junction Box (BJB) (Expedition)	Center front of engine compartment. See **Fig. 5**.
Battery Junction Box (BJB) (Navigator)	Center front of engine compartment. See **Fig. 7**.
Fuel Pump Motor Diode	In battery junction box (BJB). See **Fig. 1**.
Fuel Pump Motor Diode	In battery junction box (BJB). See **Fig. 1**.
Fusible Link A (Expedition)	Near battery. See **Fig. 6**.
Fusible Link A (Navigator)	Near battery. See **Fig. 8**.
Fusible Link B (Expedition)	Near battery. See **Fig. 6**.
Fusible Link B (Navigator)	Near battery. See **Fig. 8**.
Fusible Link C (Expedition)	Near battery. See **Fig. 6**.
Fusible Link C (Navigator)	Near battery. See **Fig. 8**.
Fusible Link D (Expedition)	Near battery. See **Fig. 6**.
Fusible Link D (Navigator)	Near battery. See **Fig. 8**.
Smart Junction Box (SJB) (Expedition)	Behind right kick panel. See **Fig. 15**.
Smart Junction Box (SJB) (Navigator)	Behind right kick panel. See **Fig. 17**.
Start/Run Diode	In battery junction box (BJB). See **Fig. 1**.
Start/Run Diode	In battery junction box (BJB). See **Fig. 1**.

CONTROL UNITS

CONTROL UNITS LOCATION

Component	Location
ABS Control Module (Expedition)	Left side of engine compartment. See **Fig. 5**.
ABS Control Module (Navigator)	Left side of engine compartment. See **Fig. 7**.
Air Suspension Module (Expedition)	Under left end of dash. See **Fig. 6**.
Air Suspension Module (Navigator)	Under left end of dash. See **Fig. 8**.
Auxiliary Audio Module	Rear of center console. See **Fig. 23**.
Climate Controlled Seat Module (Passenger Side)	Under front passenger's seat. See **Fig. 37**.
Driver Air Bag Module	Center of steering wheel. See **Fig. 21**.
Driver Seat Module	Under driver's seat. See **Fig. 36**.
Electronic Automatic Temperature Control (ETAC) Module (Expedition)	In center of dash. See **Fig. 16**.
Electronic Automatic Temperature Control (ETAC) Module (Navigator)	In center of dash. See **Fig. 18**.
Four-Wheel Drive Control Module (Expedition)	Behind right kick panel. See **Fig. 5**.
Four-Wheel Drive Control Module (Navigator)	Behind right kick panel. See **Fig. 7**.
Fuel Pump Module (Expedition-EL & Navigator-L)	In fuel tank. See **Fig. 35**.
Fuel Pump Module (Expedition & Navigator)	In fuel tank. See **Fig. 34**.
Heater Blower Control Module	Right side of HVAC unit. See **Fig. 50**.
Manual Climate Control Module (Expedition)	Behind center of dash. See **Fig. 16**.
Parking Aid Module (PAM) (Expedition-EL & Navigator-L)	Under center rear of vehicle. See **Fig. 35**.
Parking Aid Module (PAM) (Expedition & Navigator)	Under center rear of vehicle. See **Fig. 34**.
Passenger Air Bag Module (Expedition)	Behind right side of dash. See **Fig. 16**.

Passenger Air Bag Module (Navigator)	Behind right side of dash. See **Fig. 18**.
Power Fold Running Board Module	In left "B" pillar. See **Fig. 26**.
Power Liftgate Module (Expedition)	Left side of cargo area, behind trim. See **Fig. 28**.
Power Liftgate Module (Expedition-EL & Navigator-L)	Left side of cargo area, behind trim. See **Fig. 32**.
Power Liftgate Module (Navigator)	Left side of cargo area, behind trim. See **Fig. 30**.
Powertrain Control Module (PCM) (Expedition)	Right rear of engine compartment. See **Fig. 5**.
Powertrain Control Module (PCM) (Navigator)	Right rear of engine compartment. See **Fig. 7**.
Restraints Control Module (RCM) (Expedition)	Below center console. See **Fig. 25**.
Restraints Control Module (RCM) (Navigator)	Below center console. See **Fig. 27**.
Roof Opening Panel Module (Expedition)	In roof panel. See **Fig. 46**.
Roof Opening Panel Module (Expedition-EL & Navigator-L)	In roof panel. See **Fig. 48**.
Roof Opening Panel Module (Navigator)	In roof panel. See **Fig. 47**.
Trailer Electronic Brake Control Module (Expedition)	Under center of dash. See **Fig. 15**.
Trailer Electronic Brake Control Module (Navigator)	Under left side of dash. See **Fig. 17**.

MOTORS

MOTORS LOCATION

Component	Location
Adjustable Pedal Motor (Expedition)	On accelerator pedal support. See **Fig. 15**.
Adjustable Pedal Motor (Navigator)	On accelerator pedal support. See **Fig. 17**.
Air Suspension Compressor (Expedition)	Right front of engine compartment. See **Fig. 6**.
Air Suspension Compressor (Navigator)	Right front of engine compartment. See **Fig. 8**.
Auxiliary Blower Motor (Expedition-EL & Navigator-L)	Right side of auxiliary HVAC unit. See **Fig. 52**.
Auxiliary Blower Motor (Expedition & Navigator)	Right side of auxiliary HVAC unit. See **Fig. 51**.
Blend Door Actuator (Rear) (Expedition-EL & Navigator-L)	Left side of auxiliary HVAC unit. See **Fig. 52**.
Blend Door Actuator (Rear) (Expedition & Navigator)	Center of auxiliary HVAC unit. See **Fig. 51**.
Blower Motor (Auto A/C)	Right side of HVAC unit. See **Fig. 50**.
Blower Motor (Manual A/C)	Right side of HVAC unit. See **Fig. 49**.
Driver Seat Front Height Motor	Under driver's seat. See **Fig. 36**.
Driver Seat Horizontal Motor	Under driver's seat. See **Fig. 36**.
Driver Seat Rear Height Motor	Under driver's seat. See **Fig. 36**.
Driver Seat Recliner Motor	In driver's seat seatback. See **Fig. 36**.
Electronic Throttle Control (ETC) Motor	Top rear of engine. See **Fig. 9**.
Exterior Rear View Mirror (Left Side) (Expedition)	At left rear view mirror. See **Fig. 38**.
Exterior Rear View Mirror (Left Side) (Navigator)	At left rear view mirror. See **Fig. 40**.
Exterior Rear View Mirror (Right Side) (Expedition)	At right rear view mirror. See **Fig. 39**.

Exterior Rear View Mirror (Right Side) (Navigator)	At right rear view mirror. See **Fig. 41**.
Fresh/Recirculation Door Actuator (Auto A/C)	Right side of HVAC unit. See **Fig. 50**.
Fresh/Recirculation Door Actuator (Manual A/C)	Right side of HVAC unit. See **Fig. 49**.
Liftgate Drive Motor Assembly (Expedition)	Left rear corner of vehicle. See **Fig. 28**.
Liftgate Drive Motor Assembly (Expedition-EL & Navigator-L)	Left rear corner of vehicle. See **Fig. 32**.
Liftgate Drive Motor Assembly (Navigator)	Left rear corner of vehicle. See **Fig. 30**.
Liftgate Glass Actuator (Expedition)	In liftgate. See **Fig. 44**.
Liftgate Glass Actuator (Navigator)	In liftgate. See **Fig. 45**.
Liftgate Latch (Expedition)	In liftgate. See **Fig. 44**.
Liftgate Latch (Navigator)	In liftgate. See **Fig. 45**.
Liftgate Latch/Unlatch Assembly (Expedition)	In right side of liftgate. See **Fig. 44**.
Liftgate Latch/Unlatch Assembly (Navigator)	In right side of liftgate. See **Fig. 45**.
Lumbar Motor (Driver Seat)	In driver's seat seatback. See **Fig. 36**.
Lumbar Motor (Passenger Seat)	In front passenger's seat seatback. See **Fig. 37**.
Mode Door Actuator (Auto A/C)	Left side of HVAC unit. See **Fig. 50**.
Mode Door Actuator (Manual A/C)	Left side of HVAC unit. See **Fig. 49**.
Mode Door Actuator (Rear) (Expedition-EL & Navigator-L)	Left side of HVAC unit. See **Fig. 52**.
Mode Door Actuator (Rear) (Expedition & Navigator)	Top left side of HVAC unit. See **Fig. 51**.
Passenger Seat Front Height Motor	Under front passenger's seat. See **Fig. 37**.
Passenger Seat Horizontal Motor	Under front passenger's seat. See **Fig. 37**.
Passenger Seat Rear Height Motor	Under front passenger's seat. See **Fig. 37**.
Passenger Seat Recliner Motor	In front passenger's seat seatback. See **Fig. 37**.
Power Window Motor (Driver Side Front) (Expedition)	In rear of driver's door. See **Fig. 38**.
Power Window Motor (Driver Side Front) (Navigator)	In rear of driver's door. See **Fig. 40**.
Power Window Motor (Left Rear)	In rear of left rear door. See **Fig. 42**.
Power Window Motor (Passenger Side Front) (Expedition)	In rear of front passenger's door. See **Fig. 39**.
Power Window Motor (Passenger Side Front) (Navigator)	In rear of front passenger's door. See **Fig. 41**.
Power Window Motor (Right Rear)	In rear of right rear door. See **Fig. 43**.
Quarter Window Motor (Left Rear) (Expedition)	In left "D" pillar. See **Fig. 28**.
Quarter Window Motor (Left Rear) (Expedition-EL & Navigator-L)	In left "D" pillar. See **Fig. 32**.
Quarter Window Motor (Left Rear) (Navigator)	In left "D" pillar. See **Fig. 30**.
Quarter Window Motor (Right Rear) (Expedition)	In right "D" pillar. See **Fig. 29**.
Quarter Window Motor (Right Rear) (Expedition-EL & Navigator-L)	In right "D" pillar. See **Fig. 33**.
Quarter Window Motor (Right Rear) (Navigator)	In right "D" pillar. See **Fig. 31**.
Rear Wiper Motor Assembly (Expedition)	In liftgate. See **Fig. 44**.
Rear Wiper Motor Assembly (Navigator)	In liftgate. See **Fig. 45**.

Running Board Motor (Left)	Under left side of vehicle. See **Fig. 26**.
Running Board Motor (Right)	Under right side of vehicle. See **Fig. 27**.
Starter Motor (Expedition)	Lower right side of engine. See **Fig. 5**.
Starter Motor (Navigator)	Lower right side of engine. See **Fig. 7**.
Steering Column Position Motor	Base of steering column. See **Fig. 20**.
Temperature Blend Door Actuator (Driver)	Bottom left side of HVAC unit. See **Fig. 50**.
Temperature Blend Door Actuator (Manual A/C)	Top left side of HVAC unit. See **Fig. 49**.
Temperature Blend Door Actuator (Passenger)	Top front of HVAC unit. See **Fig. 50**.
Third Row Power- Fold Seat Motor (Left) (Expedition)	Behind center of rear seat. See **Fig. 29**.
Third Row Power- Fold Seat Motor (Left) (Expedition-EL & Navigator-L)	Behind center of rear seat. See **Fig. 33**.
Third Row Power-Fold Seat Motor (Left) (Navigator)	Behind center of rear seat. See **Fig. 31**.
Third Row Power-Fold Seat Motor (Right) (Expedition)	Behind right side of rear seat. See **Fig. 29**.
Third Row Power-Fold Seat Motor (Right) (Expedition-EL & Navigator-L)	Behind right side of rear seat. See **Fig. 33**.
Third Row Power-Fold Seat Motor (Right) (Navigator)	Behind right side of rear seat. See **Fig. 31**.
Washer Pump Motor (Front & Rear) (Expedition)	Right front of engine compartment, on washer fluid reservoir. See **Fig. 6**.
Washer Pump Motor (Front & Rear) (Navigator)	Right front of engine compartment, on washer fluid reservoir. See **Fig. 8**.
Windshield Wiper Motor (Expedition)	On left side of firewall. See **Fig. 5**.
Windshield Wiper Motor (Navigator)	On left side of firewall. See **Fig. 7**.

SENDING UNITS & SENSORS

SENDING UNITS & SENSORS LOCATION

Component	Location
Accelerator Pedal Position Sensor (Expedition)	Above accelerator pedal. See **Fig. 5**.
Accelerator Pedal Position Sensor (Navigator)	Above accelerator pedal. See **Fig. 7**.
A/C Pressure Transducer Sensor (Expedition)	Right front of engine compartment. See **Fig. 6**.
A/C Pressure Transducer Sensor (Navigator)	Right front of engine compartment. See **Fig. 8**.
Ambient Air Temperature Sensor (Expedition)	Behind front of radiator grille. See **Fig. 5**.
Ambient Air Temperature Sensor (Navigator)	Behind front of radiator grille. See **Fig. 7**.
Brake Booster Sensor (Expedition)	Left rear of engine compartment. See **Fig. 5**.
Brake Booster Sensor (Navigator)	Left rear of engine compartment. See **Fig. 7**.
Camshaft Position Sensor 1	Front of right cylinder bank. See **Fig. 9**.
Camshaft Position Sensor 2	Front of left cylinder bank. See **Fig. 9**.
Crankshaft Position Sensor	Lower right front of engine. See **Fig. 10**.
Cylinder-Head Temperature Sensor	Right rear of engine. See **Fig. 10**.
Driver Memory Seat Front Height Position Sensor	Under driver's seat. See **Fig. 36**.
Driver Memory Seat Horizontal Position Sensor	Under driver's seat. See **Fig. 36**.
Driver Memory Seat Rear Height Position Sensor	Under driver's seat. See **Fig. 36**.

Evaporator Discharge Air Temperature Sensor (Auto A/C)	Top center of HVAC unit. See **Fig. 50**.
Evaporator Discharge Air Temperature Sensor (Manual A/C)	Top center of HVAC unit. See **Fig. 49**.
Front Impact Severity Sensor (Expedition)	Right front of engine compartment. See **Fig. 5**.
Front Impact Severity Sensor (Navigator)	Right front of engine compartment. See **Fig. 7**.
Fuel Tank Pressure Sensor (Expedition-EL & Navigator-L)	In fuel tank. See **Fig. 35**.
Fuel Tank Pressure Sensor (Expedition & Navigator)	In fuel tank. See **Fig. 34**.
Heated Oxygen Sensor (HO2S) #11	On right exhaust downpipe. See **Fig. 10**.
Heated Oxygen Sensor (HO2S) #12 (6HP26 2WD)	On rear of exhaust system. See **Fig. 13**.
Heated Oxygen Sensor (HO2S) #12 (6HP26 4WD)	On rear of exhaust system. See **Fig. 14**.
Heated Oxygen Sensor (HO2S) #12 (6R75 2WD)	On rear of exhaust system. See **Fig. 11**.
Heated Oxygen Sensor (HO2S) #12 (6R75 4WD)	On rear of exhaust system. See **Fig. 12**.
Heated Oxygen Sensor (HO2S) #21	On left exhaust downpipe. See **Fig. 9**.
Heated Oxygen Sensor (HO2S) #22 (6HP26 2WD)	On rear of exhaust system. See **Fig. 13**.
Heated Oxygen Sensor (HO2S) #22 (6HP26 4WD)	On rear of exhaust system. See **Fig. 14**.
Heated Oxygen Sensor (HO2S) #22 (6R75 2WD)	On rear of exhaust system. See **Fig. 11**.
Heated Oxygen Sensor (HO2S) #22 (6R75 4WD)	On rear of exhaust system. See **Fig. 12**.
Height Sensor (Left Rear) (Expedition-EL & Navigator-L)	Left rear shock tower. See **Fig. 35**.
Height Sensor (Left Rear) (Expedition & Navigator)	Left rear shock tower. See **Fig. 34**.
Height Sensor (Right Rear) (Expedition-EL & Navigator-L)	Right rear shock tower. See **Fig. 35**.
Height Sensor (Right Rear) (Expedition & Navigator)	Right rear shock tower. See **Fig. 34**.
In-Vehicle Temperature/Humidity Sensor	Behind left side of dash. See **Fig. 18**.
In-Vehicle Temperature Sensor	Behind left side of dash. See **Fig. 16**.
Knock Sensor 1	Right rear of engine. See **Fig. 10**.
Knock Sensor 2	Left rear of engine. See **Fig. 10**.
Liftgate Obstacle Detection Strip (Left) (Expedition)	Left rear corner of vehicle. See **Fig. 28**.
Liftgate Obstacle Detection Strip (Left) (Expedition-EL & Navigator-L)	Left rear corner of vehicle. See **Fig. 32**.
Liftgate Obstacle Detection Strip (Left) (Navigator)	Left rear corner of vehicle. See **Fig. 30**.
Liftgate Obstacle Detection Strip (Right) (Expedition)	Right rear corner of vehicle. See **Fig. 29**.
Liftgate Obstacle Detection Strip (Right) (Expedition-EL & Navigator-L)	Right rear corner of vehicle. See **Fig. 33**.
Liftgate Obstacle Detection Strip (Right)	

(Navigator)	Right rear corner of vehicle. See **Fig. 31**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (Expedition)	In intake system. See **Fig. 6**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (Navigator)	In intake system. See **Fig. 8**.
Safety Canopy Sensor (Driver 1) (Expedition)	In driver's door. See **Fig. 38**.
Safety Canopy Sensor (Driver 1) (Navigator)	In driver's door. See **Fig. 40**.
Safety Canopy Sensor (Driver 2) (Expedition)	Base of left "C" pillar. See **Fig. 28**.
Safety Canopy Sensor (Driver 2) (Expedition-EL & Navigator-L)	Base of left "C" pillar. See **Fig. 32**.
Safety Canopy Sensor (Driver 2) (Navigator)	Base of left "C" pillar. See **Fig. 30**.
Safety Canopy Sensor (Passenger 1) (Expedition)	In front passenger's door. See **Fig. 39**.
Safety Canopy Sensor (Passenger 1) (Navigator)	In front passenger's door. See **Fig. 41**.
Safety Canopy Sensor (Passenger 2) (Expedition)	Base of right "C" pillar. See **Fig. 29**.
Safety Canopy Sensor (Passenger 2) (Expedition-EL & Navigator-L)	Base of right "C" pillar. See **Fig. 33**.
Safety Canopy Sensor (Passenger 2) (Navigator)	Base of right "C" pillar. See **Fig. 31**.
Seat Position Sensor (Driver)	Under driver's seat. See **Fig. 36**.
Stability Control Sensor Cluster (Expedition)	Under center console. See **Fig. 16**.
Stability Control Sensor Cluster (Navigator)	Under center console. See **Fig. 18**.
Steering Position Sensor (Expedition)	On steering column. See **Fig. 19**.
Steering Position Sensor (Navigator)	On steering column. See **Fig. 20**.
Sunload Sensor	Under top center of dash. See **Fig. 17**.
Throttle Position Sensor (TPS)	On throttle body. See **Fig. 9**.
Wheel Speed Sensor (Left Front) (Expedition)	Left side of engine compartment. See **Fig. 5**.
Wheel Speed Sensor (Left Front) (Navigator)	Left side of engine compartment. See **Fig. 7**.
Wheel Speed Sensor (Left Rear) (Expedition-EL & Navigator-L)	At left rear wheel. See **Fig. 35**.
Wheel Speed Sensor (Left Rear) (Expedition & Navigator)	At left rear wheel. See **Fig. 34**.
Wheel Speed Sensor (Right Front) (Expedition)	Right side of engine compartment. See **Fig. 5**.
Wheel Speed Sensor (Right Front) (Navigator)	Right side of engine compartment. See **Fig. 7**.
Wheel Speed Sensor (Right Rear) (Expedition-EL & Navigator-L)	At right rear wheel. See **Fig. 35**.
Wheel Speed Sensor (Right Rear) (Expedition & Navigator)	At right rear wheel. See **Fig. 34**.

SOLENOIDS & SOLENOID VALVES

SOLENOIDS & SOLENOID VALVES LOCATION

Component	Location
A/C Clutch Field Coil	Right front of engine. See **Fig. 10**.
Air Spring Solenoid Valve (Left Rear) (Expedition-EL & Navigator-L)	Left rear shock tower. See **Fig. 35**.
Air Spring Solenoid Valve (Left Rear) (Expedition & Navigator)	Left rear shock tower. See **Fig. 34**.

Air Spring Solenoid Valve (Right Rear) (Expedition-EL & Navigator-L)	Right rear shock tower. See **Fig. 35**.
Air Spring Solenoid Valve (Right Rear) (Expedition & Navigator)	Right rear shock tower. See **Fig. 34**.
Auto Park Brake Release Solenoid	In driver's footwell. See **Fig. 17**.
Brake Shift Interlock (Expedition)	On steering column. See **Fig. 19**.
Charge Motion Control Valve (CMCV)	Rear of engine. See **Fig. 10**.
Door Lock Actuator (Left Front) (Expedition)	In rear of driver's door. See **Fig. 38**.
Door Lock Actuator (Left Front) (Navigator)	In rear of driver's door. See **Fig. 40**.
Door Lock Actuator (Left Rear)	In rear of left rear door. See **Fig. 42**.
Door Lock Actuator (Right Front) (Expedition)	In rear of front passenger's door. See **Fig. 39**.
Door Lock Actuator (Right Front) (Navigator)	In rear of front passenger's door. See **Fig. 41**.
Door Lock Actuator (Right Rear)	In rear of right rear door. See **Fig. 43**.
Electronic Fan Clutch (Expedition)	Top front of engine. See **Fig. 6**.
Electronic Fan Clutch (Navigator)	Top front of engine. See **Fig. 8**.
EVAP Canister Purge Valve (Expedition)	Left rear of engine compartment. See **Fig. 6**.
EVAP Canister Purge Valve (Navigator)	Left rear of engine compartment. See **Fig. 8**.
EVAP Canister Vent Solenoid (Expedition)	Under left side of vehicle. See **Fig. 24**.
EVAP Canister Vent Solenoid (Navigator)	Under left side of vehicle. See **Fig. 26**.
Fuel Injector 1	On right cylinder head. See **Fig. 9**.
Fuel Injector 2	On right cylinder head. See **Fig. 9**.
Fuel Injector 3	On right cylinder head. See **Fig. 9**.
Fuel Injector 4	On right cylinder head. See **Fig. 9**.
Fuel Injector 5	On left cylinder head. See **Fig. 10**.
Fuel Injector 6	On left cylinder head. See **Fig. 10**.
Fuel Injector 7	On left cylinder head. See **Fig. 10**.
Fuel Injector 8	On left cylinder head. See **Fig. 10**.
Headlamp Solenoid (Left) (Navigator)	Behind left headlight assembly. See **Fig. 8**.
Headlamp Solenoid (Right) (Navigator)	Behind right headlight assembly. See **Fig. 8**.
Heated Positive Crankcase Ventilation (PCV) Valve	Left rear of engine. See **Fig. 9**.
Integrated Wheel Ends Solenoid (Expedition)	Right front of engine compartment. See **Fig. 6**.
Integrated Wheel Ends Solenoid (Navigator)	Right front of engine compartment. See **Fig. 8**.
Key Release Interlock Actuator (Expedition)	On steering column. See **Fig. 19**.
Key Release Interlock Actuator (Navigator)	On steering column. See **Fig. 20**.
Variable Camshaft Timing (VCT) Valve 1	Right front of engine. See **Fig. 9**.
Variable Camshaft Timing (VCT) Valve 2	Left side of engine. See **Fig. 9**.

SWITCHES

SWITCHES LOCATION

Component	Location
Brake Fluid Level Switch (Expedition)	In brake fluid reservoir. See **Fig. 6**.
Brake Fluid Level Switch (Navigator)	In brake fluid reservoir. See **Fig. 8**.
Brake Pedal Position Switch (Expedition)	On brake pedal support. See **Fig. 6**.

Brake Pedal Position Switch (Navigator)	On brake pedal support. See **Fig. 8**.
Door Ajar Switch (Driver Side Rear)	In rear of left rear door. See **Fig. 42**.
Door Ajar Switch (Left Front) (Expedition)	In rear of driver's door. See **Fig. 38**.
Door Ajar Switch (Left Front) (Navigator)	In rear of driver's door. See **Fig. 40**.
Door Ajar Switch (Passenger Side Rear)	In rear of right rear door. See **Fig. 43**.
Door Ajar Switch (Right Front) (Expedition)	In rear of front passenger's door. See **Fig. 39**.
Door Ajar Switch (Right Front) (Navigator)	In rear of front passenger's door. See **Fig. 41**.
Horn Switch	In steering wheel. See **Fig. 21**.
Inertia Fuel Shutoff (IFS) Switch (Expedition)	Left rear corner of cargo area, behind trim. See **Fig. 28**.
Inertia Fuel Shutoff (IFS) Switch (Expedition-EL & Navigator-L)	Left rear corner of cargo area, behind trim. See **Fig. 32**.
Inertia Fuel Shutoff (IFS) Switch (Navigator)	Left rear corner of cargo area, behind trim. See **Fig. 30**.
Oil Pressure Switch	Lower left front of engine. See **Fig. 9**.
Parking Brake Switch (Expedition)	Above left kick panel. See **Fig. 24**.
Parking Brake Switch (Navigator)	Above left kick panel. See **Fig. 26**.
Safety Belt Buckle Switch (Driver)	In driver's safety belt buckle assembly. See **Fig. 36**.
Safety Belt Buckle Switch (Passenger)	In front passenger's safety belt buckle assembly. See **Fig. 37**.
Transmission Control Switch (Expedition)	On steering column. See **Fig. 19**.
Washer Fluid Level Switch (Expedition)	Right front of engine compartment, on washer fluid reservoir. See **Fig. 6**.
Washer Fluid Level Switch (Navigator)	Right front of engine compartment, on washer fluid reservoir. See **Fig. 8**.

MISCELLANEOUS

MISCELLANEOUS LOCATION

Component	Location
Adjustable Pedal Memory Potentiometer (Expedition)	Under left side of dash. See **Fig. 15**.
Adjustable Pedal Memory Potentiometer (Navigator)	Under left side of dash. See **Fig. 17**.
Antenna Module (Expedition)	Top of right "C" pillar. See **Fig. 29**.
Antenna Module (Expedition-EL & Navigator-L)	Top of right "C" pillar. See **Fig. 33**.
Antenna Module (Navigator)	Top of right "C" pillar. See **Fig. 31**.
Auxiliary Blower Motor Resistor Assembly (Expedition-EL & Navigator-L)	Right side of auxiliary HVAC unit. See **Fig. 52**.
Auxiliary Blower Motor Resistor Assembly (Expedition & Navigator)	Right side of auxiliary HVAC unit. See **Fig. 51**.
Battery (Expedition)	Right front of engine compartment. See **Fig. 5**.
Battery (Navigator)	Right front of engine compartment. See **Fig. 7**.
Blower Motor Resistor	Bottom right side of HVAC unit. See **Fig. 49**.
Climate Controlled Seat Backrest Thermo-Electric	In driver's seat seatback. See **Fig. 36**.

Device (TED) (Driver Side)	
Climate Controlled Seat Backrest Thermo-Electric Device (TED) (Passenger Side)	In front passenger's seat seatback. See **Fig. 37**.
Climate Controlled Seat Cushion Thermo-Electric Device (TED) (Driver Side)	Under driver seat. See **Fig. 36**.
Climate Controlled Seat Cushion Thermo-Electric Device (TED) (Passenger Side)	Under front passenger's seat. See **Fig. 37**.
Clockspring	In steering wheel. See **Fig. 21**.
Coil On Plug (COP) 1	On right cylinder head. See **Fig. 9**.
Coil On Plug (COP) 2	On right cylinder head. See **Fig. 9**.
Coil On Plug (COP) 3	On right cylinder head. See **Fig. 9**.
Coil On Plug (COP) 4	On right cylinder head. See **Fig. 9**.
Coil On Plug (COP) 5	On left cylinder head. See **Fig. 10**.
Coil On Plug (COP) 6	On left cylinder head. See **Fig. 10**.
Coil On Plug (COP) 7	On left cylinder head. See **Fig. 10**.
Coil On Plug (COP) 8	On left cylinder head. See **Fig. 10**.
Data Link Connector (Expedition)	Under left side of dash. See **Fig. 16**.
Data Link Connector (Navigator)	Under left side of dash. See **Fig. 18**.
Floor Shifter (Expedition)	Under center console. See **Fig. 22**.
Floor Shifter (Navigator)	Under center console. See **Fig. 23**.
Generator (Expedition)	Top front of engine. See **Fig. 6**.
Generator (Navigator)	Top front of engine. See **Fig. 8**.
GPS Antenna (Expedition)	Behind right side of dash. See **Fig. 16**.
GPS Antenna (Navigator)	Behind right side of dash. See **Fig. 18**.
Horn (Expedition)	Left front of engine compartment. See **Fig. 5**.
Horn (Navigator)	Left front of engine compartment. See **Fig. 7**.
Ignition Transformer Capacitor 1	Top right front of engine. See **Fig. 9**.
Ignition Transformer Capacitor 2	Top left front of engine. See **Fig. 10**.
Parking Aid Speaker (Expedition)	At left "C" pillar. See **Fig. 28**.
Parking Aid Speaker (Expedition-EL & Navigator-L)	At left "C" pillar. See **Fig. 32**.
Parking Aid Speaker (Navigator)	At left "C" pillar. See **Fig. 30**.
Passive Anti-Theft Transceiver (Expedition)	Top of steering column. See **Fig. 19**.
Passive Anti-Theft Transceiver (Navigator)	Top of steering column. See **Fig. 20**.
Power Liftgate Chime (Expedition)	Left rear corner of vehicle. See **Fig. 28**.
Power Liftgate Chime (Expedition-EL & Navigator-L)	Left rear corner of vehicle. See **Fig. 32**.
Power Liftgate Chime (Navigator)	Left rear corner of vehicle. See **Fig. 30**.
Safety Belt Pretensioner (Driver)	In driver's safety belt buckle assembly. See **Fig. 36**.
Safety Belt Pretensioner (Passenger)	In passenger's safety belt buckle assembly. See **Fig. 37**.
Safety Canopy (Left) (Expedition)	Top of left "C" pillar. See **Fig. 28**.
Safety Canopy (Left) (Expedition-EL & Navigator-L)	Top of left "C" pillar. See **Fig. 32**.

Safety Canopy (Left) (Navigator)	Top of left "C" pillar. See **Fig. 30**.
Safety Canopy (Right) (Expedition)	Top of right "C" pillar. See **Fig. 29**.
Safety Canopy (Right) (Expedition-EL & Navigator-L)	Top of right "C" pillar. See **Fig. 33**.
Safety Canopy (Right) (Navigator)	Top of right "C" pillar. See **Fig. 31**.
Satellite Antenna (Expedition)	Under front of center console. See **Fig. 22**.
Satellite Antenna (Navigator)	Under front of center console. See **Fig. 23**.
Satellite Radio Receiver (Expedition)	Under front of center console. See **Fig. 22**.
Satellite Radio Receiver (Navigator)	Under front of center console. See **Fig. 23**.
Side Thorax Air Bag Module (Driver)	In driver's seat seatback. See **Fig. 36**.
Side Thorax Air Bag Module (Passenger)	In front passenger's seat seatback. See **Fig. 37**.
Subwoofer Amplifier (Expedition)	Left side of cargo area, behind trim. See **Fig. 28**.
Subwoofer Amplifier (Expedition-EL & Navigator-L)	Left side of cargo area, behind trim. See **Fig. 32**.
Subwoofer Amplifier (Navigator)	Left side of cargo area, behind trim. See **Fig. 30**.
THX Amplifier	Under center of dash. See **Fig. 18**.
Trailer Tow Connector (4-Pin) (Expedition-EL & Navigator-L)	Under center of rear bumper. See **Fig. 35**.
Trailer Tow Connector (4-Pin) (Expedition & Navigator)	Under center of rear bumper. See **Fig. 34**.
Trailer Tow Connector (7-Pin) (Expedition-EL & Navigator-L)	Under center of rear bumper. See **Fig. 35**.
Trailer Tow Connector (7-Pin) (Expedition & Navigator)	Under center of rear bumper. See **Fig. 34**.
6HP26 Automatic Transmission (2WD)	Right rear of transmission. See **Fig. 13**.
6HP26 Automatic Transmission (4WD)	Right rear of transmission. See **Fig. 14**.
6R75 Automatic Transmission (2WD)	Right rear of transmission. See **Fig. 11**.
6R75 Automatic Transmission (4WD)	Right rear of transmission. See **Fig. 12**.

CONNECTORS

CONNECTORS LOCATION

Component	Location
C133 (7 Pin)	Left front of engine compartment. See **Fig. 8**.
C134 (Black, 7 Pin)	Right front of engine compartment. See **Fig. 8**.
C139 (Expedition) (Black, 34 Pin)	Left side of engine compartment. See **Fig. 6**.
C139 (Navigator) (Black, 34 Pin)	Left side of engine compartment. See **Fig. 8**.
C140 (Brown, 8 Pin)	Right front of engine. See **Fig. 8**.
C144 (Black, 4 Pin)	Right rear side of engine. See **Fig. 10**.
C145 (Expedition) (Black, 16 Pin)	Right side of engine compartment. See **Fig. 6**.
C145 (Navigator) (Black, 16 Pin)	Right side of engine compartment. See **Fig. 8**.
C146 (Expedition) (Black, 34 Pin)	Right side of engine compartment. See **Fig. 6**.
C146 (Navigator) (Black, 34 Pin)	Right side of engine compartment. See **Fig. 8**.
C192 (Expedition) (Black, 4 Pin)	Right front of engine compartment. See **Fig. 5**.
C192 (Navigator) (Black, 4 Pin)	Right front of engine compartment. See **Fig. 7**.

C210 (Expedition) (White, 20 Pin)	Behind right end of dash. See **Fig. 15**.
C210 (Navigator) (White, 20 Pin)	Behind right end of dash. See **Fig. 17**.
C211 (Expedition) (Black, 30 Pin)	Behind right end of dash. See **Fig. 25**.
C211 (Navigator) (Black, 30 Pin)	Behind right end of dash. See **Fig. 27**.
C212 (Expedition) (Gray, 13 Pin)	Behind left kick panel. See **Fig. 24**.
C212 (Navigator) (Gray, 13 Pin)	Behind left kick panel. See **Fig. 26**.
C213 (Expedition) (Green, 20 Pin)	Behind left kick panel. See **Fig. 15**.
C213 (Navigator) (Green, 20 Pin)	Behind left kick panel. See **Fig. 17**.
C214 (Expedition) (Green, 20 Pin)	Behind right end of dash. See **Fig. 15**.
C214 (Navigator) (Green, 20 Pin)	Behind right end of dash. See **Fig. 17**.
C219 (Expedition) (Gray, 6 Pin)	Behind left side of dash. See **Fig. 15**.
C219 (Navigator) (Gray, 6 Pin)	Behind left side of dash. See **Fig. 17**.
C237 (Black, 12 Pin)	Right side of HVAC unit. See **Fig. 49**.
C238 (Expedition) (Gray, 66 Pin)	Behind left kick panel. See **Fig. 24**.
C238 (Navigator) (Gray, 66 Pin)	Behind left kick panel. See **Fig. 17**.
C248 (Expedition) (Black, 12 Pin)	Behind left kick panel. See **Fig. 24**.
C248 (Navigator) (Black, 12 Pin)	Behind left kick panel. See **Fig. 26**.
C291 (Auto A/C) (Gray, 12 Pin)	Right side of HVAC unit. See **Fig. 50**.
C291 (navigator) (Gray, 12 Pin)	Behind right side of dash. See **Fig. 17**.
C298 (Expedition) (Gray, 16 Pin)	Behind right end of dash. See **Fig. 15**.
C298 (Navigator) (Gray, 16 Pin)	Behind right end of dash. See **Fig. 17**.
C299 (Auto A/C) (Black, 8 Pin)	Right side of HVAC unit. See **Fig. 50**.
C299 (Manual A/C) (Black, 8 Pin)	Right side of HVAC unit. See **Fig. 49**.
C311 (Black, 30 Pin)	Under driver' seat. See **Fig. 36**.
C312 (White, 40 Pin)	Under driver's seat. See **Fig. 36**.
C314 (Expedition) (Black, 42 Pin)	Under front of center console. See **Fig. 22**.
C314 (Navigator) (Black, 42 Pin)	Under front of center console. See **Fig. 23**.
C315 (Expedition) (Green, 20 Pin)	Below center console. See **Fig. 22**.
C315 (Navigator) (Green, 20 Pin)	Below center console. See **Fig. 23**.
C316 (Black, 30 Pin)	Under front passenger's seat. See **Fig. 37**.
C327 (Black, 14 Pin)	Under driver's seat. See **Fig. 36**.
C328 (Black, 14 Pin)	Under front passenger's seat. See **Fig. 37**.
C405 (Expedition-EL & Navigator-L) (Gray, 12 Pin)	At left "C" pillar. See **Fig. 32**.
C405 (Expedition) (Gray, 12 Pin)	At left "C" pillar. See **Fig. 28**.
C405 (Navigator) (Gray, 12 Pin)	At left "C" pillar. See **Fig. 30**.
C406 (Expedition) (Black, 12 Pin)	Top of left "D" pillar. See **Fig. 28**.
C406 (Expedition-EL & Navigator-L) (Black, 12 Pin)	Top of left "D" pillar. See **Fig. 32**.
C406 (Navigator) (Black, 12 Pin)	Top of left "D" pillar. See **Fig. 30**.
C408 (Gray, 13 Pin)	Top right side of HVAC unit. See **Fig. 52**.
C410 (Expedition) (Black, 16 Pin)	Right side of cargo area, behind trim. See **Fig. 29**.
C410 (Expedition-EL & Navigator-L) (Black, 16 Pin)	Right side of cargo area, behind trim. See **Fig. 33**.
C410 (Navigator) (Black, 16 Pin)	Right side of cargo area, behind trim. See **Fig. 31**.

C411 (Expedition) (Black, 12 Pin)	Right side of cargo area, behind trim. See **Fig. 29**.
C411 (Expedition-EL & Navigator-L) (Black, 12 Pin)	Right side of cargo area, behind trim. See **Fig. 33**.
C411 (Navigator) (Black, 12 Pin)	Right side of cargo area, behind trim. See **Fig. 31**.
C423 (Expedition) (Black, 2 Pin)	Under center of vehicle. See **Fig. 24**.
C423 (Navigator) (Black, 2 Pin)	Under center of vehicle. See **Fig. 26**.
C431 (Gray, 2 Pin)	Center rear of loading space. See **Fig. 33**.
C432 (Gray, 2 Pin)	Right rear of loading space. See **Fig. 33**.
C465 (Expedition-EL & Navigator-L) (Green, 20 Pin)	At left "C" pillar. See **Fig. 32**.
C465 (Expedition) (Green, 20 Pin)	At left "C" pillar. See **Fig. 28**.
C465 (Navigator) (Green, 20 Pin)	At left "C" pillar. See **Fig. 30**.
C494 (Expedition) (Black, 8 Pin)	Left rear corner of vehicle. See **Fig. 28**.
C494 (Expedition-EL & Navigator-L) (Black, 8 Pin)	Left rear corner of vehicle. See **Fig. 32**.
C494 (Navigator) (Black, 8 Pin)	Left rear corner of vehicle. See **Fig. 30**.
C495 (Expedition) (Black, 4 Pin)	In liftgate. See **Fig. 44**.
C495 (Navigator) (Black, 4 Pin)	In liftgate. See **Fig. 45**.
C510 (Expedition) (Black, 16 Pin)	In driver's door. See **Fig. 38**.
C510 (Navigator) (Black, 16 Pin)	In driver's door. See **Fig. 40**.
C610 (Expedition) (Black, 16 Pin)	In front passenger's door. See **Fig. 39**.
C610 (Navigator) (Black, 16 Pin)	In front passenger's door. See **Fig. 41**.
C700 (Black, 12 Pin)	In left rear door. See **Fig. 42**.
C800 (Black, 12 Pin)	In right rear door. See **Fig. 43**.
C913 (Expedition) (Black, 34 Pin)	Top of left "C" pillar. See **Fig. 28**.
C913 (Expedition-EL & Navigator-L) (Black, 34 Pin)	Top of left "C" pillar. See **Fig. 32**.
C913 (Navigator) (Black, 34 Pin)	Top of left "C" pillar. See **Fig. 30**.
C922 (Expedition-EL & Navigator-L) (Gray, 6 Pin)	Center of roof. See **Fig. 48**.
C922 (Expedition) (Gray, 6 Pin)	Center of roof. See **Fig. 46**.
C922 (Navigator) (Gray, 6 Pin)	Center of roof. See **Fig. 47**.
C934 (Expedition-EL & Navigator-L) (Gray, 10 Pin)	Left rear of roof. See **Fig. 32**.
C934 (Expedition) (Gray, 10 Pin)	Left rear of roof. See **Fig. 28**.
C934 (Navigator) (Gray, 10 Pin)	Left rear of roof. See **Fig. 30**.
C935 (Expedition) (Black, 8 Pin)	Left rear of roof. See **Fig. 28**.
C935 (Expedition-EL & Navigator-L) (Black, 8 Pin)	Left rear of roof. See **Fig. 32**.
C935 (Navigator) (Black, 8 Pin)	Left rear of roof. See **Fig. 30**.
C991 (Expedition-EL & Navigator-L) (Gray, 8 Pin)	Left rear of roof. See **Fig. 32**.
C991 (Expedition) (Gray, 8 Pin)	Left rear of roof. See **Fig. 28**.
C991 (Navigator) (Gray, 8 Pin)	Left rear of roof. See **Fig. 30**.
C1026 (Expedition) (Black, 1 Pin)	Right side of engine compartment. See **Fig. 5**.

C1026 (Navigator) (Black, 1 Pin)	Right side of engine compartment. See **Fig. 7**.
C2239 (Gray, 8 Pin)	On steering column. See **Fig. 19**.
C3049 (Yellow, 2 Pin)	Under driver's seat. See **Fig. 36**.
C3050 (Yellow, 2 Pin)	Under front passenger's seat. See **Fig. 37**.
C3051 (Yellow, 2 Pin)	Under driver's seat. See **Fig. 36**.
C3052 (Yellow, 2 Pin)	Under front passenger's seat. See **Fig. 37**.

GROUNDS

GROUNDS LOCATION

Component	Location
G100 (Expedition)	Right side of engine compartment. See **Fig. 5**.
G100 (Navigator)	Right side of engine compartment. See **Fig. 7**.
G101 (Expedition)	Near right side of radiator. See **Fig. 6**.
G101 (Navigator)	Near right side of radiator. See **Fig. 8**.
G102 (Expedition)	Right rear of engine compartment. See **Fig. 6**.
G102 (Navigator)	Right rear of engine compartment. See **Fig. 8**.
G103 (Expedition)	Left front of engine compartment. See **Fig. 5**.
G103 (Navigator)	Left front of engine compartment. See **Fig. 7**.
G104 (Expedition)	Left front of engine compartment. See **Fig. 5**.
G104 (Navigator)	Left front of engine compartment. See **Fig. 7**.
G105 (Expedition)	Right front of engine compartment. See **Fig. 6**.
G105 (Navigator)	Right front of engine compartment. See **Fig. 7**.
G106 (Expedition)	Right front of engine compartment. See **Fig. 5**.
G106 (Navigator)	Right front of engine compartment. See **Fig. 7**.
G107 (Expedition)	Right rear of engine compartment. See **Fig. 6**.
G107 (Navigator)	Right rear of engine compartment. See **Fig. 8**.
G108 (Expedition)	Right rear of engine compartment. See **Fig. 6**.
G108 (Navigator)	Right rear of engine compartment. See **Fig. 8**.
G109	Rear of right cylinder bank. See **Fig. 10**.
G110	Front of engine. See **Fig. 10**.
G200 (Expedition)	Behind right kick panel. See **Fig. 16**.
G200 (Navigator)	Behind right kick panel. See **Fig. 18**.
G201 (Expedition)	Under center of dash. See **Fig. 15**.
G201 (Navigator)	Behind center of dash. See **Fig. 17**.
G202 (Expedition)	Under center of dash. See **Fig. 15**.
G202 (Navigator)	Behind center of dash. See **Fig. 17**.
G203 (Expedition)	Behind left kick panel. See **Fig. 24**.
G203 (Navigator)	Behind left kick panel. See **Fig. 26**.
G204 (Expedition)	Behind left kick panel. See **Fig. 24**.
G204 (Navigator)	Behind left kick panel. See **Fig. 26**.
G205 (Expedition)	Under left end of dash. See **Fig. 15**.
G205 (Navigator)	Under left end of dash. See **Fig. 17**.
G300 (Expedition)	Behind right kick panel. See **Fig. 25**.

G300 (Navigator)	Behind right kick panel. See **Fig. 27**.
G301 (Expedition)	On left "B" pillar. See **Fig. 24**.
G301 (Navigator)	On left "B" pillar. See **Fig. 26**.
G302 (Expedition)	Behind right kick panel. See **Fig. 25**.
G302 (Navigator)	Behind right kick panel. See **Fig. 27**.
G400 (Expedition)	Under left quarter window. See **Fig. 28**.
G400 (Expedition-EL & Navigator-L)	Under left quarter window. See **Fig. 32**.
G400 (Navigator)	Under left quarter window. See **Fig. 30**.
G401 (Expedition)	Under left quarter window. See **Fig. 28**.
G401 (Expedition-EL & Navigator-L)	Under left quarter window. See **Fig. 32**.
G401 (Navigator)	Under left quarter window. See **Fig. 30**.
G402 (Expedition)	Right rear corner of vehicle. See **Fig. 29**.
G402 (Expedition-EL & Navigator-L)	Right rear corner of vehicle. See **Fig. 33**.
G402 (Navigator)	Left rear corner of vehicle. See **Fig. 31**.
G403 (Expedition)	Right rear corner of vehicle. See **Fig. 29**.
G403 (Expedition-EL & Navigator-L)	Right rear corner of vehicle. See **Fig. 33**.
G403 (Navigator)	Left rear corner of vehicle. See **Fig. 31**.
G404 (Expedition-EL & Navigator-L)	Under left rear of vehicle. See **Fig. 35**.
G404 (Expedition & Navigator)	Under left rear of vehicle. See **Fig. 34**.
G405 (Expedition-EL & Navigator-L)	Under left rear of vehicle. See **Fig. 35**.
G405 (Expedition & Navigator)	Under left rear of vehicle. See **Fig. 34**.

SPLICES

SPLICES LOCATION

Component	Location
S100 (Expedition)	In engine control sensor harness, near breakout to C211. See **Fig. 5**.
S100 (Navigator)	In engine control sensor harness, near breakout to C211. See **Fig. 7**.
S101 (Expedition)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 6**.
S101 (Navigator)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 8**.
S102 (Expedition)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 6**.
S102 (Navigator)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 8**.
S103 (Expedition)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 6**.
S103 (Navigator)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 8**.
S104 (Expedition)	In engine control sensor harness, near breakout to C140. See **Fig. 6**.
S104 (Navigator)	In engine control sensor harness, near breakout to C140. See **Fig. 8**.

S105 (Expedition)	In engine control sensor harness, near breakout to C140. See **Fig. 6**.
S105 (Navigator)	In engine control sensor harness, near breakout to C140. See **Fig. 8**.
S106 (Expedition)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 6**.
S106 (Navigator)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 8**.
S107 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 5**.
S107 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 7**.
S108 (Expedition)	In engine control sensor harness, near breakout to washer fluid switch. See **Fig. 6**.
S108 (Navigator)	In engine control sensor harness, near breakout to washer fluid switch. See **Fig. 8**.
S109 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 6**.
S109 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 8**.
S110 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 6**.
S110 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 8**.
S111 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 6**.
S111 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 8**.
S112 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 6**.
S112 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 8**.
S113 (Expedition)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 6**.
S113 (Navigator)	In engine control sensor harness, near breakout to battery junction box. See **Fig. 8**.
S114 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S114 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S115 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S115 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S116 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S116 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.

S117 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S117 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S118 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S118 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S119 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S119 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S120 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S120 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S121 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S121 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S122 (Expedition)	In engine control sensor harness, near breakout to horn. See **Fig. 6**.
S122 (Navigator)	In engine control sensor harness, near breakout to horn. See **Fig. 8**.
S123 (Expedition)	In engine control sensor harness, near breakout to left front foglight. See **Fig. 6**.
S123 (Navigator)	In engine control sensor harness, near breakout to left front foglight. See **Fig. 8**.
S124 (Expedition)	In engine control sensor harness, near breakout to left front foglight. See **Fig. 6**.
S124 (Navigator)	In engine control sensor harness, near breakout to left front foglight. See **Fig. 8**.
S125 (Expedition)	In engine control sensor harness, near breakout to left front side light. See **Fig. 6**.
S125 (Navigator)	In engine control sensor harness, near breakout to left front side light. See **Fig. 8**.
S126 (Expedition)	In engine control sensor harness, near breakout to left front side light. See **Fig. 6**.
S126 (Navigator)	In engine control sensor harness, near breakout to left front side light. See **Fig. 8**.
S127 (Expedition)	In engine control sensor harness, near breakout to brake fluid level switch. See **Fig. 5**.
S127 (Navigator)	In engine control sensor harness, near breakout to brake fluid level switch. See **Fig. 7**.
S128 (Expedition)	In engine control sensor harness, near breakout to brake fluid level switch. See **Fig. 5**.
S128 (Navigator)	In engine control sensor harness, near breakout to brake fluid level switch. See **Fig. 7**.

S129 (Expedition)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 6**.
S129 (Navigator)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 8**.
S130 (Expedition)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 6**.
S130 (Navigator)	In engine control sensor harness, near breakout to left front wheel speed sensor. See **Fig. 8**.
S131 (Expedition)	In engine control sensor harness, near breakout to EVAP canister purge valve. See **Fig. 6**.
S131 (Navigator)	In engine control sensor harness, near breakout to EVAP canister purge valve. See **Fig. 8**.
S132 (Expedition)	In engine control sensor harness, near breakout to windshield wiper motor assembly. See **Fig. 5**.
S132 (Navigator)	In engine control sensor harness, near breakout to windshield wiper motor assembly. See **Fig. 7**.
S133 (Expedition)	In engine control sensor harness, near breakout to C212. See **Fig. 5**.
S133 (Navigator)	In engine control sensor harness, near breakout to C212. See **Fig. 7**.
S135	In headlights harness, in breakout to C133. See **Fig. 9**.
S136	In engine control sensor & fuel charge harness, near breakout to fuel injector 7. See **Fig. 9**.
S137	In engine control sensor & fuel charge harness, near breakout to charge motion control valve. See **Fig. 10**.
S138	In engine control sensor & fuel charge harness, near breakout to heated oxygen sensor #11. See **Fig. 10**.
S139	In engine control sensor & fuel charge harness, near breakout to powertrain control module. See **Fig. 9**.
S140	In engine control sensor & fuel charge harness, near breakout to C145. See **Fig. 10**.
S141	In engine control sensor & fuel charge harness, near breakout to powertrain control module. See **Fig. 10**.
S142	In engine control sensor & fuel charge harness, near breakout to fuel injector 3. See **Fig. 10**.
S143	In engine control sensor & fuel charge harness, near breakout to fuel injector 3. See **Fig. 9**.
S144 (Expedition)	In alternator rectifier system harness, near breakout to battery. See **Fig. 6**.
S144 (Navigator)	In alternator rectifier system harness, near breakout to battery. See **Fig. 8**.
S145 (Expedition)	In alternator rectifier system harness, near breakout to battery. See **Fig. 6**.

S145 (Navigator)	In alternator rectifier system harness, near breakout to battery. See **Fig. 8**.
S146 (Expedition)	In alternator rectifier system harness, near breakout to battery. See **Fig. 6**.
S146 (Navigator)	In alternator rectifier system harness, near breakout to battery. See **Fig. 8**.
S147	In headlights harness, in breakout to C133. See **Fig. 8**.
S148	In headlights harness, in breakout to C134. See **Fig. 8**.
S149 (6HP26 2WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 13**.
S149 (6HP26 4WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 14**.
S149 (6R75 2WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 11**.
S149 (6R75 4WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 12**.
S150 (6HP26 2WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 13**.
S150 (6HP26 4WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 14**.
S150 (6R75 2WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 11**.
S150 (6R75 4WD)	In back-up light switch to rear light feed harness, near breakout to C146. See **Fig. 12**.
S151 (6HP26 2WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 13**.
S151 (6HP26 4WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 14**.
S151 (6R75 2WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 11**.
S151 (6R75 4WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 12**.
S152 (6HP26 2WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 13**.
S152 (6HP26 4WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 14**.
S152 (6R75 2WD)	In back-up light switch to rear light feed harness, near breakout to heated oxygen sensor #12. See **Fig. 11**.
	In back-up light switch to rear light feed harness

S152 (6R75 4WD)	near breakout to heated oxygen sensor #12. See **Fig. 12**.
S153 (6HP26 2WD)	In back-up light switch to rear light feed harness, near breakout to 6HP26 automatic transmission. See **Fig. 13**.
S153 (6HP26 4WD)	In back-up light switch to rear light feed harness, near breakout to 6HP26 automatic transmission. See **Fig. 14**.
S153 (6R75 2WD)	In back-up light switch to rear light feed harness, near breakout to 6R75 automatic transmission. See **Fig. 11**.
S153 (6R75 4WD)	In back-up light switch to rear light feed harness, near breakout to 6R75 automatic transmission. See **Fig. 12**.
S154 (Expedition)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 6**.
S154 (Navigator)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 8**.
S155 (Expedition)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 6**.
S155 (Navigator)	In engine control sensor harness, near breakout to powertrain control module. See **Fig. 8**.
S156 (Expedition)	In engine control sensor harness, under battery junction box. See **Fig. 6**.
S156 (Navigator)	In engine control sensor harness, under battery junction box. See **Fig. 8**.
S200 (Expedition)	In engine control sensor harness, near breakout to C211. See **Fig. 5**.
S200 (Navigator)	In engine control sensor harness, near breakout to C211. See **Fig. 7**.
S201 (Expedition)	In engine control sensor harness, near breakout to C211. See **Fig. 5**.
S201 (Navigator)	In engine control sensor harness, near breakout to C211. See **Fig. 7**.
S202 (Expedition)	In engine control sensor harness, near breakout to C211. See **Fig. 5**.
S202 (Navigator)	In engine control sensor harness, near breakout to C211. See **Fig. 7**.
S203 (Expedition)	In engine control sensor harness, in breakout to air suspension module. See **Fig. 5**.
S203 (Navigator)	In engine control sensor harness, in breakout to air suspension module. See **Fig. 7**.
S204 (Expedition)	In body main harness, in breakout to C211. See **Fig. 25**.
S204 (Navigator)	In body main harness, in breakout to C211. See **Fig. 27**.
S205 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.

S205 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S206 (Expedition)	In body main harness, near breakout to C214. See **Fig. 25**.
S206 (Navigator)	In body main harness, near breakout to C211. See **Fig. 27**.
S207 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.
S207 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S208 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.
S208 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S209 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.
S209 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S210 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.
S210 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S211 (Expedition)	In body main harness, near breakout to smart junction box. See **Fig. 25**.
S211 (Navigator)	In body main harness, near breakout to smart junction box. See **Fig. 27**.
S212 (Expedition)	In body main harness, near breakout to G203. See **Fig. 24**.
S212 (Navigator)	In body main harness, near breakout to G203. See **Fig. 26**.
S213 (Expedition)	In body main harness, near breakout to G203. See **Fig. 24**.
S213 (Navigator)	In body main harness, near breakout to G203. See **Fig. 26**.
S214 (Expedition)	In body main harness, near breakout to parking brake switch. See **Fig. 24**.
S214 (Navigator)	In body main harness, near breakout to C238. See **Fig. 26**.
S215	In body main harness, near breakout to left side exterior rearview mirror. See **Fig. 38**.
S216	In body main harness, near breakout to C212. See **Fig. 24**.
S217	In front heater blower motor harness, near breakout to C299. See **Fig. 50**.
S218	In front heater blower motor harness, near breakout to C237. See **Fig. 49**.
S219 (Auto A/C)	In front heater blower motor harness, near breakout to passenger temperature blend door

	actuator. See **Fig. 50**.
S219 (Manual A/C)	In front heater blower motor harness, near breakout to temperature blend door actuator. See **Fig. 49**.
S220 (Auto A/C)	In front heater blower motor harness, near breakout to driver temperature blend door actuator. See **Fig. 50**.
S220 (Manual A/C)	In front heater blower motor harness, in breakout to mode door actuator. See **Fig. 49**.
S221 (Expedition)	In main harness, near breakout to C210. See **Fig. 16**.
S221 (Navigator)	In main harness, near breakout to C210. See **Fig. 18**.
S222 (Expedition)	In main harness, near breakout to glove box light. See **Fig. 16**.
S222 (Navigator)	In main harness, near breakout to glove box light. See **Fig. 18**.
S223 (Expedition)	In main harness, near breakout to glove box light. See **Fig. 16**.
S223 (Navigator)	In main harness, near breakout to glove box light. See **Fig. 18**.
S224 (Expedition)	In main harness, near breakout to passenger air bag module. See **Fig. 16**.
S224 (Navigator)	In main harness, near breakout to passenger air bag module. See **Fig. 18**.
S225 (Expedition)	In main harness, near breakout to passenger air bag module. See **Fig. 16**.
S225 (Navigator)	In main harness, near breakout to passenger air bag module. See **Fig. 18**.
S226	In main harness, near breakout to message center switch. See **Fig. 18**.
S227 (Expedition)	In main harness, near breakout to passenger air bag module. See **Fig. 16**.
S227 (Navigator)	In main harness, near breakout to passenger air bag module. See **Fig. 18**.
S228 (Expedition)	In main harness, near breakout to instrument panel power point. See **Fig. 16**.
S228 (Navigator)	In main harness, near breakout to clock. See **Fig. 17**.
S231 (Expedition)	In main harness, near breakout to audio unit. See **Fig. 15**.
S231 (Navigator)	In main harness, near breakout to sunload sensor. See **Fig. 17**.
S232 (Expedition)	In main harness, near breakout to sunload sensor. See **Fig. 15**.
S232 (Navigator)	In main harness, near breakout to clock. See **Fig. 17**.
	In main harness, near breakout to instrument

S233	cluster. See **Fig. 15**.
S234 (Expedition)	In main harness, near breakout to audio unit. See **Fig. 15**.
S234 (Navigator)	In main harness, near breakout to sunload sensor. See **Fig. 17**.
S235 (Expedition)	In main harness, near breakout to audio unit. See **Fig. 15**.
S235 (Navigator)	In main harness, near breakout to sunload sensor. See **Fig. 17**.
S236	In main harness, near breakout to sunload sensor. See **Fig. 17**.
S237	In main harness, near breakout to THX amplifier. See **Fig. 17**.
S238	In main harness, near breakout to THX amplifier. See **Fig. 17**.
S239	In main harness, near breakout to THX amplifier. See **Fig. 17**.
S240	In main harness, near breakout to THX amplifier. See **Fig. 17**.
S241 (Expedition)	In main harness, near breakout to audio unit. See **Fig. 15**.
S241 (Navigator)	In main harness, near breakout to clock. See **Fig. 17**.
S242 (Expedition)	In main harness, near breakout to audio unit. See **Fig. 15**.
S242 (Navigator)	In main harness, near breakout to clock. See **Fig. 17**.
S243	In main harness, near breakout to audio unit. See **Fig. 17**.
S244	In main harness, near breakout to audio unit. See **Fig. 17**.
S245 (Expedition)	In main harness, near breakout to four-wheel drive switch. See **Fig. 16**.
S245 (Navigator)	In main harness, near breakout to in-vehicle temperature/humidity sensor. See **Fig. 18**.
S246	In main harness, near breakout to audio unit. See **Fig. 17**.
S247	In main harness, near breakout to audio unit. See **Fig. 17**.
S248	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S249	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S250 (Expedition)	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S250 (Navigator)	In main harness, near breakout to instrument cluster. See **Fig. 17**.
	In main harness, near breakout to instrument

S251 (Expedition)	cluster. See **Fig. 15**.
S251 (Navigator)	In main harness, near breakout to instrument cluster. See **Fig. 17**.
S252 (Expedition)	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S252 (Navigator)	In main harness, near breakout to instrument cluster. See **Fig. 17**.
S253 (Expedition)	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S253 (Navigator)	In main harness, near breakout to instrument cluster. See **Fig. 17**.
S254 (Expedition)	In main harness, near breakout to instrument cluster. See **Fig. 15**.
S254 (Navigator)	In main harness, near breakout to instrument cluster. See **Fig. 17**.
S255	In main harness, near breakout to auxiliary relay box 1. See **Fig. 20**.
S256	In main harness, near breakout to auxiliary relay box 1. See **Fig. 20**.
S257 (Expedition)	In main harness, near breakout to ignition switch. See **Fig. 19**.
S257 (Navigator)	In main harness, near breakout to auxiliary relay box 1. See **Fig. 20**.
S258 (Expedition) (Early Production)	In main harness, near breakout to C238. See **Fig. 16**.
S258 (Expedition) (Late Production)	In main harness, near breakout to sunload sensor. See **Fig. 16**.
S258 (Navigator) (Early Production)	In main harness, near breakout to clock. See **Fig. 17**.
S258 (Navigator) (Late Production)	In main harness, near breakout to clock. See **Fig. 17**.
S259 (Expedition)	In main harness, near breakout to C238. See **Fig. 16**.
S259 (Navigator)	In main harness, near breakout to C238. See **Fig. 17**.
S260 (Expedition)	In main harness, near breakout to headlight switch. See **Fig. 15**.
S260 (Navigator)	In main harness, near breakout to headlight switch. See **Fig. 17**.
S261 (Expedition)	In main harness, near breakout to C238. See **Fig. 15**.
S261 (Navigator)	In main harness, near breakout to C238. See **Fig. 17**.
S262	In main harness, near breakout to C238. See **Fig. 17**.
S263	In main harness, near breakout to C238. See **Fig. 17**.
	In main harness, near breakout to C238. See **Fig**

S264	**17**.
S265	In main harness, near breakout to C238. See **Fig. 17**.
S266	In main harness, near breakout to C238. See **Fig. 17**.
S267	In body main harness, near breakout to C212. See **Fig. 24**.
S268	In body main harness, near breakout to G203. See **Fig. 26**.
S269	In body main harness, near breakout to G203. See **Fig. 26**.
S270	In body main harness, near breakout to G203. See **Fig. 26**.
S271	In body main harness, near breakout to G203. See **Fig. 26**.
S272	In body main harness, near breakout to keyless entry keypad. See **Fig. 40**.
S273	In body main harness, in breakout to C238. See **Fig. 26**.
S276 (Expedition)	In body main harness, in breakout to G300. See **Fig. 25**.
S276 (Navigator)	In body main harness, in breakout to G300. See **Fig. 27**.
S300 (Expedition)	In body main harness, near breakout to G300. See **Fig. 25**.
S300 (Navigator)	In body main harness, near breakout to G300. See **Fig. 27**.
S301 (Expedition)	In body main harness, near breakout to C800. See **Fig. 25**.
S301 (Navigator)	In body main harness, near breakout to G300. See **Fig. 27**.
S302 (Expedition)	In body main harness, near breakout to G300. See **Fig. 25**.
S302 (Navigator)	In body main harness, near breakout to G300. See **Fig. 27**.
S303 (Expedition)	In body main harness, near breakout to C3051. See **Fig. 24**.
S303 (Navigator)	In body main harness, near breakout to C3051. See **Fig. 26**.
S304 (Expedition)	In body main harness, near breakout to C3050. See **Fig. 25**.
S304 (Navigator)	In body main harness, near breakout to G300. See **Fig. 27**.
S305 (Expedition)	In body main harness, near breakout to C3050. See **Fig. 25**.
S305 (Navigator)	In body main harness, near breakout to G300. See **Fig. 27**.
	In body main harness, near breakout to C314. See

S306 (Expedition)	**Fig. 25**.
S306 (Navigator)	In body main harness, near breakout to C314. See **Fig. 27**.
S307 (Expedition)	In body main harness, near breakout to C314. See **Fig. 25**.
S307 (Navigator)	In body main harness, near breakout to C314. See **Fig. 27**.
S308 (Expedition)	In body main harness, near breakout to C314. See **Fig. 25**.
S308 (Navigator)	In body main harness, near breakout to C314. See **Fig. 27**.
S309 (Expedition)	In body main harness, near breakout to C314. See **Fig. 25**.
S309 (Navigator)	In body main harness, near breakout to C314. See **Fig. 27**.
S310 (Expedition)	In body main harness, near breakout to C314. See **Fig. 25**.
S310 (Navigator)	In body main harness, near breakout to C314. See **Fig. 27**.
S311 (Expedition)	In body main harness, near breakout to C3051. See **Fig. 24**.
S311 (Navigator)	In body main harness, near breakout to C3051. See **Fig. 26**.
S312 (Expedition)	In body main harness, near breakout to C3051. See **Fig. 24**.
S312 (Navigator)	In body main harness, near breakout to C3051. See **Fig. 26**.
S313 (Expedition)	In body main harness, near breakout to C3051. See **Fig. 24**.
S313 (Navigator)	In body main harness, near breakout to C3051. See **Fig. 26**.
S314 (Expedition)	In body main harness, near breakout to C3051. See **Fig. 24**.
S314 (Navigator)	In body main harness, near breakout to C3051. See **Fig. 26**.
S315 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S315 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S316 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S316 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S317 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S317 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
	In body main harness, near breakout to G301. See

S318 (Expedition)	**Fig. 24**.
S318 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S319 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S319 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S320 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S320 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S321 (Expedition)	In body main harness, near breakout to G301. See **Fig. 24**.
S321 (Navigator)	In body main harness, near breakout to G301. See **Fig. 26**.
S322	In body main harness, near breakout to G301. See **Fig. 26**.
S323	In power seats harness, near breakout to driver seat rear height motor. See **Fig. 36**.
S324	In power seats harness, near breakout to C327. See **Fig. 36**.
S325	In power seats harness, near breakout to C327. See **Fig. 36**.
S326	In power seats harness, near breakout to driver seat rear height motor. See **Fig. 36**.
S327	In power seats harness, near breakout to C316. See **Fig. 37**.
S328	In power seats harness, near breakout to climate controlled seat module. See **Fig. 37**.
S329	In power seats harness, near breakout to passenger side climate controlled seat cushion thermo-electric device. See **Fig. 37**.
S330	N power seats harness, near breakout to passenger side climate controlled seat cushion thermo-electric device. See **Fig. 37**.
S331	In body main harness, near breakout to G300. See **Fig. 27**.
S332	In body main harness, in breakout to C314. See **Fig. 27**.
S333	In body main harness, near breakout to G301. See **Fig. 26**.
S334	In body main harness, near breakout to G301. See **Fig. 26**.
S335	In body main harness, near breakout to G301. See **Fig. 26**.
S336	In body main harness, near breakout to G301. See **Fig. 26**.
	In main harness, near breakout to C315. See **Fig**

S337 (Expedition)	**16**.
S337 (Navigator)	In main harness, near breakout to C315. See **Fig. 17**.
S337 (Navigator) (W/THX)	In main harness, near breakout to THX amplifier. See **Fig. 18**.
S338 (Expedition)	In main harness, near breakout to C315. See **Fig. 16**.
S338 (Navigator)	In main harness, near breakout to C315. See **Fig. 17**.
S338 (Navigator) (W/THX)	In main harness, near breakout to THX amplifier. See **Fig. 18**.
S339 (Expedition)	In console panel harness, in breakout to C315. See **Fig. 22**.
S339 (Navigator)	In console panel harness, in breakout to C315. See **Fig. 23**.
S340 (Expedition)	In console panel harness, in breakout to C314. See **Fig. 22**.
S340 (Navigator)	In console panel harness, in breakout to C314. See **Fig. 23**.
S341 (Expedition)	In console panel harness, in breakout to C315. See **Fig. 22**.
S341 (Navigator)	In console panel harness, in breakout to C315. See **Fig. 23**.
S342 (Expedition)	In console panel harness, in breakout to C314. See **Fig. 22**.
S342 (Navigator)	In console panel harness, in breakout to C314. See **Fig. 23**.
S343 (Expedition)	In console panel harness, in breakout to C315. See **Fig. 22**.
S343 (Navigator)	In console panel harness, in breakout to C315. See **Fig. 23**.
S344 (Expedition)	In console panel harness, in breakout to C314. See **Fig. 22**.
S344 (Navigator)	In console panel harness, in breakout to C314. See **Fig. 23**.
S345 (Expedition)	In console panel harness, in breakout to C315. See **Fig. 22**.
S345 (Navigator)	In console panel harness, in breakout to C315. See **Fig. 23**.
S346 (Expedition)	In console panel harness, in breakout to C314. See **Fig. 22**.
S346 (Navigator)	In console panel harness, in breakout to C314. See **Fig. 23**.
S347 (Expedition)	In console panel harness, in breakout to satellite radio receiver. See **Fig. 22**.
S347 (Navigator)	In console panel harness, in breakout to satellite radio receiver. See **Fig. 23**.
	In console panel harness, in breakout to satellite

S348 (Expedition)	radio receiver. See **Fig. 22**.
S348 (Navigator)	In console panel harness, in breakout to satellite radio receiver. See **Fig. 23**.
S349 (Expedition)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 22**.
S349 (Navigator)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 23**.
S350 (Expedition)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 22**.
S350 (Navigator)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 23**.
S351 (Expedition)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 22**.
S351 (Navigator)	In console panel harness, near breakout to satellite radio receiver. See **Fig. 23**.
S352 (Expedition)	In console panel harness, in breakout to auxiliary audio module. See **Fig. 22**.
S352 (Navigator)	In console panel harness, in breakout to auxiliary audio module. See **Fig. 23**.
S353	In console panel harness, in breakout to C315. See **Fig. 22**.
S354	In console panel harness, in breakout to C314. See **Fig. 23**.
S400 (Expedition)	In rear light connector harness, near breakout to left rear quarter window motor. See **Fig. 28**.
S400 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to left rear quarter window motor. See **Fig. 32**.
S400 (Navigator)	In rear light connector harness, near breakout to left rear quarter window motor. See **Fig. 30**.
S401 (Expedition)	In rear light connector harness, in breakout to C494. See **Fig. 28**.
S401 (Expedition-EL & Navigator-L)	In rear light connector harness, in breakout to C494. See **Fig. 32**.
S401 (Navigator)	In rear light connector harness, in breakout to C494. See **Fig. 30**.
S402 (Expedition)	In rear light connector harness, in breakout to C494. See **Fig. 28**.
S402 (Expedition-EL & Navigator-L)	In rear light connector harness, in breakout to C494. See **Fig. 32**.
S402 (Navigator)	In rear light connector harness, in breakout to C494. See **Fig. 30**.
S403 (Expedition)	In rear light connector harness, near breakout to G400. See **Fig. 28**.
S403 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to G400. See **Fig. 32**.
S403 (Navigator)	In rear light connector harness, near breakout to G400. See **Fig. 30**.
	In rear light connector harness, near breakout to

S404 (Expedition)	G400. See **Fig. 28**.
S404 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to G400. See **Fig. 32**.
S404 (Navigator)	In rear light connector harness, near breakout to G400. See **Fig. 30**.
S405 (Expedition)	In rear light connector harness, near breakout to G401. See **Fig. 28**.
S405 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to C405. See **Fig. 32**.
S405 (Navigator)	In rear light connector harness, near breakout to power liftgate module. See **Fig. 30**.
S406 (Expedition)	In rear light connector harness, near breakout to G401. See **Fig. 28**.
S406 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to C405. See **Fig. 32**.
S406 (Navigator)	In rear light connector harness, near breakout to power liftgate module. See **Fig. 30**.
S407 (Expedition)	In rear light connector harness, near breakout to G401. See **Fig. 28**.
S407 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to C405. See **Fig. 32**.
S407 (Navigator)	In rear light connector harness, near breakout to power liftgate module. See **Fig. 30**.
S408 (Expedition)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 28**.
S408 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 32**.
S408 (Navigator)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 30**.
S409 (Expedition)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 28**.
S409 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 32**.
S409 (Navigator)	In rear light connector harness, near breakout to parking aid speaker. See **Fig. 30**.
S410	In rear light connector harness, in breakout to rear mode door actuator. See **Fig. 51**.
S411	In rear light connector harness, in breakout to rear mode door actuator. See **Fig. 51**.
S412	In rear light connector harness, near breakout to auxiliary blower motor resistor assembly. See **Fig. 51**.
S413 (Expedition)	In rear light connector harness, near breakout to C410. See **Fig. 29**.
S413 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to C410. See **Fig. 33**.
S413 (Navigator)	In rear light connector harness, near breakout to C410. See **Fig. 31**.

S414	In rear light connector harness, near breakout to G402. See **Fig. 31**.
S415 (Expedition)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 29**.
S415 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 33**.
S415 (Navigator)	In rear light connector harness, near breakout to G402. See **Fig. 31**.
S416 (Expedition)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 29**.
S416 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 33**.
S416 (Navigator)	In rear light connector harness, near breakout to G402. See **Fig. 31**.
S417 (Expedition)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 29**.
S417 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 33**.
S417 (Navigator)	In rear light connector harness, near breakout to auxiliary relay box 2. See **Fig. 31**.
S418 (Expedition)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 29**.
S418 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 33**.
S418 (Navigator)	In rear light connector harness, near breakout to G402. See **Fig. 31**.
S419 (Expedition)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 29**.
S419 (Expedition-EL & Navigator-L)	In rear light connector harness, near breakout to right rear quarter window motor. See **Fig. 33**.
S419 (Navigator)	In rear light connector harness, near breakout to G402. See **Fig. 31**.
S420	In rear light connector harness, near breakout to right rear park/stop/turn light 1. See **Fig. 31**.
S421	In rear light connector harness, near breakout to left rear park/stop/turn light 1. See **Fig. 30**.
S422	In rear light connector harness, near breakout to C408. See **Fig. 33**.
S423 (Expedition)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 44**.
S423 (Navigator)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 45**.
S424 (Expedition)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 44**.
S424 (Navigator)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 45**.
S425	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 45**.

S426 (Expedition)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 44**.
S426 (Navigator)	In switch & wiring assembly, near breakout to rear window defrost grid. See **Fig. 45**.
S427	In switch & wiring assembly, near breakout to C495. See **Fig. 45**.
S428	In auxiliary case jumper, near breakout to rear mode door actuator. See **Fig. 52**.
S429	In auxiliary case jumper, near breakout to rear mode door actuator. See **Fig. 52**.
S430	In auxiliary case jumper, near breakout to rear mode door actuator. See **Fig. 52**.
S431 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to fuel pump module. See **Fig. 35**.
S431 (Expedition & Navigator)	In taillights harness, near breakout to fuel pump module. See **Fig. 34**.
S432 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to fuel pump module. See **Fig. 35**.
S432 (Expedition & Navigator)	In taillights harness, near breakout to fuel pump module. See **Fig. 34**.
S433 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to fuel pump module. See **Fig. 35**.
S433 (Expedition & Navigator)	In taillights harness, near breakout to fuel pump module. See **Fig. 34**.
S434 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to fuel pump module. See **Fig. 35**.
S434 (Expedition & Navigator)	In taillights harness, near breakout to fuel pump module. See **Fig. 34**.
S435 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to fuel pump module. See **Fig. 35**.
S435 (Expedition & Navigator)	In taillights harness, near breakout to fuel pump module. See **Fig. 34**.
S436 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to G405. See **Fig. 35**.
S436 (Expedition & Navigator)	In taillights harness, near breakout to G405. See **Fig. 34**.
S437 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to G405. See **Fig. 35**.
S437 (Expedition & Navigator)	In taillights harness, near breakout to G405. See **Fig. 34**.
S438 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to 4-pin trailer tow connector. See **Fig. 35**.
S438 (Expedition & Navigator)	In taillights harness, near breakout to 4-pin trailer tow connector. See **Fig. 34**.
S439 (Expedition-EL & Navigator-L)	In taillights harness, near breakout to 4-pin trailer tow connector. See **Fig. 35**.
S439 (Expedition & Navigator)	In taillights harness, near breakout to 4-pin trailer tow connector. See **Fig. 34**.

S442	In body main harness, near breakout to C465. See **Fig. 32**.
S443	In body main harness, near breakout to C405. See **Fig. 32**.
S444 (Expedition)	In body main harness, in breakout to subwoofer amplifier. See **Fig. 28**.
S444 (Expedition-EL & Navigator-L)	In body main harness, in breakout to subwoofer amplifier. See **Fig. 32**.
S444 (Navigator)	In body main harness, in breakout to subwoofer amplifier. See **Fig. 30**.
S445	In rear light connector harness, near breakout to right rear tweeter. See **Fig. 31**.
S500	In driver's door window regulator harness, in breakout keyless entry keypad. See **Fig. 40**.
S501	In driver's door window regulator harness, in breakout keyless entry keypad. See **Fig. 40**.
S502	In main body harness, in breakout to left side exterior rearview mirror. See **Fig. 38**.
S503 (Expedition)	In main body harness, near breakout to master window adjust switch. See **Fig. 38**.
S503 (Navigator)	In main body harness, near breakout to master window adjust switch. See **Fig. 40**.
S504	In main body harness, in breakout to master window adjust switch. See **Fig. 40**.
S505	In main body harness, in breakout to master window adjust switch. See **Fig. 40**.
S600	In right front window regulator harness, near breakout to front passenger's door ajar switch. See **Fig. 41**.
S601	In body main harness, near breakout to right side exterior rearview mirror. See **Fig. 41**.
S602	In body main harness, near breakout to right side exterior rearview mirror. See **Fig. 41**.
S603	In body main harness, near breakout to passenger side door lock switch. See **Fig. 41**.
S604	In body main harness, near breakout to passenger side door lock switch. See **Fig. 41**.
S900 (Expedition)	In interior illumination harness, near breakout to C406. See **Fig. 46**.
S900 (Expedition-EL & Navigator-L)	In interior illumination harness, near breakout to C406. See **Fig. 48**.
S900 (Navigator)	In interior illumination harness, near breakout to C406. See **Fig. 47**.
S901 (Expedition)	In interior illumination harness, near breakout to C406. See **Fig. 46**.
S901 (Expedition-EL & Navigator-L)	In interior illumination harness, near breakout to C406. See **Fig. 48**.
	In interior illumination harness, near breakout to

S901 (Navigator)	C406. See **Fig. 47**.
S902 (Expedition)	In interior illumination harness, near breakout to C406. See **Fig. 46**.
S902 (Expedition-EL & Navigator-L)	In interior illumination harness, near breakout to C406. See **Fig. 48**.
S902 (Navigator)	In interior illumination harness, near breakout to C406. See **Fig. 47**.
S903 (Expedition)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 46**.
S903 (Expedition-EL & Navigator-L)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 48**.
S903 (Navigator)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 47**.
S904 (Expedition)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 46**.
S904 (Expedition-EL & Navigator-L)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 48**.
S904 (Navigator)	In interior illumination harness, near breakout to left vanity mirror light. See **Fig. 47**.
S905 (Expedition)	In body main harness, near breakout to C913. See **Fig. 28**.
S905 (Expedition-EL & Navigator-L)	In body main harness, near breakout to C913. See **Fig. 32**.
S905 (Navigator)	In body main harness, near breakout to C913. See **Fig. 30**.
S906 (Expedition)	In body main harness, near breakout to C913. See **Fig. 28**.
S906 (Expedition-EL & Navigator-L)	In body main harness, near breakout to C913. See **Fig. 32**.
S906 (Navigator)	In body main harness, near breakout to C913. See **Fig. 30**.
S907 (Expedition)	In body main harness, near breakout to C913. See **Fig. 28**.
S907 (Expedition-EL & Navigator-L)	In body main harness, near breakout to C913. See **Fig. 32**.
S907 (Navigator)	In body main harness, near breakout to C913. See **Fig. 30**.
S908 (Expedition)	In roof sliding panel control switch harness, in breakout to DVD player. See **Fig. 46**.
S908 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, in breakout to DVD player. See **Fig. 48**.
S908 (Navigator)	In roof sliding panel control switch harness, in breakout to DVD player. See **Fig. 47**.
S909 (Expedition)	In roof sliding panel control switch harness, in breakout to DVD player. See **Fig. 46**.
S909 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, in breakout to DVD player. See **Fig. 48**.
	In roof sliding panel control switch harness, in

S909 (Navigator)	breakout to DVD player. See **Fig. 47**.
S910 (Expedition)	In vanity mirror light harness, in breakout to C298. See **Fig. 46**.
S910 (Expedition-EL & Navigator-L)	In vanity mirror light harness, in breakout to C298. See **Fig. 48**.
S910 (Navigator)	In vanity mirror light harness, in breakout to C298. See **Fig. 47**.
S911 (Expedition)	In vanity mirror light harness, in breakout to C298. See **Fig. 46**.
S911 (Expedition-EL & Navigator-L)	In vanity mirror light harness, in breakout to C298. See **Fig. 48**.
S911 (Navigator)	In vanity mirror light harness, in breakout to C298. See **Fig. 47**.
S912 (Expedition)	In vanity mirror light harness, in breakout to C298. See **Fig. 46**.
S912 (Expedition-EL & Navigator-L)	In vanity mirror light harness, in breakout to C298. See **Fig. 48**.
S912 (Navigator)	In vanity mirror light harness, in breakout to C298. See **Fig. 47**.
S913 (Expedition)	In vanity mirror light harness, near breakout to electronic compass. See **Fig. 46**.
S913 (Expedition-EL & Navigator-L)	In vanity mirror light harness, near breakout to electronic compass. See **Fig. 48**.
S913 (Navigator)	In vanity mirror light harness, near breakout to electronic compass. See **Fig. 47**.
S914 (Expedition)	In roof sliding panel control switch harness, near breakout to DVD player. See **Fig. 46**.
S914 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, near breakout to DVD player. See **Fig. 48**.
S914 (Navigator)	In roof sliding panel control switch harness, near breakout to DVD player. See **Fig. 47**.
S915 (Expedition)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 46**.
S915 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 48**.
S915 (Navigator)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 47**.
S916 (Expedition)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 46**.
S916 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 48**.
S916 (Navigator)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 47**.
S917 (Expedition)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 46**.
S917 (Expedition-EL & Navigator-L)	In roof sliding panel control switch harness, in breakout to C913. See **Fig. 48**.
	In roof sliding panel control switch harness, in

S917 (Navigator)	breakout to C913. See **Fig. 47**.

COMPONENT LOCATION GRAPHICS

NOTE: Figures may show multiple component locations. Refer to appropriate table for proper figure references.

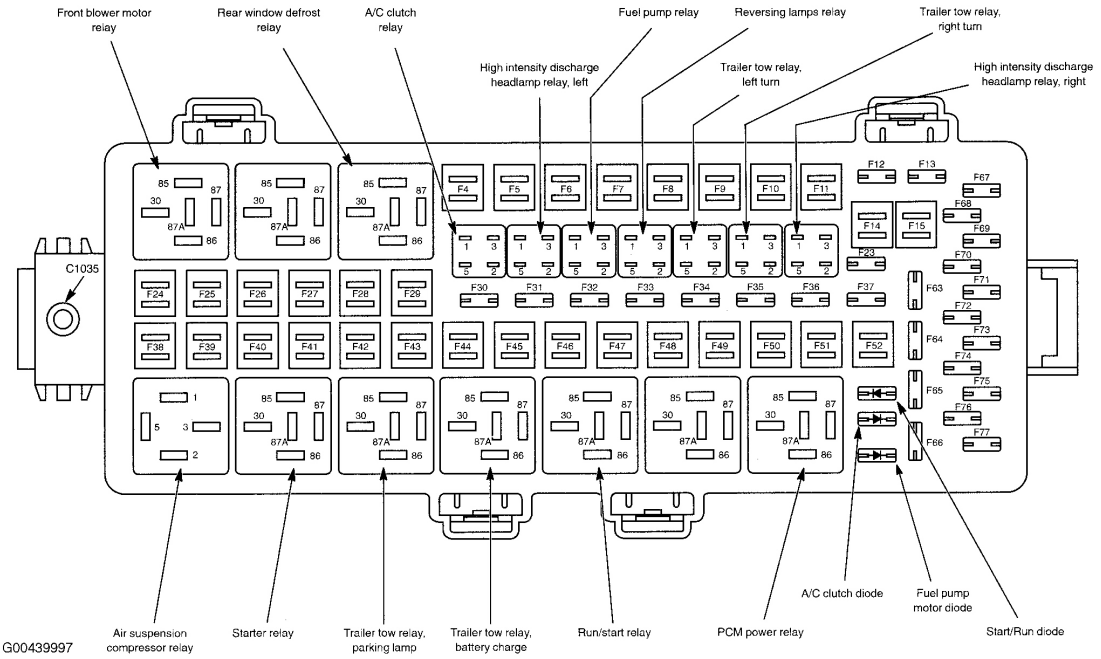


Fig. 1: Battery Junction Box (BJB)
Courtesy of FORD MOTOR CO.

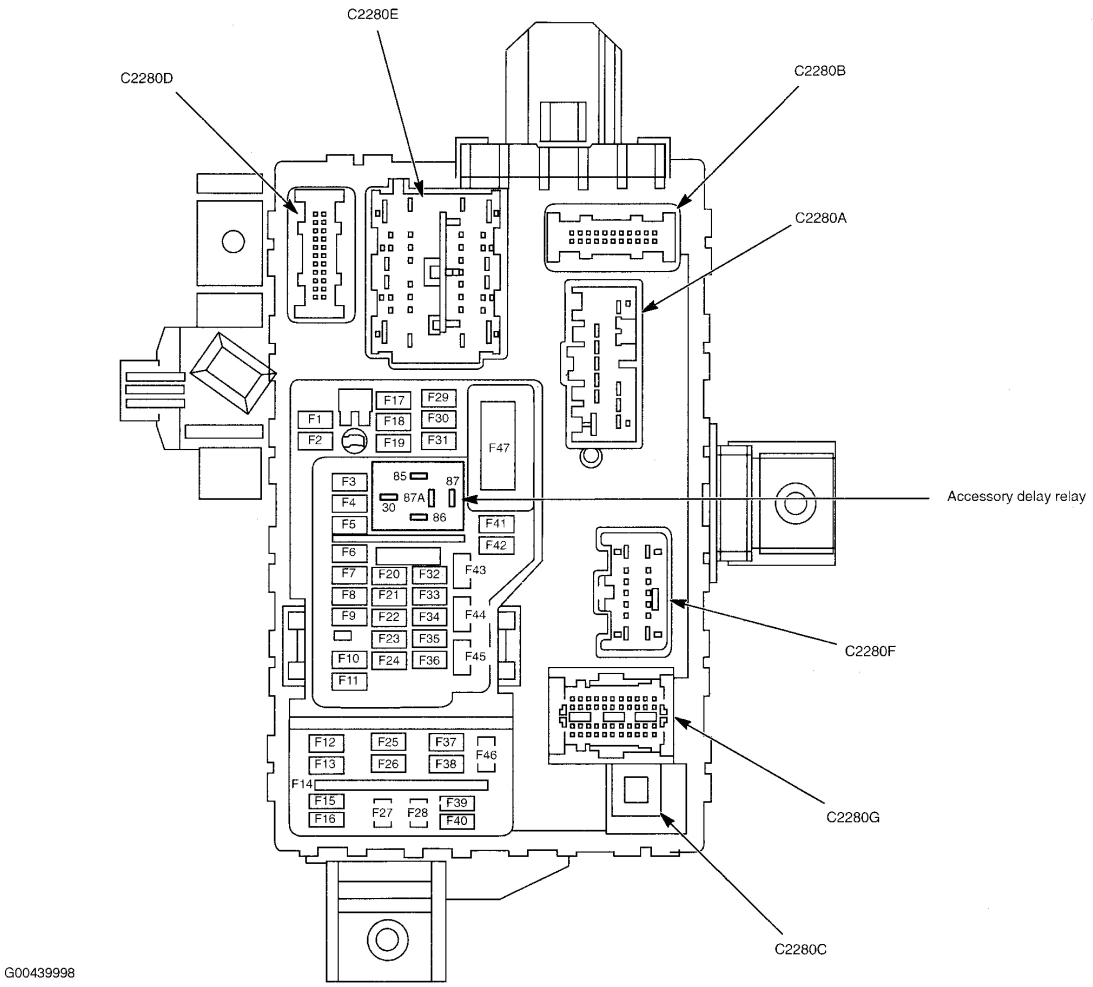


Fig. 2: Smart Junction Box (SJB)
Courtesy of FORD MOTOR CO.

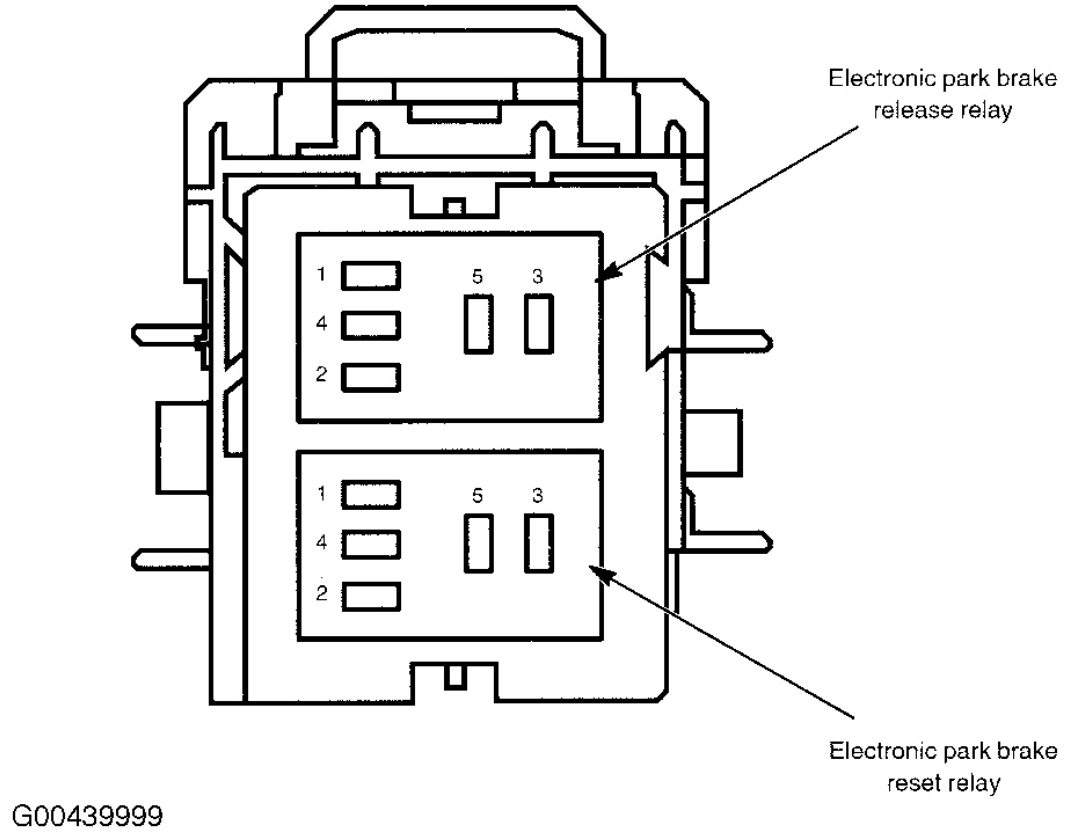


Fig. 3: Auxiliary Relay Box 1
Courtesy of FORD MOTOR CO.

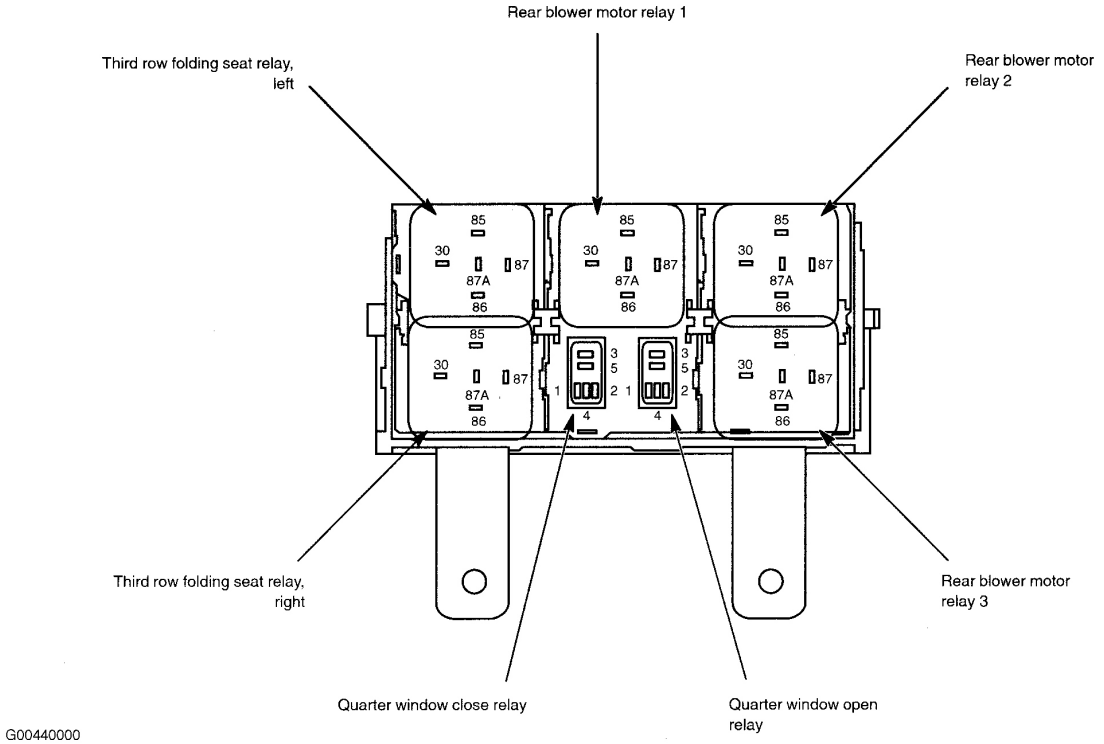


Fig. 4: Auxiliary Relay Box 2
Courtesy of FORD MOTOR CO.

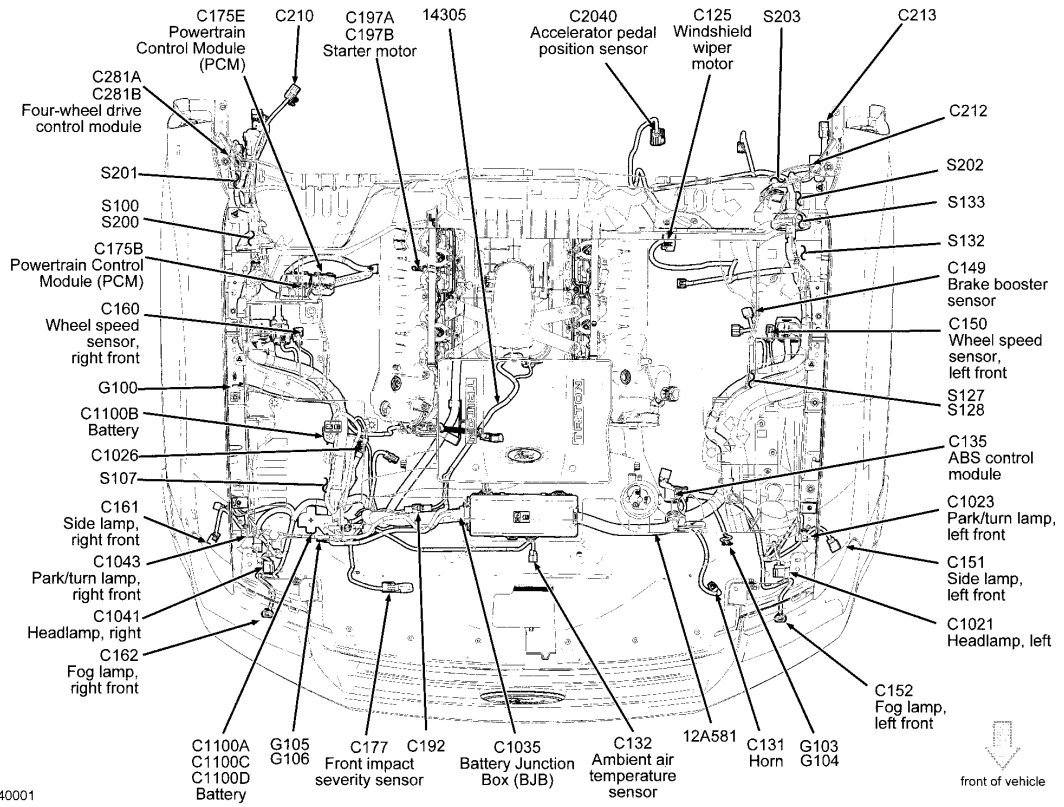


Fig. 5: Engine Compartment (Expedition)

Courtesy of FORD MOTOR CO.

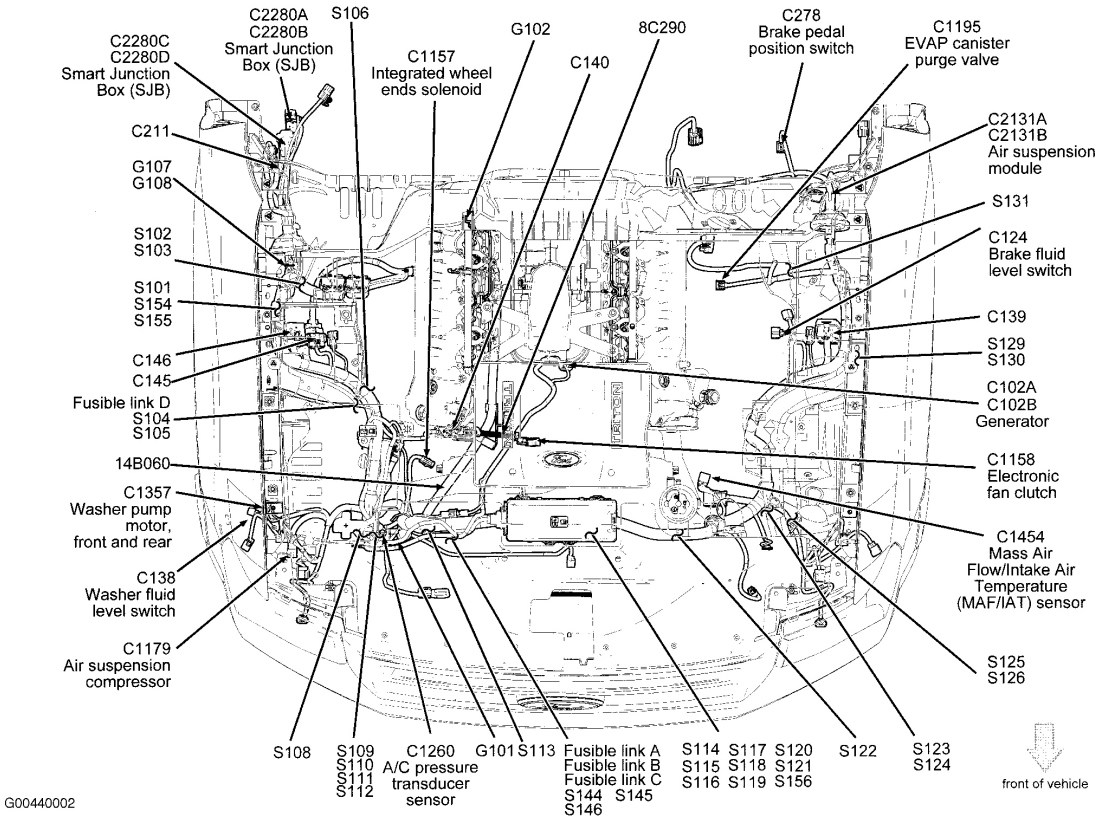


Fig. 6: Engine Compartment (Expedition)
Courtesy of FORD MOTOR CO.

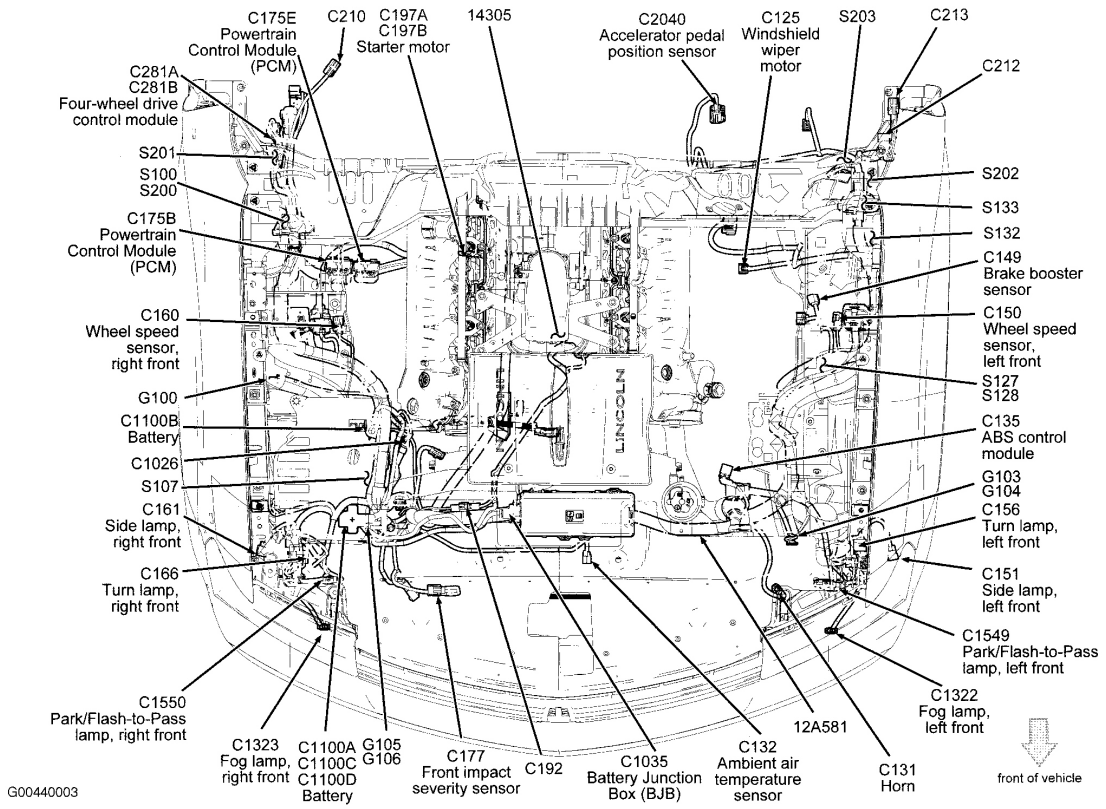


Fig. 7: Engine Compartment (Navigator)
Courtesy of FORD MOTOR CO.

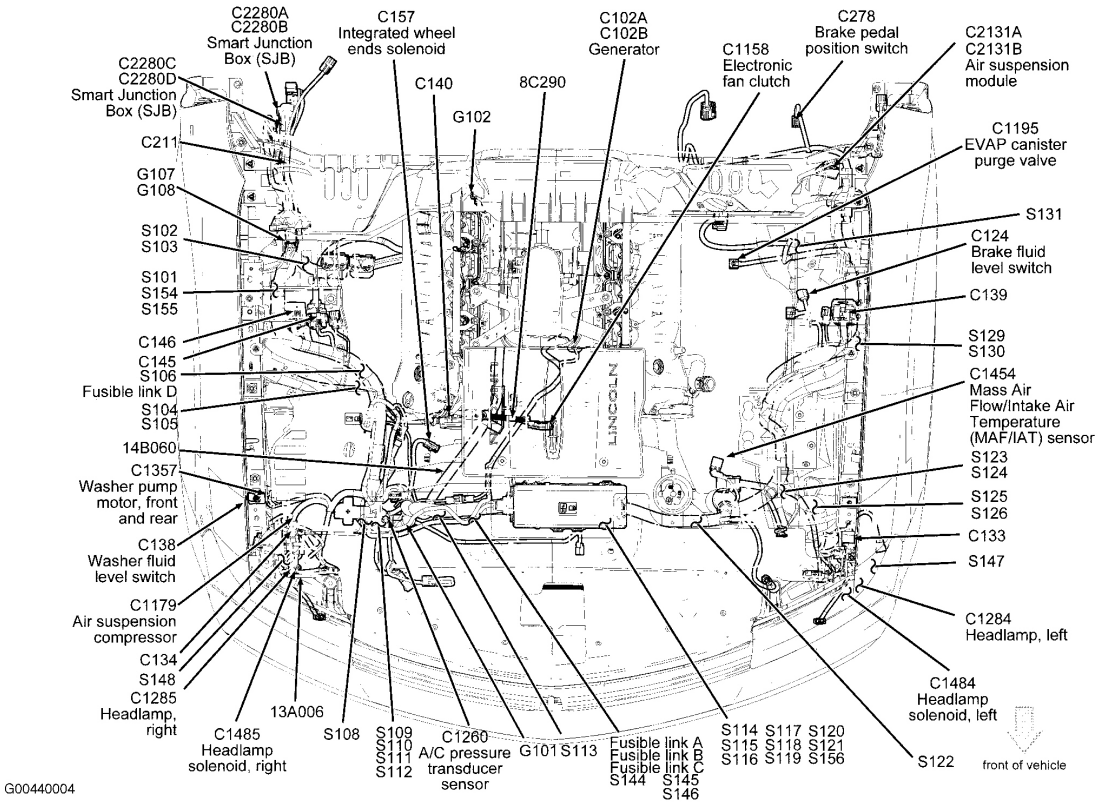


Fig. 8: Engine Compartment (Navigator)
Courtesy of FORD MOTOR CO.

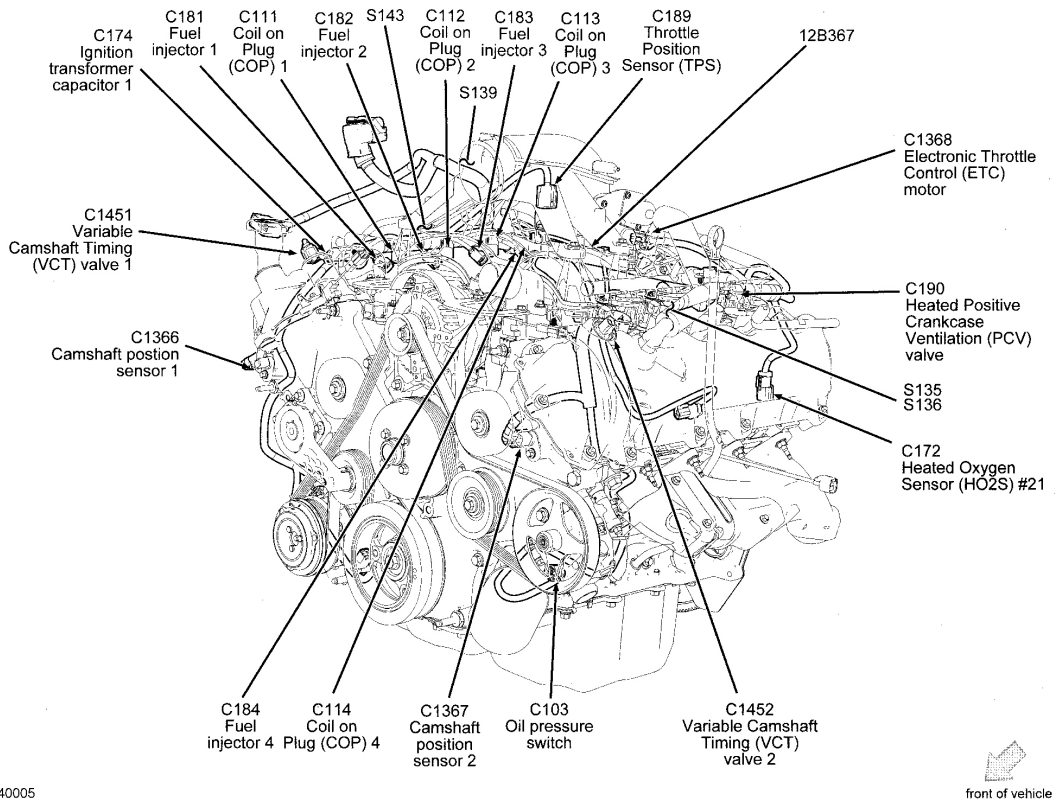


Fig. 9: Front Of Engine
Courtesy of FORD MOTOR CO.

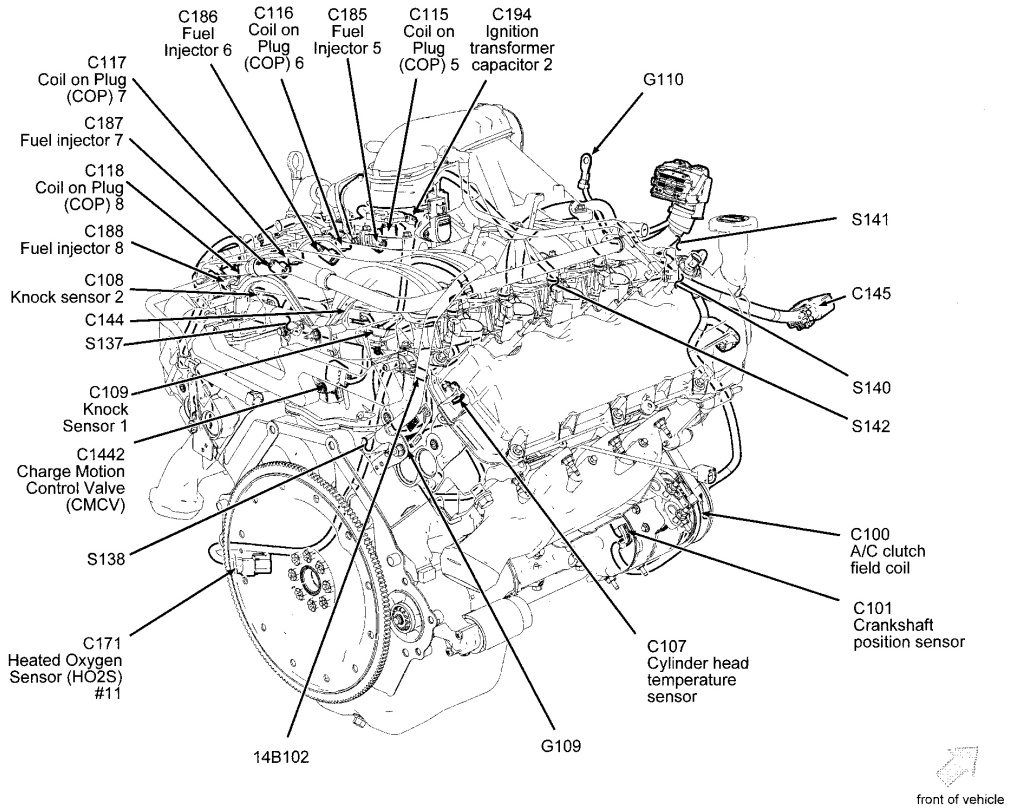


Fig. 10: Rear Of Engine
Courtesy of FORD MOTOR CO.

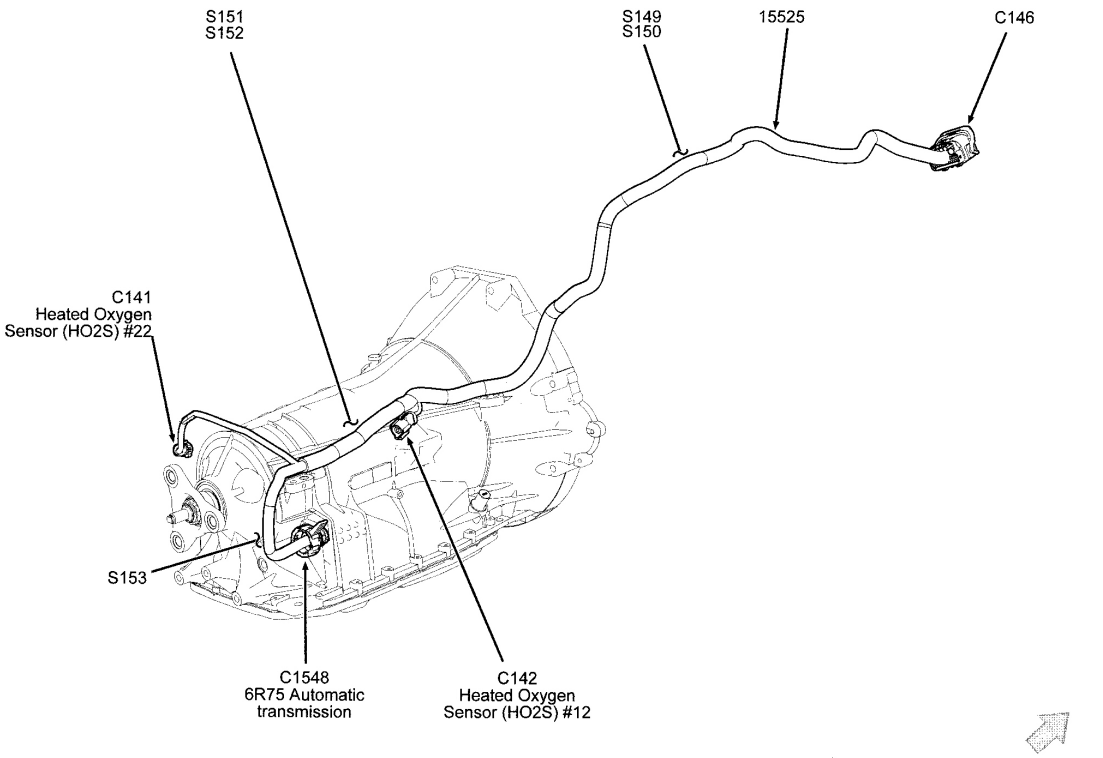


Fig. 11: Automatic Transmission (6R75 2WD)
Courtesy of FORD MOTOR CO.

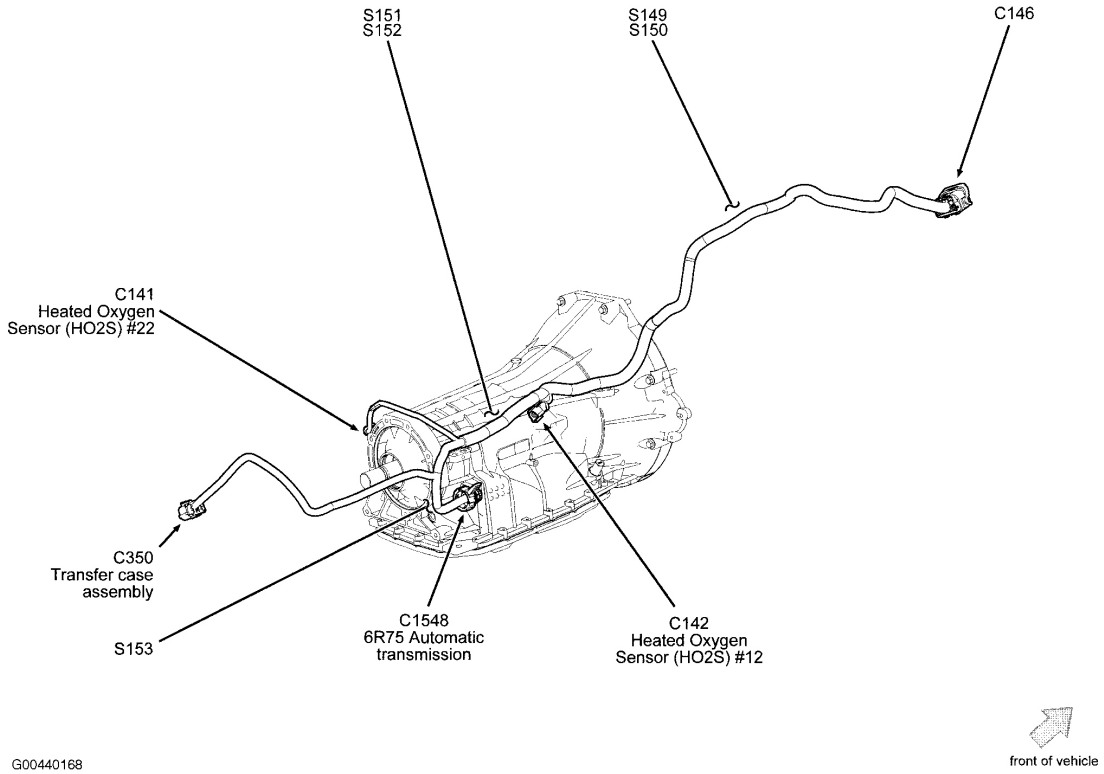


Fig. 12: Automatic Transmission (6R75 4WD)
Courtesy of FORD MOTOR CO.

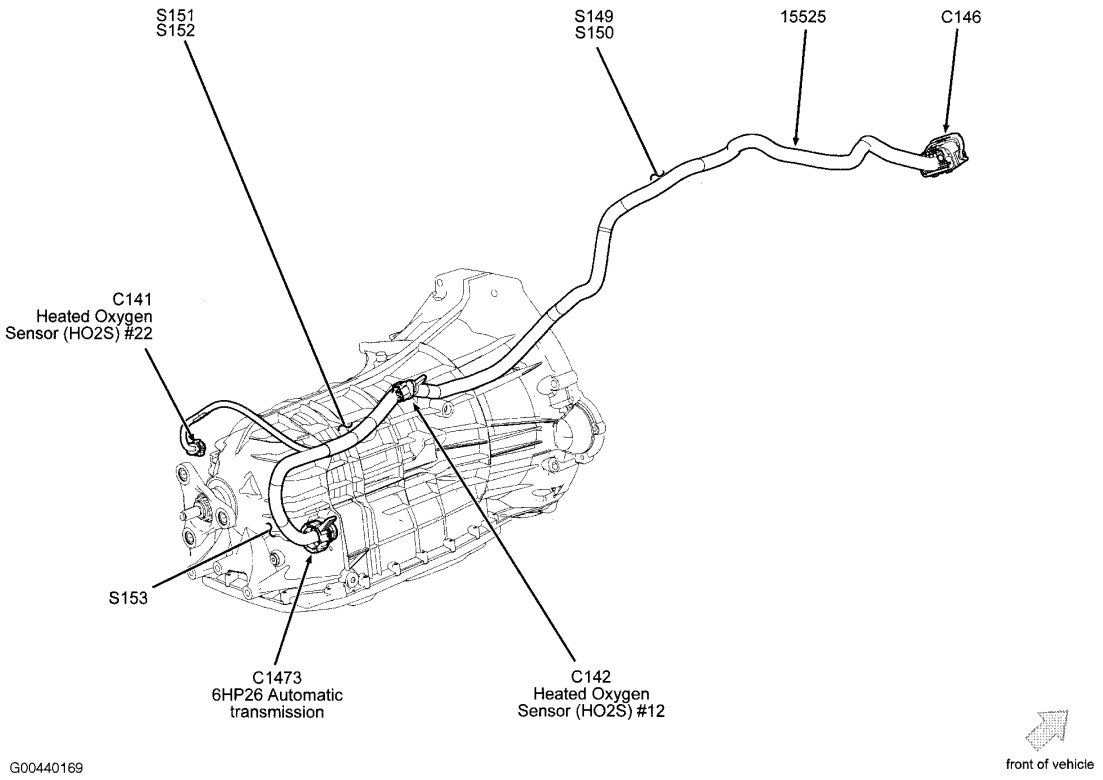


Fig. 13: Automatic Transmission (6HP26 2WD)
Courtesy of FORD MOTOR CO.

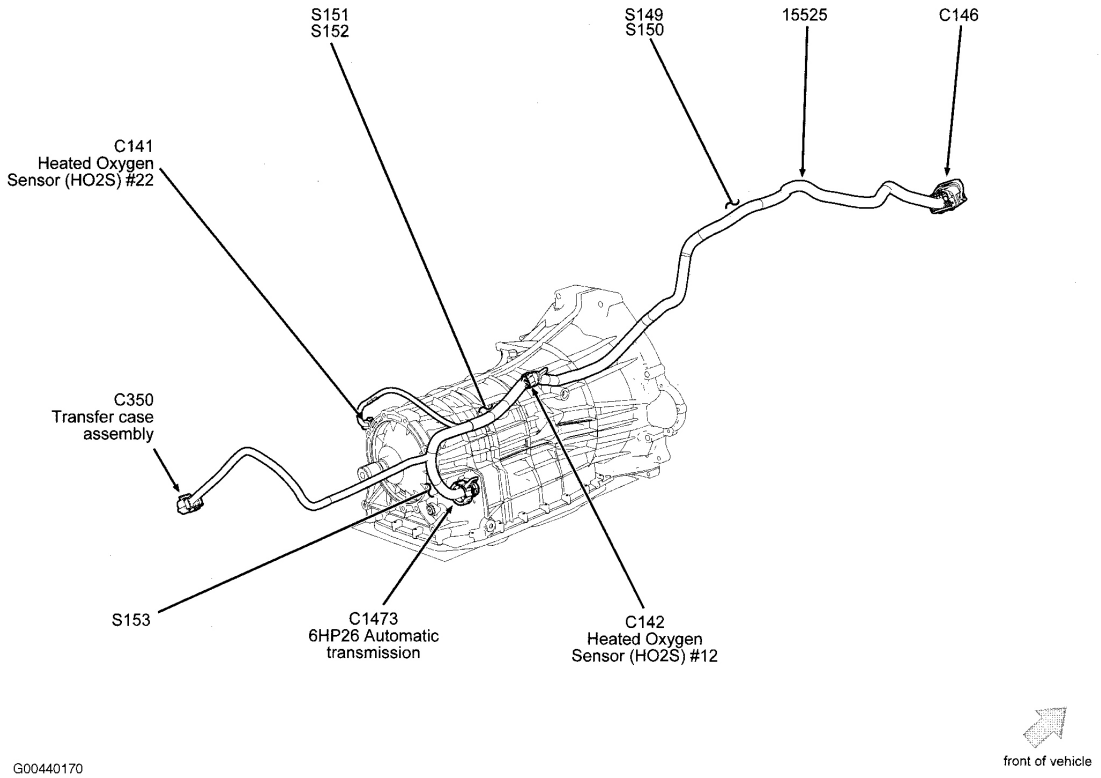


Fig. 14: Automatic Transmission (6HP26 4WD)
Courtesy of FORD MOTOR CO.

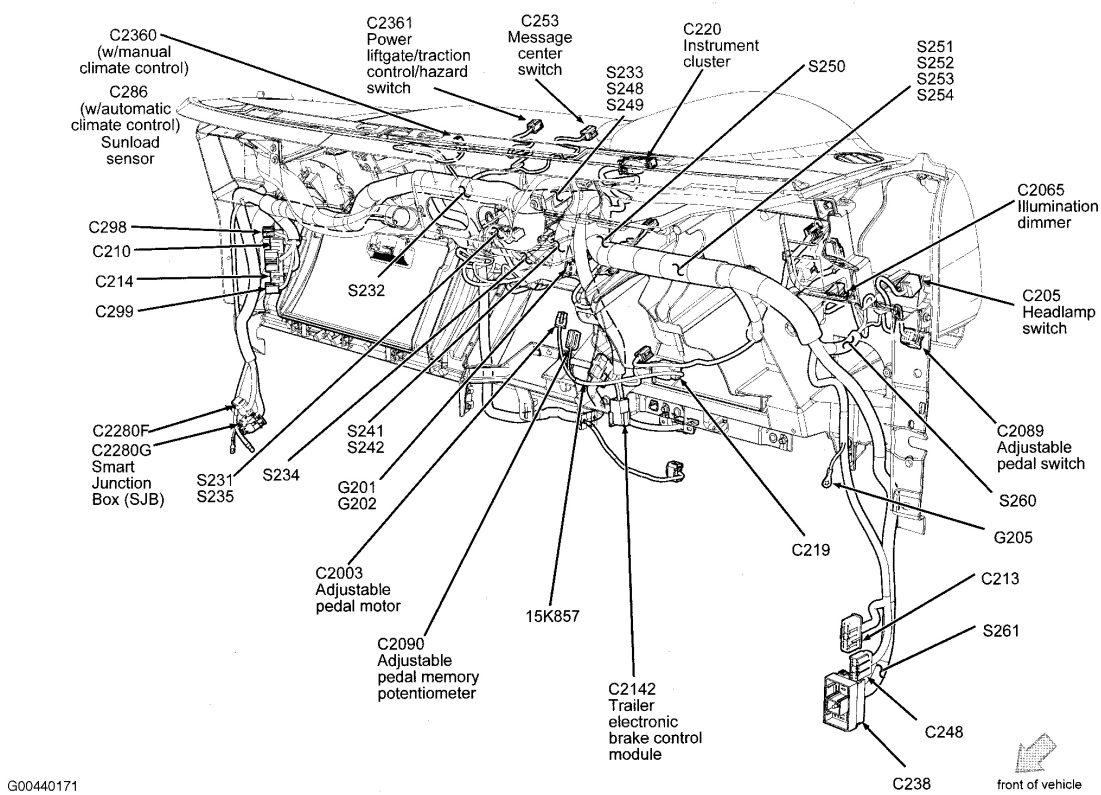


Fig. 15: Rear Of Dash (Expedition)
Courtesy of FORD MOTOR CO.

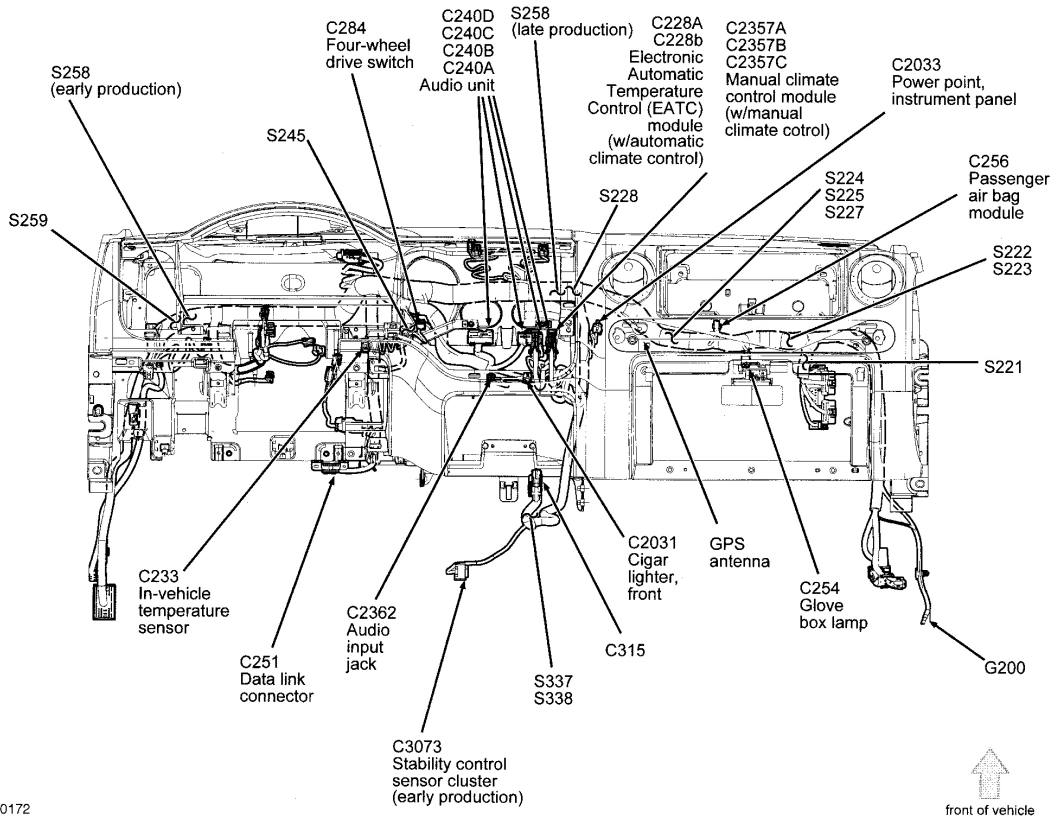


Fig. 16: Front Of Dash (Expedition)
Courtesy of FORD MOTOR CO.

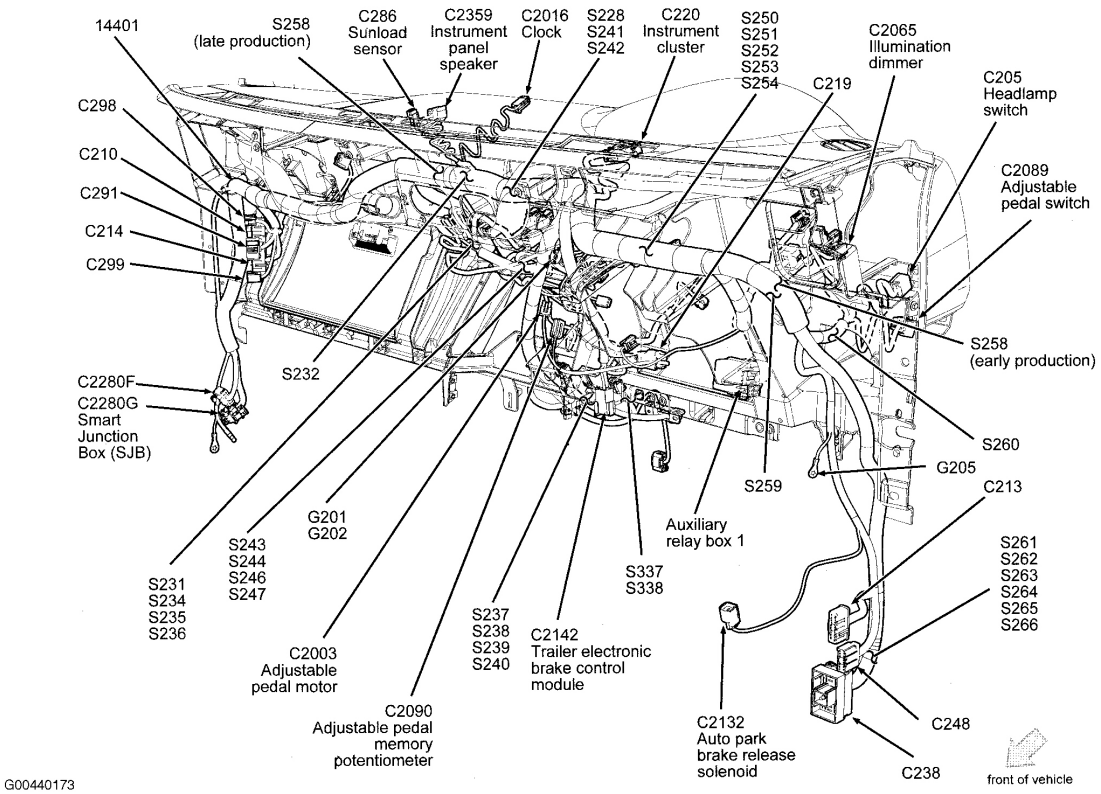


Fig. 17: Rear Of Dash (Navigator)
Courtesy of FORD MOTOR CO.

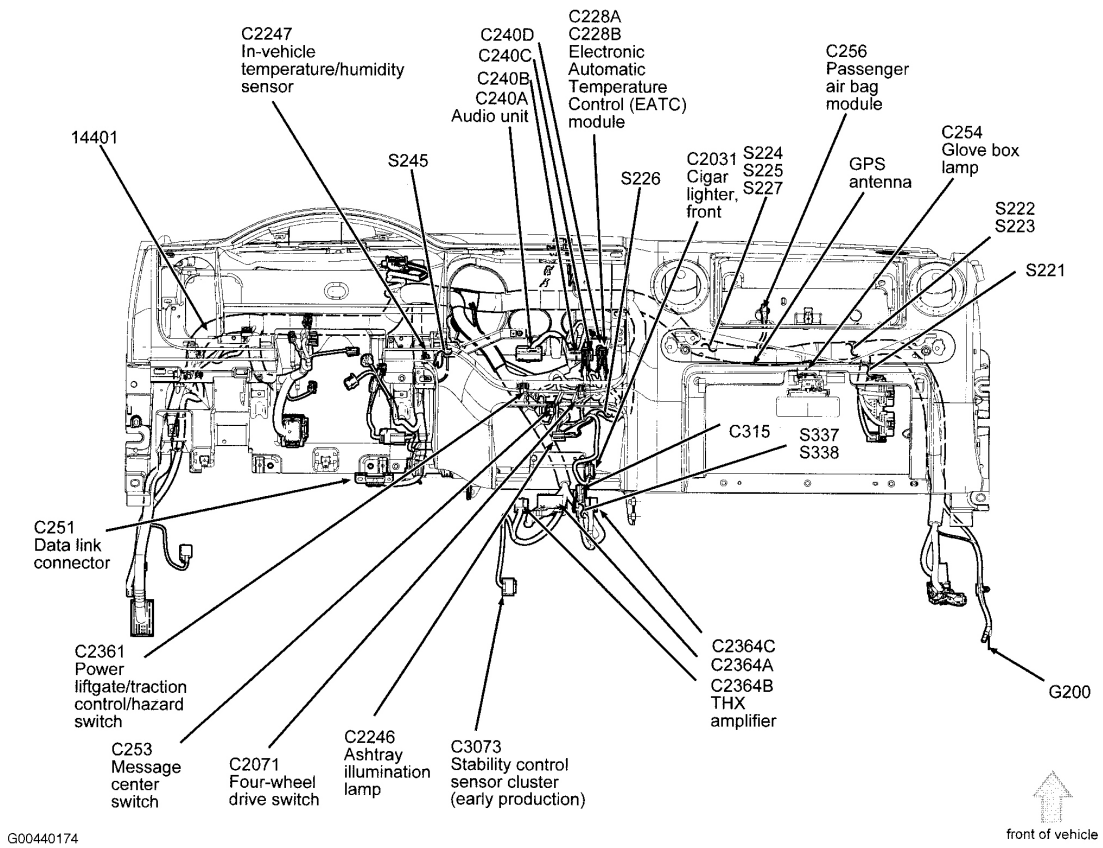


Fig. 18: Front Of Dash (Navigator)
Courtesy of FORD MOTOR CO.

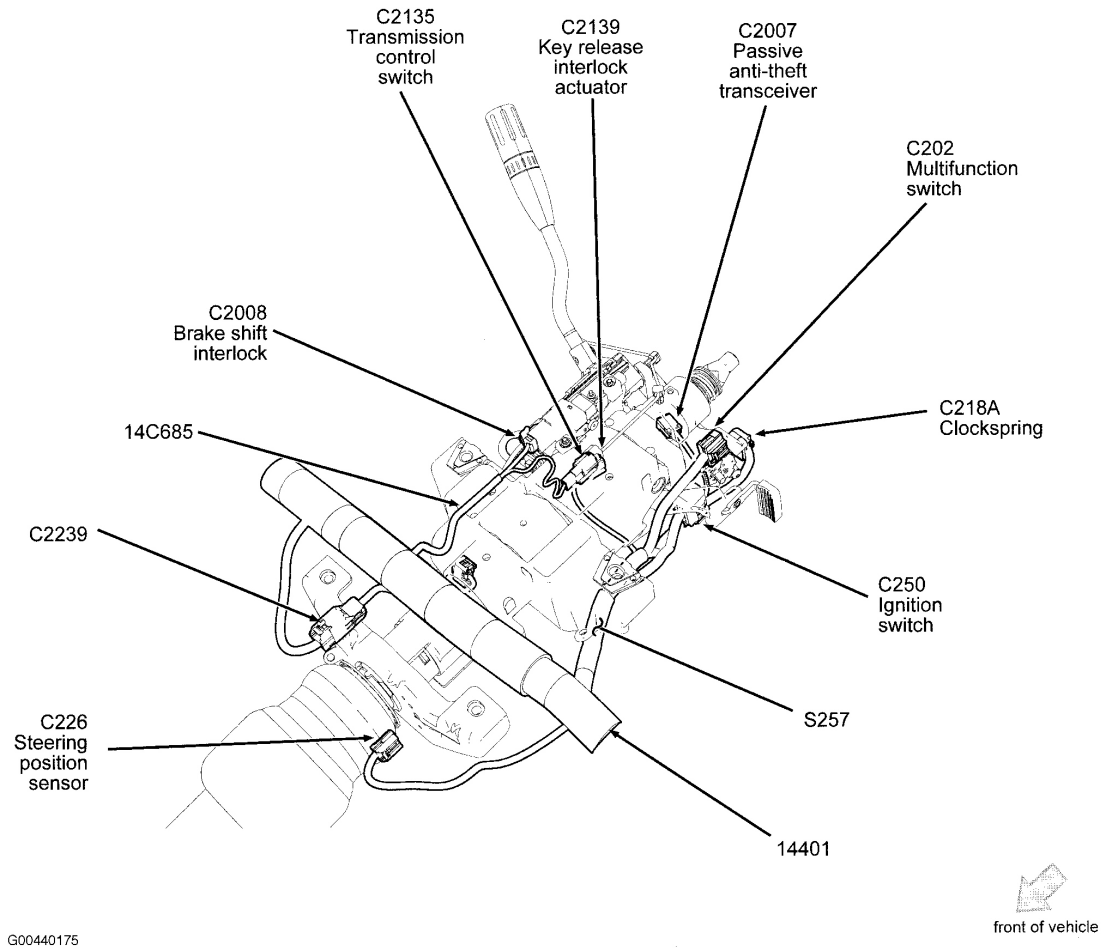


Fig. 19: Steering Column (Expedition)
Courtesy of FORD MOTOR CO.

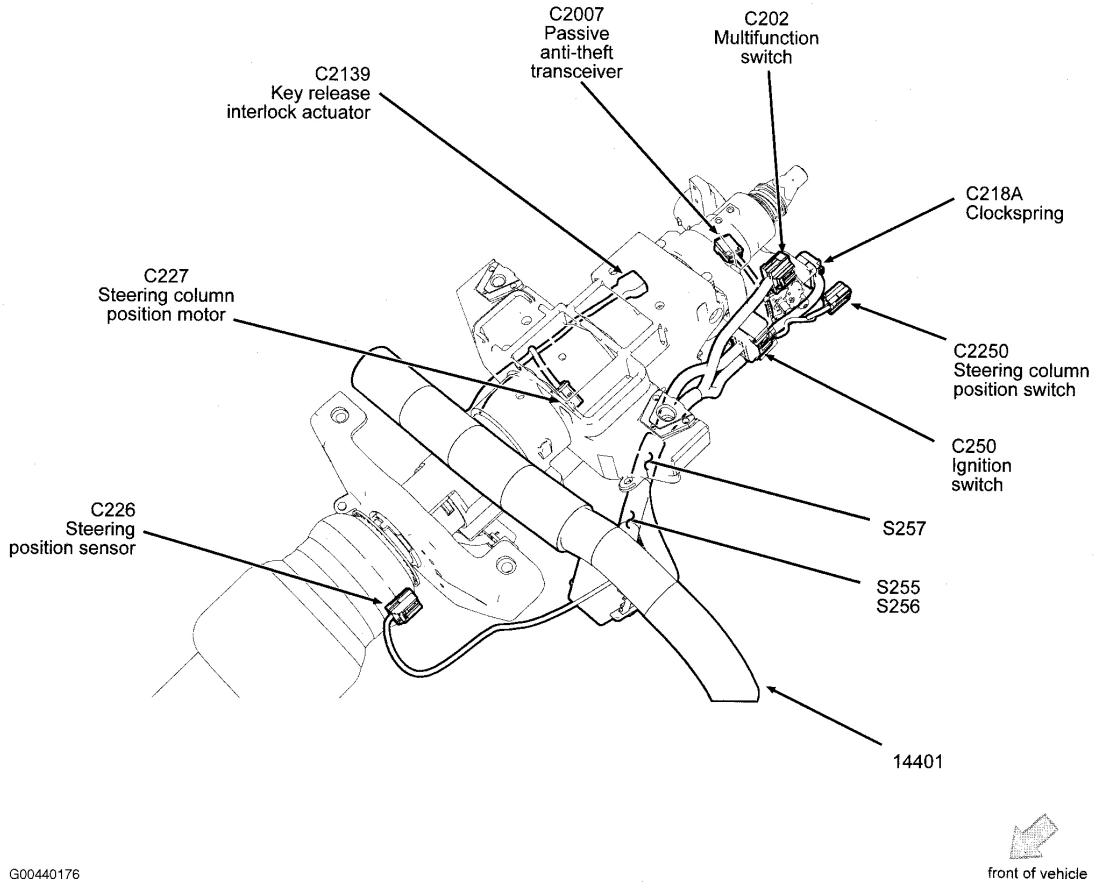


Fig. 20: Steering Column (Navigator)
Courtesy of FORD MOTOR CO.

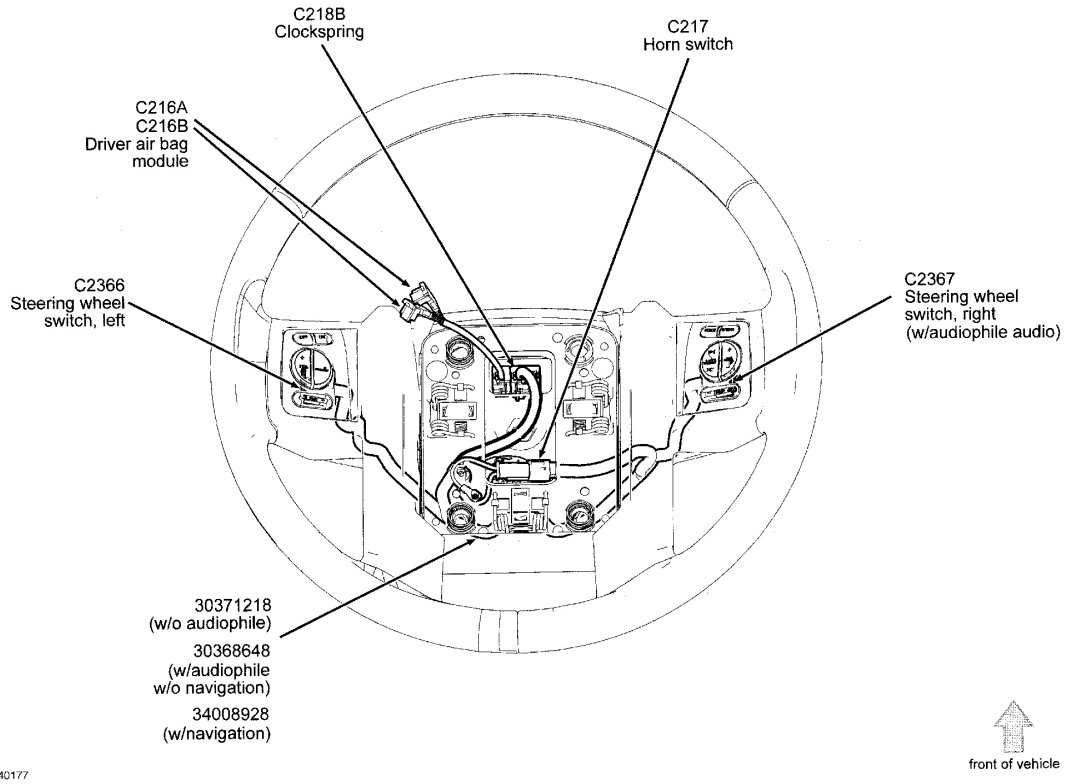


Fig. 21: Steering Wheel
Courtesy of FORD MOTOR CO.

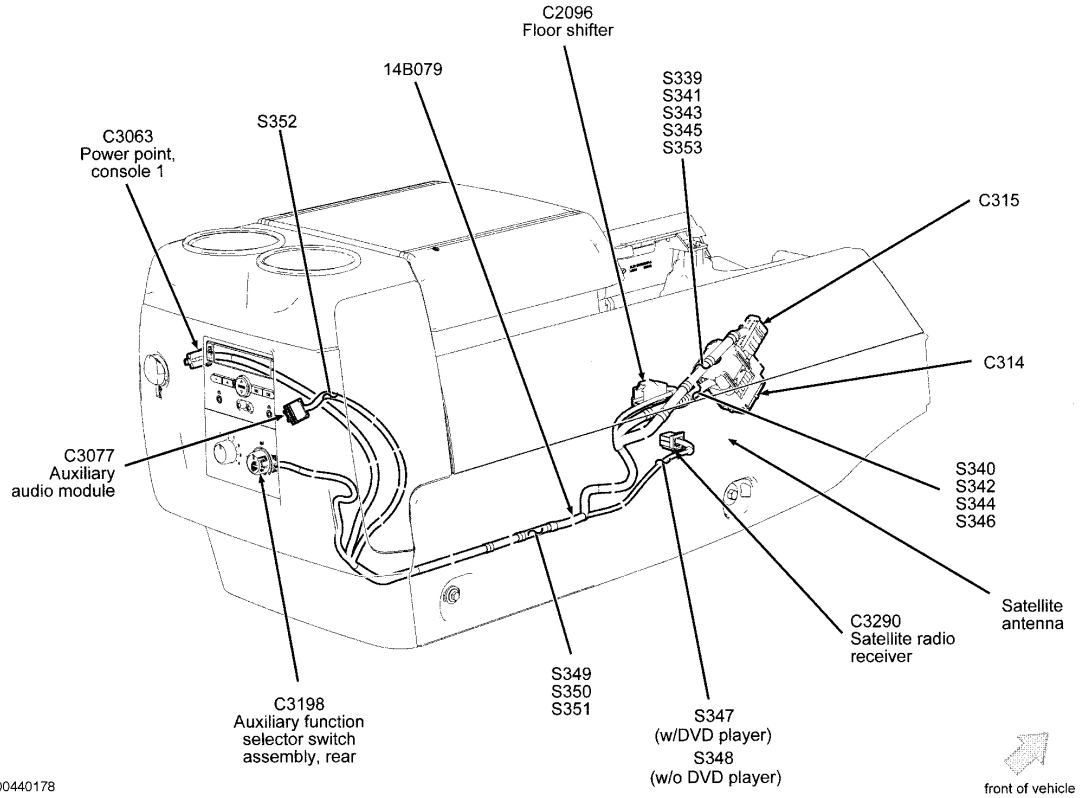


Fig. 22: Center Console (Expedition)
Courtesy of FORD MOTOR CO.

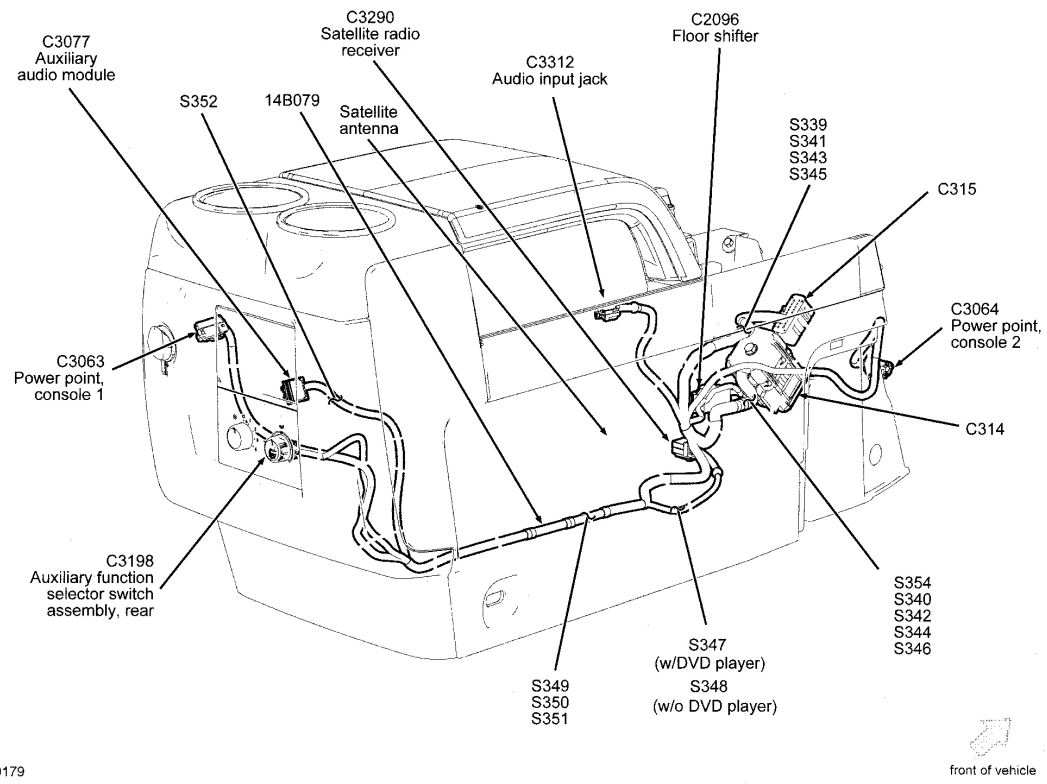


Fig. 23: Center Console (Navigator)
Courtesy of FORD MOTOR CO.

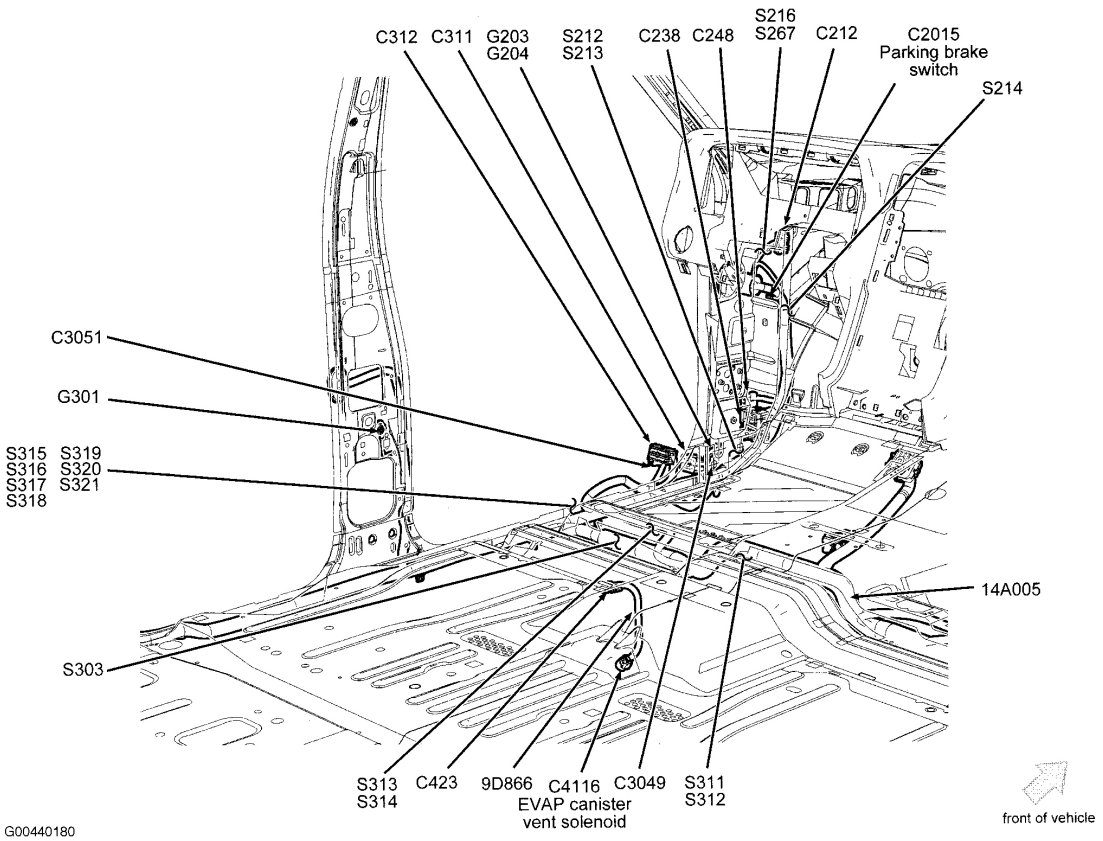


Fig. 24: Left Front Of Vehicle Interior (Expedition)
Courtesy of FORD MOTOR CO.

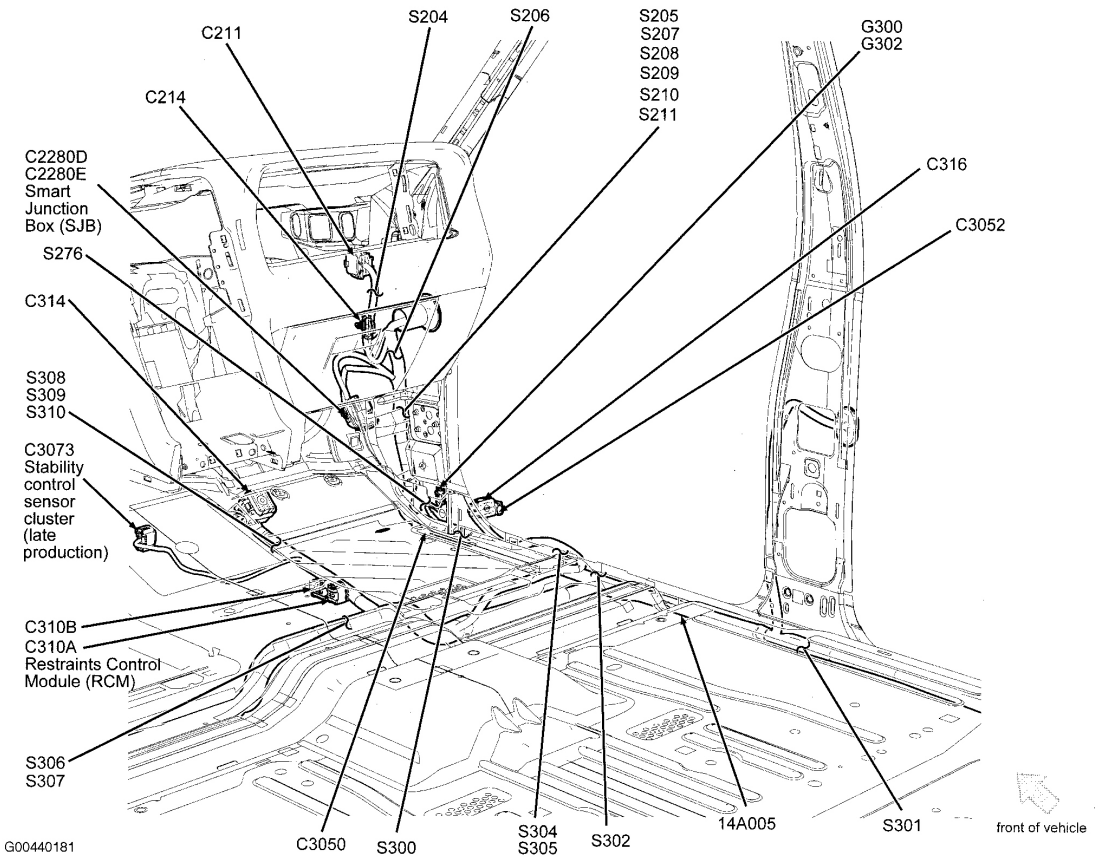


Fig. 25: Right Front Of Vehicle Interior (Expedition)
Courtesy of FORD MOTOR CO.

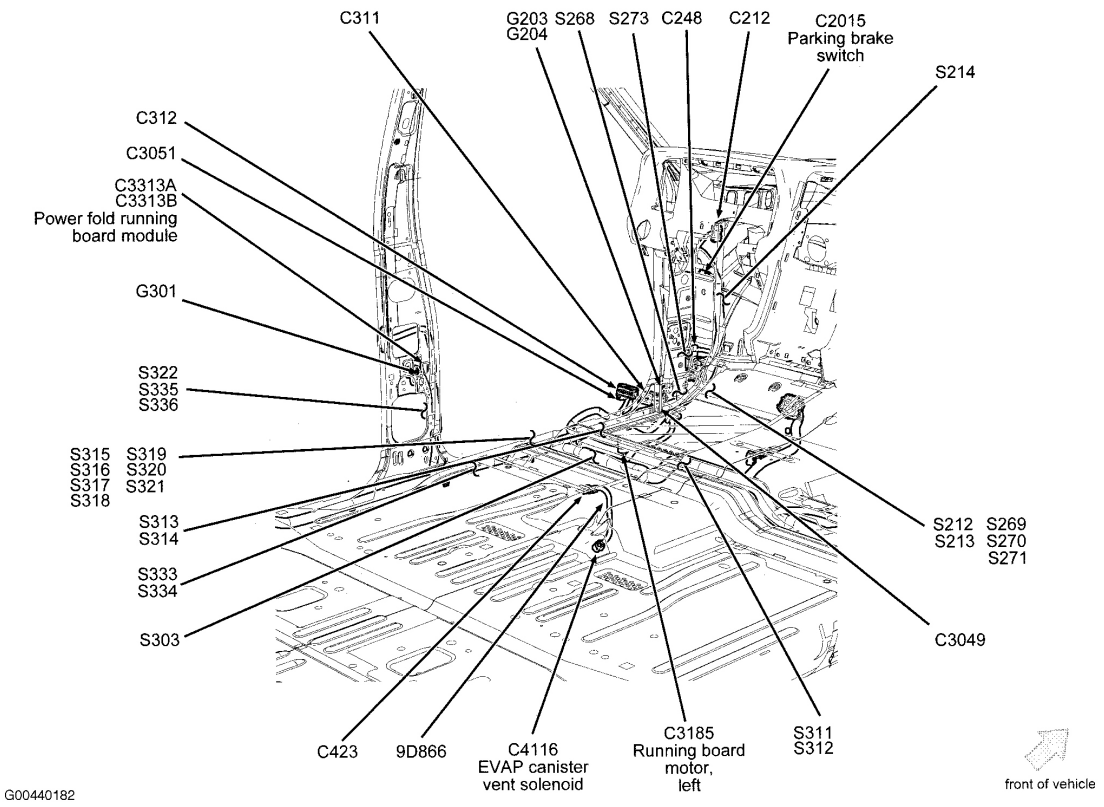


Fig. 26: Left Front Of Vehicle Interior (Navigator)
Courtesy of FORD MOTOR CO.

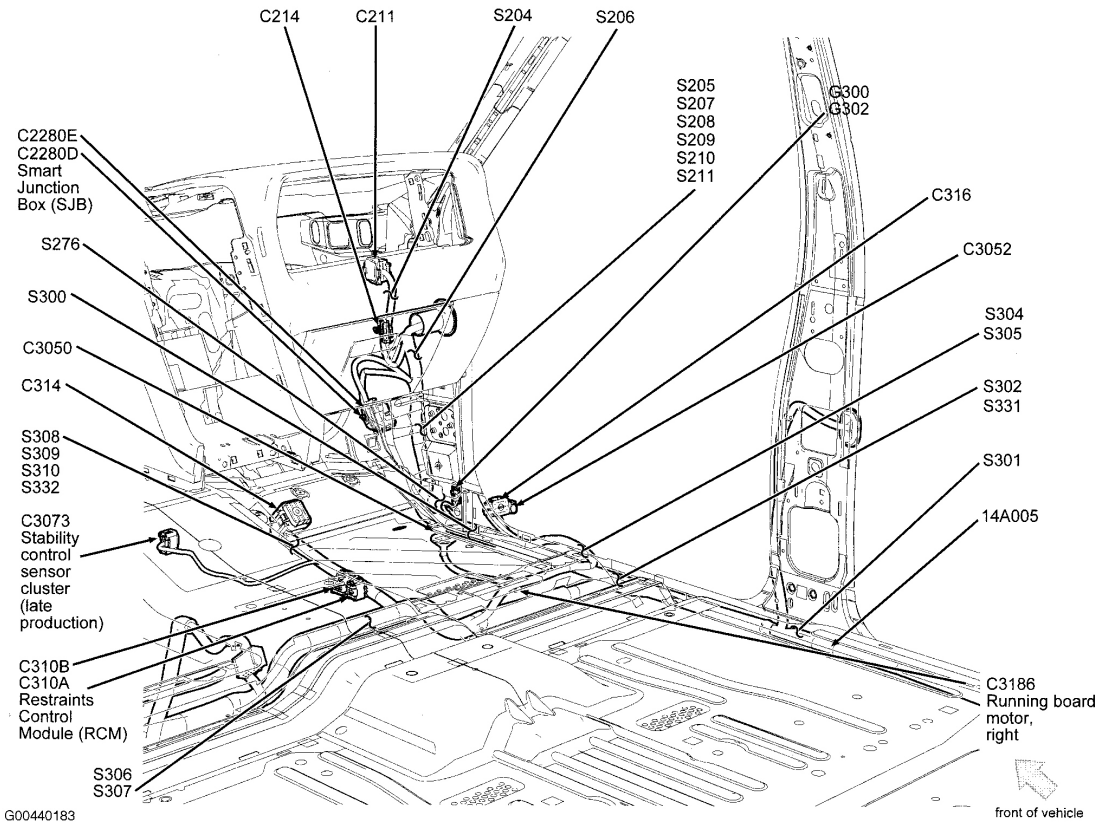


Fig. 27: Right Front Of Vehicle Interior (Navigator)
Courtesy of FORD MOTOR CO.

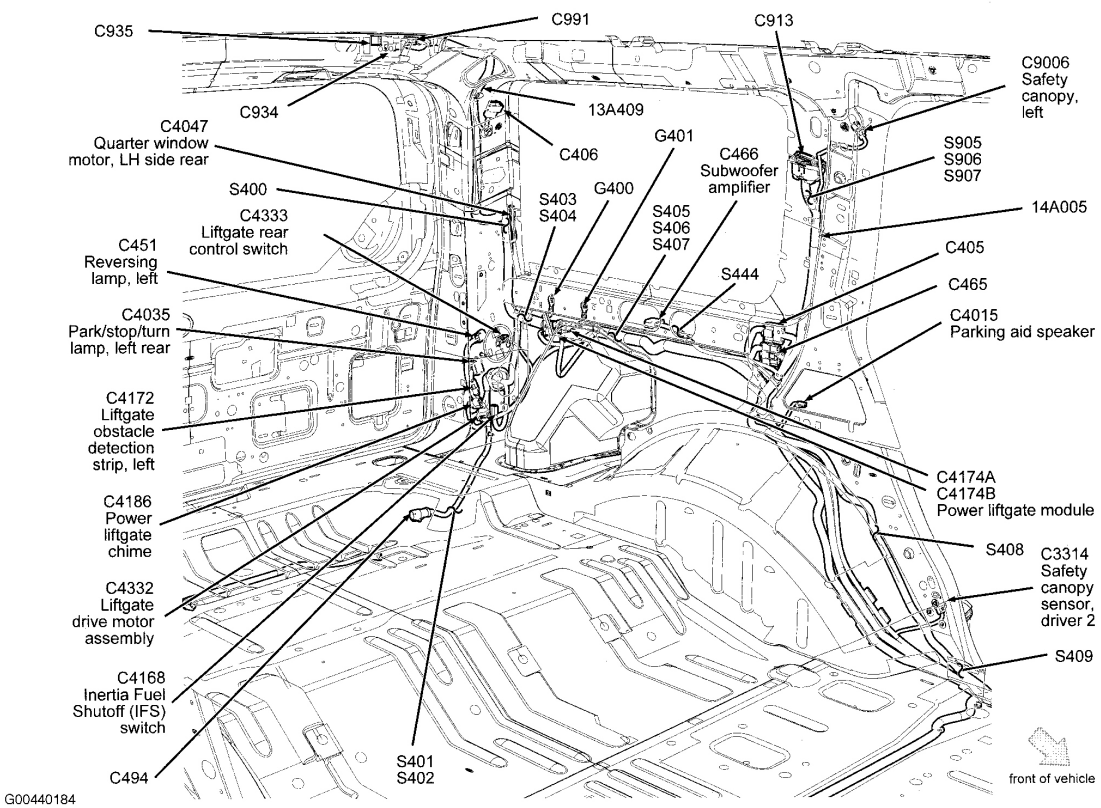


Fig. 28: Left Rear Of Vehicle Interior (Expedition)
Courtesy of FORD MOTOR CO.

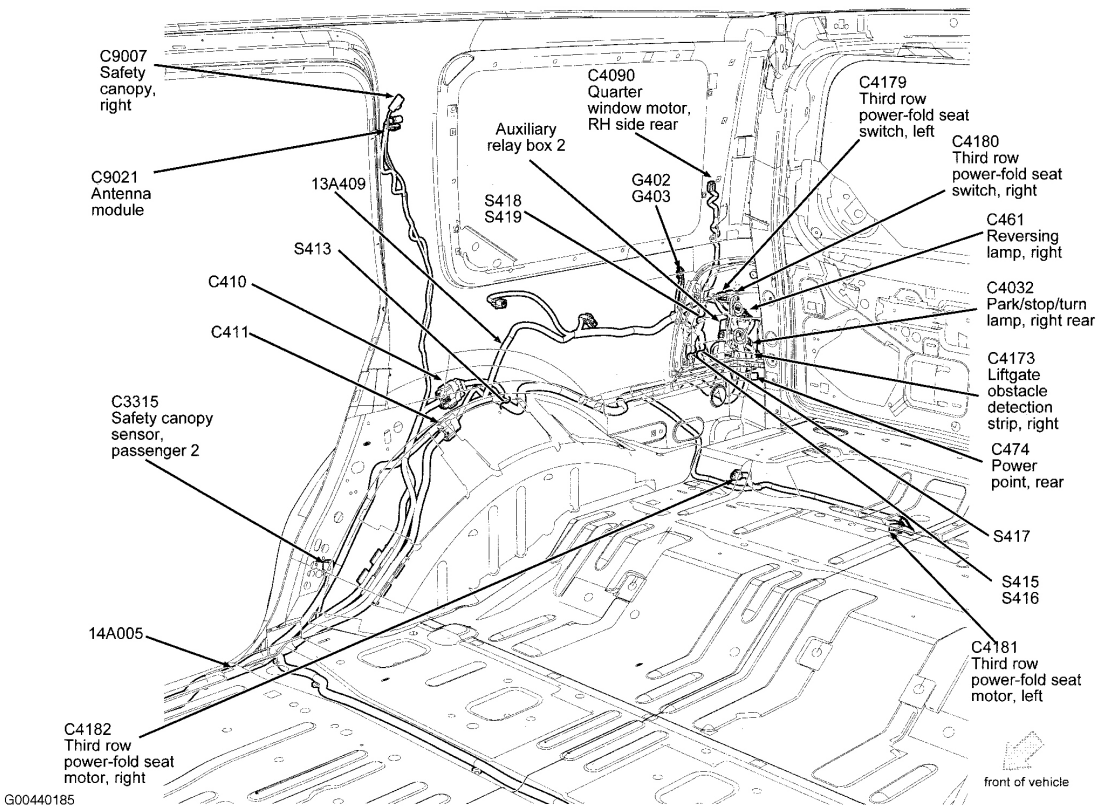


Fig. 29: Right Rear Of Vehicle Interior (Expedition)
Courtesy of FORD MOTOR CO.

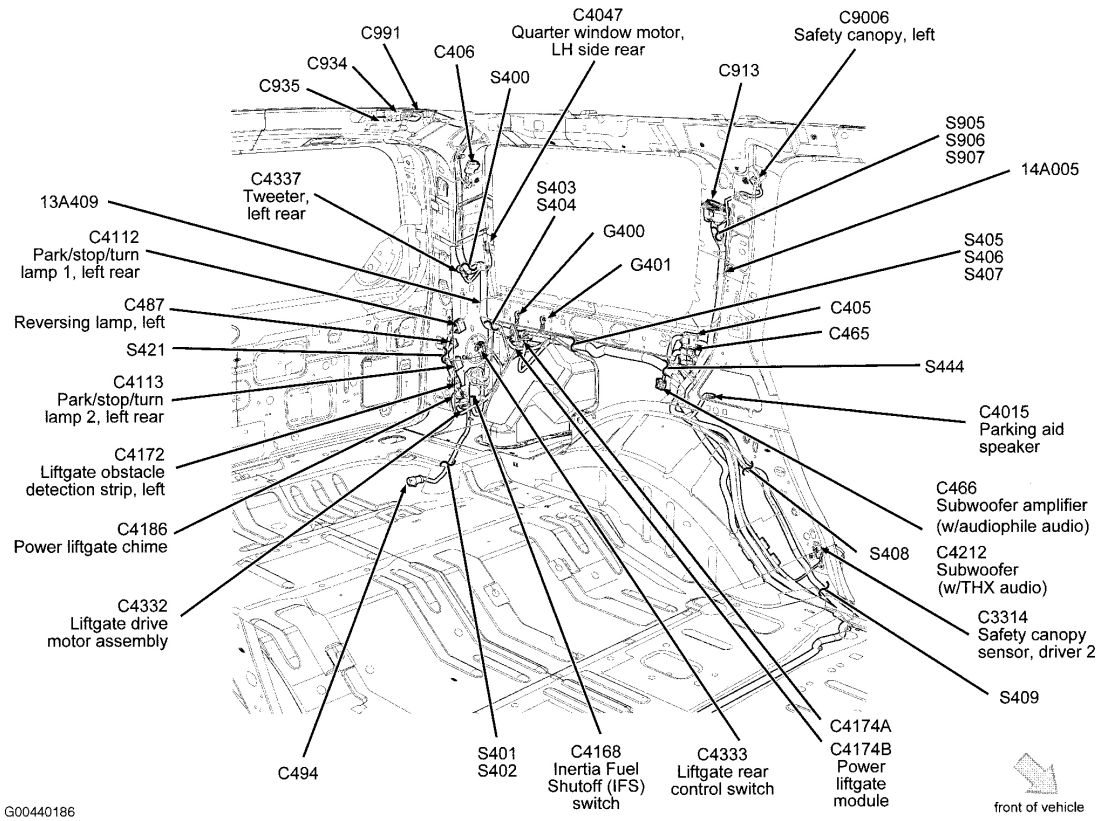


Fig. 30: Left Rear Of Vehicle Interior (Navigator)
Courtesy of FORD MOTOR CO.

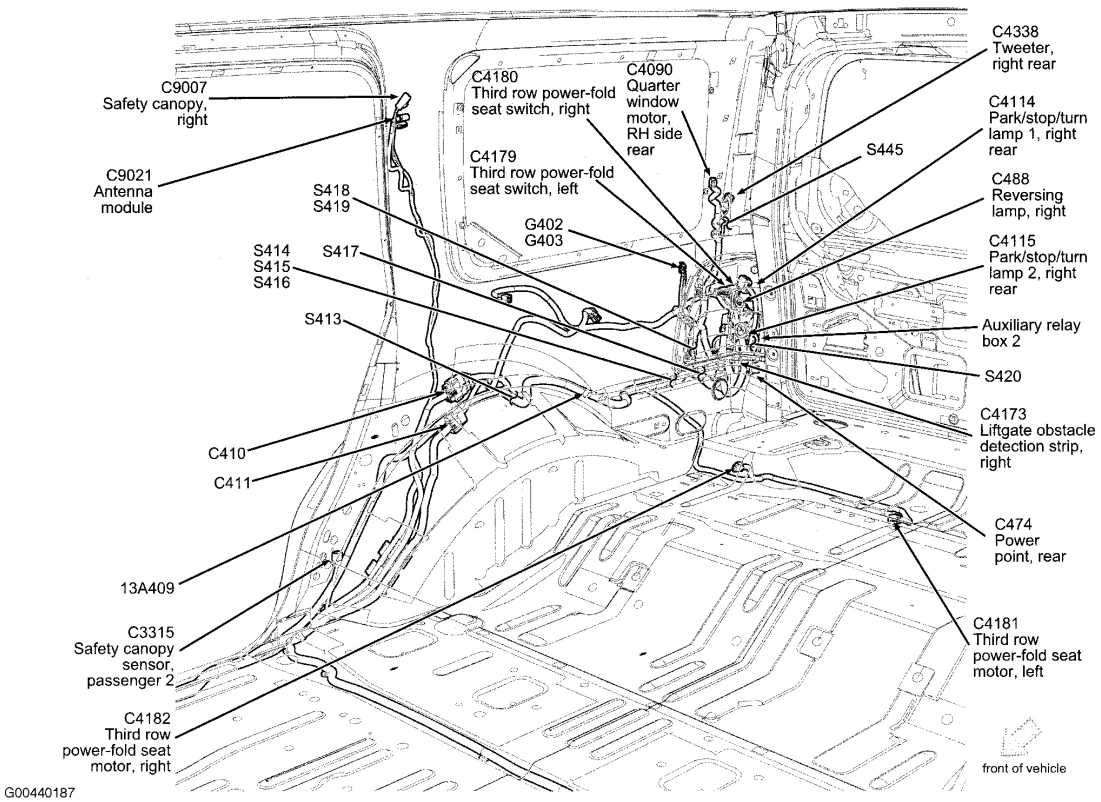


Fig. 31: Right Rear Of Vehicle Interior (Navigator)
Courtesy of FORD MOTOR CO.

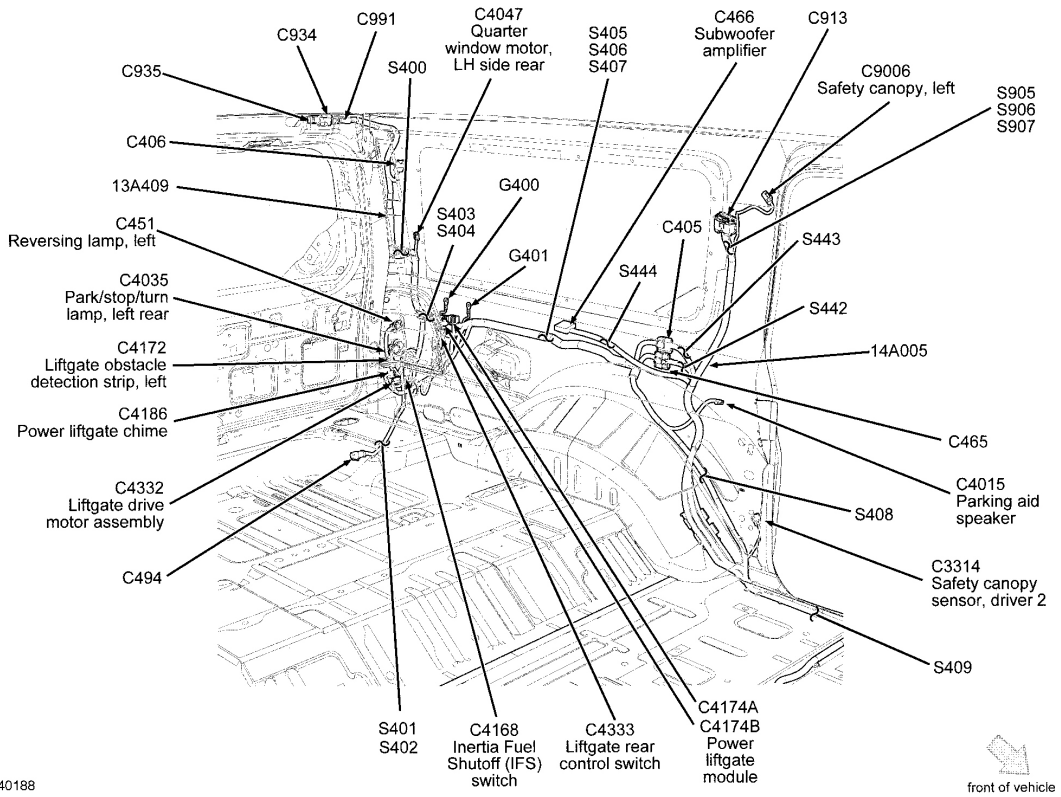


Fig. 32: Left Rear Of Vehicle Interior (Expedition-EL & Navigator-L)
Courtesy of FORD MOTOR CO.

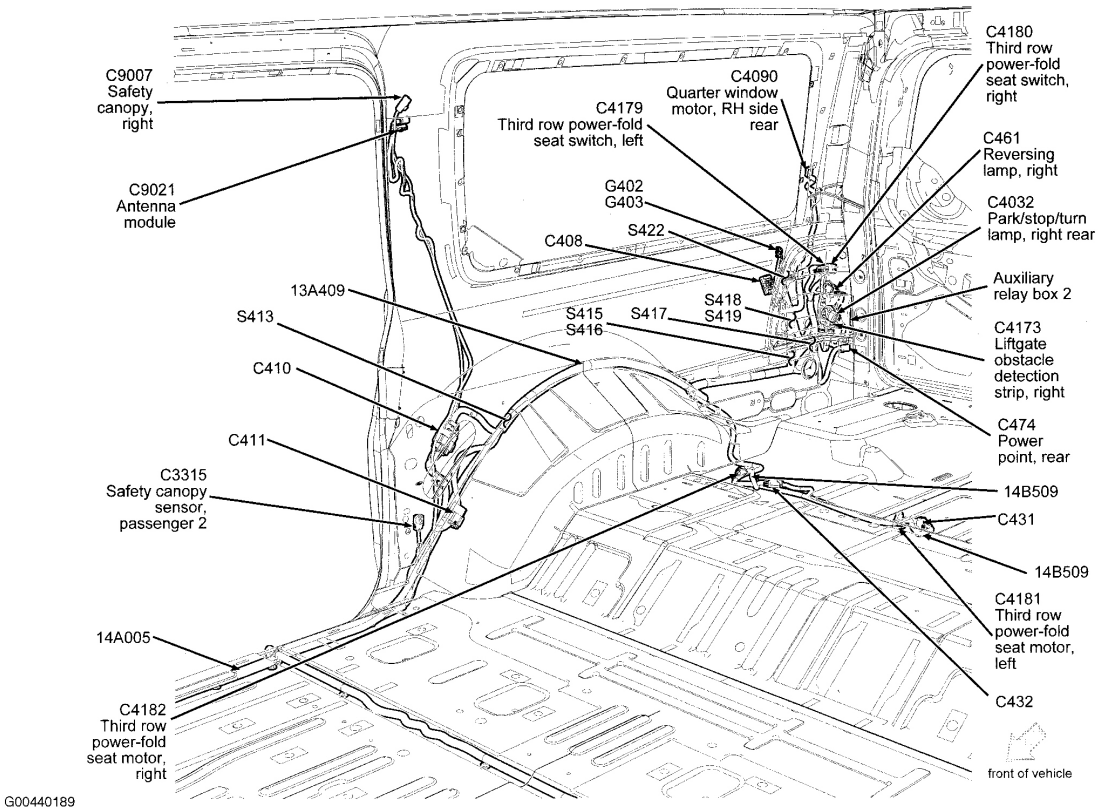


Fig. 33: Right Rear Of Vehicle Interior (Expedition-EL & Navigator-L)
Courtesy of FORD MOTOR CO.

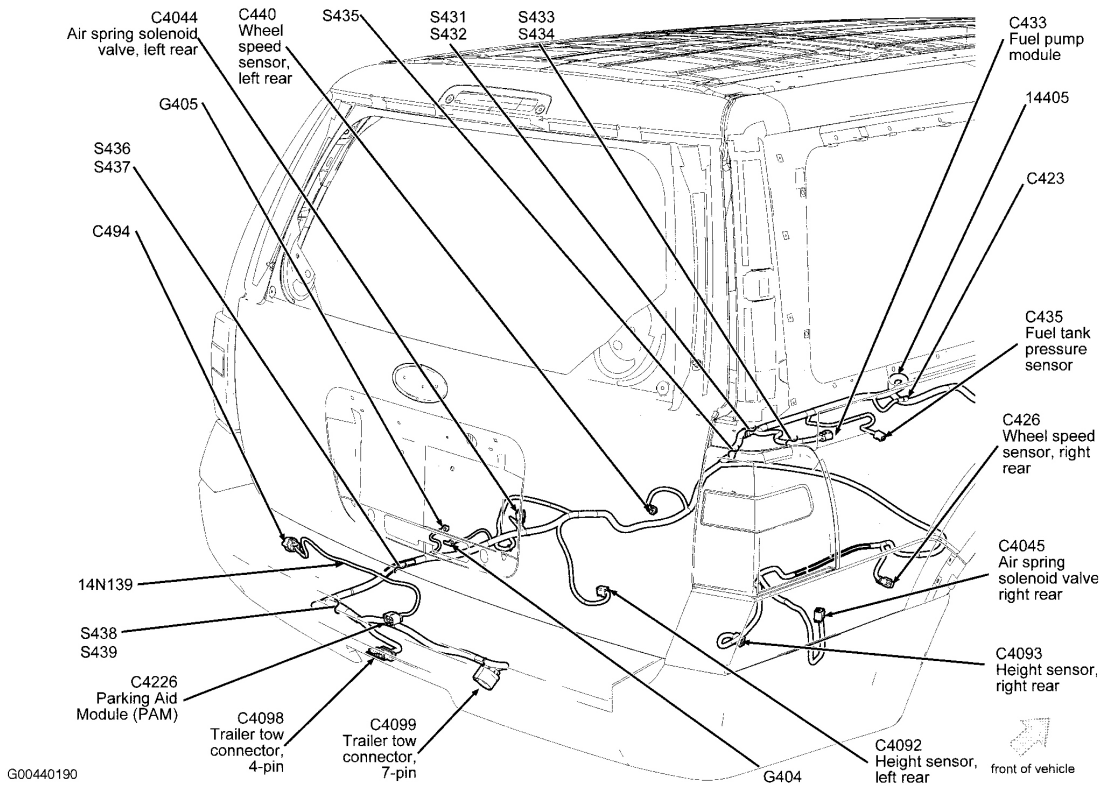


Fig. 34: Rear Of Vehicle (Expedition & Navigator)
Courtesy of FORD MOTOR CO.

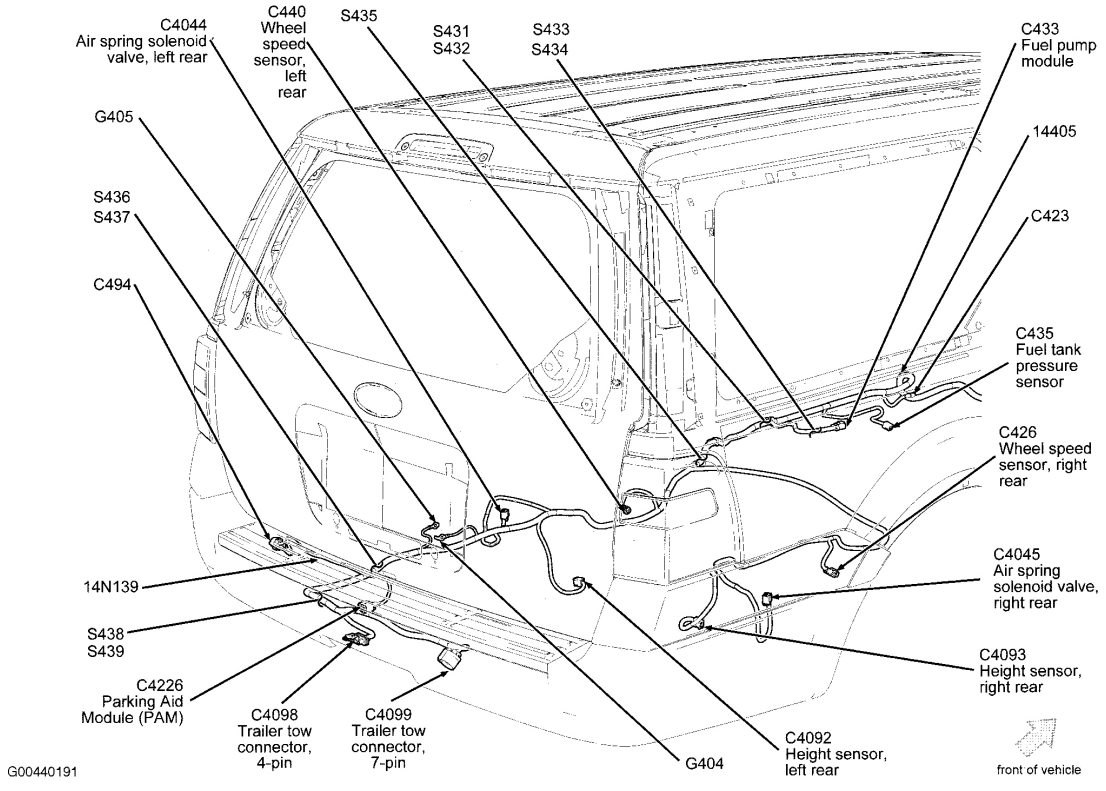


Fig. 35: Rear Of Vehicle (Expedition-EL & Navigator-L)
Courtesy of FORD MOTOR CO.

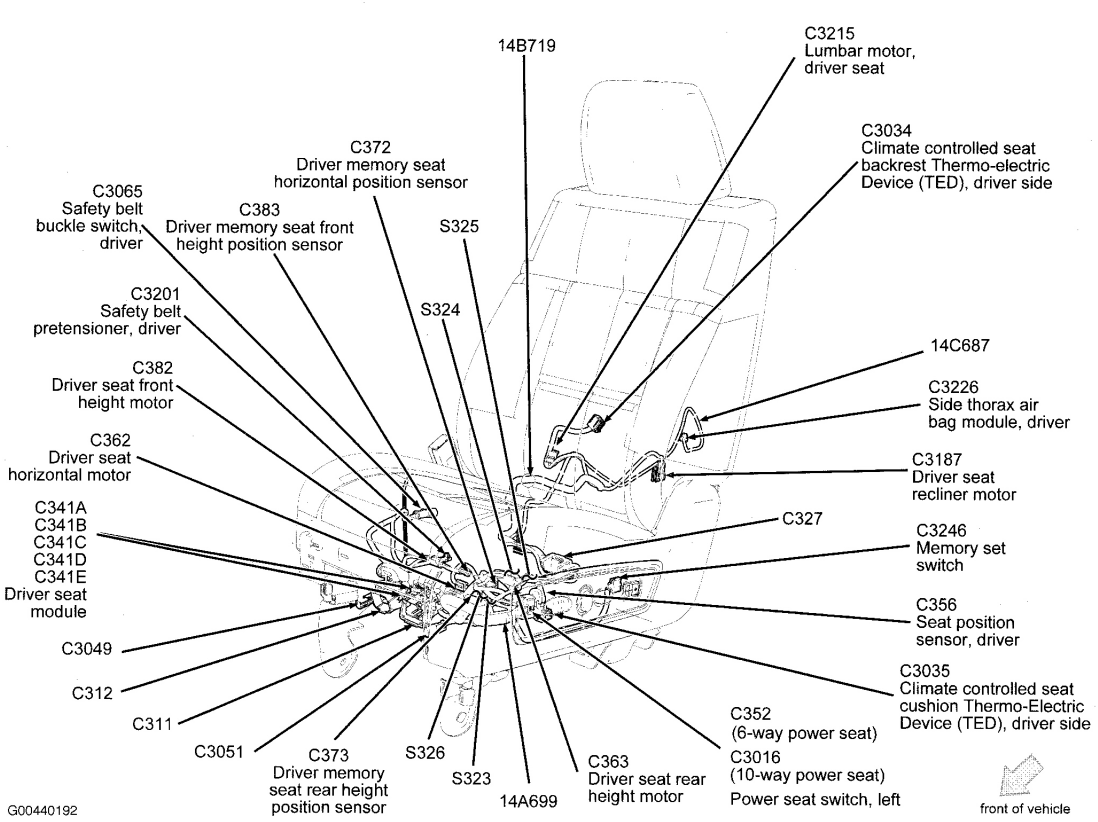


Fig. 36: Driver's Seat
Courtesy of FORD MOTOR CO.

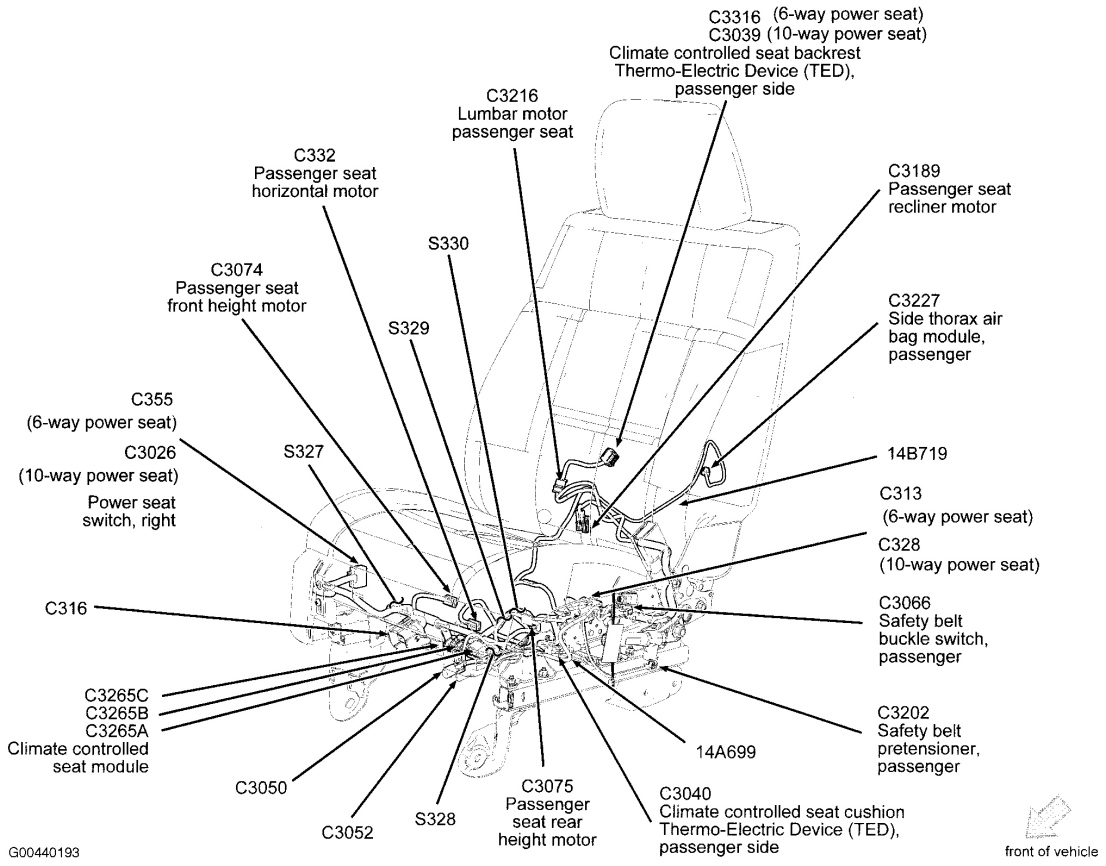


Fig. 37: Front Passenger's Seat
Courtesy of FORD MOTOR CO.

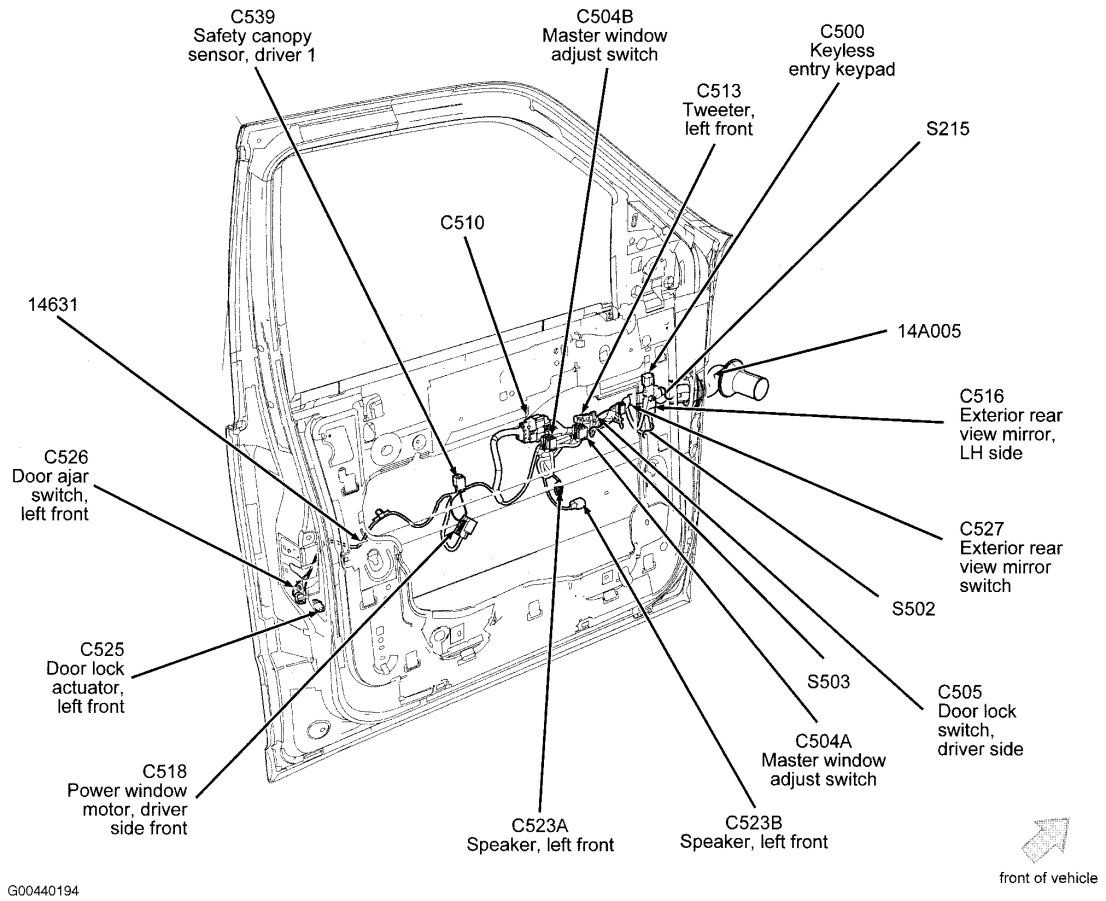


Fig. 38: Driver's Door (Expedition)
Courtesy of FORD MOTOR CO.

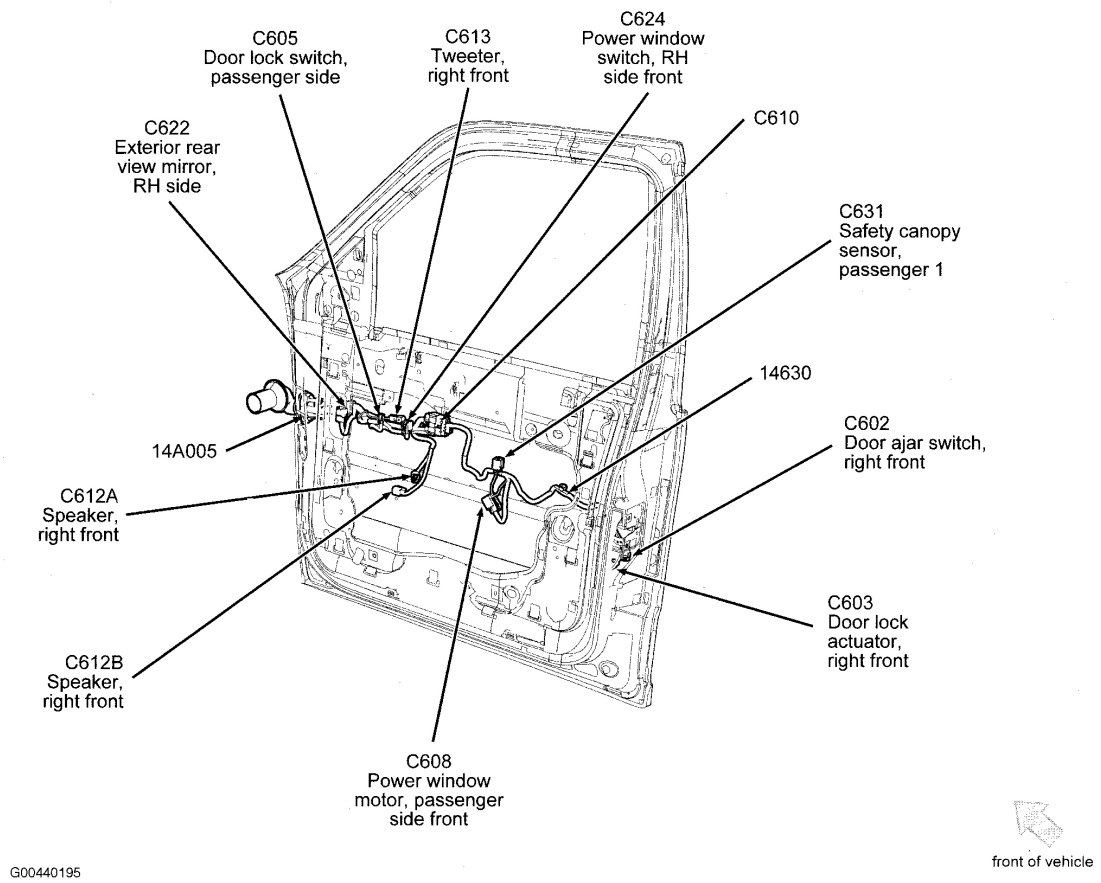


Fig. 39: Front Passenger's Door (Expedition)
Courtesy of FORD MOTOR CO.

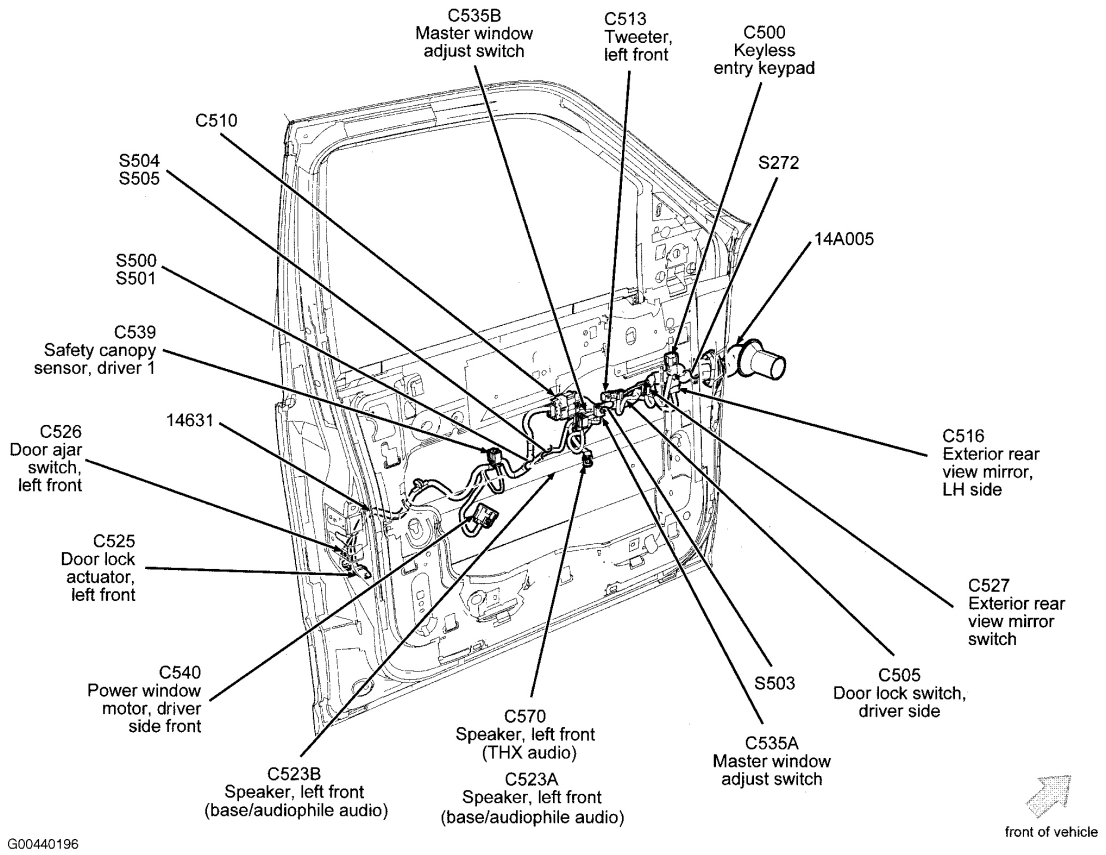


Fig. 40: Driver's Door (Navigator)
Courtesy of FORD MOTOR CO.

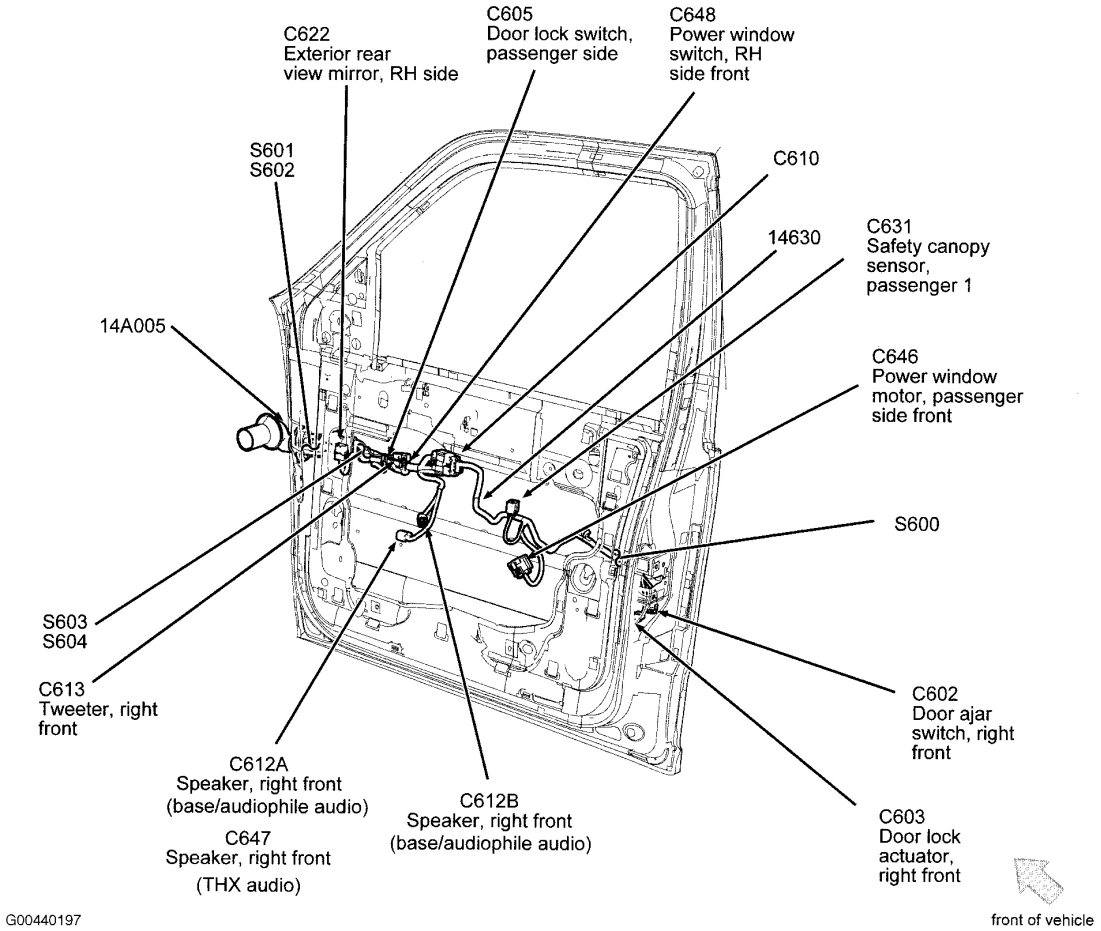


Fig. 41: Front Passenger's Door (Navigator)
Courtesy of FORD MOTOR CO.

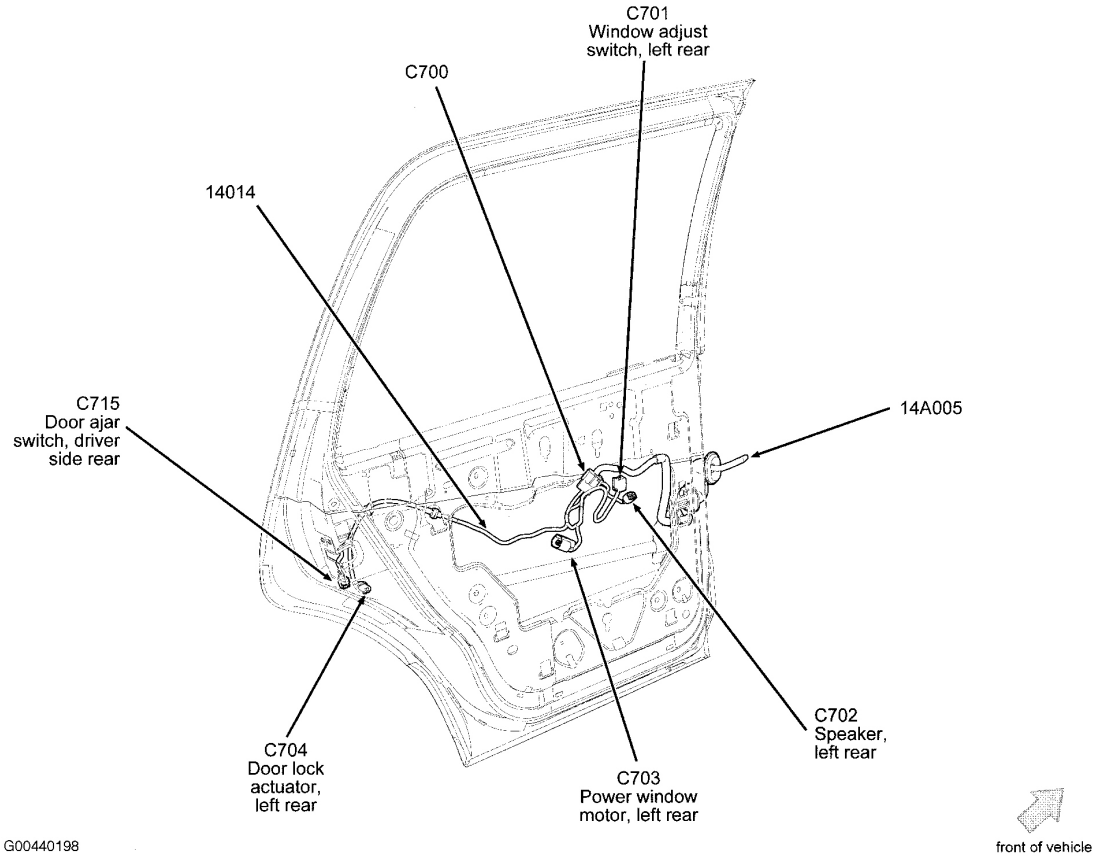


Fig. 42: Left Rear Door
Courtesy of FORD MOTOR CO.

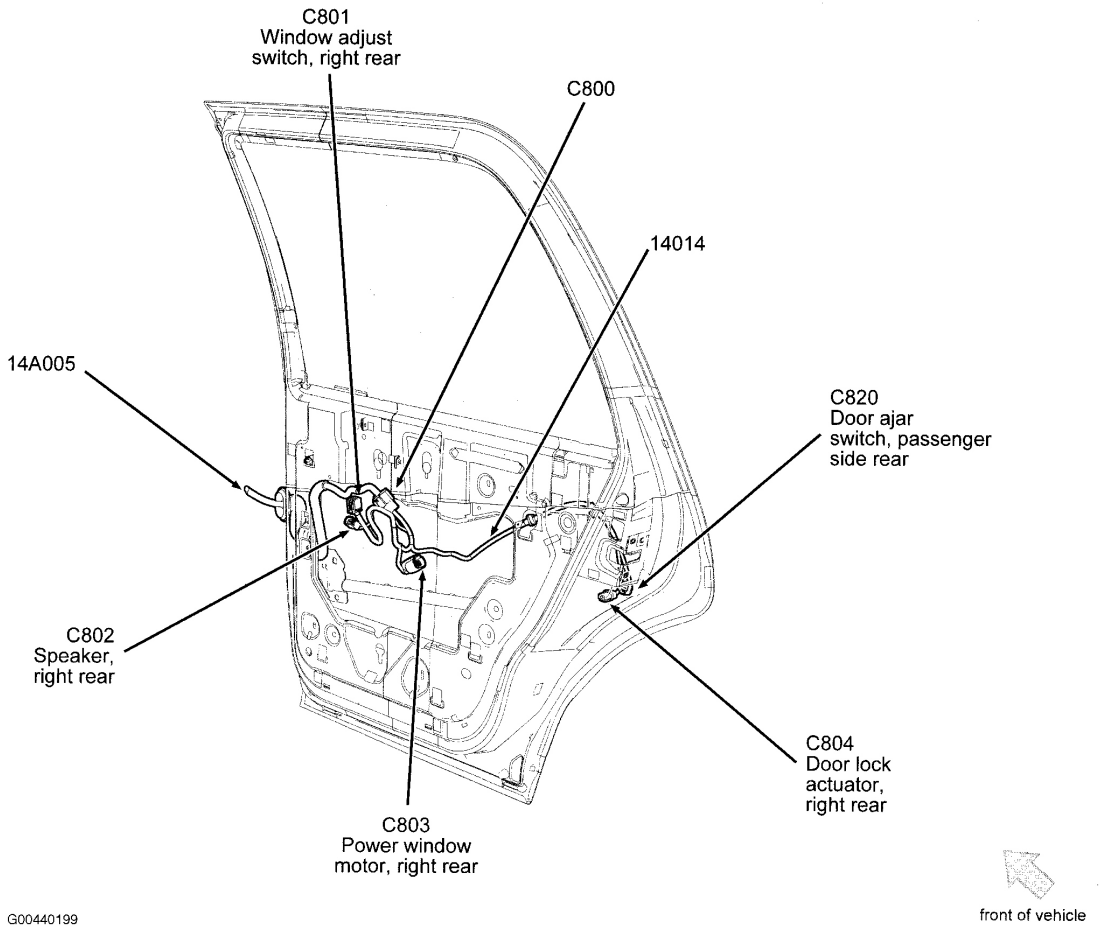


Fig. 43: Right Rear Door
Courtesy of FORD MOTOR CO.

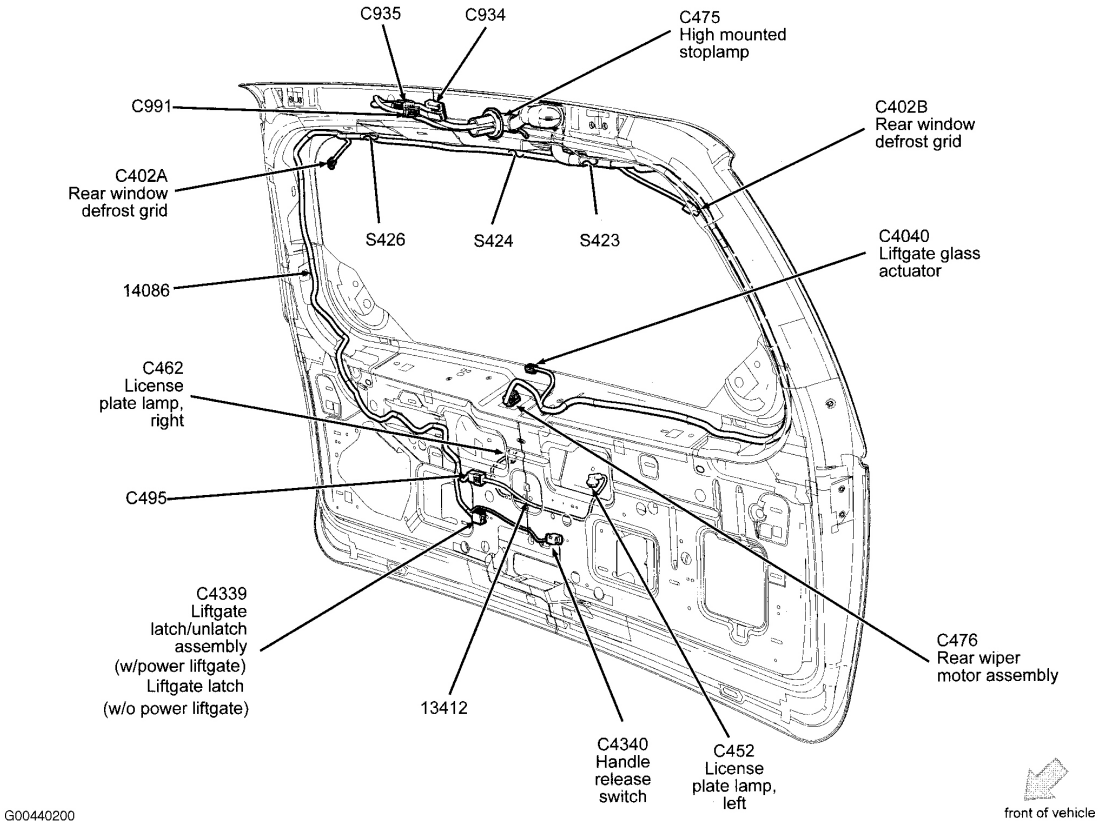


Fig. 44: Liftgate (Expedition)
Courtesy of FORD MOTOR CO.

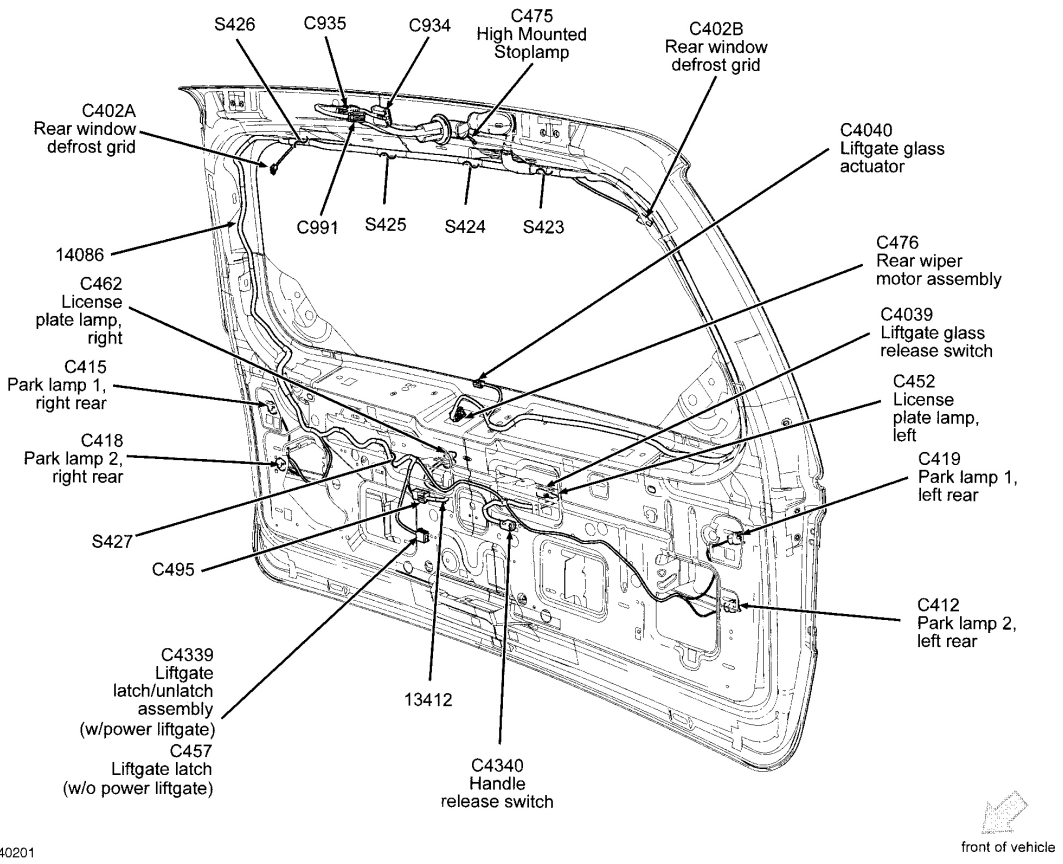


Fig. 45: Liftgate (Navigator)
Courtesy of FORD MOTOR CO.

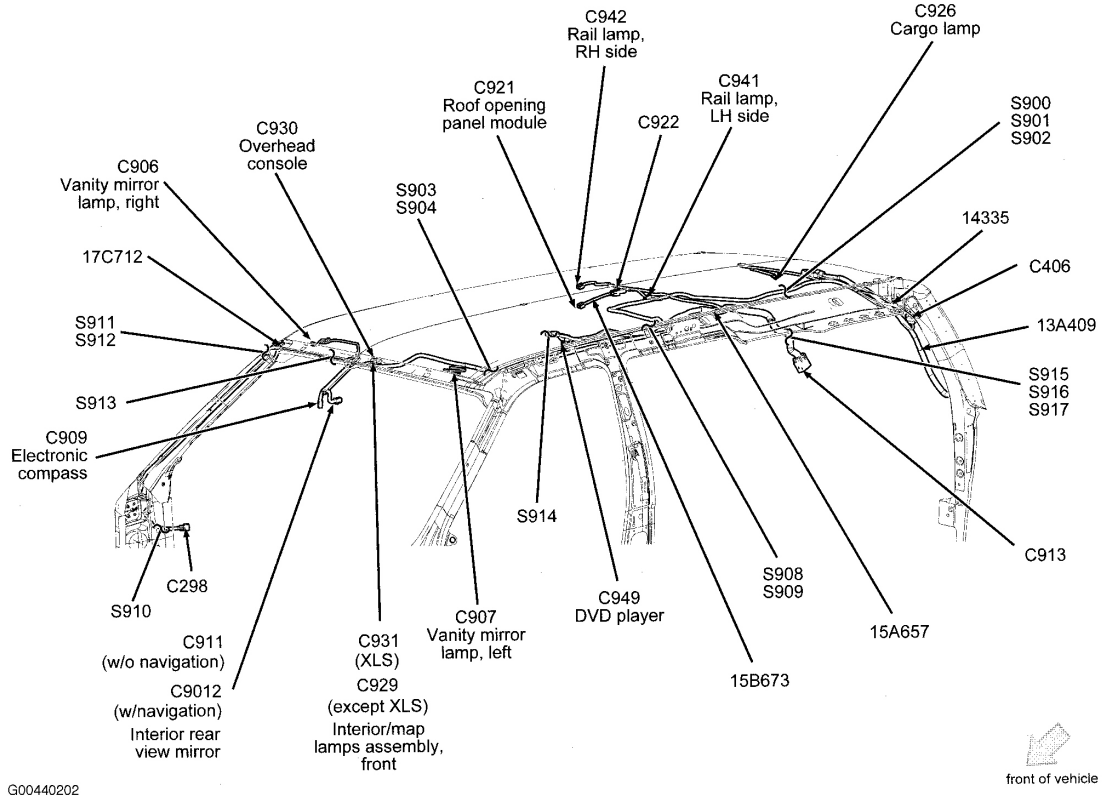


Fig. 46: Roof (Expedition)
Courtesy of FORD MOTOR CO.

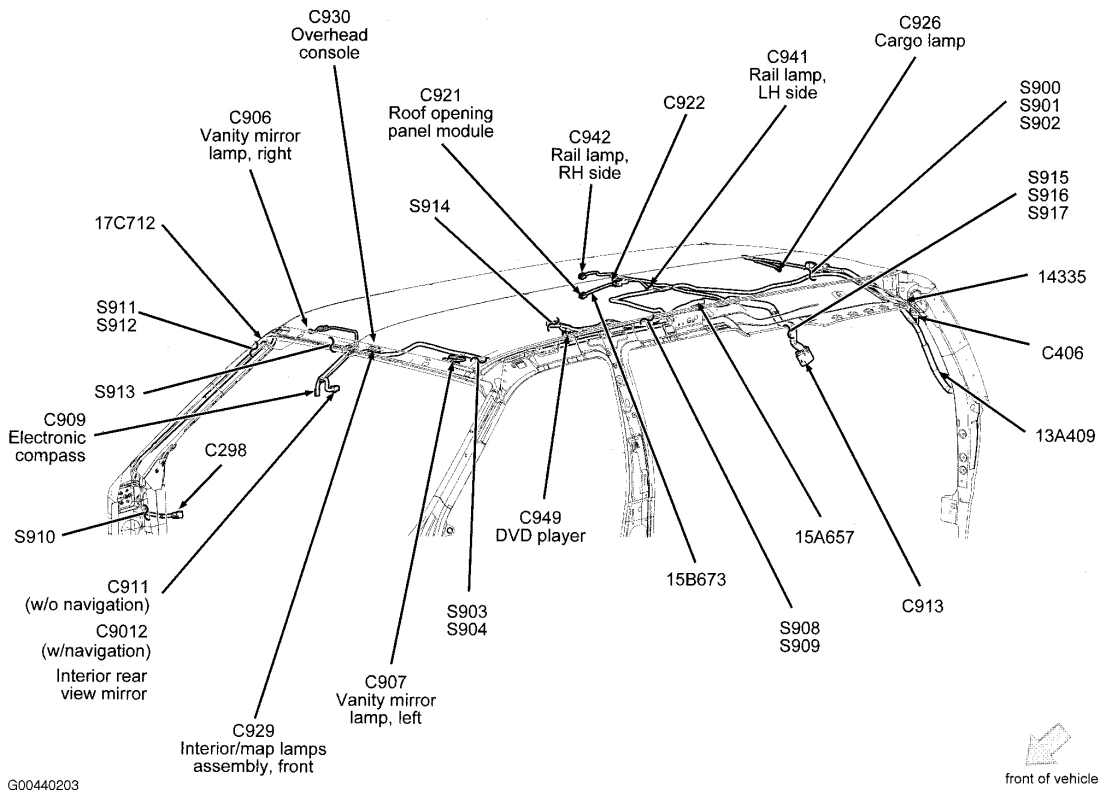


Fig. 47: Roof (Navigator)
Courtesy of FORD MOTOR CO.

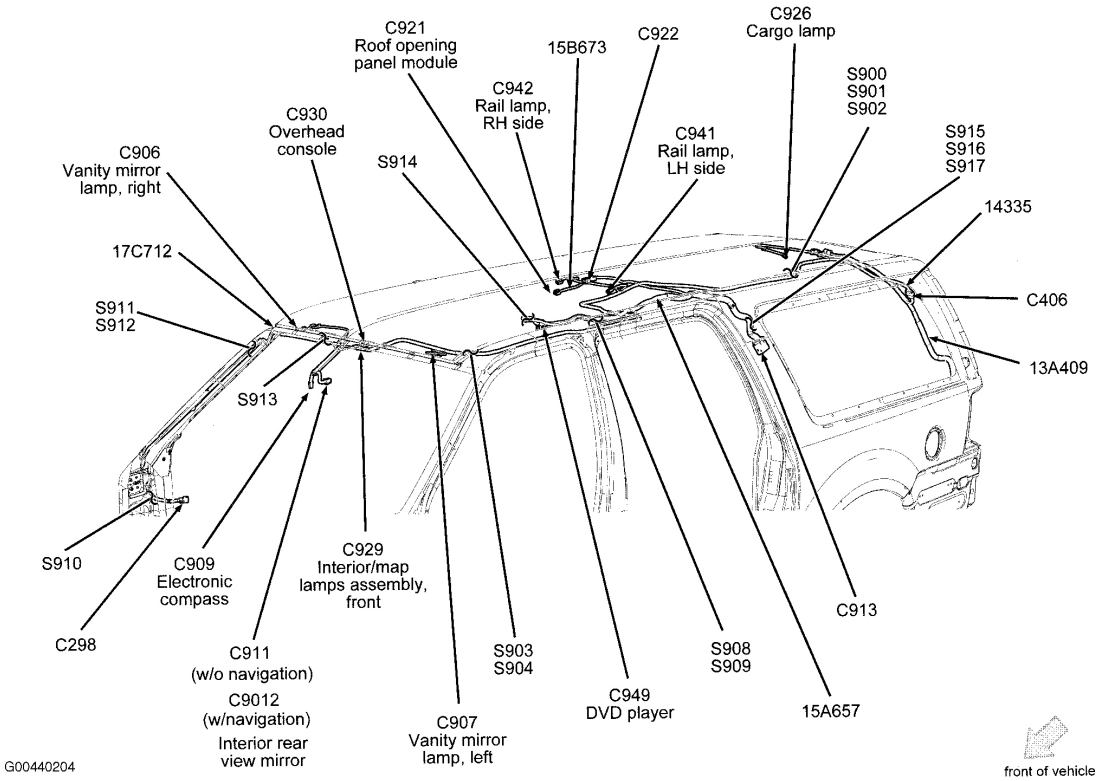


Fig. 48: Roof (Expedition-EL & Navigator-L)
Courtesy of FORD MOTOR CO.

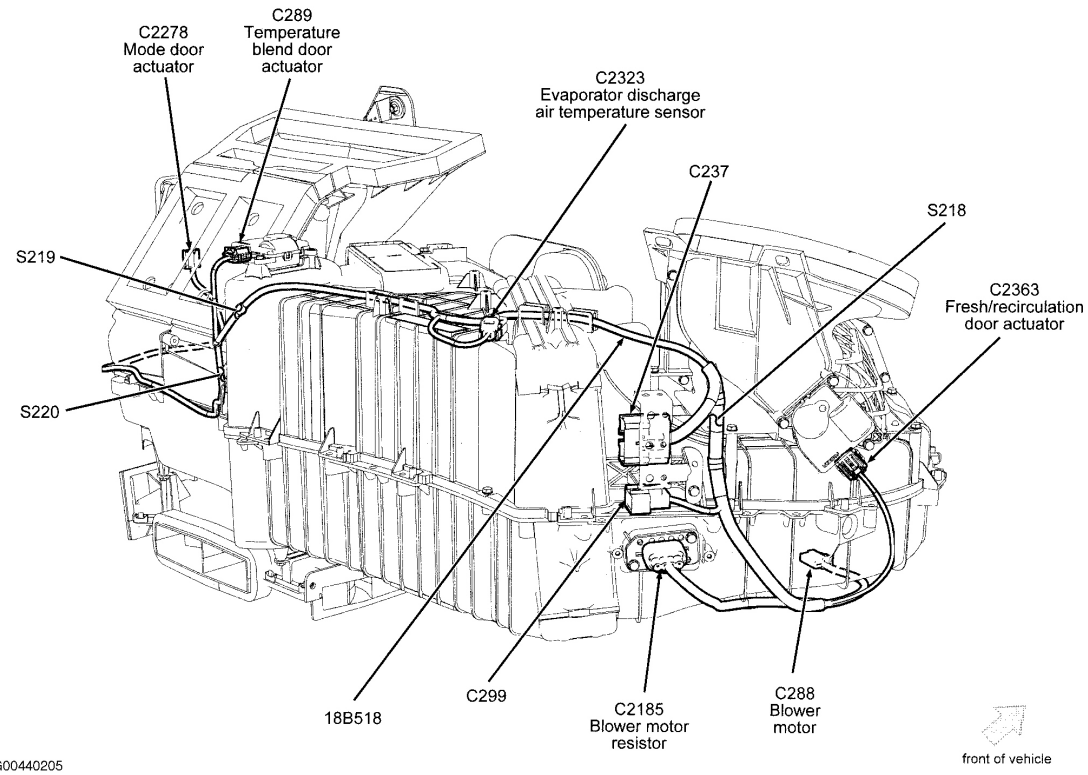


Fig. 49: HVAC (Manual A/C)
Courtesy of FORD MOTOR CO.

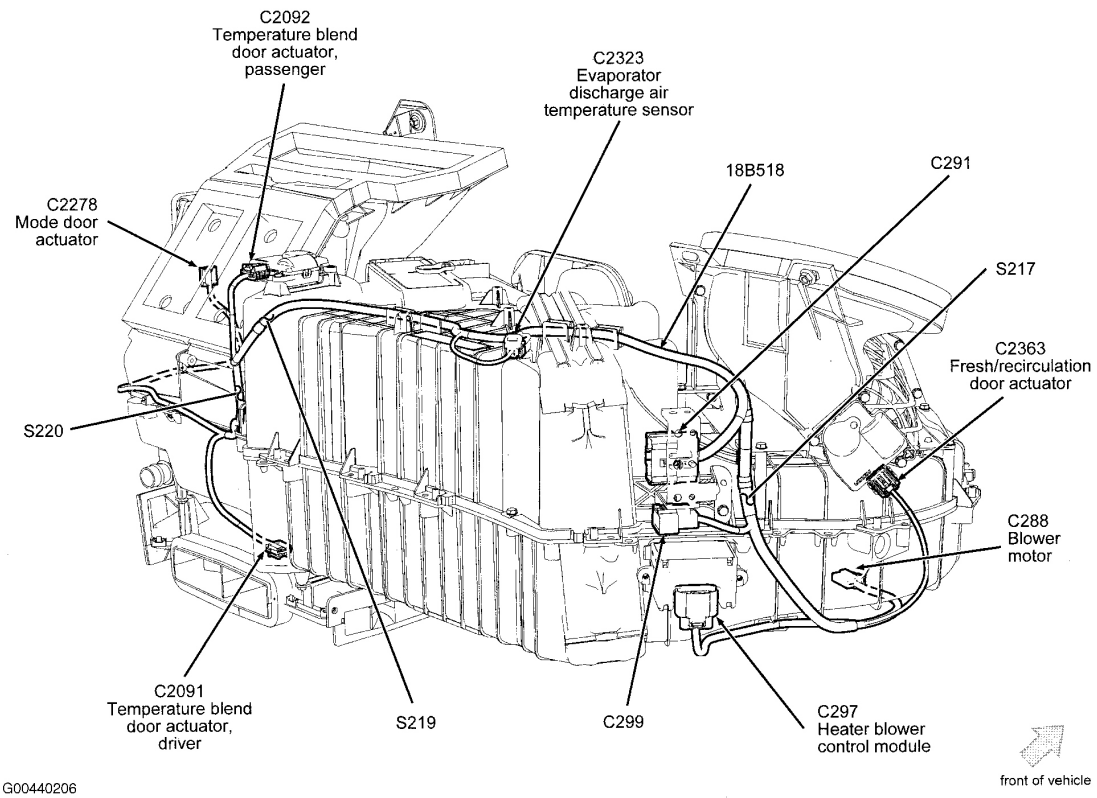


Fig. 50: HVAC (EATC) (Auto A/C)
Courtesy of FORD MOTOR CO.

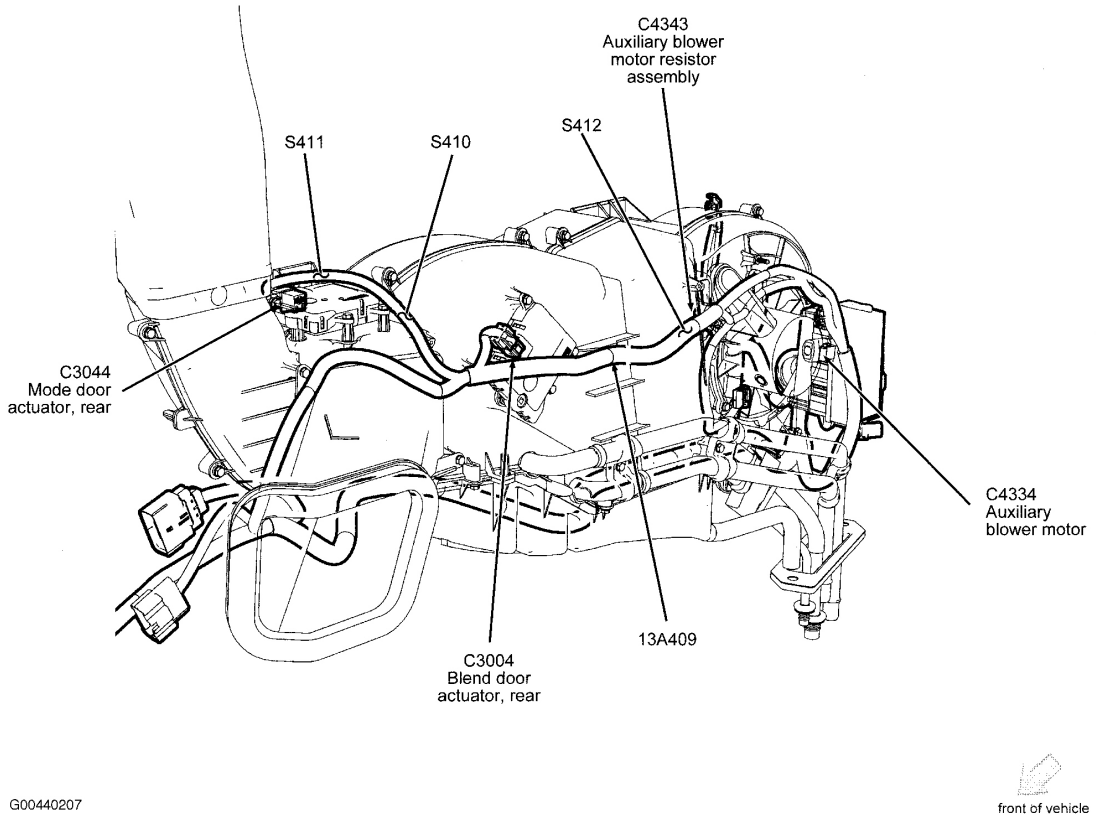


Fig. 51: Auxiliary HVAC (Expedition & Navigator)
Courtesy of FORD MOTOR CO.

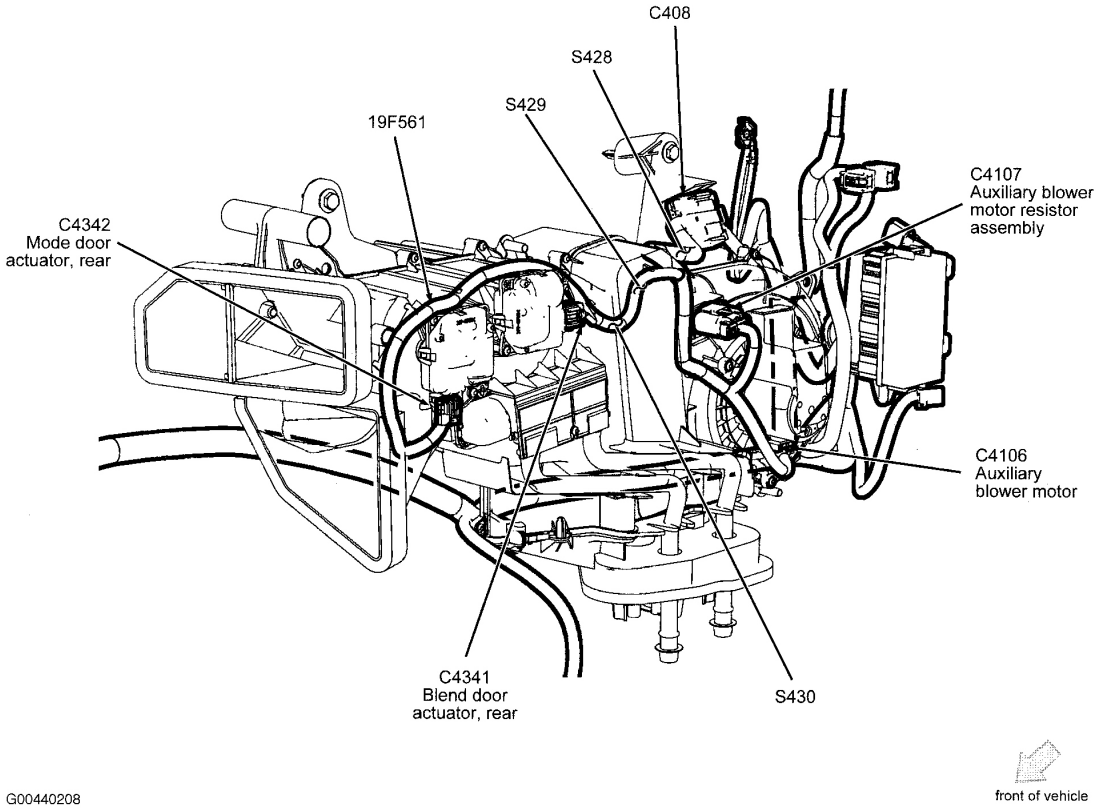


Fig. 52: Auxiliary HVAC (Expedition-EL & Navigator-L)
Courtesy of FORD MOTOR CO.

2007 ELECTRICAL

Fuses & Circuit Breakers - Expedition, Expedition EL, Navigator & Navigator L

IDENTIFICATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BATTERY JUNCTION BOX (BJB)

NOTE: For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.

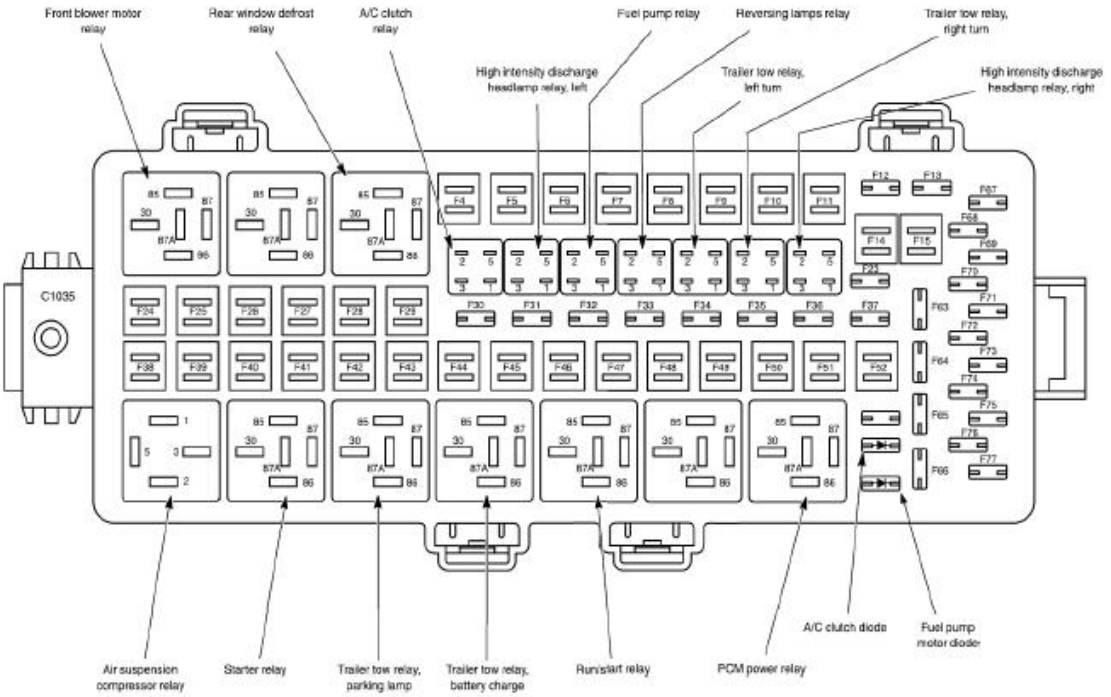


Fig. 1: Battery Junction Box Components

BATTERY JUNCTION BOX LEGENDS

Fuse	Amps	Circuits protected
F4	30	Third row folding seat relay, left
F5	40	Trailer electronic brake control module
F6	60	ABS control module
F7	40	Power fold running board module (Navigator)
F8	40	Climate controlled seat module
F9	60	ABS control module
F10	20	Power point, console 1
F11	30	Rear blower motor relay 1

F12	25	Trailer tow relay, parking lamp
F13	30	Trailer tow relay, battery charge
F14	-	Not used
F15	-	Not used
F23	15	Exterior rear view mirror, LH side, Exterior rear view mirror, RH side
F24	40	Front blower motor relay
F25	-	Not used
F26	-	Not used
F27	30	Power liftgate module
F28	40	Rear window defrost relay
F29	30	Power seat switch, right
F30	10	A/C clutch relay
F31	15	Brake pedal position switch
F32	20	Fuel pump relay
F33	20	Reversing lamps relay
F34	25	Trailer tow relay, left turn
F35	20	Four-wheel drive control module
F36	10	Powertrain Control Module (PCM), EVAP canister vent control solenoid
F37	15	6R75 automatic transmission (Expedition), 6HP26 automatic transmission (Navigator)
F38	30	Third row folding seat relay, right
F39	50	Air suspension compressor relay
F40	30	Starter relay
F41	20	Power point, instrument panel (Expedition), Power point, console 2 (Navigator)
F42	-	Not used
F43	20	Four-wheel drive control module (Expedition)
F44	20	High intensity discharge headlamp relay, left (Navigator)
F45	30	Power seat switch, left (without memory), Driver seat module (with memory)
F46	40	Run/start relay
F47	30	Air suspension module
F48	20	High intensity discharge headlamp relay, right (Navigator)
F49	30	Windshield wiper motor
F50	30	PCM power relay
F51	20	Power point, rear
F52	20	Cigar lighter, front
F63	15	Trailer tow connector, 7-pin
F64	-	Not used
F65	10	Air suspension module
F66	-	Not used
F67	10	Front blower motor relay
F68	-	Not used
F69	30	Smart Junction Box (SJB)
F70	20	A/C clutch relay, Electronic fan clutch, Heated Positive Crankcase Ventilation (PCV) valve
F71	5	Powertrain Control Module (PCM), Fuel pump motor diode

F72	20	Coil On Plug (COP) 1, Coil On Plug (COP) 2, Coil On Plug (COP) 3, Coil On Plug (COP) 4, Coil On Plug (COP) 5, Coil On Plug (COP) 6, Coil On Plug (COP) 7, Coil On Plug (COP) 8, Ignition transformer capacitor 1, Ignition transformer capacitor 2
F73	5	6R75 automatic transmission (Expedition), 6HP26 automatic transmission (Navigator)
F74	20	Brake pedal position switch, Charge Motion Control Valve (CMCV), Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Vapor management valve, Variable Camshaft Timing (VCT) valve 1, Variable Camshaft Timing (VCT) valve 2
F75	5	Integrated wheel ends solenoid
F76	20	Powertrain Control Module (PCM)
F77	10	ABS control module

SMART JUNCTION BOX (SJB)

NOTE: For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.

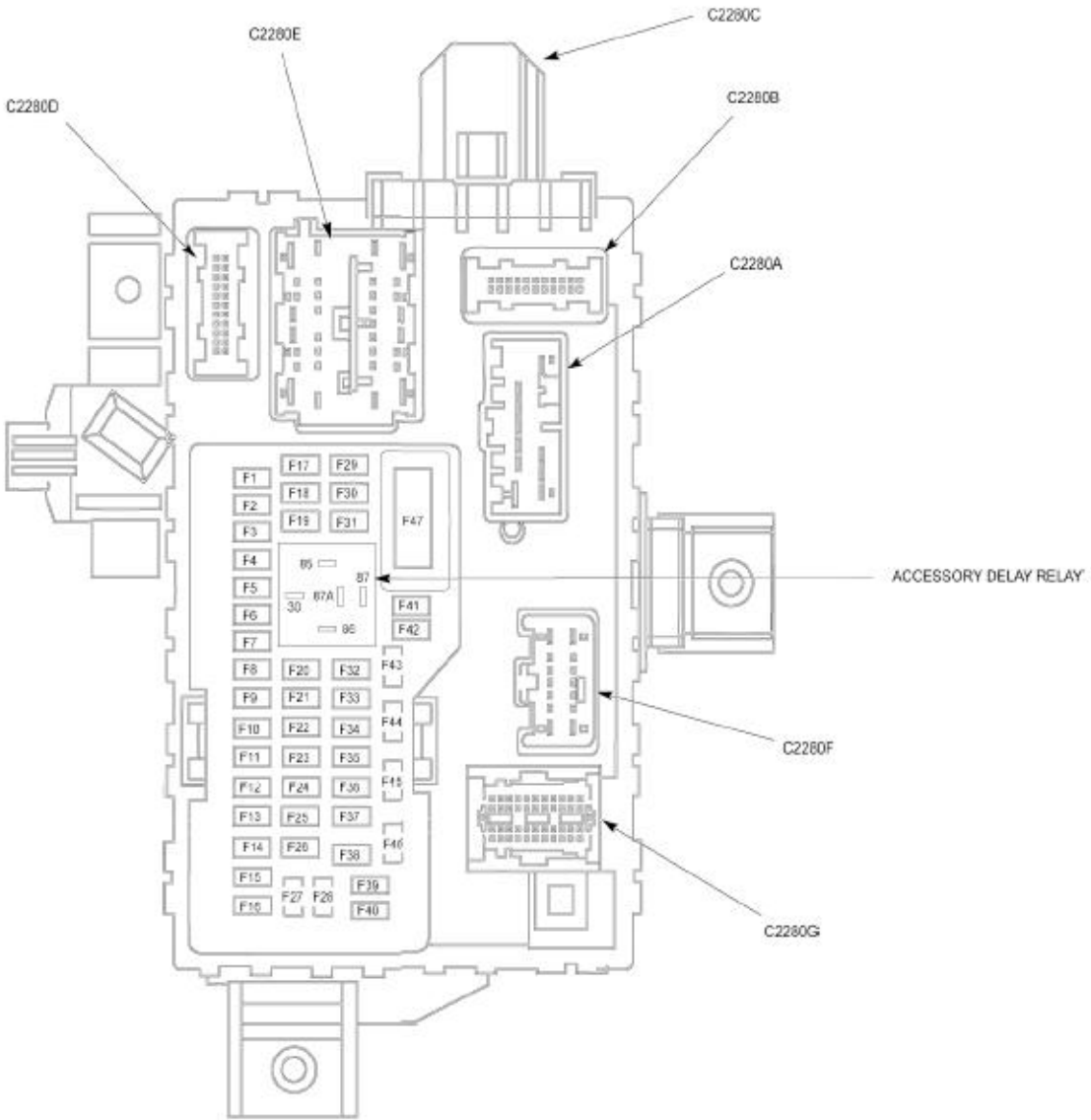


Fig. 2: Smart Junction Box Components

SMART JUNCTION BOX LEGENDS

Fuse	Amps	Circuits protected
F1	30	Power window motor, driver side front (Navigator)
F2	15	Driver seat module
F3	15	Auxiliary audio module, Satellite radio receiver, DVD player
F4	30	Power window motor, passenger side front (Navigator)
F5	10	Smart Junction Box (SJB)
F6	20	Smart Junction Box (SJB)
F7	10	Smart Junction Box (SJB)
F8	10	Smart Junction Box (SJB)
F9	15	Smart Junction Box (SJB)
F10	15	Smart Junction Box (SJB)
F11	10	Not used
F12	7.5	Exterior rear view mirror switch, Power seat switch, left (with memory)
F13	7.5	Not used
F14	10	Power liftgate module, Clock (Navigator)
F15	10	Manual climate control module, Electronic Automatic Temperature Control (EATC) module
F16	15	Electronic park brake release relay (Navigator), Electronic park brake reset relay (Navigator)
F17	20	Driver door unlock relay, Door lock relay, Liftgate glass release relay, Smart Junction Box (SJB)
F18	20	Not used
F19	25	Rear wiper motor assembly
F20	15	Adjustable pedal switch (without memory), Data Link Connector (DLC)
F21	15	Fog lamp relay, Smart Junction Box (SJB)
F22	15	Park lamp relay
F23	15	High beam relay
F24	20	Horn relay
F25	10	Battery saver relay
F26	10	Instrument cluster
F27	20	Ignition switch, Key release interlock actuator
F28	5	Audio unit
F29	5	Instrument cluster
F30	5	Not used
F31	10	Auto-dimming interior mirror unit, Electronic compass
F32	10	Restraints control module
F33	10	Electronic park brake release relay (Navigator), Electronic park brake reset relay (Navigator)
F34	5	Not used
F35	10	Four-wheel drive control module, Parking Aid Module (PAM)
F36	5	Passive anti-theft transceiver
F37	10	Manual climate control module, Electronic Automatic Temperature Control (EATC)

		module
F38	20	Subwoofer amplifier (with audiophile), THX amplifier (Navigator With THX audio)
F39	20	Audio unit
F40	20	THX amplifier (Navigator With THX audio)
F41	15	Master window adjust switch (Navigator), Power window switch, RH side front (Navigator), Power window motor, driver side front (Navigator), Power window motor, passenger side front (Navigator), Quarter window open relay, Quarter window close relay
F42	10	Trailer tow relay, battery charge
F43	10	Rear wiper motor assembly
F44	10	Not used
F45	5	Windshield wiper motor
F46	7.5	Rear blower motor relay 1, Rear blower motor relay 2, Rear blower motor relay 3
F47	30 CB	Master window adjust switch, Roof opening panel module

AUXILIARY RELAY BOX 1

NOTE: For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.

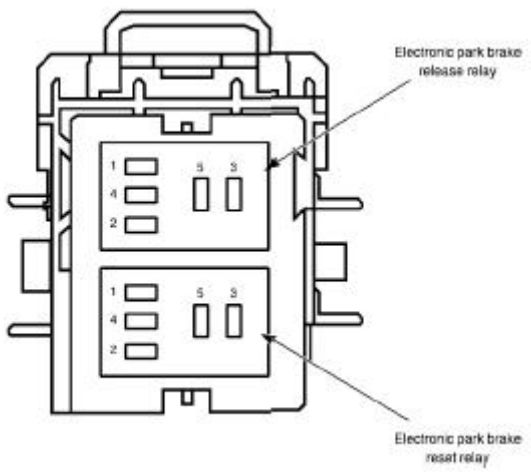


Fig. 3: Identifying Auxiliary Relay Box 1 Relays

AUXILIARY RELAY BOX 2

NOTE: For component location, see appropriate ELECTRICAL COMPONENT LOCATIONS article.

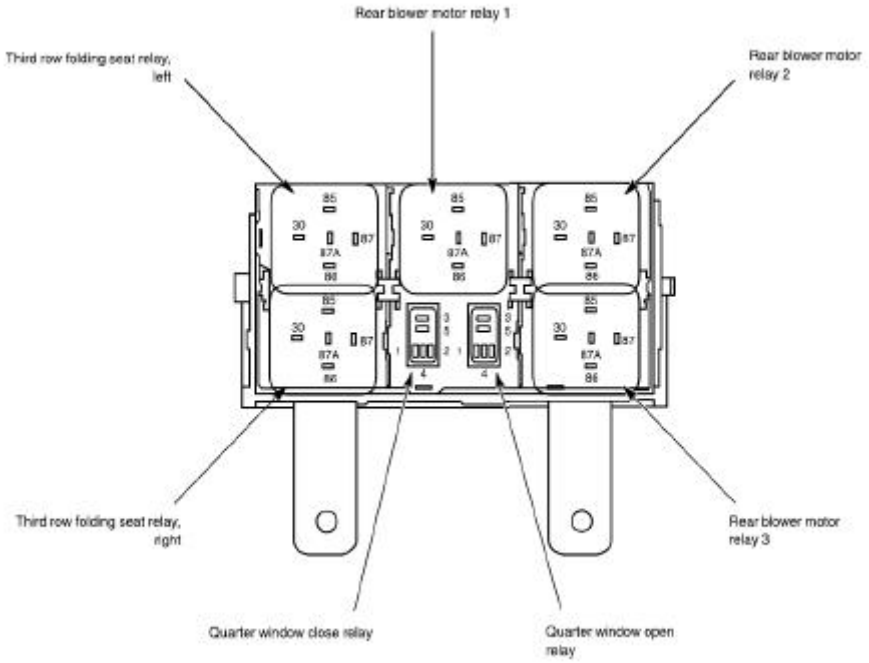


Fig. 4: Identifying Auxiliary Relay Box 2 Relays

2007 ELECTRICAL

Connector Views - Expedition, Expedition EL, Navigator & Navigator L

CONNECTOR VIEWS

Connector: C100

Description:	Harness:	Base Part #:
A/C CLUTCH FIELD COIL	12B637	19D798

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	321 (GY-WH)	18	A/C clutch relay output	
2	57 (BK)	18	Ground	

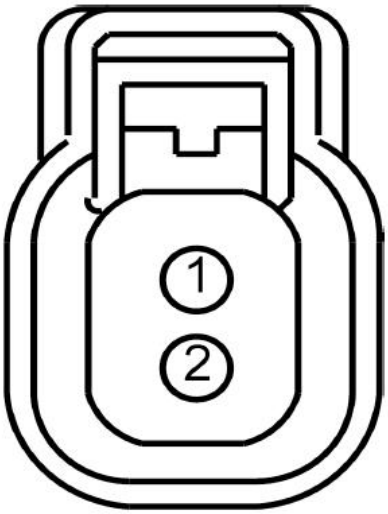


Fig. 1: Identifying Connector C100 (A/C Clutch Field Coil)
Courtesy of FORD MOTOR CO.

Connector: C102A

Description:	Harness:	Base Part #:
GENERATOR	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1817 (YE)	20	Generator monitor circuit	
2	1816 (YE-LB)	20	Generator communication	
3	35 (OG-LB)	20	Voltage supplied at all times (overload protected)	

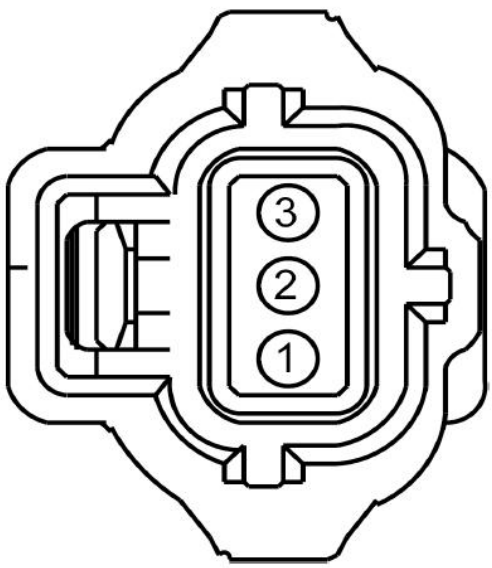
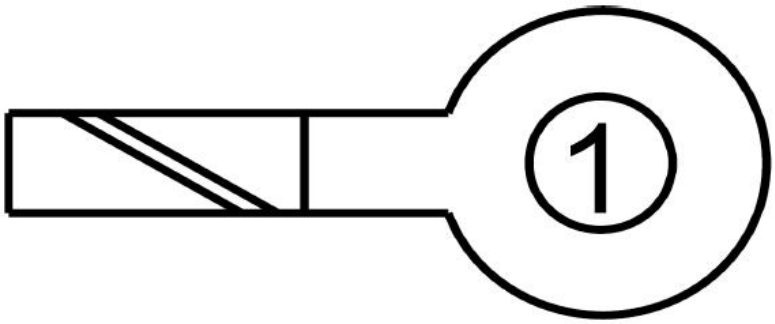


Fig. 2: Identifying Connector C102A (Generator)
Courtesy of FORD MOTOR CO.

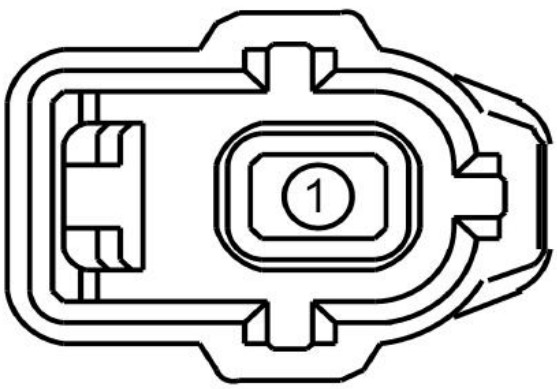
Connector: C102B	Description:	Harness:	Base Part #:
	GENERATOR	14B060	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	38 (RD)	04	Voltage supplied at all times (fusible link)	

Fig. 3: Identifying Connector C102B (Generator)
Courtesy of FORD MOTOR CO.

Connector: C103	Description:	Harness:	Base Part #:
	OIL PRESSURE SWITCH	12B637	9278



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	31 (WH-RD)	20	Engine oil pressure indicator, control	

Fig. 4: Identifying Connector C103 (Oil Pressure Switch)
Courtesy of FORD MOTOR CO.

Connector: C107	Description:	Harness:	Base Part #:
	CYLINDERHEAD TEMPERATURE SENSOR	12A654	6G004

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1102 (YE-LG)	20	Cylinder head temperature sensor signal	
2	359 (GY-RD)	20	Signal return	

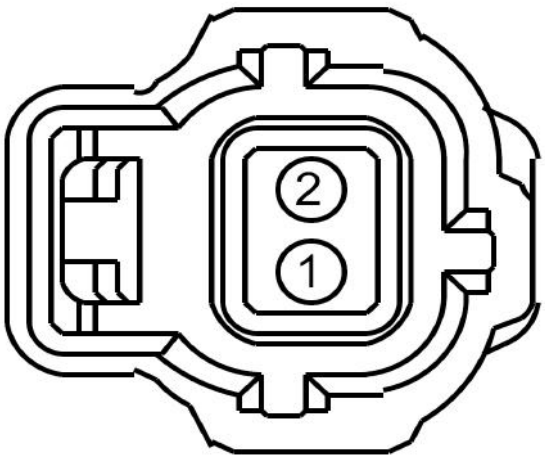
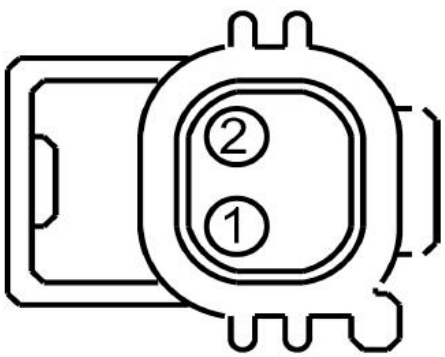


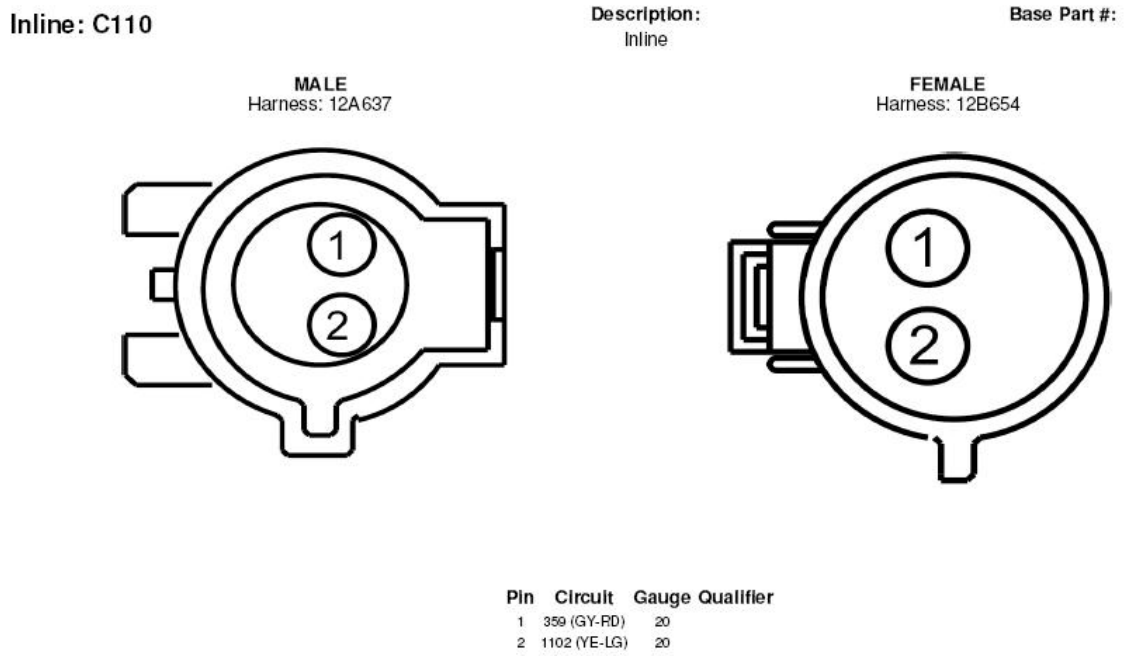
Fig. 5: Identifying Connector C107 (Cylinderhead Temperature Sensor)
Courtesy of FORD MOTOR CO.

Connector: C109	Description:	Harness:	Base Part #:
	KNOCK SENSOR	12B637	12A699



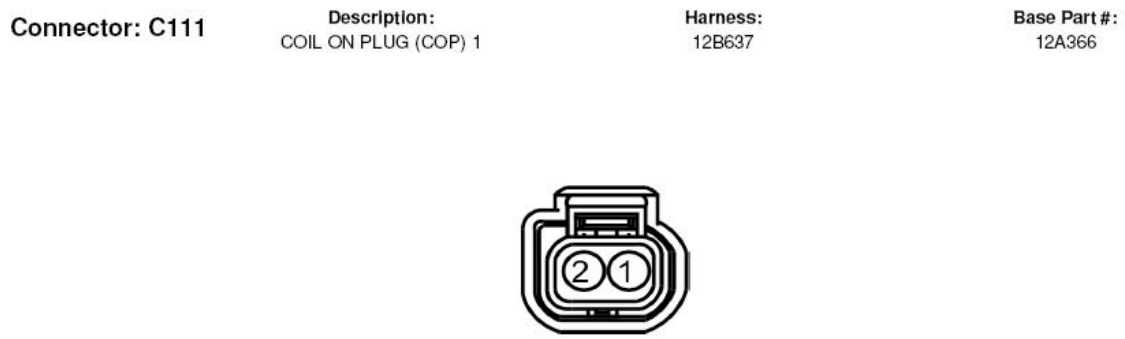
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1273 (YE)	20	Knock sensor -	
2	310 (YE-RD)	20	Knock sensor +	

Fig. 6: Identifying Connector C109 (Knock Sensor)
Courtesy of FORD MOTOR CO.



Pin	Circuit	Gauge	Qualifier
1	359 (GY-RD)	20	
2	1102 (YE-LG)	20	

Fig. 7: Identifying Connector C110 (Inline)
Courtesy of FORD MOTOR CO.



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1024 (LG-WH)	20	Coil on Plug (COP) 1 control	

Fig. 8: Identifying Connector C111 (Coil On Plug (COP) 1)
Courtesy of FORD MOTOR CO.

Connector: C112	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 2	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1026 (PK-WH)	20	Coil on Plug (COP) 2 control	

Fig. 9: Identifying Connector C112 (Coil On Plug (COP) 2)
Courtesy of FORD MOTOR CO.

Connector: C113	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 3	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1028 (WH-PK)	20	Coil on Plug (COP) 3 control	

Fig. 10: Identifying Connector C113 (Coil On Plug (COP) 3)
Courtesy of FORD MOTOR CO.

Connector: C114	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 4	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1030 (DG-VT)	20	Coil on Plug (COP) 4 control	

Fig. 11: Identifying Connector C114 (Coil On Plug (COP) 4)
Courtesy of FORD MOTOR CO.

Connector: C115	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 5	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1021 (LG-YE)	20	Coil on Plug (COP) 5 control	

Fig. 12: Identifying Connector C115 (Coil On Plug (COP) 5)
Courtesy of FORD MOTOR CO.

Connector: C116	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 6	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1025 (OG-YE)	20	Coil on Plug (COP) 6 control	

Fig. 13: Identifying Connector C116 (Coil On Plug (COP) 6)
Courtesy of FORD MOTOR CO.

Connector: C117	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 7	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1027 (PK-LB)	20	Coil on Plug (COP) 7 control	

Fig. 14: Identifying Connector C117 (Coil On Plug (COP) 7)
Courtesy of FORD MOTOR CO.

Connector: C118	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 8	12B637	12A366

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	
2	1029 (WH-RD)	20	Coil on Plug (COP) 8 control	

Fig. 15: Identifying Connector C118 (Coil On Plug (COP) 8)
Courtesy of FORD MOTOR CO.

Connector: C120	Description:	Harness:	Base Part #:
	POWER STEERING VALVE SOLENOID	12B637	3783

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	115 (LG-BK)	20	Power steering valve solenoid -	
2	114 (LB-YE)	20	Power steering valve solenoid +	

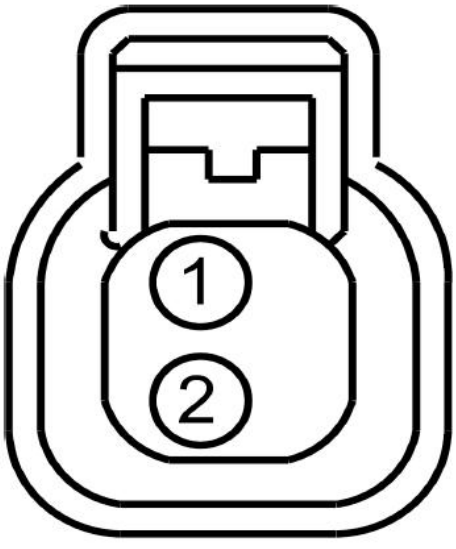


Fig. 16: Identifying Connector C120 (Power Steering Valve Solenoid)
Courtesy of FORD MOTOR CO.

Connector: C124 | **Description:** BRAKE FLUID LEVEL SWITCH | **Harness:** 14290 | **Base Part #:** 2L414

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	409 (TN-BK)	20	Brake fluid level switch signal	
3	977 (VT-WH)	20	Brake indicator, control	

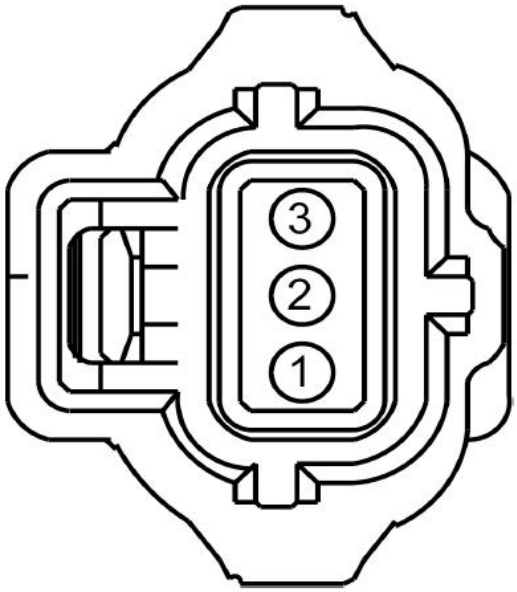


Fig. 17: Identifying Connector C124 (Brake Fluid Level Switch)
Courtesy of FORD MOTOR CO.

Connector: C125 | **Description:** WINDSHIELD WIPER MOTOR | **Harness:** 14290 | **Base Part #:** 17508

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	61 (YE-RD)	20	Front wiper switch circuit H	
2	28 (BK-PK)	20	Wiper ON/OFF signal	
3	676 (PK-OG)	20	Ground	
4	*	*	not used	
5	2025 (RD-YE)	14	Voltage supplied at all times (overload protected)	
6	57 (BK)	14	Ground	
7	941 (BK-WH)	14	Windshield washer pump motor, feed	
8	65 (DG)	14	Voltage in Run or Accessory (overload protected)	
9	63 (RD)	20	Front wiper switch circuit A	
10	56 (DB-OG)	20	Front wiper switch circuit C	
11	58 (WH)	20	Front wiper switch circuit B	
12	680 (LB-OG)	20	Washer switch signal	

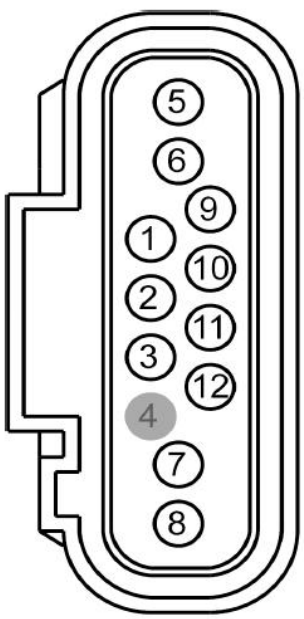


Fig. 18: Identifying Connector C125 (Windshield Wiper Motor)
Courtesy of FORD MOTOR CO.

Connector: C127

Description:	Harness:	Base Part #:
ENGINE COMPARTMENT PERIMETER DISARM SWITCH	14290	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1304 (VT-OG)	20	Anti-theft hood switch signal	
2	57 (BK)	20	Ground	

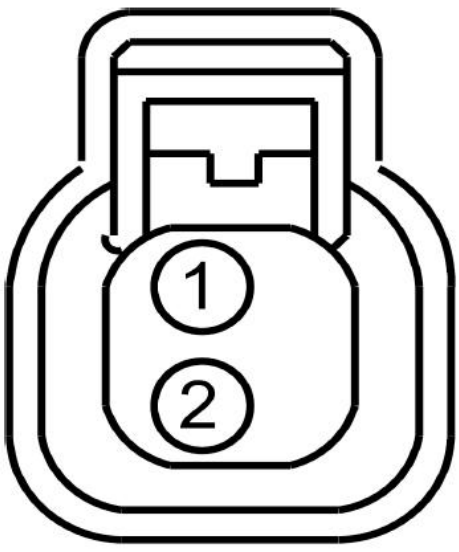


Fig. 19: Identifying Connector C127 (Engine Compartment Perimeter Disarm Switch)
Courtesy of FORD MOTOR CO.

Connector: C128

Description:	Harness:	Base Part #:
MASS AIR FLOW/ INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	12B637	

Pin: 4 - 968(TN-LB) - Mass Air Flow (MAF) sensor, signal return, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	743 (GY)	20	Intake Air Temperature (IAT) sensor signal	
2	359 (GY-RD)	20	Signal return	
3	967 (LB-RD)	20	Mass Air Flow (MAF) sensor, signal	
4	968 (TN-LB)	20	Mass Air Flow (MAF) sensor, signal return	
5	570 (BK-WH)	20	Ground	
6	361 (RD)	20	Voltage supplied in Start and Run (overload protected)	

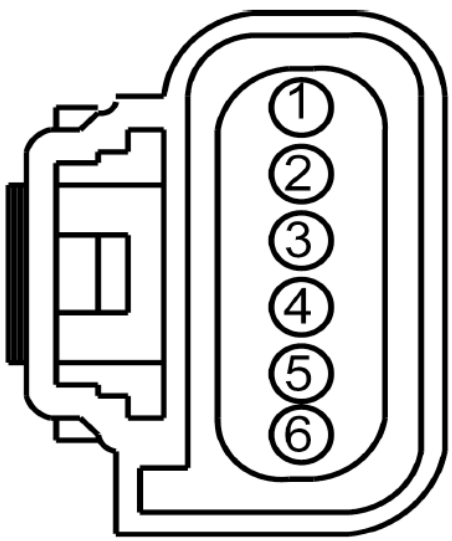


Fig. 20: Identifying Connector C128 (Mass Air Flow/ Intake Air Temperature (MAF/IAT) Sensor)
Courtesy of FORD MOTOR CO.

Connector: C131	Description:	Harness:	Base Part #:
	HORN	14290/15A599	13832

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	16	Ground	
2	3040 (LG-OG)	16	R4.B3 relay switched power Police	
2	6 (YE-LG)	18	Horn relay output	

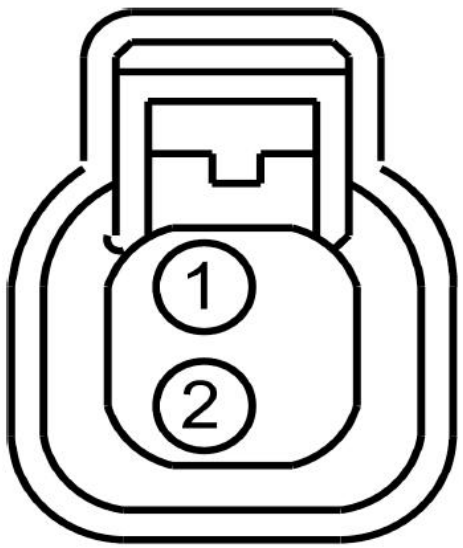
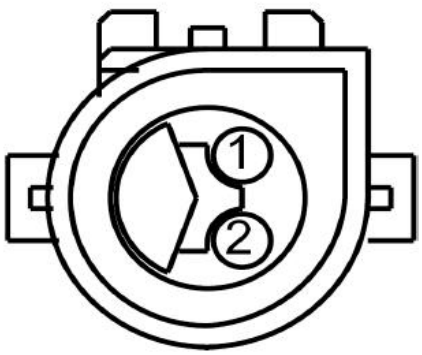


Fig. 21: Identifying Connector C131 (Horn)
Courtesy of FORD MOTOR CO.

Connector: C132	Description:	Harness:	Base Part #:
	AMBIENT AIR TEMPERATURE SENSOR	14290	19E702



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	3061 (LB-OG)	14	Ambient air temperature sensor signal	
2	3059 (YE-LG)	14	Signal return	

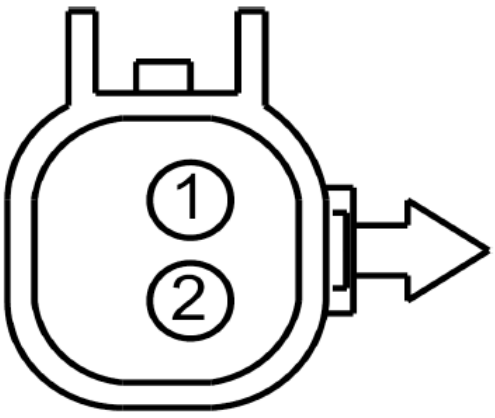
Fig. 22: Identifying Connector C132 (Ambient Air Temperature Sensor)
Courtesy of FORD MOTOR CO.

Inline: C133

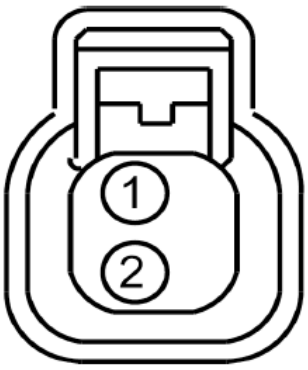
Description:
Inline

Base Part #:

MALE
Harness: 15A599



FEMALE
Harness: 14290

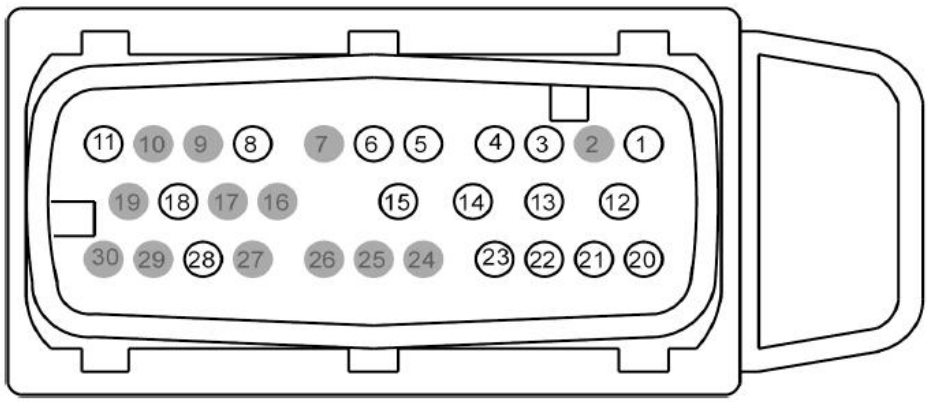


Pin: 1 - 57(BK) - Ground, Gauge: 16

Pin	Circuit	Gauge	Qualifier
1	57 (BK)	16	15A599
1	57 (BK)	18	14290
2	6 (YE-LG)	16	15A599

Fig. 23: Identifying Connector C133 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C135	Description:	Harness:	Base Part #:
	ANTI-LOCK BRAKE SYSTEM (ABS) MODULE	14290	2C219



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	523 (RD-PK)	20	Wheel speed sensor, right rear -	
2	*	*	not used	
3	524 (PK-BK)	20	Wheel speed sensor, right rear +	
4	514 (YE-RD)	20	Wheel speed sensor, right front -	
5	516 (YE-BK)	20	Wheel speed sensor, right front +	
6	1651 (WH-RD)	20	Brake pedal position switch signal	
7	*	*	not used	
8	1003 (GY-YE)	16	Voltage supplied in Run (overload protected)	
9	*	*	not used	
10	*	*	not used	
11	959 (GY)	20	Traction control switch, On/Off signal	
12	57 (BK)	12	Ground	
13	601 (LB-PK)	12	Voltage supplied at all times (overload protected)	
14	483 (RD)	14	Voltage supplied at all times (overload protected)	
15	57 (BK)	12	Ground	
16	*	*	not used	
17	*	*	not used	
18	1827 (WH-LG)	20	HS CAN +	
19	*	*	not used	
20	521 (TN-OG)	20	Wheel speed sensor, left front -	
21	522 (TN-BK)	20	Wheel speed sensor, left front +	
22	518 (LG-RD)	20	Wheel speed sensor, left rear -	
23	519 (LG-BK)	20	Wheel speed sensor, left rear +	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	1828 (PK-LG)	20	HS CAN -	
29	*	*	not used	
30	*	*	not used	

Fig. 24: Identifying Connector C135 (Anti-Lock Brake System (ABS) Module)
Courtesy of FORD MOTOR CO.

Connector: C137	Description:	Harness:	Base Part #:
	WINDSHIELD WASHER PUMP MOTOR	14290	17618

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	941 (BK-WH)	14	Windshield washer pump motor, feed	
2	57 (BK)	14	Ground	

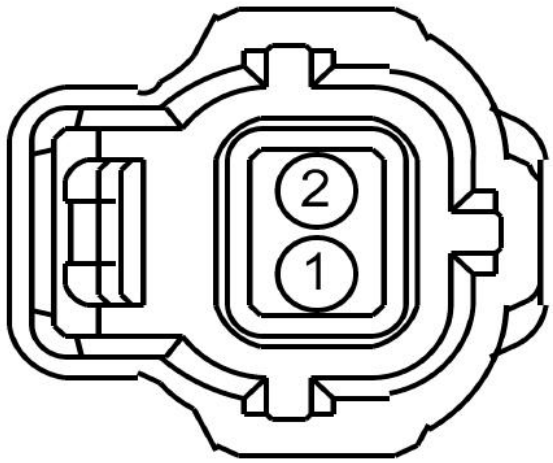


Fig. 25: Identifying Connector C137 (Windshield Washer Pump Motor)
Courtesy of FORD MOTOR CO.

Connector: C138	Description:	Harness:	Base Part #:
	WASHER FLUID LEVEL SWITCH	14290	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	82 (PK-YE)	20	Low washer fluid indicator control	
2	57 (BK)	20	Ground	

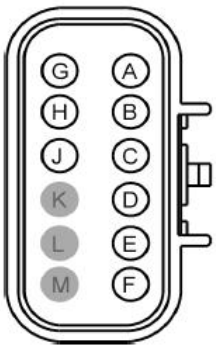
Fig. 26: Identifying Connector C138 (Washer Fluid Level Switch)
Courtesy of FORD MOTOR CO.

Inline: C139

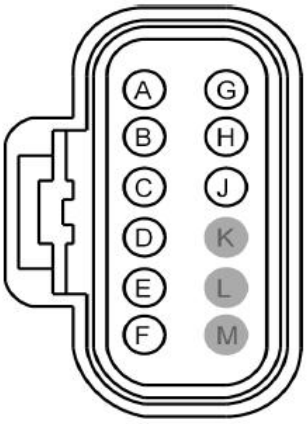
Description: Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 12B637



Pin	Circuit	Gauge	Qualifier
A	262 (BN-PK)	14	14290
A	262 (BN-PK)	20	12B637
B	883 (PK-LB)	20	
C	348 (VT)	14	14290
C	348 (VT)	20	12B637
D	1789 (VT-WH)	14	14290
D	1789 (VT-WH)	20	12B637
E	140 (BK-PK)	14	14290
E	140 (BK-PK)	20	12B637
F	1269 (OG-RD)	16	
G	229 (RD-OG)	20	
H	1154 (WH-BK)	20	
J	1816 (YE-LB)	16	
K	*	*	
L	*	*	
M	*	*	

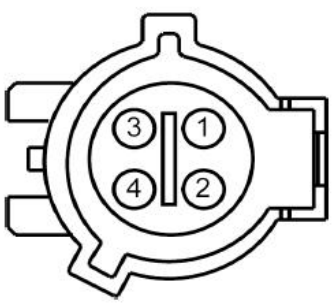
Fig. 27: Identifying Connector C139 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C141

Description: HEATED OXYGEN SENSOR (HO2S) #22

Harness: 12B637

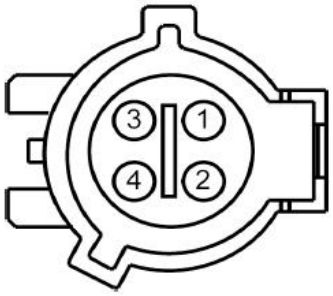
Base Part #: 9G4444



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	390 (TN-YE)	18	Heated oxygen sensor (HO2S) #22 heater	
2	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
3	393 (VT-LG)	18	Heated oxygen sensor (HO2S) #22 input	
4	359 (GY-RD)	20	Signal return	

Fig. 28: Identifying Connector C141 (Heated Oxygen Sensor (HO2S) #22)
Courtesy of FORD MOTOR CO.

Connector: C142	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #12	12B637	9G444



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	389 (WH-BK)	18	Heated oxygen sensor (HO2S) #12 heater	
2	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
3	392 (RD-LG)	18	Heated oxygen sensor (HO2S) #12 input	
4	359 (GY-RD)	20	Signal return	

Fig. 29: Identifying Connector C142 (Heated Oxygen Sensor (HO2S) #12)
Courtesy of FORD MOTOR CO.

Connector: C143	Description:	Harness:	Base Part #:
	TURBINE SHAFT SPEED (TSS) SENSOR	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	970 (DG-WH)	20	Turbine shaft speed (TSS) sensor signal	
2	359 (GY-RD)	20	Signal return	

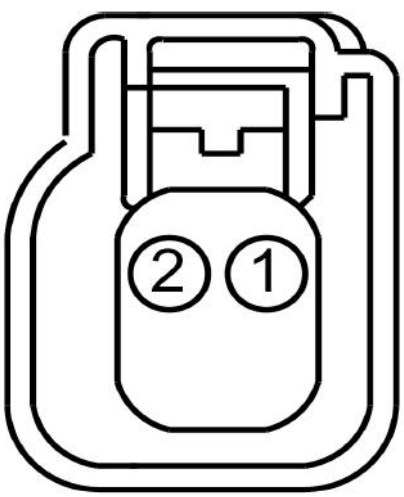


Fig. 30: Identifying Connector C143 (Turbine Shaft Speed (TSS) Sensor)
Courtesy of FORD MOTOR CO.

Connector: C144

Description:	Harness:	Base Part #:
FRONT FLASHER CONNECTOR	14290	13350

Pin: 2 - 42(RD-WH) - Ends in harness, Gauge: 14

Pin	Circuit	Gauge	Circuit Function Qualifier
1	44 (LB)	14	Turn lamps power feed
2	42 (RD-WH)	14	Ends in harness
3	41 (BK-LB)	14	Ends in harness

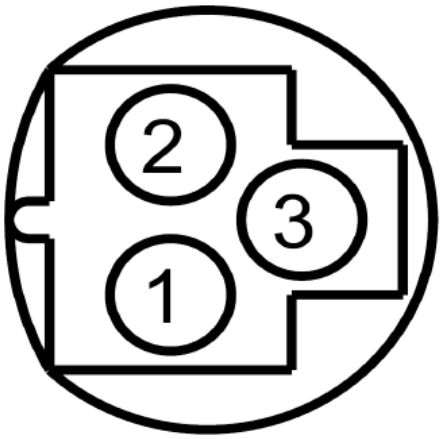
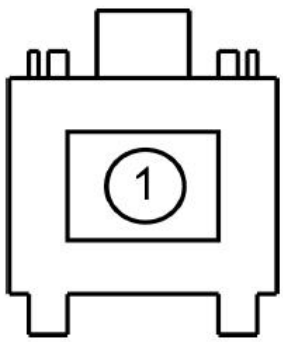


Fig. 31: Identifying Connector C144 (Front Flasher Connector)
Courtesy of FORD MOTOR CO.

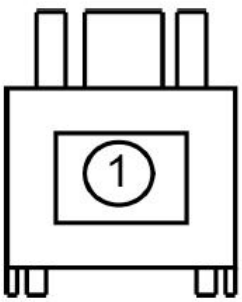
Inline: C146

Description:	Base Part #:
Inline	

MALE
Harness: 14290



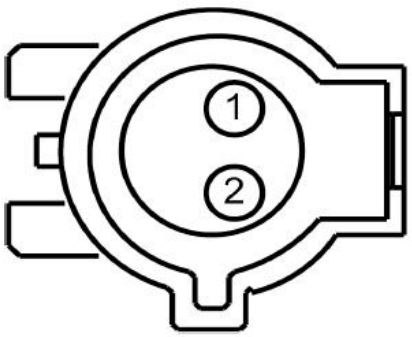
FEMALE
Harness: 14B060



Pin	Circuit	Gauge	Qualifier
1	113 (YE-LB)	12	

Fig. 32: Identifying Connector C146 (Inline)
Courtesy of FORD MOTOR CO.

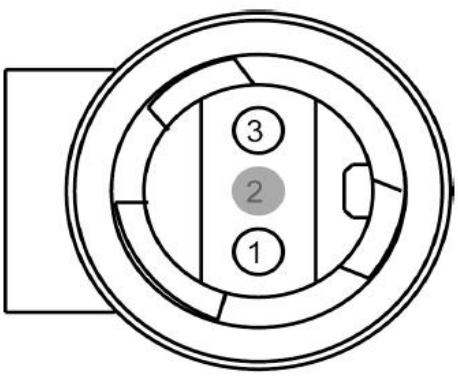
Connector: C150	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, LEFT FRONT	14290	2C205



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	521 (TN-OG)	20	Wheel speed sensor, left front -	
2	522 (TN-BK)	20	Wheel speed sensor, left front +	

Fig. 33: Identifying Connector C150 (Wheel Speed Sensor, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C151	Description:	Harness:	Base Part #:
	CORNERING LAMP, LEFT FRONT	15A219	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	380 (VT-YE)	18	Left cornering lamp control	
2	*	*	not used	
3	14 (BN)	20	Power, Exterior lamps	

Fig. 34: Identifying Connector C151 (Cornering Lamp, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C152 | Description: FOG LAMP, LEFT FRONT | Harness: 15A211 | Base Part #:

Pin: 2 - 478(TN-OG) - Fog lamp indicator feed, Gauge: 18

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	478 (TN-OG)	18	Fog lamp indicator feed	

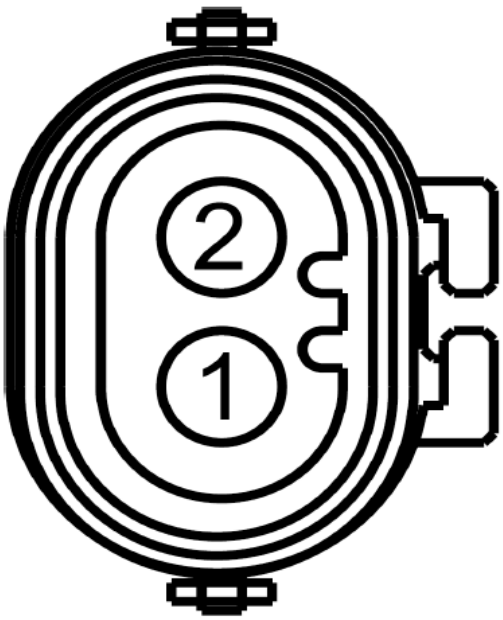
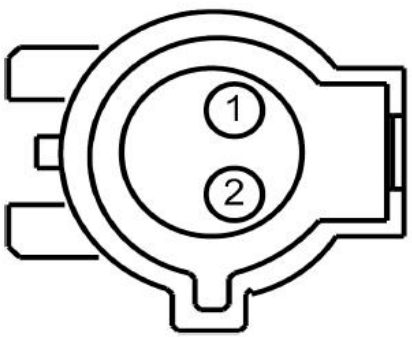


Fig. 35: Identifying Connector C152 (Fog Lamp, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C160 | Description: WHEEL SPEED SENSOR, RIGHT FRONT | Harness: 14290 | Base Part #: 2C204

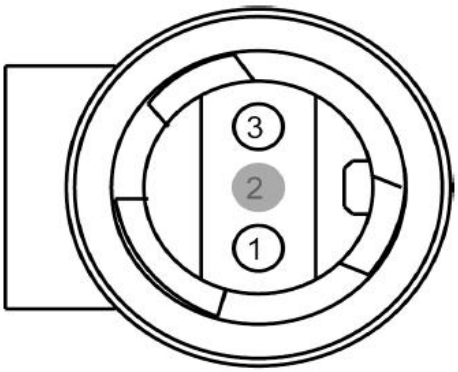


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	514 (YE-RD)	20	Wheel speed sensor, right front -	
2	516 (YE-BK)	20	Wheel speed sensor, right front +	

Fig. 36: Identifying Connector C160 (Wheel Speed Sensor, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C161

Description:	Harness:	Base Part #:
CORNERING LAMP, RIGHT FRONT	15A219	13411



Pin	Circuit	Gauge	Circuit Function Qualifier
1	379 (BN-WH)	18	Cornering lamp control
2	*	*	not used
3	14 (BN)	20	Power, Exterior lamps

Fig. 37: Identifying Connector C161 (Cornering Lamp, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C162

Description:	Harness:	Base Part #:
FOG LAMP, RIGHT FRONT	15A211	

Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	478 (TN-OG)	18	Fog lamp indicator feed

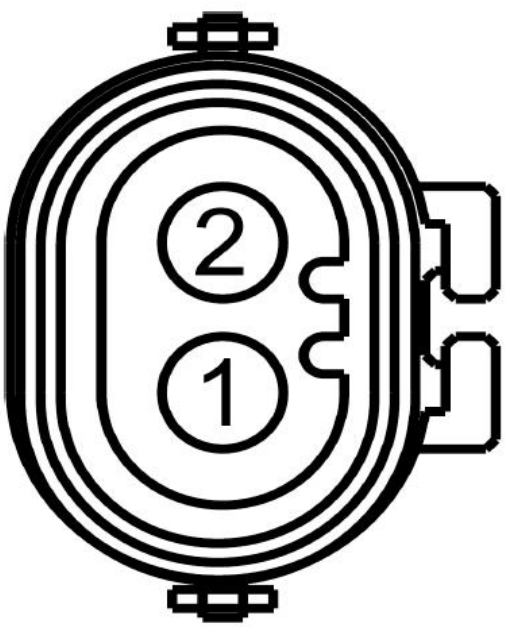
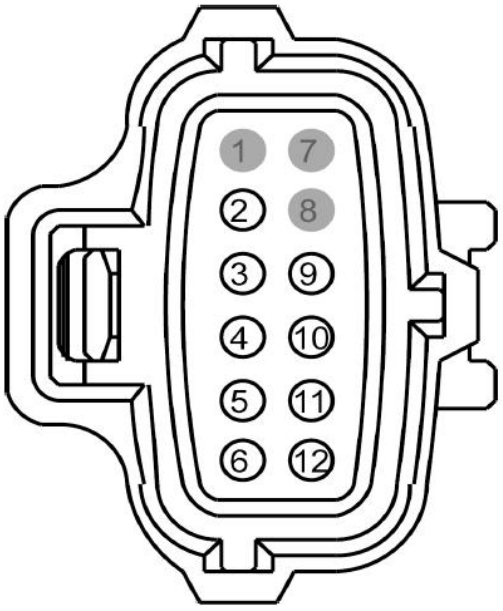


Fig. 38: Identifying Connector C162 (Fog Lamp, Right Front)
Courtesy of FORD MOTOR CO.

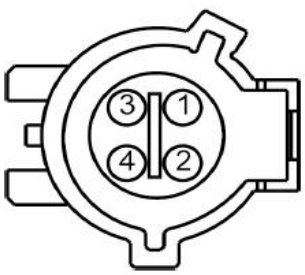
Connector: C167	Description:	Harness:	Base Part #:
	DIGITAL TRANSMISSION RANGE (DTR) SENSOR	12B637	7F293



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	359 (GY-RD)	20	Signal return	
3	1268 (RD-BK)	20	Digital Transmission Range (DTR) sensor, TR3A	
4	1144 (YE-BK)	20	Digital Transmission Range (DTR) sensor, TR1	
5	1145 (LB-BK)	20	Digital Transmission Range (DTR) sensor, TR2	
6	1143 (WH-BK)	20	Digital Transmission Range (DTR) sensor, TR4	
7	*	*	not used	
8	*	*	not used	
9	1789 (VT-WH)	20	Voltage in Start and Run (overload protected)	
10	33 (WH-PK)	20	Hot in start with park or neutral	
11	140 (BK-PK)	20	Voltage supplied in reverse	
12	262 (BN-PK)	20	Voltage supplied in Start (overload protected)	

Fig. 39: Identifying Connector C167 (Digital Transmission Range (DTR) Sensor)
Courtesy of FORD MOTOR CO.

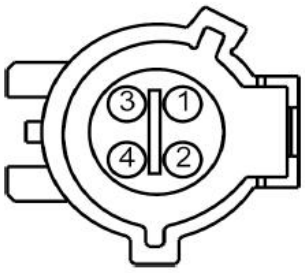
Connector: C171	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	387 (RD-WH)	18	Heated oxygen sensor (HO2S) #11 heater	
2	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
3	74 (GY-LB)	18	Heated oxygen sensor (HO2S) #11 input	
4	359 (GY-RD)	20	Signal return	

Fig. 40: Identifying Connector C171 (Heated Oxygen Sensor (HO2S) #11)
Courtesy of FORD MOTOR CO.

Connector: C172	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472

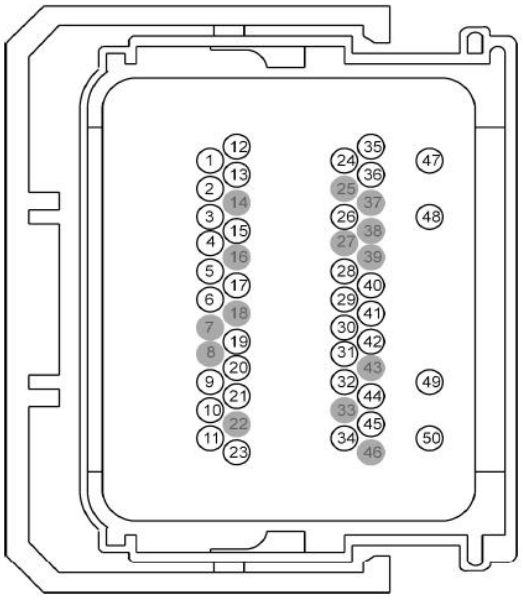


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	388 (YE-LB)	18	Heated oxygen sensor (HO2S) #21 heater	
2	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
3	94 (RD-BK)	18	Heated oxygen sensor (HO2S) #21 input	
4	359 (GY-RD)	20	Signal return	

Fig. 41: Identifying Connector C172 (Heated Oxygen Sensor (HO2S) #21)
Courtesy of FORD MOTOR CO.

Connector: C175B

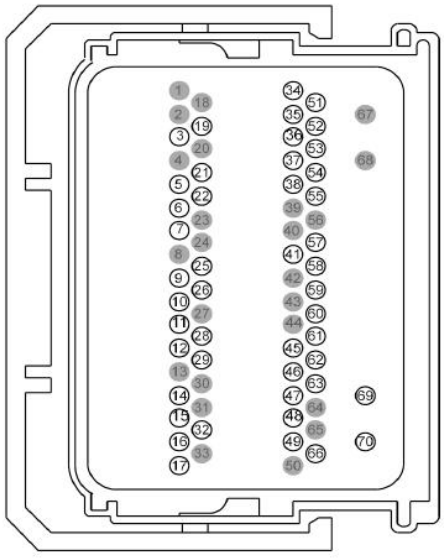
Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	14290	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	679 (GY-BK)	20	Vehicle speed signal	
2	3405 (BK)	20	Starter relay control	
3	791 (RD-PK)	20	Fuel tank pressure transducer sensor signal	
4	3093 (WH-LB)	20	Electronic throttle control, Vref 1	
5	1283 (TN-YE)	20	Accelerator pedal position 1 signal	
6	1284 (TN-WH)	20	Electronic throttle control, signal return	
7	*	*	not used	
8	*	*	not used	
9	636 (OG)	20	Deactivator switch signal	
10	57 (BK)	18	Ground	
11	1827 (WH-LG)	20	HS CAN +	
12	926 (LB-OG)	20	Modulated fuel pump signal	
13	91 (VT-WH)	20	EVAP canister vent control solenoid control	
14	*	*	not used	
14	73 (OG-LB)	20	A/C clutch relay control	
15	883 (PK-LB)	20	A/C Low pressure switch signal	
16	*	*	not used	
17	3012 (WH)	20	Accelerator pedal position 2 signal	
18	*	*	not used	
19	151 (LB-BK)	20	Speed control switch reference voltage	
20	1799 (YE-BK)	20	RDI/VEMS signal	
21	238 (DG-YE)	20	Fuel pump monitor	
22	*	*	not used	
23	1828 (PK-LG)	20	HS CAN -	
24	3091 (LB-BK)	20	Electronic throttle control, Vref 2	
25	*	*	not used	
26	1154 (WH-BK)	20	A/C pressure transducer sensor signal	
27	*	*	not used	
28	3015 (WH-RD)	20	Accelerator pedal position 3 signal	
29	224 (TN-WH)	20	Transmission control switch signal	
30	848 (DG-OG)	20	Speed control switch, Signal return	
31	1215 (WH-LG)	20	TX signal	
32	1816 (YE-LB)	20	Generator communication	
33	*	*	not used	
34	330 (YE-LG)	20	Power steering pressure switch signal	
35	361 (RD)	20	Voltage supplied in Start and Run (overload protected)	
36	361 (RD)	20	Voltage supplied in Start and Run (overload protected)	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	351 (BN-WH)	20	Reference voltage	
41	359 (GY-RD)	20	Signal return	
42	1216 (GY-OG)	20	RX signal	
43	*	*	not used	
44	107 (VT)	20	Flash/EEPROM power supply	
45	729 (RD-WH)	20	Voltage supplied at all times (overload protected)	
46	*	*	not used	
47	570 (BK-WH)	18	Ground	
48	570 (BK-WH)	18	Ground	
49	570 (BK-WH)	18	Ground	
50	570 (BK-WH)	18	Ground	

Fig. 42: Identifying Connector C175B (Powertrain Control Module (PCM))
Courtesy of FORD MOTOR CO.

Connector: C175E | **Description:** POWERTRAIN CONTROL MODULE (PCM) | **Harness:** 12B637 | **Base Part #:** 12A650



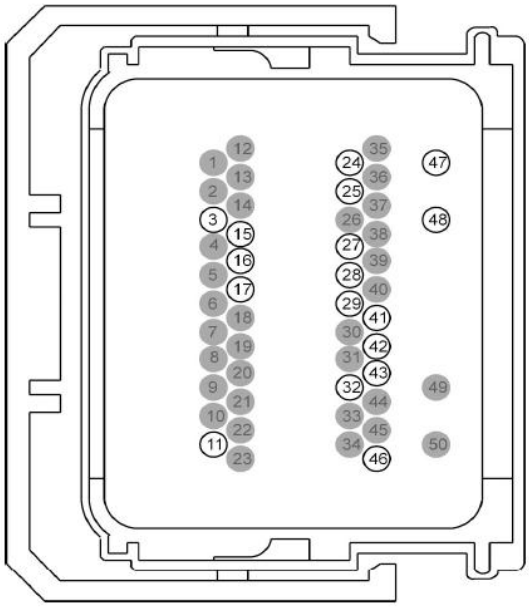
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	369 (WH-OG)	20	Heated PVC control	
4	*	*	not used	
5	1817 (YE)	20	Generator monitor circuit	
6	191 (LB-BK)	20	Vapor management volve control	
7	229 (RD-OG)	20	Engine cooling fan motor control	
8	*	*	not used	
9	1029 (WH-RD)	20	Coil on Plug (COP) 8 control	
10	1021 (LG-YE)	20	Coil on Plug (COP) 5 control	
11	1026 (PK-WH)	20	Coil on Plug (COP) 2 control	
12	1028 (WH-PK)	20	Coil on Plug (COP) 3 control	
13	*	*	not used	
14	1030 (DG-VT)	20	Coil on Plug (COP) 4 control	
15	1025 (OG-YE)	20	Coil on Plug (COP) 6 control	
16	1027 (PK-LB)	20	Coil on Plug (COP) 7 control	
17	1024 (LG-WH)	20	Coil on Plug (COP) 1 control	
18	*	*	not used	
19	1164 (LB)	20	Injector temperature sensor signal	
20	*	*	not used	
21	352 (BN-LG)	20	Differential Pressure Feedback EGR (DPFE) sensor input	
22	743 (GY)	20	Intake Air Temprature (IAT) sensor signal	
23	*	*	not used	
24	*	*	not used	
25	967 (LB-RD)	20	Mass Air Flow (MAF) sensor signal	
26	968 (TN-LB)	20	Mass Air Flow (MAF) sensor signal	
27	*	*	not used	
28	74 (GY-LB)	18	Heated oxygen sensor (HO2S) #11 input	
29	94 (RD-BK)	18	Heated oxygen sensor (HO2S) #21 input	
30	*	*	not used	
31	*	*	not used	

Fig. 43: Identifying Connector C175E (Powertrain Control Module (PCM)) (1 Of 2)
Courtesy of FORD MOTOR CO.

32	141 (RD-PK)	20	Injector presser sensor signal
33	*	*	not used
34	1835 (DB-YE)	20	Electornic throttle control motor +/-
35	556 (WH)	20	Fuel injector 2 control
36	558 (BN-LB)	20	Fuel injector 4 control
37	560 (LG-OG)	20	Fuel injector 6 control
38	562 (LB)	20	Fuel injector 8 control
39	*	*	not used
40	*	*	not used
41	1102 (YE-LG)	20	Cylinder head temperature sensor signal
42	*	*	not used
43	*	*	not used
44	*	*	not used
45	282 (DB-OG)	20	Camshaft Position sensor signal
46	139 (GY-YE)	20	Crankshaft position sensor -
47	138 (BK-PK)	20	Crankshaft postion sensor +
48	1273 (YE)	20	Knock sensor -
49	310 (YE-RD)	20	Knock sensor +
50	*	*	not used
51	1836 (OG-YE)	20	Electornic throttle control motor +/-
52	555 (TN)	20	Fuel injector 1 control
53	557 (BN-YE)	20	Fuel injector 3 control
54	559 (TN-BK)	20	Fuel injector 5 control
55	561 (TN-RD)	20	Fuel injector 7 control
56	*	*	not used
57	351 (BN-WH)	20	Reference voltage
58	359 (GY-RD)	20	Signal return
59	1858 (PK-OG)	20	Electronic throttle control module signal return
60	357 (YE-WH)	20	Throttle position (TPS) sensor signal 2
61	355 (GY-WH)	20	Throttle position (TPS) sensor signal 1
62	3067 (LB-RD)	20	Manifold Absolute Pressure (MAP) sensor input
63	360 (BN-PK)	20	EGR Vacuum regulator signal
64	*	*	not used
65	*	*	not used
66	1857 (YE-WH)	20	Electronic throttle control module reference voltage
67	*	*	not used
68	*	*	not used
69	387 (RD-WH)	18	Heated oxygen sensor (HO2S) #11 heater
70	388 (YE-LB)	18	Heated oxygen sensor (HO2S) #21 heater

Fig. 44: Identifying Connector C175E (Powertrain Control Module (PCM)) (2 Of 2)
Courtesy of FORD MOTOR CO.

Connector: C175T | **Description:** POWERTRAIN CONTROL MODULE (PCM) | **Harness:** 12B637 | **Base Part #:** 12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	136 (DB-YE)	20	Output shaft speed (OSS) sensor signal	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	925 (WH-YE)	20	Electronic Pressure Control (EPC) solenoid	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	970 (DG-WH)	20	Turbine shaft speed (TSS) sensor signal	
16	1144 (YE-BK)	20	Digital Transmission Range (DTR) sensor, TR1	
17	1145 (LB-BK)	20	Digital Transmission Range (DTR) sensor, TR2	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	392 (RD-LG)	18	Heated oxygen sensor (HO2S) #12 input	
25	393 (VT-LG)	18	Heated oxygen sensor (HO2S) #22 input	
26	*	*	not used	
27	1268 (RD-BK)	20	Digital Transmission Range (DTR) sensor, TR3A	
28	1143 (WH-BK)	20	Digital Transmission Range (DTR) sensor, TR4	
29	923 (OG-BK)	20	Transmission Fluid Temperature (TFT) sensor	
30	*	*	not used	
31	*	*	not used	
32	1269 (OG-RD)	20	Anti-theft indicator control	
33	*	*	not used	
34	*	*	not used	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	
41	359 (GY-RD)	20	Signal return	
42	237 (OG-YE)	20	Shift solenoid A	
43	315 (VT-OG)	20	Shift solenoid B	
44	*	*	not used	
45	*	*	not used	
46	126 (VT-YE)	20	Torque Converter Clutch (TCC) soleniod	
47	389 (WH-BK)	18	Heated oxygen sensor (HO2S) #12 heater	
48	390 (TN-YE)	18	Heated oxygen sensor (HO2S) #22 heater	
49	*	*	not used	
50	*	*	not used	

Fig. 45: Identifying Connector C175T (Powertrain Control Module (PCM))
Courtesy of FORD MOTOR CO.

Connector: C180 | **Description:** CAMSHAFT POSITION SENSOR | **Harness:** 12B637 | **Base Part #:** 6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	359 (GY-RD)	20	Signal return	
2	282 (DB-OG)	20	Camshaft Position sensor signal	

Fig. 46: Identifying Connector C180 (Camshaft Position Sensor)

Courtesy of FORD MOTOR CO.

Connector: C181	Description:	Harness:	Base Part #:
	FUEL INJECTOR 1	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	555 (TN)	20	Fuel injector 1 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

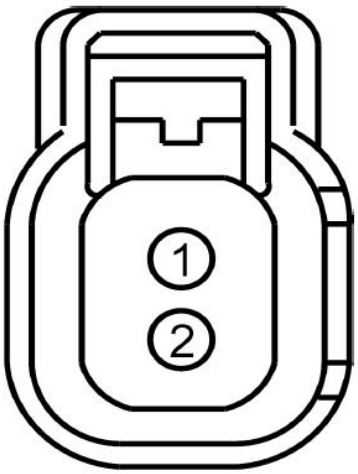


Fig. 47: Identifying Connector C181 (Fuel Injector 1)
Courtesy of FORD MOTOR CO.

Connector: C182	Description:	Harness:	Base Part #:
	FUEL INJECTOR 2	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	556 (WH)	20	Fuel injector 2 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

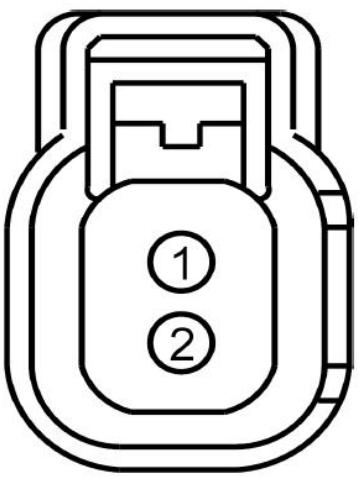


Fig. 48: Identifying Connector C182 (Fuel Injector 2)
Courtesy of FORD MOTOR CO.

Connector: C183	Description:	Harness:	Base Part #:
	FUEL INJECTOR 3	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	557 (BN-YE)	20	Fuel injector 3 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

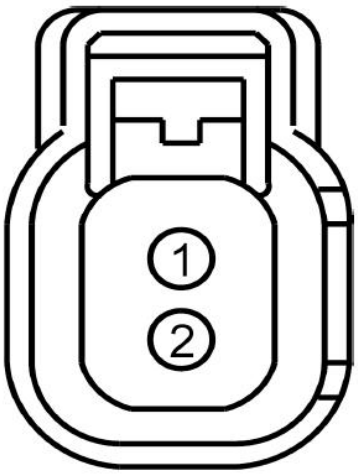


Fig. 49: Identifying Connector C183 (Fuel Injector 3)
Courtesy of FORD MOTOR CO.

Connector: C184	Description:	Harness:	Base Part #:
	FUEL INJECTOR 4	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	558 (BN-LB)	20	Fuel injector 4 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

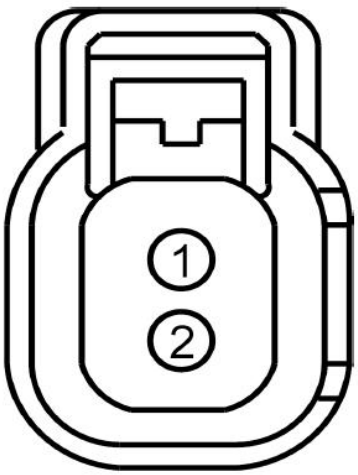


Fig. 50: Identifying Connector C184 (Fuel Injector 4)
Courtesy of FORD MOTOR CO.

Connector: C185	Description:	Harness:	Base Part #:
	FUEL INJECTOR 5	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	559 (TN-BK)	20	Fuel injector 5 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

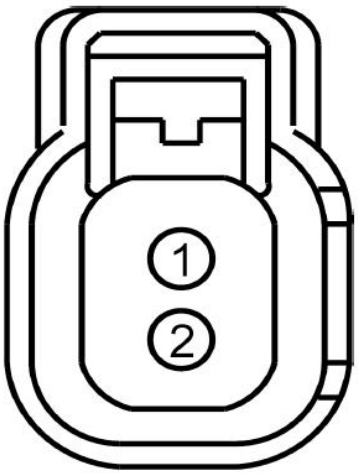


Fig. 51: Identifying Connector C185 (Fuel Injector 5)
Courtesy of FORD MOTOR CO.

Connector: C186	Description:	Harness:	Base Part #:
	FUEL INJECTOR 6	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	560 (LG-OG)	20	Fuel injector 6 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

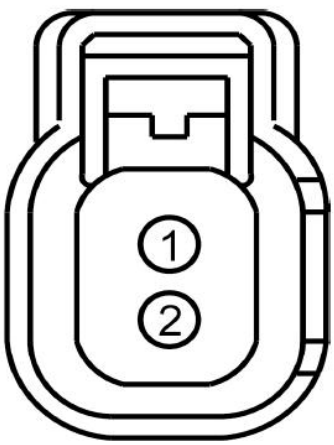


Fig. 52: Identifying Connector C186 (Fuel Injector 6)
Courtesy of FORD MOTOR CO.

Connector: C187	Description:	Harness:	Base Part #:
	FUEL INJECTOR 7	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	561 (TN-RD)	20	Fuel injector 7 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

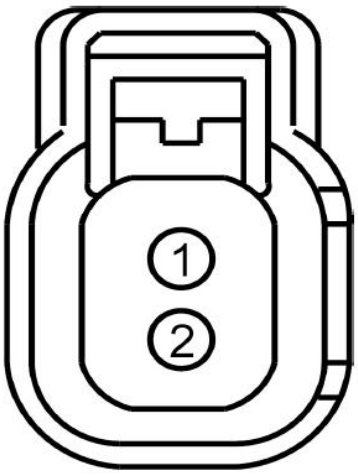


Fig. 53: Identifying Connector C187 (Fuel Injector 7)
Courtesy of FORD MOTOR CO.

Connector: C188	Description:	Harness:	Base Part #:
	FUEL INJECTOR 8	12B637	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	562 (LB)	20	Fuel injector 8 control	
2	1838 (WH-RD)	20	Voltage supplied in Start and Run (overload protected)	

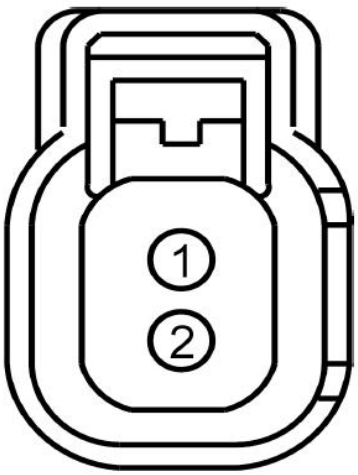


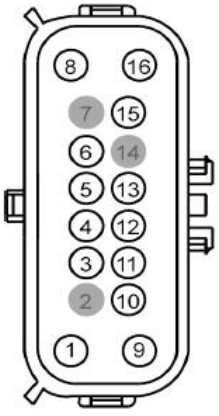
Fig. 54: Identifying Connector C188 (Fuel Injector 8)
Courtesy of FORD MOTOR CO.

Inline: C192

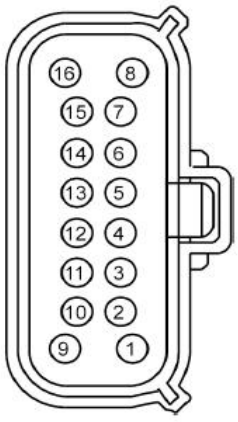
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	1118 (RD)	18	
2	*	*	
3	114 (LB-YE)	20	
4	115 (LG-BK)	20	
5	31 (WH-RD)	20	
6	57 (BK)	18	
7	*	*	
8	321 (GY-WH)	18	
9	1838 (WH-RD)	20	
10	35 (OG-LB)	20	
11	33 (WH-PK)	20	
12	570 (BK-WH)	20	
13	48 (OR-WH)	20	
14	*	*	
15	330 (YE-LG)	20	
16	391 (RD-YE)	18	

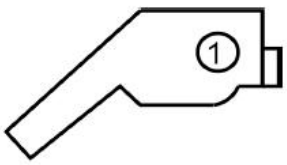
Fig. 55: Identifying Connector C192 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C197A

Description:
STARTER MOTOR

Harness:
14B060

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2037 (RD)	04	Battery cable +	

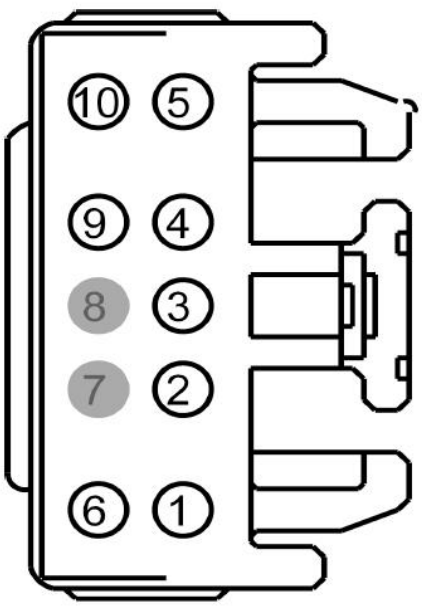
Fig. 56: Identifying Connector C197A (Starter Motor)
Courtesy of FORD MOTOR CO.

Connector: C197B	Description:	Harness:	Base Part #:
	STARTER MOTOR	14B060	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	113 (YE-LB)	12	Starter relay switched power	

Fig. 57: Identifying Connector C197B (Starter Motor)
Courtesy of FORD MOTOR CO.

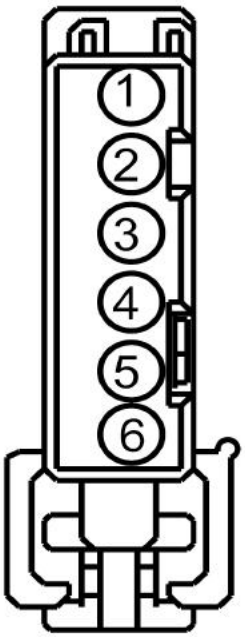
Connector: C202A	Description:	Harness:	Base Part #:
	MULTIFUCTION SWITCH	14401	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	44 (LB)	16	Turn lamps power feed	
2	3 (LG-WH)	20	Left turn signal	
3	2 (WH-LB)	20	Right turn signal	
4	10 (LG-RD)	16	Brake pedal position switch output	
5	5 (OG-LB)	16	Left rear turn signal	
6	383 (RD-WH)	16	Voltage supplied at all times (overload protected)	
7	*	*	not used	
8	*	*	not used	
9	1039 (BK-YE)	16	Voltage supplied in Run (overload protected)	
10	385 (WH-RD)	16	Rear flasher relay switched power	

Fig. 58: Identifying Connector C202A (Multifuction Switch)
Courtesy of FORD MOTOR CO.

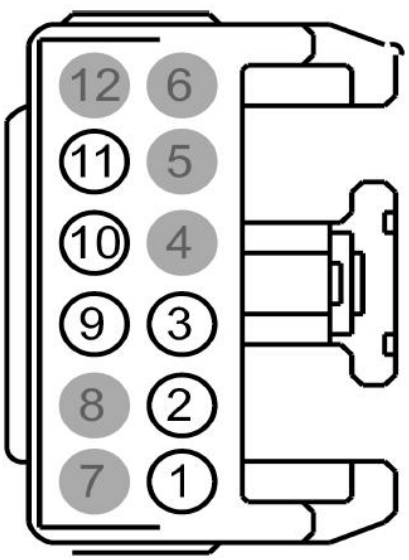
Connector: C202B	Description:	Harness:	Base Part #:
	MULTIFUNCTION SWITCH	14401	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	61 (YE-RD)	22	Front wiper switch circuit H	
2	680 (LB-OG)	22	Washer switch signal	
3	58 (WH)	22	Front wiper switch circuit B	
4	63 (RD)	22	Front wiper switch circuit A	
5	57 (BK)	22	Ground	
6	56 (DB-OG)	22	Front wiper switch circuit C	

Fig. 59: Identifying Connector C202B (Multifunction Switch)
Courtesy of FORD MOTOR CO.

Connector: C202C	Description:	Harness:	Base Part #:
	MULTIFUNCTION SWITCH	14401	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	380 (VT-YE)	18	Left cornering lamp control	
2	9 (LG-OG)	16	Left rear turn signal	
3	379 (BN-WH)	18	Cornering lamp control	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	57 (BK)	18	Ground	
10	12 (LG-BK)	18	High beam signal	
11	910 (PK)	18	Voltage supplied at all times (overload protected)	
12	*	*	not used	

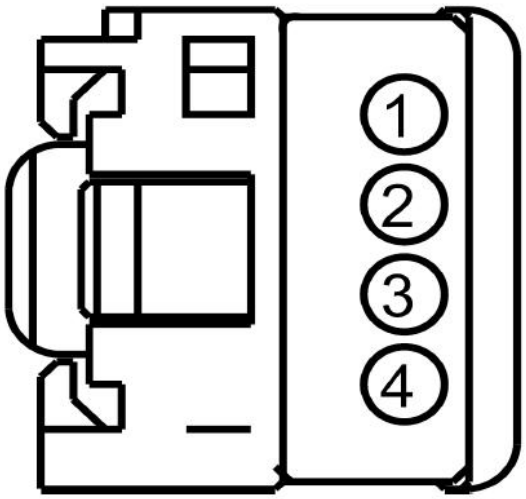
Fig. 60: Identifying Connector C202C (Multifunction Switch)
Courtesy of FORD MOTOR CO.

Connector: C203

Description: STEERING WHEEL/ SPEED CONTROL SWITCH

Harness: 13B319

Base Part #: 9E740



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	151 (LB-BK)	22	Speed control switch reference voltage	
2	848 (DG-OG)	22	Speed control switch, Signal return	
3	57 (BK)	22	Ground	
4	484 (OG-BK)	22	Switch illumination +	

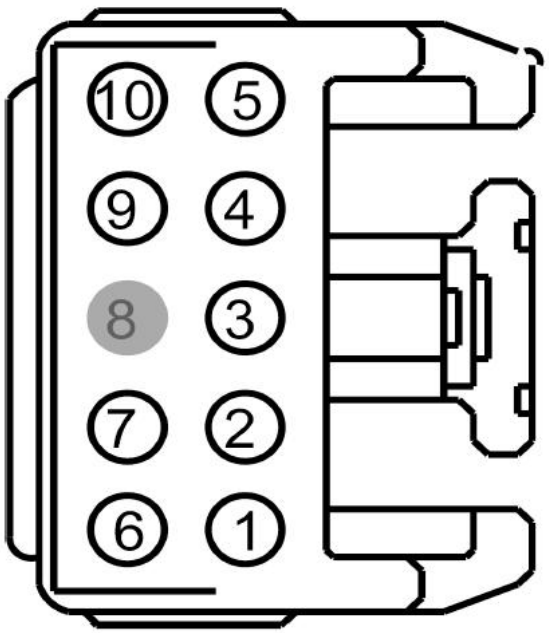
Fig. 61: Identifying Connector C203 (Steering Wheel/ Speed Control Switch)
Courtesy of FORD MOTOR CO.

Connector: C205A

Description: MAIN LIGHT SWITCH

Harness: 14401

Base Part #: 11654

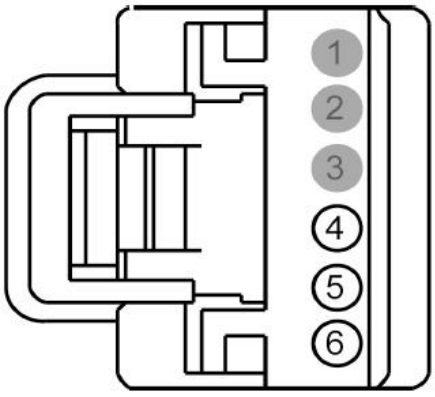


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	Ground	
2	484 (OG-BK)	22	Switch illumination +	
3	478 (TN-OG)	20	Fog lamp indicator feed	
4	220 (VT-OG)	22	Autolamp On/Off signal	
5	1032 (WH-BK)	22	Park lamps, On, signal	
6	477 (LB-BK)	22	Fog lamp signal	
7	57 (BK)	22	Ground	
8	*	*	not used	
9	1400 (TN-WH)	22	Headlamps Off signal	
10	1033 (RD-YE)	22	Headlamp, On, signal	

Fig. 62: Identifying Connector C205A (Main Light Switch)
Courtesy of FORD MOTOR CO.

Connector: C205B

Description:	Harness:	Base Part #:
MAIN LIGHT SWITCH	14401	11654



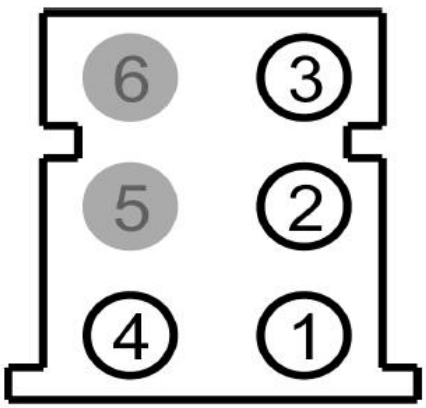
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	57 (BK)	22	Ground	
5	1034 (BK-WH)	22	Front dome lamp switch signal	
6	1036 (BN-WH)	22	Illumination dimmer signal	

Fig. 63: Identifying Connector C205B (Main Light Switch)
Courtesy of FORD MOTOR CO.

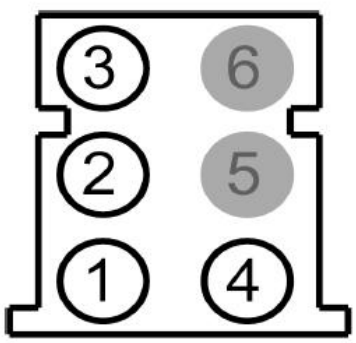
Inline: C210

Description:	Base Part #:
Inline	

MALE
Harness: 14401



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	752 (YE-RD)	12	
2	754 (LG-WH)	12	
3	37 (YE)	10	
4	260 (OG-BK)	20	
4	261 (OG-BK)	10	
5	*	*	
6	*	*	

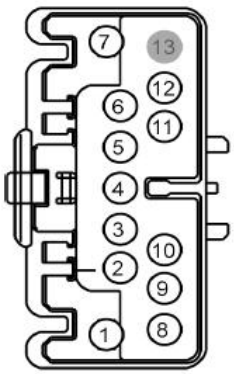
Fig. 64: Identifying Connector C210 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C211

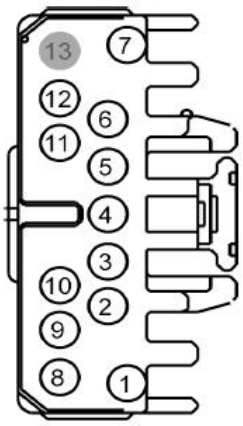
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	193 (YE-LG)	14	
2	705 (LB-OG)	18	14A005
3	53 (BK-LB)	22	
4	84 (VT-YE)	14	
5	10 (LG-RD)	14	14A005
5	10 (LG-RD)	18	14401
6	1495 (WH)	18	14401
6	1495 (WH)	20	14A005
7	517 (BK-WH)	14	
8	1523 (DG)	20	
9	14 (BN)	22	
10	1494 (RD)	18	14401
10	1494 (RD)	20	14A005
11	9 (LG-OG)	16	
12	5 (OG-LB)	16	
13	*	*	

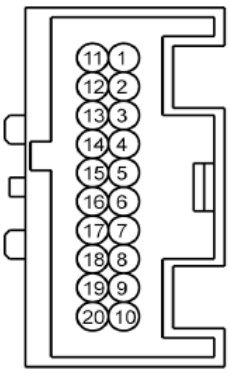
Fig. 65: Identifying Connector C211 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C213

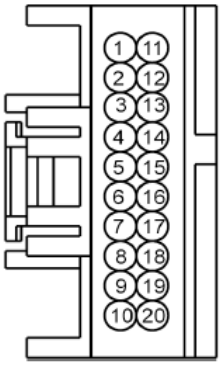
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14401



Pin: 5 - 1350(WH-PK) - Trunk lock disarm switch signal, Gauge: 22

Pin	Circuit	Gauge	Qualifier
1	1827 (WH-LG)	20	
1	48 (OG-WH)	22	
2	167 (BN-OG)	22	
2	1828 (PK-LG)	20	
3	168 (RD-BK)	22	
3	2318 (LG-RD)	20	14401
3	2318 (LG-RD)	20	14A005 - POLICE WITH FIRE SUPPRESSION
3	57 (BK)	20	14A005 - POLICE WITHOUT FIRE SUPPRESSION
4	25 (DG-VT)	20	14401
4	25 (DG-VT)	22	14A005
4	70 (LB-WH)	22	
5	1350 (WH-PK)	22	
6	1040 (RD-BK)	20	
6	246 (RD-BK)	20	
7	29 (YE-WH)	20	
8	1010 (DB-OG)	22	
9	1092 (PK-OG)	20	
10	2319 (RD-YE)	20	
11	801 (TN-YE)	18	
12	800 (GY-LB)	18	
13	804 (OG-LG)	18	
14	813 (LB-WH)	18	
15	173 (DG-VT)	22	
16	1843 (BK-OG)	20	14A005
16	1843 (BK-OG)	22	14401
17	486 (BN-WH)	20	14A005
17	486 (BN-WH)	22	14401
18	964 (DB-LG)	20	14A005
18	964 (DB-LG)	22	14401
19	298 (VT-OG)	20	14A005
19	298 (VT-OG)	22	14401
20	569 (DG)	20	

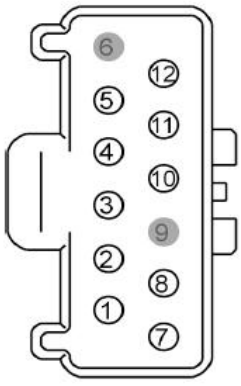
Fig. 66: Identifying Connector C213 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C214

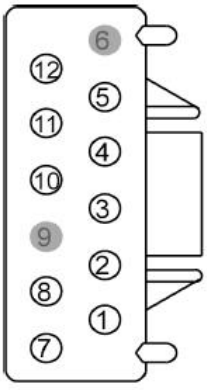
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	517 (BK-WH)	14	
2	1048 (LB-WH)	14	
3	2300 (RD)	14	
4	931 (RD-BK)	14	14290
4	931 (RD-BK)	18	14A005
5	688 (GY-LB)	18	
6	*	*	
7	186 (BN-LB)	20	
8	57 (BK)	20	
9	*	*	
10	57 (BK)	20	
11	57 (BK)	20	
12	57 (BK)	20	

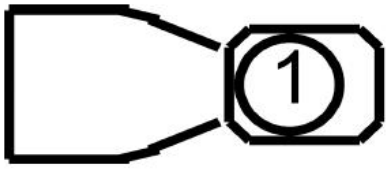
Fig. 67: Identifying Connector C214 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C217A

Description:
HORN SWITCH

Harness:
13B319

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1 (DB)	22	Horn relay control	

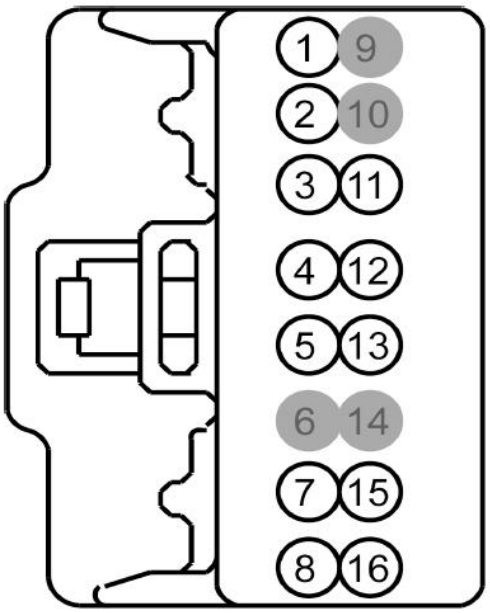
Fig. 68: Identifying Connector C217A (Horn Switch)
Courtesy of FORD MOTOR CO.

Connector: C217B | **Description:** HORN SWITCH | **Harness:** 13B319 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	460 (YE-LB)	22	Ground	

Fig. 69: Identifying Connector C217B (Horn Switch)
Courtesy of FORD MOTOR CO.

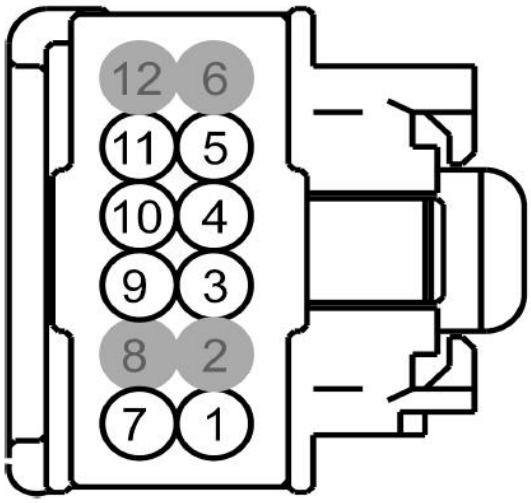
Connector: C218A | **Description:** AIR BAG SLIDING CONTACT | **Harness:** 14401 | **Base Part #:** 14A664



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	614 (GY-OG)	20	Driver air bag feed	
2	615 (GY-WH)	20	Driver air bag return	
3	848 (DG-OG)	22	Speed control switch, Signal return	
4	1070 (BN-LB)	22	Audio/climate control switch, Climate, signal	
5	595 (LB-RD)	22	Audio/climate control switch, Radio, signal	
6	*	*	not used	
7	1516 (YE-WH)	20	Driver air bag feed 2, signal	
8	1517 (RD-OG)	20	Driver air bag feed 2, return	
9	*	*	not used	
10	*	*	not used	
11	1 (DB)	22	Horn relay control	
12	484 (OG-BK)	22	Switch illumination +	
13	151 (LB-BK)	22	Speed control switch reference voltage	
14	*	*	not used	
15	57 (BK)	22	Ground	
16	460 (YE-LB)	20	Horn switch ground	

Fig. 70: Identifying Connector C218A (Air Bag Sliding Contact)
Courtesy of FORD MOTOR CO.

Connector: C218B | **Description:** AIR BAG SLIDING CONTACT | **Harness:** 13B319 | **Base Part #:** 14A664

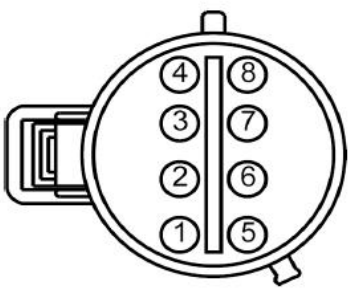


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	460 (YE-LB)	22	Horn switch ground	
2	*	*	not used	
3	151 (LB-BK)	22	Speed control switch reference voltage	
4	484 (OG-BK)	22	Switch illumination +	
5	1 (DB)	22	Horn relay control	
6	*	*	not used	
7	57 (BK)	22	Ground	
8	*	*	not used	
9	595 (LB-RD)	22	Audio/climate control switch, Radio, signal	
10	1070 (BN-LB)	22	Audio/climate control switch, Climate, signal	
11	848 (DG-OG)	22	Speed control switch, Signal return	
12	*	*	not used	

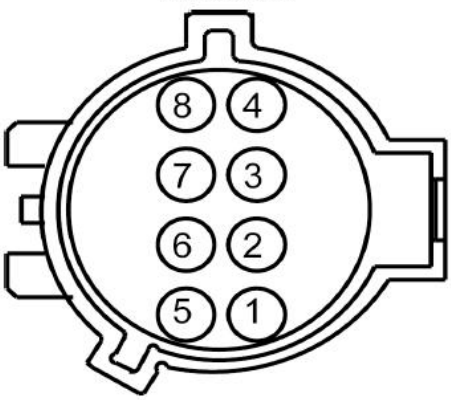
Fig. 71: Identifying Connector C218B (Air Bag Sliding Contact)
Courtesy of FORD MOTOR CO.

Inline: C219 | **Description:** Inline | **Base Part #:**

MALE
Harness: 14401



FEMALE
Harness: 14B079

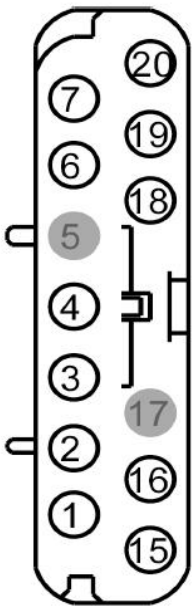


Pin	Circuit	Gauge	Qualifier
1	57 (BK)	22	
2	57 (BK)	22	
3	484 (OR-BK)	22	
4	1049 (BN-PK)	16	
5	57 (BK)	16	
6	224 (TN-WH)	22	
7	40 (LB-WH)	16	14B079
7	40 (LB-WH)	18	14401
8	640 ()		

Fig. 72: Identifying Connector C219 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C228A

Description:	Harness:	Base Part #:
HVAC MODULE, EATC	14401	19980

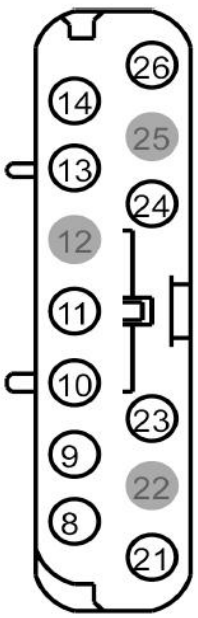


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	915 (PK-LB)	22	SCP Bus -	
2	1566 (RD-YE)	20	Voltage supplied at all times (overload protected)	
3	57 (BK)	20	Ground	
4	3059 (YE-LG)	20	Signal return	
5	*	*	not used	
6	600 (DB)	22	Air temperature door variable resistor +	
7	3061 (LB-OG)	20	Ambient air temperature sensor signal	
15	914 (TN-OG)	22	SCP Bus +	
16	1812 (BN-WH)	20	Blower motor relay control	
17	*	*	not used	
18	437 (YE-LG)	22	Air temperature door variable resistor signal	
19	19 (LB-RD)	22	Variable dimmer Instrument illumination feed	
20	476 (BN-YE)	22	Sunload sensor, driver side signal	

Fig. 73: Identifying Connector C228A (HVAC Module, EATC)
Courtesy of FORD MOTOR CO.

Connector: C228B

Description:	Harness:	Base Part #:
HVAC MODULE, EATC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
8	1070 (BN-LB)	22	Audio/climate control switch, Climate, signal	
9	438 (RD-WH)	22	Temperature blend door variable resistor -	
10	260 (OG-BK)	20	Blower motor speed controller input	
11	348 (VT)	20	A/C demand signal	
12	*	*	not used	
13	245 (BK)	22	Ground	
14	484 (OG-BK)	22	Switch illumination +	
21	3060 (GY-RD)	22	In-vehicle temperature sensor signal	
22	*	*	not used	
23	752 (YE-RD)	20	Blower motor speed control, common	
24	754 (LG-WH)	20	Blower motor speed control, high	
25	*	*	not used	
26	246 (VT)	22	Temperature blend door actuator, driver +/-	

Fig. 74: Identifying Connector C228B (HVAC Module, EATC)
Courtesy of FORD MOTOR CO.

Connector: C233

Description:	Harness:	Base Part #:
IN-VEHICLE TEMPERATURE SENSOR	14401	19C734

Pin: 1 - 3060(GY-RD) - In-vehicle temperature sensor signal, Gauge: 22

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	3060 (GY-RD)	22	In-vehicle temperature sensor signal	
2	3059 (YE-LG)	20	Signal return	

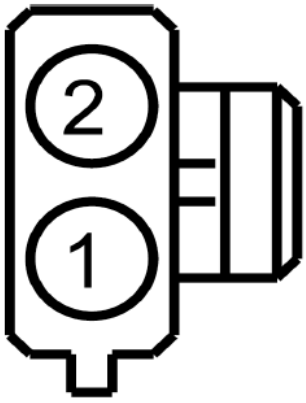
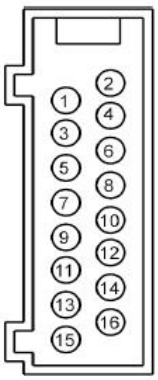


Fig. 75: Identifying Connector C233 (In-Vehicle Temperature Sensor)
Courtesy of FORD MOTOR CO.

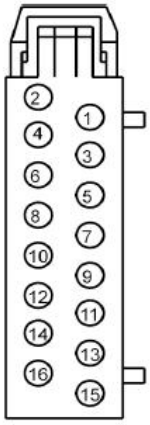
Inline: C237

Description:	Base Part #:
Inline	

MALE
Harness: 14A005



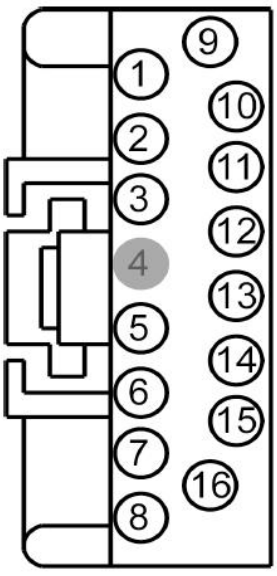
FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	436 (RD-LG)	20	
2	484 (OG-BK)	20	
3	600 (DB)	20	
4	1040 (RD-BK)	22	14401
4	246 (VT)	20	
5	245 (BN-LB)	20	
6	437 (YE-LG)	20	
7	437 (YE-LG)	22	
8	802 (OG-RD)	20	
9	438 (RD-WH)	22	
10	803 (BN-PK)	18	
11	937 (RD-WH)	20	14401
11	937 (RD-WH)	22	14A005
12	59 (DG-VT)	20	
13	805 (WH-LG)	20	
14	679 (GY-BK)	22	
15	811 (DG-OG)	18	
16	676 (PK-OG)	16	14401
16	676 (PK-OG)	18	14A005

Fig. 76: Identifying Connector C237 (Inline)
Courtesy of FORD MOTOR CO.

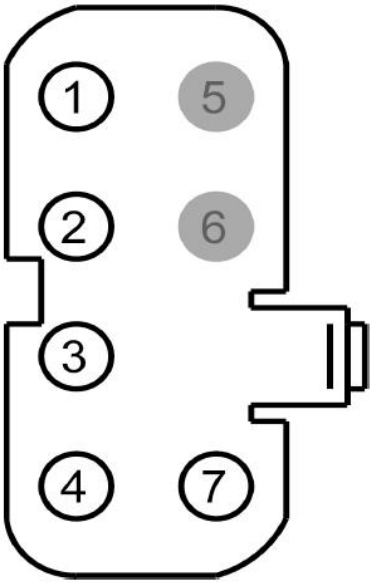
Connector: C240 | **Description:** AUDIO UNIT | **Harness:** 14401 | **Base Part #:** 18806



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	484 (OG-BK)	22	Switch illumination +	
2	57 (BK)	20	Ground	
3	1000 (RD-BK)	22	Hot in start with park or neutral	
4	*	*	not used	
5	802 (OG-RD)	18	Speaker, right rear +	
6	803 (BN-PK)	18	Speaker, right rear -	
7	805 (WH-LG)	18	Speaker, right front +	
8	811 (DG-OG)	18	Speaker, right front -	
9	1772 (VT)	16	Voltage supplied at all times (overload protected)	
10	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
11	694 (BK-LG)	18	Ground	
12	800 (GY-LB)	18	Speaker, left rear +	
13	801 (TN-YE)	18	Speaker, left rear -	
14	804 (OG-LG)	18	Speaker, left front +	
15	813 (LB-WH)	18	Speaker, left front -	
16	694 (BK-LG)	16	Ground	

Fig. 77: Identifying Connector C240 (Audio Unit)
Courtesy of FORD MOTOR CO.

Connector: C241 | **Description:** REAR WINDOW DEFROST SWITCH | **Harness:** 14401 | **Base Part #:** 18578



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1010 (DB-OG)	22	Rear defrost switch signal on demand	
2	57 (BK)	22	Ground	
3	484 (OG-BK)	22	Switch illumination +	
4	59 (DG-VT)	20	Fused rear window defrost relay, switched power	
5	*	*	not used	
6	*	*	not used	
7	57 (BK)	22	Ground	

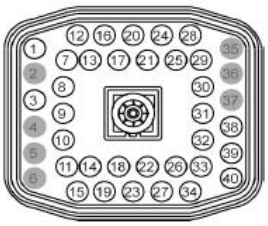
Fig. 78: Identifying Connector C241 (Rear Window Defrost Switch)
Courtesy of FORD MOTOR CO.

Inline: C248

Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14A005

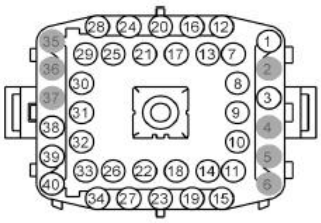
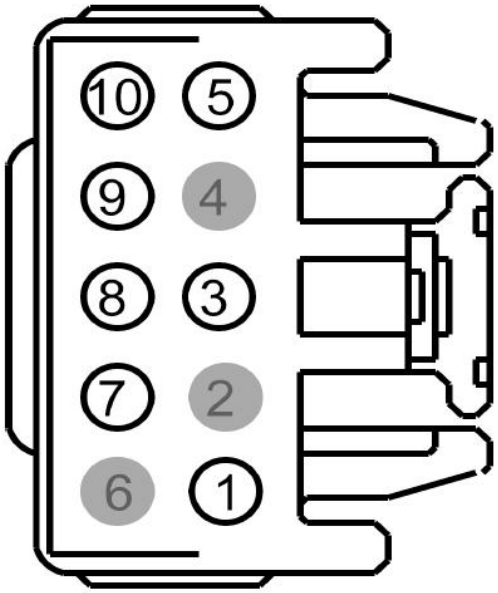


Fig. 79: Identifying Connector C248 (Inline) (1 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit	Gauge	Qualifier
1	165 (TN-WH)	20	police
2	*	*	
3	1213 (WH-LB)	14	14290
3	1213 (WH-LB)	16	14A005
4	*	*	
5	*	*	
6	*	*	
7	140 (BK-PK)	14	14290
7	140 (BK-PK)	18	14A005
8	729 (RD-WH)	20	
9	409 (TN-BK)	20	
10	359 (GY-RD)	20	14290
10	359 (GY-RD)	22	14A005
11	351 (BN-WH)	20	
12	620 (VT-LB)	20	14290
12	620 (VT-LB)	22	14A005
13	519 (LG-BK)	20	
14	238 (DG-YE)	20	14290
14	238 (DG-YE)	22	14A005
15	3012 (WH)	20	14290
15	3012 (WH)	22	14A005
16	619 (PK-WH)	20	14290
16	619 (PK-WH)	22	14A005
17	518 (LG-RD)	20	
18	791 (RD-PK)	20	
19	636 (OG)	18	14A005
19	636 (OG)	20	14290
20	617 (PK-OG)	20	14290
20	617 (PK-OG)	22	14A005
21	523 (RD-PK)	18	14A005
21	523 (RD-PK)	20	14290
22	3093 (WH-LB)	20	14290
22	3093 (WH-LB)	22	14A005
23	3015 (WH-RD)	20	14290
23	3015 (WH-RD)	22	14A005
24	618 (VT-LG)	20	14290
24	618 (VT-LG)	22	14A005
25	524 (PK-BK)	18	14A005
25	524 (PK-BK)	20	14290
26	3091 (LB-BK)	20	14290
26	3091 (LB-BK)	22	14A005
27	91 (VT-WH)	20	
28	1827 (WH-LG)	22	
29	1828 (PK-LG)	22	
30	14 (BN)	20	
31	359 (GY-RD)	20	
32	1283 (TN-YE)	20	14290
32	1283 (TN-YE)	22	14A005
33	926 (LB-OG)	20	14290
33	926 (LB-OG)	22	14A005
34	1284 (TN-WH)	20	14290
34	1284 (TN-WH)	22	14A005
35	*	*	
36	*	*	
37	*	*	
38	1271 (VT)	14	14290
38	1271 (VT)	16	14A005
38	720 (RD-YE)	14	14290
38	720 (RD-YE)	16	14A005
39	366 (RD-BK)	12	14A005
39	366 (RD-BK)	14	14290
40	1119 (RD)	12	14290
40	1119 (RD)	14	14A005

Fig. 80: Identifying Connector C248 (Inline) (2 Of 2)
Courtesy of FORD MOTOR CO.

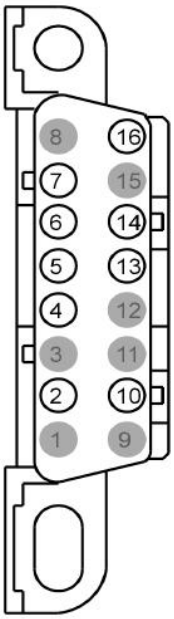
Connector: C250 | **Description:** IGNITION SWITCH | **Harness:** 14401 | **Base Part #:** 11572



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1717 (VT-OG)	12	Voltage in Start and Run (overload protected)	
2	*	*	not used	
3	1716 (GY-YE)	18	Key warning switch signal	
4	*	*	not used	
5	296 (WH-VT)	12	Voltage in Run or Accessory (overload protected)	
6	*	*	not used	
7	687 (GY-YE)	12	Voltage in Run (overload protected)	
8	1050 (LG-VT)	10	Voltage supplied at all times (overload protected)	
9	1050 (LG-VT)	10	Voltage supplied at all times (overload protected)	
10	1522 (DG)	16	Voltage supplied in Start (overload protected)	

Fig. 81: Identifying Connector C250 (Ignition Switch)
Courtesy of FORD MOTOR CO.

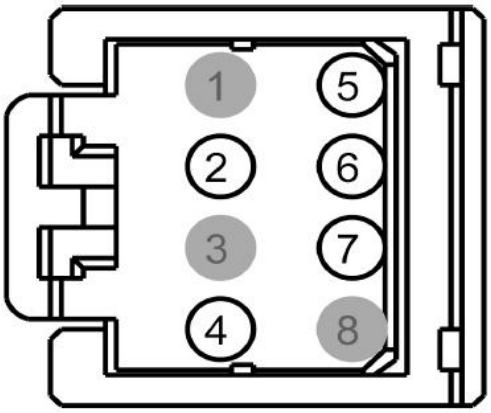
Connector: C251 | **Description:** DATA LINK CONNECTOR (DLC) | **Harness:** 14401 | **Base Part #:** 14489



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	914 (TN-OG)	22	SCP Bus +	
3	*	*	not used	
4	57 (BK)	18	Ground	
5	570 (BK-WH)	18	Ground	
6	1827 (WH-LG)	20	HS CAN +	
7	70 (LB-WH)	22	ISO Bus	
8	*	*	not used	
9	*	*	not used	
10	915 (PK-LB)	22	SCP Bus -	
11	*	*	not used	
12	*	*	not used	
13	107 (VT)	22	Flash/EEPROM power supply	
14	1828 (PK-LG)	20	HS CAN -	
15	*	*	not used	
16	40 (LB-WH)	18	Voltage supplied at all times (overload protected)	

Fig. 82: Identifying Connector C251 (Data Link Connector (DLC))
Courtesy of FORD MOTOR CO.

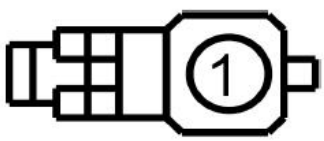
Connector: C253	Description:	Harness:	Base Part #:
	MESSAGE CENTER SWITCH	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	57 (BK)	22	Ground	
3	*	*	not used	
4	1411 (GY-OG)	22	Message center signal return	
5	143 (LB-YE)	22	Message center switch 1	
6	152 (LB-WH)	22	Message center switch 2	
7	484 (OG-BK)	22	Switch illumination +	
8	*	*	not used	

Fig. 83: Identifying Connector C253 (Message Center Switch)
Courtesy of FORD MOTOR CO.

Connector: C254	Description:	Harness:	Base Part #:
	GLOVE BOX LAMP	14401	14413



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	705 (LG-OG)	20	Demand lighting	

Fig. 84: Identifying Connector C254 (Glove Box Lamp)
Courtesy of FORD MOTOR CO.

Connector: C256

Description:	Harness:	Base Part #:
PASSENGER AIR BAG MODULE	14401	15044A74

Pin: 4 - 1519(LG-RD) - Passenger air bag feed 2, return, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	607 (LB-OG)	20	Passenger air bag feed	
2	616 (PK-BK)	20	Passenger air bag return	
3	1518 (BK-WH)	20	Passenger air bag feed 2, signal	
4	1519 (LG-RD)	20	Passenger air bag feed 2, return	

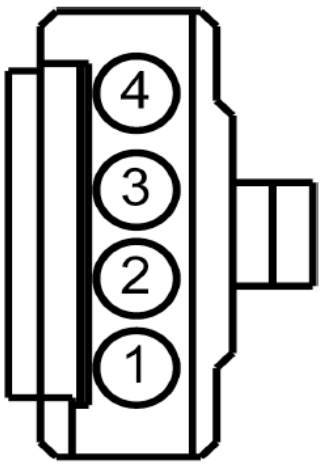
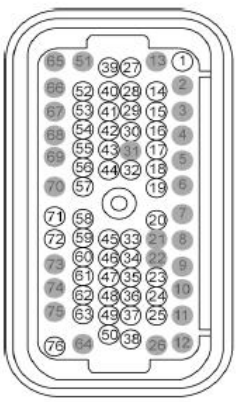


Fig. 85: Identifying Connector C256 (Passenger Air Bag Module)
Courtesy of FORD MOTOR CO.

Inline: C260

Description:	Base Part #:
Inline	

MALE
Harness: 14290



FEMALE
Harness: 14401

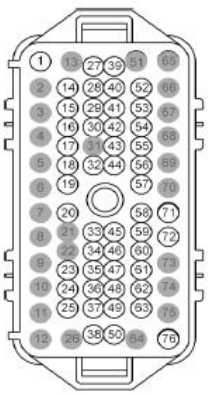


Fig. 86: Identifying Connector C260 (Inline) (1 Of 3)
Courtesy of FORD MOTOR CO.

Pin	Circuit	Gauge	Qualifier
1	570 (BK-WH)	14	14290
1	570 (BK-WH)	18	14401
2	*	*	
3	*	*	
4	*	*	
5	*	*	
6	*	*	
7	*	*	
8	*	*	
9	*	*	
10	*	*	
11	*	*	
12	*	*	
13	*	*	
14	1827 (WH-LG)	14	14290
14	1827 (WH-LG)	20	14401
15	1828 (PK-LG)	14	14290
15	1828 (PK-LG)	20	14401
16	1304 (VT-OG)	20	14290
16	1304 (VT-OG)	22	14401
17	3 (LG-WH)	18	14290
17	3 (LG-WH)	20	14401
18	380 (VT-YE)	18	
19	3061 (LB-OG)	14	14290
19	3061 (LB-OG)	20	14401
20	107 (VT)	20	14290
20	107 (VT)	22	14401
21	*	*	
21	3059 (YE-LG)	20	
22	*	*	
22	348 (VT)	20	
23	2 (WH-LB)	18	14290
23	2 (WH-LB)	20	14401
24	1789 (VT-WH)	20	
25	460 (YE-LB)	20	
26	*	*	
27	63 (RD)	20	14290
27	63 (RD)	22	14401
28	1651 (WH-RD)	20	
29	1266 (RD-YE)	20	
30	1003 (GY-YE)	20	
31	*	*	
32	964 (DG-LG)	20	
33	262 (BN-PK)	20	
34	977 (VT-WH)	20	
35	1799 (YE-BK)	20	14290
35	1799 (YE-BK)	22	14401
36	28 (BK-PK)	20	14290
36	28 (BK-PK)	22	14401
37	1000 (RD)	20	
37	1812 (BN-WH)	20	
38	61 (YE-RD)	20	14290
38	61 (YE-RD)	22	14401
39	56 (DB-OG)	20	14290
39	56 (DB-OG)	22	14401

Fig. 87: Identifying Connector C260 (Inline) (1 Of 3)
Courtesy of FORD MOTOR CO.

40	65 (DG)	20	
41	175 (BK-YE)	20	police crown
41	379 (BN-WH)	18	
41	705 (LG-OG)	20	police
42	249 (BN-WH)	20	14290
42	249 (BN-WH)	22	14401
42	82 (PK-YE)	20	
43	1335 (YE-WH)	20	
44	161 (DG-OG)	20	
45	160 (DB-WH)	20	
46	1337 (VT-YE)	20	
47	1269 (OG-RD)	20	14290
47	1269 (OG-RD)	22	14401
48	679 (GY-BK)	20	14290
48	679 (GY-BK)	22	14401
49	959 (GY)	18	14401
49	959 (GY)	20	14290
50	676 (PK-OG)	20	
51	*	*	
52	1049 (BN-PK)	20	
53	478 (TN-OG)	20	
54	31 (WH-RD)	20	
55	1 (DB)	20	14290
55	1 (DB)	22	14401
56	151 (LB-BK)	20	14290
56	151 (LB-BK)	22	14401
57	848 (DG-OG)	20	14290
57	848 (DG-OG)	22	14401
58	1215 (WH-LG)	20	14290
58	1215 (WH-LG)	22	14401
58	854 (GY-WH)	20	police
59	1216 (GY-OG)	20	14290
59	1216 (GY-OG)	22	14401
59	876 (DG-LG)	20	police crown
60	1347 (DB-WH)	20	14290
60	1347 (DB-WH)	22	14401
61	224 (TN-WH)	20	14290
61	224 (TN-WH)	22	14401
62	680 (LB-OG)	20	14290
62	680 (LB-OG)	22	14401
63	58 (WH)	20	14290
63	58 (WH)	22	14401
64	*	*	
65	*	*	
66	*	*	
67	*	*	
68	*	*	
69	*	*	
70	*	*	
71	1050 (LG-VT)	20	
72	1052 (TN-BK)	16	
73	*	*	
74	*	*	
75	*	*	
76	768 (BN-YE)	20	

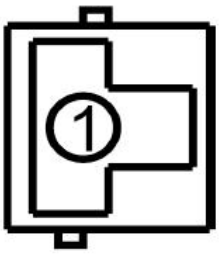
Fig. 88: Identifying Connector C260 (Inline) (3 Of 3)
Courtesy of FORD MOTOR CO.

Inline: C263

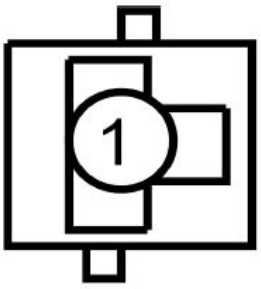
Description:
Inline

Base Part #:

MALE
Harness: 15A591



FEMALE
Harness: 15A591



Pin	Circuit	Gauge	Qualifier
1	1 (DB)	22	

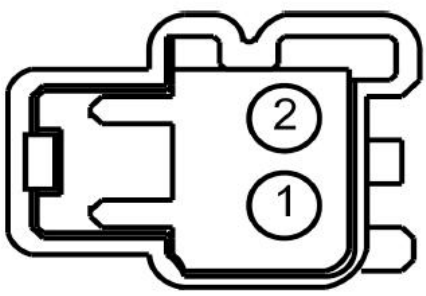
Fig. 89: Identifying Connector C263 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C264

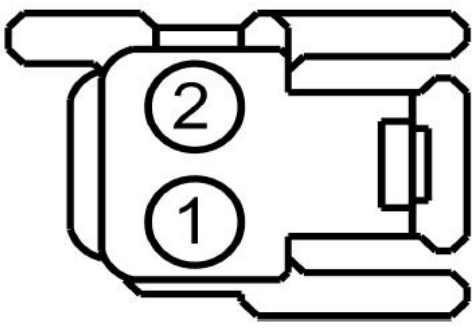
Description:
Inline

Base Part #:

MALE
Harness: 14N000



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	2136 (OG)	20	
2	2137 (RD-LB)	20	

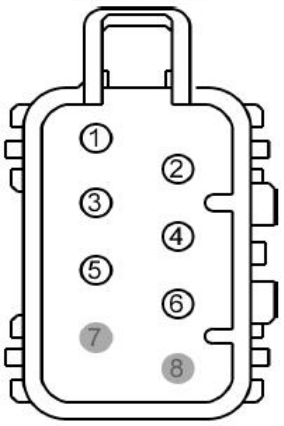
Fig. 90: Identifying Connector C264 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C268

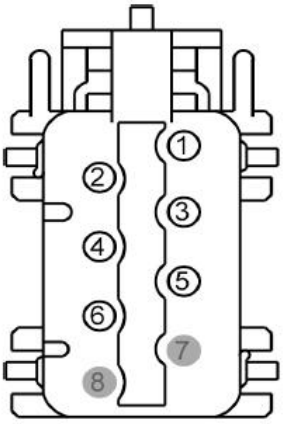
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 15A599



Pin	Circuit	Gauge Qualifier
1	3258 (RD-YE)	10
2	2301 (RD-WH)	10
3	2300 (RD)	10
3	57 (BK)	14
4	57 (BK)	14
5	2301 (RD-WH)	10
6	2300 (RD)	10
7	*	*
8	*	*

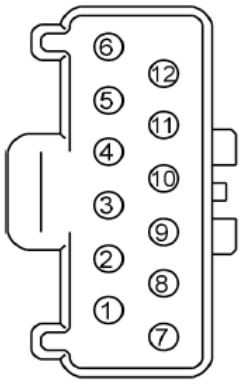
Fig. 91: Identifying Connector C268 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C275

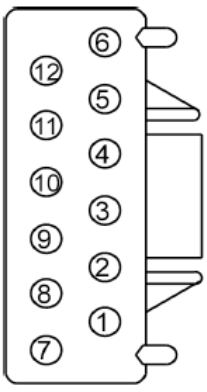
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness:



Pin: 9 - 3010(TN), Gauge: 10

Pin	Circuit	Gauge	Qualifier
1	1000 (RD)	20	police crown
2	679 (GY-BK)	16	
3	705 (LG-OG)	16	
3	876 (DG-LG)	18	police crown
4	726 (LG)	10	
5	1669 (OG-LG)	20	
6	792 (TN-YE)	10	
7	3985 (PK)	10	
7	3985 (PK)	14	police crown
7	401 (PK)	10	
8	1048 (LB-WH)	10	14290
8	1048 (LB-WH)	14	14A005
9	3010 (TN)	10	
10	175 (BK-YE)	18	
11	1504 (RD-WH)	10	
12	845 (GY-WH)	18	police crown

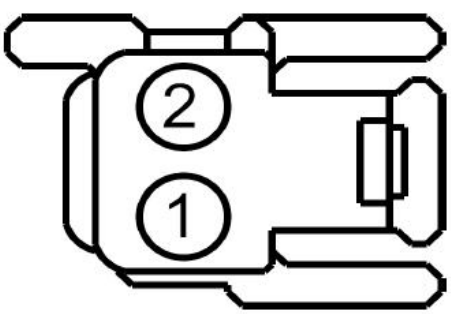
Fig. 92: Identifying Connector C275 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C277

Description:
DEACTIVATION SWITCH

Harness:
14A005

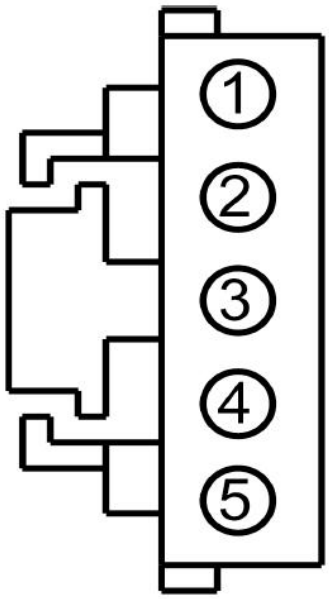
Base Part #:
9C872



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1119 (RD)	18	Voltage supplied at all times (overload protected)	
2	636 (OG)	18	Deactivator switch signal	

Fig. 93: Identifying Connector C277 (Deactivation Switch)
Courtesy of FORD MOTOR CO.

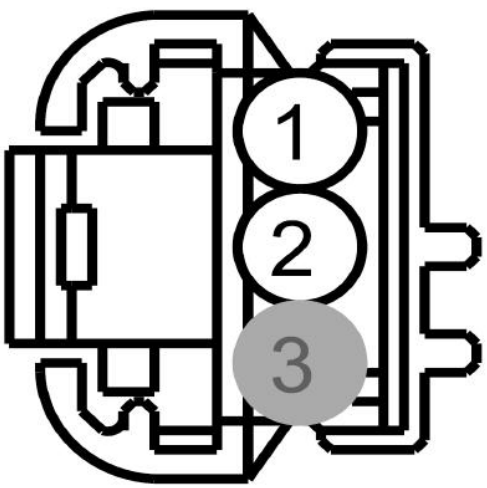
Connector: C278	Description:	Harness:	Base Part #:
	BRAKE PEDAL POSITION (BPP) SWITCH	14A005	13480



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1119 (RD)	14	Voltage supplied at all times (overload protected)	
2	10 (LG-RD)	14	Brake pedal position switch, switched power	
3	1119 (RD)	18	Voltage supplied at all times (overload protected)	
4	511 (LG)	18	Brake pedal position switch signal	
5	57 (BK)	18	Ground	

Fig. 94: Identifying Connector C278 (Brake Pedal Position (BPP) Switch)
Courtesy of FORD MOTOR CO.

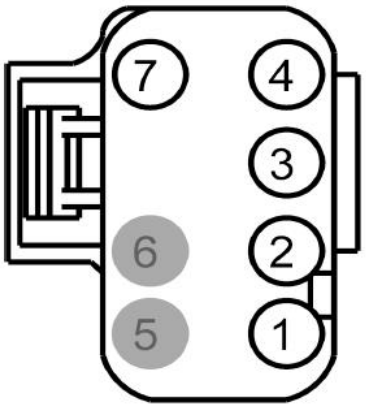
Connector: C279	Description:	Harness:	Base Part #:
	TRANSMISSION CONTROL SWITCH	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	640 (RD-YE)	22	Voltage supplied in Start and Run (overload protected)	
2	224 (TN-WH)	22	Transmission control switch signal	
3	*	*	not used	

Fig. 95: Identifying Connector C279 (Transmission Control Switch)
Courtesy of FORD MOTOR CO.

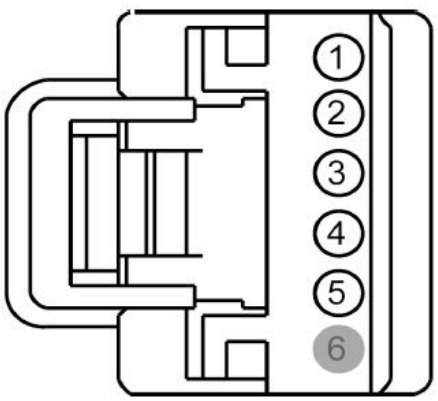
Connector: C280 | **Description:** TRACTION CONTROL SWITCH | **Harness:** 14401 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	959 (GY)	18	Traction control switch, On/Off signal	
2	57 (BK)	18	Ground	
3	484 (OG-BK)	18	Switch illumination +	
4	961 (WH-PK)	18	Traction assist on/off indicator lamp	
5	*	*	not used	
6	*	*	not used	
7	57 (BK)	18	Ground	

Fig. 96: Identifying Connector C280 (Traction Control Switch)
Courtesy of FORD MOTOR CO.

Connector: C287 | **Description:** AUTOLAMP SENSOR | **Harness:** 14401 | **Base Part #:** 13A018

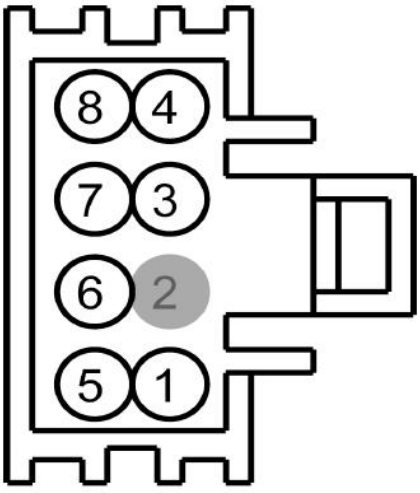


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	476 (BN-YE)	22	Sunload sensor, driver side signal	
2	218 (WH-VT)	22	Autolamp sensor signal	
3	905 (GY-LB)	20	Voltage supplied at all times (overload protected)	
4	1269 (OG-RD)	22	Anti-theft indicator control	
5	676 (PK-OG)	22	Ground	
6	*	*	not used	

Fig. 97: Identifying Connector C287 (Autolamp Sensor)
Courtesy of FORD MOTOR CO.

Connector: C289

Description:	Harness:	Base Part #:
TEMPERATURE BLEND DOOR ACTUATOR	14A005	19E616



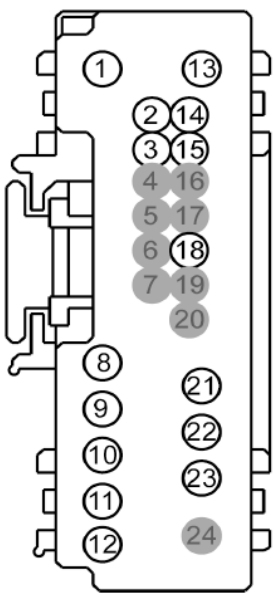
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	437 (YE-LG)	20	Air temperature door variable resistor signal	
2	*	*	not used	
3	437 (YE-LG)	20	Air temperature door variable resistor signal	
4	436 (RD-LG)	20	Air temperature door variable resistor -	
5	438 (RD-WH)	20	Temperature blend door variable resistor -	
6	600 (DB)	20	Air temperature door variable resistor +	
7	246 (RD-BK)	20	Voltage supplied in Run (overload protected)	
8	245 (BK)	20	Ground	

Fig. 98: Identifying Connector C289 (Temperature Blend Door Actuator)
Courtesy of FORD MOTOR CO.

Connector: C290A

Description:	Harness:	Base Part #:
AUDIO UNIT	14401	18806

Pin: 18 - 595(LB-RD) - Audio/climate control switch, Radio, signal, Gauge: 22



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1772 (VT)	16	Voltage supplied at all times (overload protected)	
2	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
3	484 (OG-BK)	22	Switch illumination +	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	804 (OG-LG)	18	Speaker, left front +	
9	800 (GY-LB)	18	Speaker, left rear +	
10	802 (OG-RD)	18	Speaker, right rear +	
11	805 (WH-LG)	18	Speaker, right front +	
12	811 (DG-OG)	18	Speaker, right front -	
13	694 (BK-LG)	14	Ground	
14	679 (GY-BK)	22	vehicle speed signal	
15	1000 (RD-BK)	22	Hot in start with park or neutral	
16	*	*	not used	
17	*	*	not used	
18	595 (LB-RD)	22	Audio/climate control switch, Radio, signal	
19	*	*	not used	
20	*	*	not used	
21	813 (LB-WH)	18	Speaker, left front -	
22	801 (TN-YE)	18	Speaker, left rear -	
23	803 (BN-PK)	18	Speaker, right rear -	
24	*	*	not used	

Fig. 99: Identifying Connector C290A (Audio Unit)
Courtesy of FORD MOTOR CO.

Connector: C290C

Description:	Harness:	Base Part #:
AUDIO UNIT	14401	18806

Pin: 2 - 168(RD-BK) - Subwoofer +, Gauge: 22

Pin	Circuit	Gauge	Circuit Function Qualifier
1	167 (BN-OG)	22	Subwoofer -
2	168 (RD-BK)	22	Subwoofer +
3	48 (OG-WH)	22	Shield
4	173 (DG-VT)	22	Subwoofer, High, mute
5	*	*	not used
6	*	*	not used
7	*	*	not used
8	*	*	not used

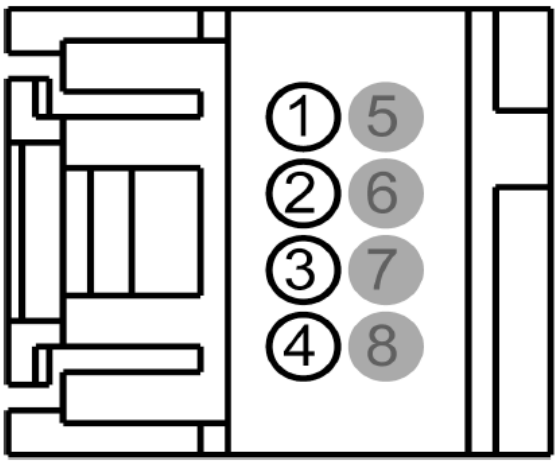


Fig. 100: Identifying Connector C290C (Audio Unit)
Courtesy of FORD MOTOR CO.

Connector: C294A

Description:	Harness:	Base Part #:
CLIMATE CONTROL ASSEMBLY	14401	19B888

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1812 (BN-WH)	20	Blower motor relay control	
2	348 (VT)	20	A/C demand signal	
3	249 (BN-WH)	22	Blower motor relay control	
4	1040 (RD-BK)	22	Voltage supplied in Run (overload protected)	

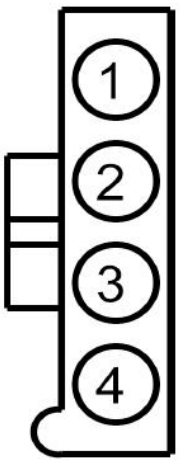
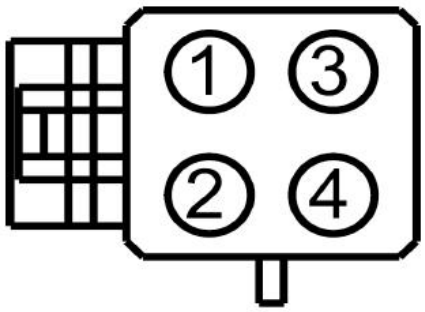


Fig. 101: Identifying Connector C294A (Climate Control Assembly)
Courtesy of FORD MOTOR CO.

Connector: C294B	Description:	Harness:	Base Part #:
	CLIMATE CONTROL ASSEMBLY	14401	19B888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	754 (LG-WH)	12	Blower motor speed control, high	
2	57 (BK)	10	Ground	
3	261 (OG-BK)	10	Blower motor speed control	
4	752 (YE-RD)	12	Blower motor speed control, common	

Fig. 102: Identifying Connector C294B (Climate Control Assembly)
Courtesy of FORD MOTOR CO.

Connector: C294C	Description:	Harness:	Base Part #:
	CLIMATE CONTROL ASSEMBLY	14401	19B888

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	436 (RD-LG)	22	Air temperature door variable resistor -	
2	437 (YE-LG)	22	Air temperature door variable resistor signal	
3	600 (DB)	22	Air temperature door variable resistor +	

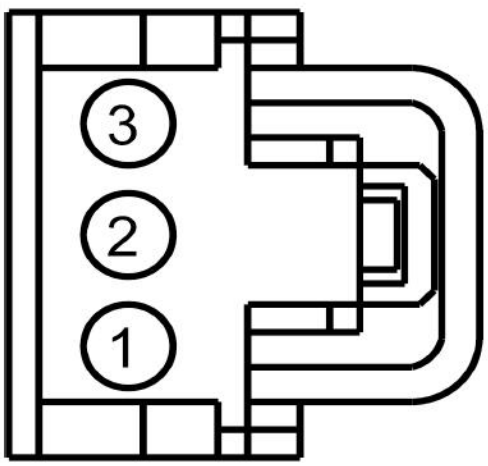
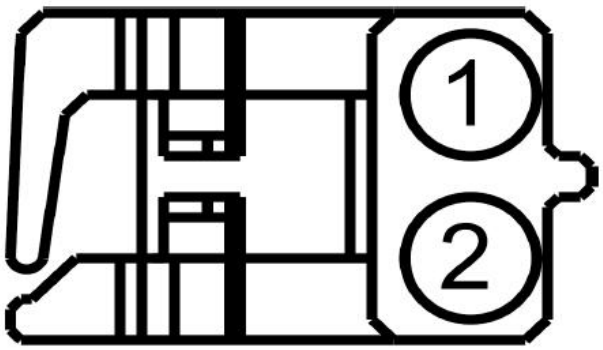


Fig. 103: Identifying Connector C294C (Climate Control Assembly)
Courtesy of FORD MOTOR CO.

Connector: C294D

Description:	Harness:	Base Part #:
CLIMATE CONTROL ASSEMBLY	14401	19B888



Pin	Circuit	Gauge	Circuit Function Qualifier
1	484 (OG-BK)	22	Switch illumination +
2	57 (BK)	22	Ground

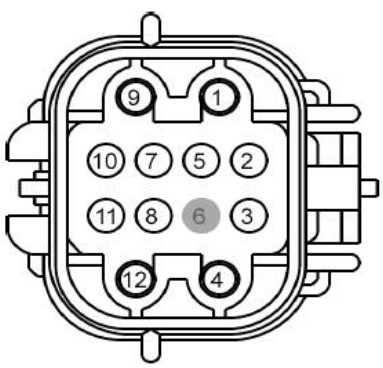
Fig. 104: Identifying Connector C294D (Climate Control Assembly)
Courtesy of FORD MOTOR CO.

Inline: C298

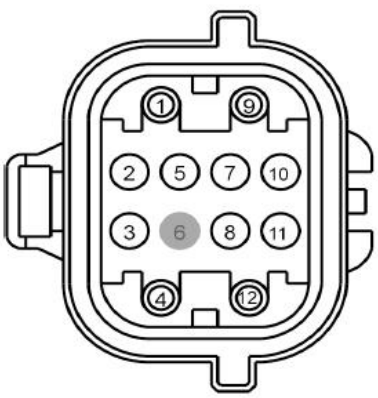
Description: Inline

Base Part #:

MALE
Harness: 15A599



FEMALE
Harness: 14A733-A



Pin	Circuit	Gauge	Qualifier
1	3010 (TN)	10	
2	165 (TN-WH)	20	
3	24 (DB-OG)	20	
4	3010 (TN)	10	
5	57 (BK)	16	
6	*	*	
7	401 (PK)	20	
8	7 (LG-YE)	16	
9	6 (YE-LG)	16	15A599
9	6 (YE-LG)	18	14290
10	57 (BK)	16	
11	14 (BN)	16	
12	3010 (TN)	10	

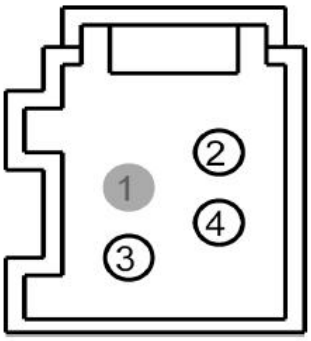
Fig. 105: Identifying Connector C298 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C299

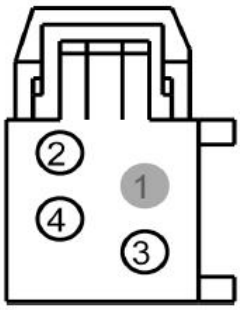
Description:
Inline

Base Part #:

MALE
Harness: 15080



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	40 (LB-WH)	16	
3	1049 (BN-PK)	16	
4	57 (BK)	12	

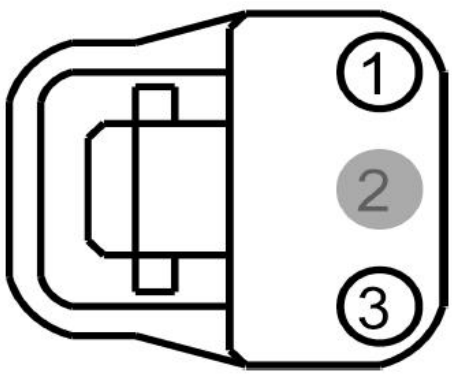
Fig. 106: Identifying Connector C299 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C303

Description:
PASSENGER SAFETY BELT
RETRACTOR PRETENSIONER

Harness:
14A005

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1081 (YE-RD)	20	Passenger safety belt retractor pretensioner, feed	
2	*	*	not used	
3	1082 (LB-BK)	20	Passenger safety belt retractor pretensioner signal return	

Fig. 107: Identifying Connector C303 (Passenger Safety Belt Retractor Pretensioner)
Courtesy of FORD MOTOR CO.

Connector: C304	Description:	Harness:	Base Part #:
	SIDE IMPACT SENSOR, RIGHT	14A005	14B345

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1263 (WH)	22	Side air bag sensor, right +	
2	1264 (BN)	22	Side air bag sensor, right -	

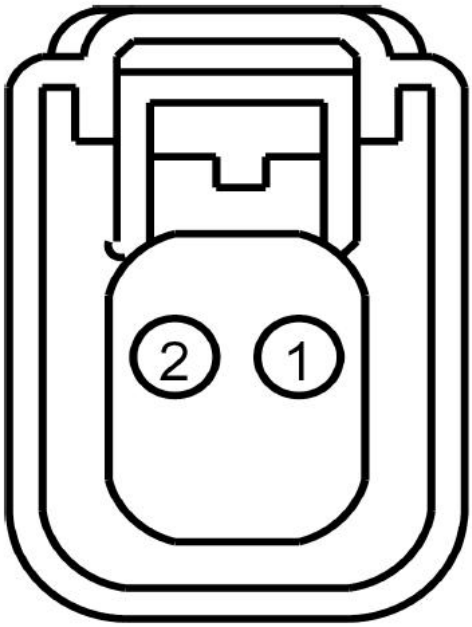


Fig. 108: Identifying Connector C304 (Side Impact Sensor, Right)
Courtesy of FORD MOTOR CO.

Connector: C305	Description:	Harness:	Base Part #:
	SIDE IMPACT SENSOR, LEFT	14A005	14B345

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1261 (WH-LG)	22	Side air bag sensor, left +	
2	1262 (BN-LG)	22	Side air bag sensor, left -	

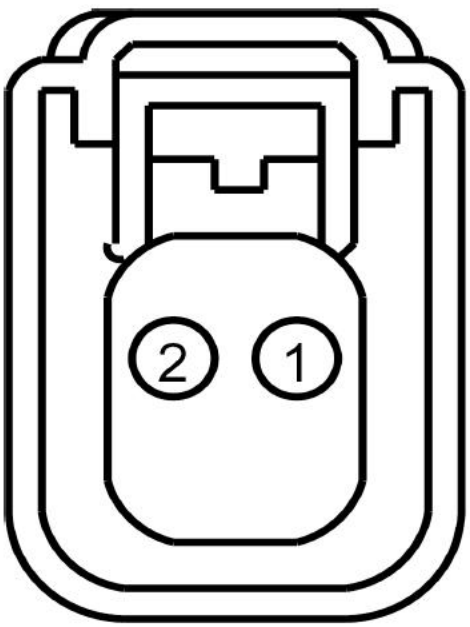
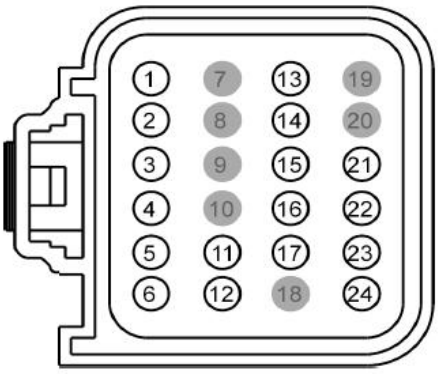


Fig. 109: Identifying Connector C305 (Side Impact Sensor, Left)
Courtesy of FORD MOTOR CO.

Connector: C310A	Description:	Harness:	Base Part #:
	RESTRAINTS CONTROL MODULE (RCM)	14401	14B321

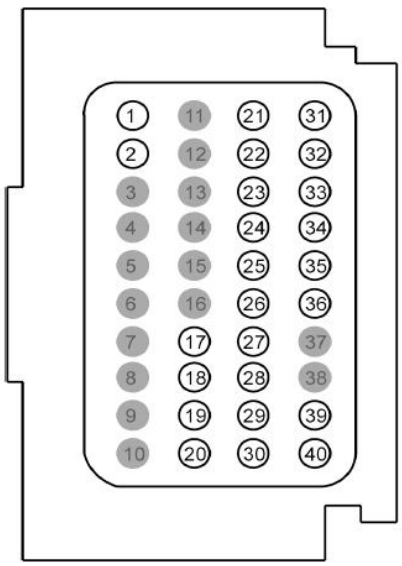


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	614 (GY-OG)	20	Driver air bag feed	
2	615 (GY-WH)	20	Driver air bag return	
3	607 (LB-OG)	20	Passenger air bag feed	
4	616 (PK-BK)	20	Passenger air bag return	
5	1516 (YE-WH)	20	Driver air bag feed 2, signal	
6	1517 (RD-OG)	20	Driver air bag feed 2, return	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	70 (LB-WH)	22	ISO Bus	
12	937 (RD-WH)	20	Voltage supplied in Start and Run (overload protected)	
13	1518 (BK-WH)	20	Passenger air bag feed 2, signal	
14	1519 (LG-RD)	20	Passenger air bag feed 2, return	
15	608 (BK-YE)	20	Air bag indicator control	
16	676 (PK-OG)	20	Ground	
17	1799 (YE-BK)	22	RDI/VEMS signal	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	2136 (OG)	20	Deployable steering column feed	
22	2137 (RD-LB)	20	Deployable steering column return	
23	1083 (LB-PK)	22	Air bag, tone driver	
24	1632 (TN-LB)	22	Passenger air bag deactivation indicator control	

Fig. 110: Identifying Connector C310A (Restraints Control Module (RCM))
Courtesy of FORD MOTOR CO.

Connector: C310B

Description:	Harness:	Base Part #:
RESTRAINTS CONTROL MODULE (RCM)	14A005	14B321



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1257 (WH-LB)	20	Side air bag module impact - Left +	
2	1258 (RD)	20	Side air bag module impact - Left -	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	1079 (LG-RD)	20	Driver safety belt retractor pretensioner, feed	
18	1080 (LG-BK)	20	Driver safety belt retractor pretensioner, return	
19	617 (PK-OG)	22	Front impact severity sensor feed	
20	618 (VT-LG)	22	Front impact severity sensor return	
21	1259 (WH-YE)	18	Side air bag module impact - Right -	
22	1260 (BN-YE)	18	Side air bag module impact - Right +	
23	1520 (LG)	22	Seat position sensor - horizontal sense	
24	1558 (TN-BK)	22	Signal return	
25	85 (BN-LB)	22	Safety belt buckle switch, driver +	
26	1514 (RD-BK)	22	Safety belt buckle switch, passenger signal	
27	1261 (WH-LG)	22	Side air bag sensor, left +	
28	1262 (BN-LG)	22	Side air bag sensor, left -	
29	1263 (WH)	22	Side air bag sensor, right +	
30	1264 (BN)	22	Side air bag sensor, right -	
31	937 (RD-WH)	22	Voltage supplied in Start and Run (overload protected)	
32	676 (PK-OG)	22	Ground	
33	1919 (PK-OG)	22	CAN +	
34	1918 (BN-WH)	22	CAN -	
35	1081 (YE-RD)	20	Passenger safety belt retractor pretensioner, feed	
36	1082 (LB-BK)	20	Passenger safety belt retractor pretensioner signal return	
37	*	*	not used	
38	*	*	not used	
39	619 (PK-WH)	22	Air bag crash sensor #2 feed	
40	620 (VT-LB)	22	Air bag crash sensor #2 ground monitor	

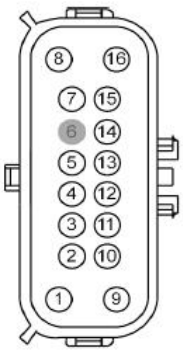
Fig. 111: Identifying Connector C310B (Restraints Control Module (RCM))
Courtesy of FORD MOTOR CO.

Inline: C311

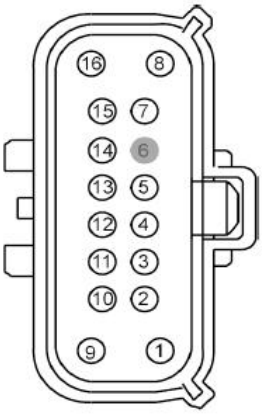
Description:
Inline

Base Part #:

MALE
Harness: 14A699D



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	918 (GY)	14	
2	1048 (LB-WH)	14	14A005
2	1048 (LB-WH)	16	14A699D
3	1255 (WH-RD)	22	
4	1257 (WH-LB)	20	
5	1258 (RD)	20	
6	*	*	
7	1018 (LG-OG)	20	14A005
7	1018 (LG-OG)	22	14A699D
8	517 (BK-WH)	16	
9	57 (BK)	14	
10	85 (BN-LB)	22	
11	1558 (TN-BK)	22	
12	1520 (LG)	22	
13	1020 (DG-VT)	20	14A005
13	1020 (DG-VT)	22	14A699D
14	1040 (RD-BK)	20	
15	1019 (TN-LB)	20	14A005
15	1019 (TN-LB)	22	14A699D
16	919 (GY-BK)	14	

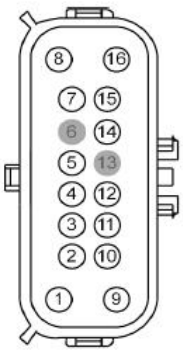
Fig. 112: Identifying Connector C311 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C312

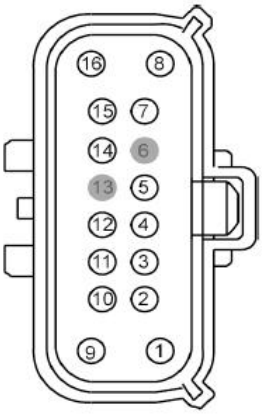
Description:
Inline

Base Part #:

MALE
Harness: 14A699P



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	918 (GY)	14	
2	581 (RD)	20	14A005
2	581 (RD)	22	14A699P
3	1256 (WH-YE)	20	14A005
3	1256 (WH-YE)	22	14A699P
4	1259 (WH-YE)	18	
5	1260 (BN-YE)	18	
6	*	*	
7	1514 (RD-BK)	22	
8	517 (BK-WH)	16	
9	919 (GY-BK)	14	
10	676 (PK-OG)	22	
11	937 (RD-WH)	22	
12	1558 (TN-BK)	22	
13	*	*	
14	1918 (BN-WH)	22	
15	1919 (PK-OG)	22	
16	57 (BK)	14	

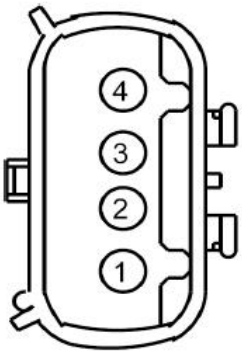
Fig. 113: Identifying Connector C312 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C313

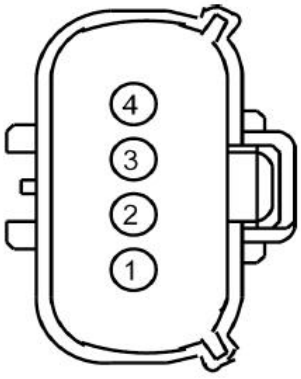
Description:
Inline

Base Part #:

MALE
Harness: 14A699



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	1048 (LB-WH)	14	14A005
1	1048 (LB-WH)	16	14A699P
2	579 (BK-OG)	20	14A005
2	579 (BK-OG)	22	14A699P
3	580 (BN)	20	14A005
3	580 (BN)	22	14A699P
4	1040 (RD-BK)	20	

Fig. 114: Identifying Connector C313 (Inline)
Courtesy of FORD MOTOR CO.

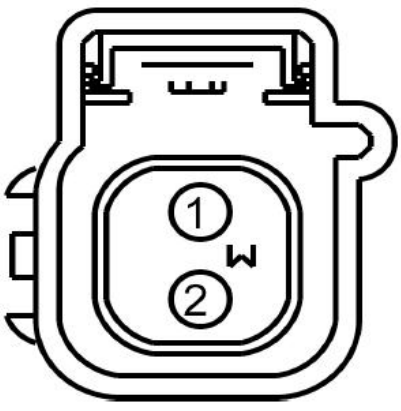
Inline: C315

Description:
Inline

Base Part #:

MALE
Harness: 14716

FEMALE
Harness: 14A699D



Pin	Circuit	Gauge	Qualifier
1	1257 (WH-LB)	20	
2	1258 (RD)	20	

Fig. 115: Identifying Connector C315 (Inline)
Courtesy of FORD MOTOR CO.

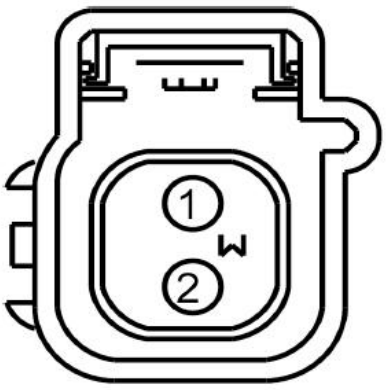
Inline: C316

Description:
Inline

Base Part #:

MALE
Harness: 14A699P

FEMALE
Harness: 14716



Pin	Circuit	Gauge	Qualifier
1	1259 (WH-YE)	18	14A699P
1	1259 (WH-YE)	20	14716
2	1260 (BN-YE)	18	14A699P
2	1260 (BN-YE)	20	14716

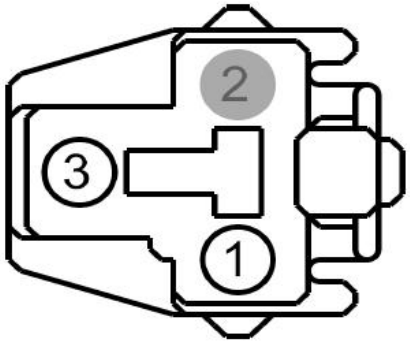
Fig. 116: Identifying Connector C316 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C319

Description:
CIGAR LIGHTER, FRONT

Harness:
14B079

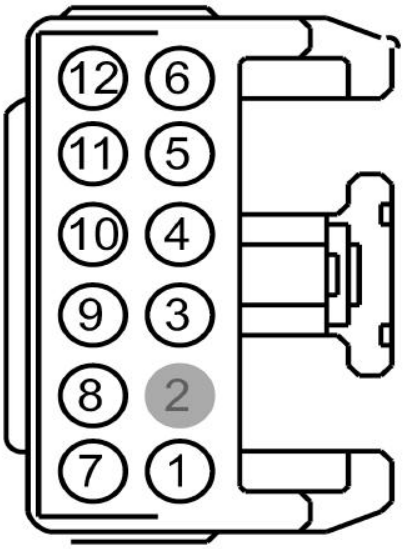
Base Part #:
15055



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	40 (LB-WH)	16	Voltage supplied at all times (overload protected)	
2	*	*	not used	
3	57 (BK)	16	Ground	

Fig. 117: Identifying Connector C319 (Cigar Lighter, Front)
Courtesy of FORD MOTOR CO.

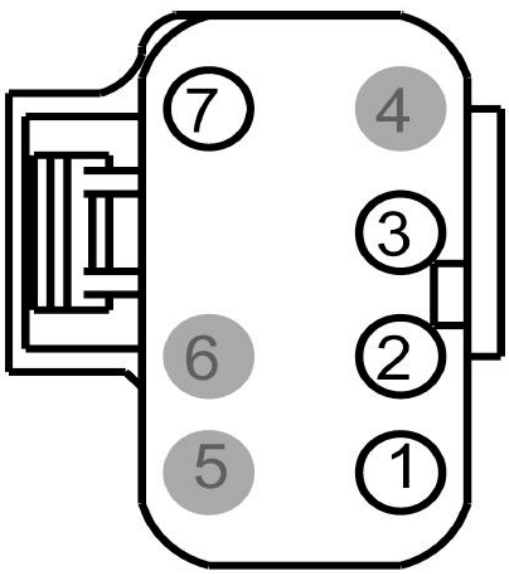
Connector: C329	Description:	Harness:	Base Part #:
	HEATED SEAT MODULE, PASSENGER SIDE FRONT	14A699P	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	16	Ground	
2	*	*	not used	
3	1061 (BN-LB)	22	Temperature return	
4	1060 (BK-LB)	22	Temperature signal	
5	1040 (RD-BK)	20	Voltage supplied in Run (overload protected)	
6	1064 (YE-LB)	18	heater feed	
7	1065 (WH-LB)	18	heater return	
8	581 (RD)	22	High temperature switch, passenger side signal	
9	579 (BK-OG)	22	Low temperature indicator control, passenger side	
10	580 (BN)	22	High temperature indicator control, passenger side	
11	1256 (WH-YE)	22	Low temperature switch signal	
12	1048 (LB-WH)	16	Voltage supplied at all times (overload protected)	

Fig. 118: Identifying Connector C329 (Heated Seat Module, Passenger Side Front)
Courtesy of FORD MOTOR CO.

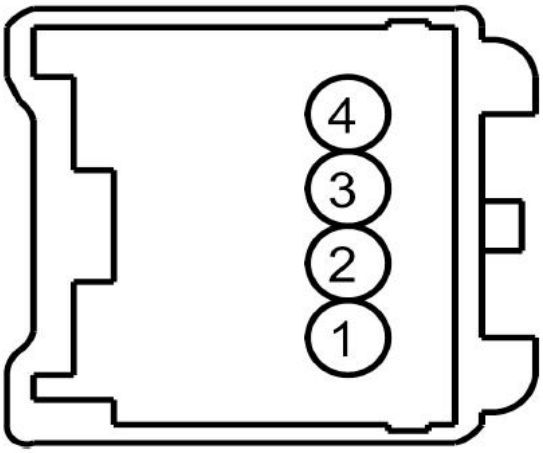
Connector: C331	Description:	Harness:	Base Part #:
	LUMBAR ADJUST SWITCH, PASSENGER SIDE	14A699P	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1094 (PK)	16	Lumbar compressor motor +/-	
2	517 (BK-WH)	16	Voltage supplied at all times (overload protected)	
3	1094 (PK)	16	Lumbar compressor motor +/-	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	1097 (BN)	16	Lumbar compressor motor +/-	

Fig. 119: Identifying Connector C331 (Lumbar Adjust Switch, Passenger Side)
Courtesy of FORD MOTOR CO.

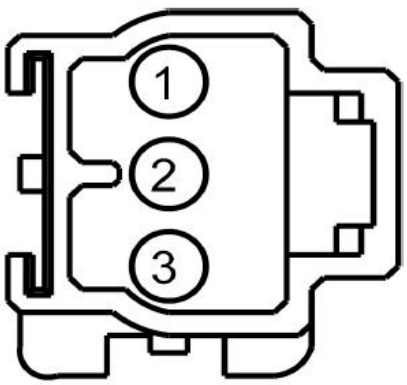
Connector: C334	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER, RIGHT FRONT	14A699P	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1065 (WH-LB)	18	heater return	
2	1061 (BN-LB)	22	Temperature return	
3	1060 (BK-LB)	22	Temperature signal	
4	1064 (YE-LB)	18	heater feed	

Fig. 120: Identifying Connector C334 (Seat Cushion Heater, Right Front)
Courtesy of FORD MOTOR CO.

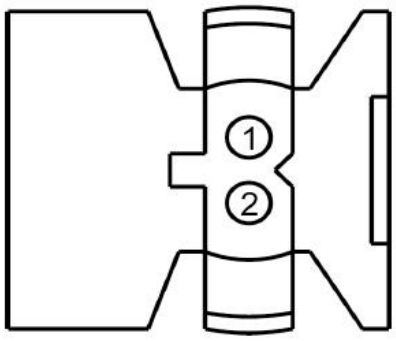
Connector: C336	Description:	Harness:	Base Part #:
	PASSENGER SEAT LUMBAR COMPRESSOR MOTOR	14A699P	65500



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1094 (PK)	16	Lumbar compressor motor +/-	
2	1097 (BN)	16	Lumbar compressor motor +/-	
3	57 (BK)	16	Ground	

Fig. 121: Identifying Connector C336 (Passenger Seat Lumbar Compressor Motor)
Courtesy of FORD MOTOR CO.

Connector: C337	Description:	Harness:	Base Part #:
	SIDE AIR BAG MODULE, RIGHT	14716	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1259 (WH-YE)	20	Side air bag module impact - Right -	
2	1260 (BN-YE)	20	Side air bag module impact - Right +	

Fig. 122: Identifying Connector C337 (Side Air Bag Module, Right)
Courtesy of FORD MOTOR CO.

Connector: C338	Description:	Harness:	Base Part #:
	POWER SEAT MOTOR ASSEMBLY, RIGHT	14A699P	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	918 (GY)	14	Seat backrest motor +/-	
2	919 (GY-BK)	14	Seat backrest motor +/-	

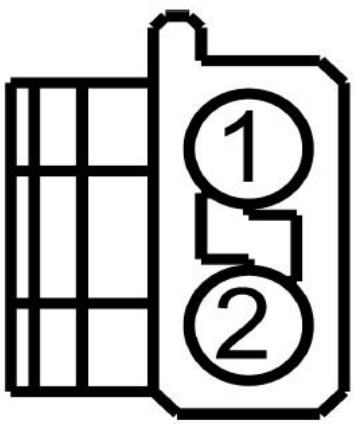


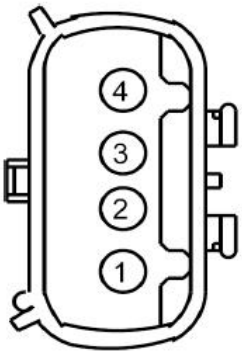
Fig. 123: Identifying Connector C338 (Power Seat Motor Assembly, Right)
Courtesy of FORD MOTOR CO.

Inline: C339

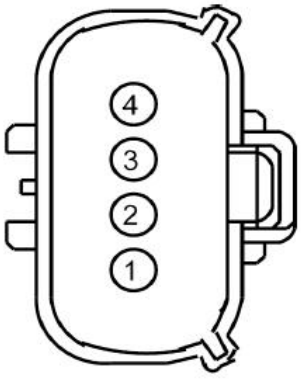
Description:
Inline

Base Part #:

MALE
Harness: 14C369



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	2310 (OG)	18	14C369
1	2310 (OG)	20	14A005
2	2311 (DG)	18	14C369
2	2311 (DG)	20	14A005
3	2312 (LG)	18	14C369
3	2312 (LG)	20	14A005
4	2313 (BK-WH)	18	14C369
4	2313 (BK-WH)	20	14A005

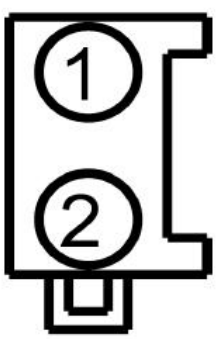
Fig. 124: Identifying Connector C339 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C340

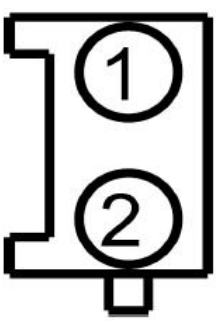
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness:



Pin	Circuit	Gauge	Qualifier
1	170 (RD-LB)	12	
2	170 (RD-LB)	12	

Fig. 125: Identifying Connector C340 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C353	Description:	Harness:	Base Part #:
	POWER SEAT MOTOR ASSEMBLY, LEFT	14A005	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	981 (RD-WH)	14	Fwd/Rwd motor +/-	
2	978 (YE-LB)	14	Front height motor +/-	
3	979 (RD-LB)	14	Front height motor +/-	
4	980 (YE-WH)	14	Fwd/Rwd motor +/-	
5	983 (RD-LG)	14	Rear height motor +/-	
6	982 (YE-LG)	14	Rear height motor +/-	

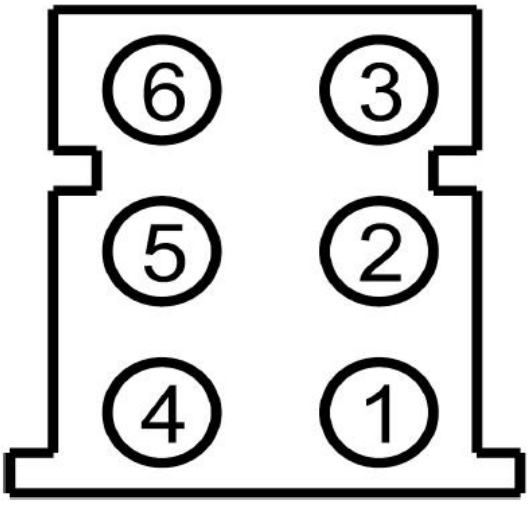


Fig. 126: Identifying Connector C353 (Power Seat Motor Assembly, Left)
Courtesy of FORD MOTOR CO.

Connector: C356	Description:	Harness:	Base Part #:
	SEAT POSITION SENSOR, DRIVER SIDE	14A699D	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1558 (TN-BK)	22	Signal return	
2	1520 (LG)	22	Seat position sensor - horizontal sense	

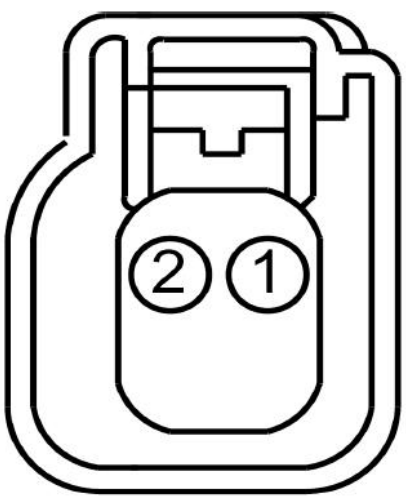
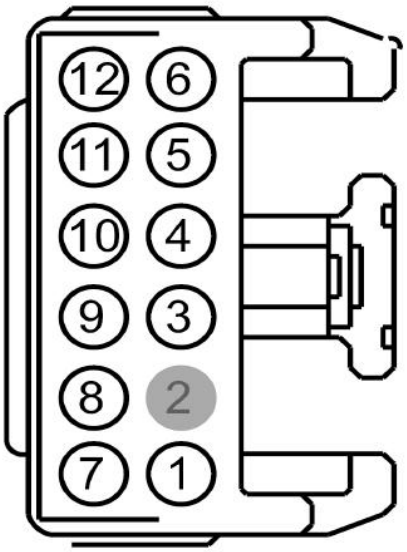


Fig. 127: Identifying Connector C356 (Seat Position Sensor, Driver Side)
Courtesy of FORD MOTOR CO.

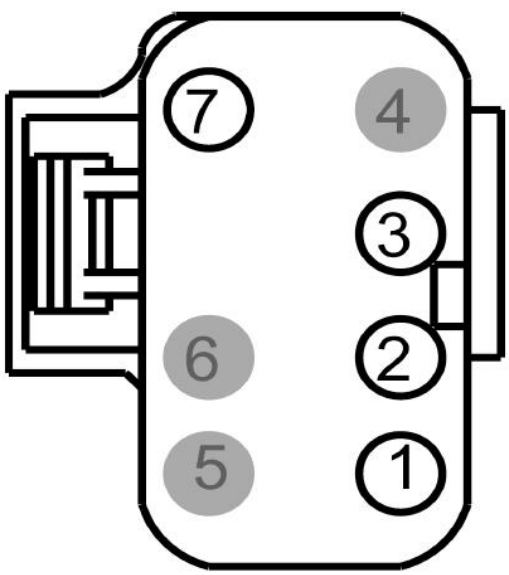
Connector: C359	Description:	Harness:	Base Part #:
	HEATED SEAT MODULE, DRIVER SIDE FRONT	14A699D	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	16	Ground	
2	*	*	not used	
3	1061 (BN-LB)	22	Temperature return	
4	1060 (BK-LB)	22	Temperature signal	
5	1040 (RD-BK)	20	Voltage supplied in Run (overload protected)	
6	1064 (YE-LB)	18	heater feed	
7	1065 (WH-LB)	18	heater return	
8	1020 (DG-VT)	22	High temperature switch signal	
9	1018 (LG-OG)	22	Low temperature indicator control	
10	1019 (TN-LB)	22	High temperature indicator control	
11	1255 (WH-RD)	22	Low temperature switch signal	
12	1048 (LB-WH)	16	Voltage supplied at all times (overload protected)	

Fig. 128: Identifying Connector C359 (Heated Seat Module, Driver Side Front)
Courtesy of FORD MOTOR CO.

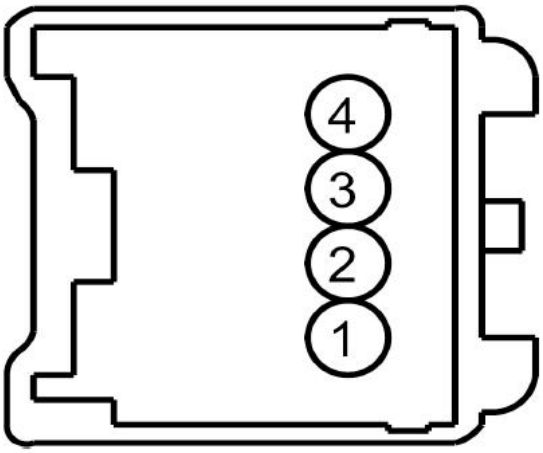
Connector: C361	Description:	Harness:	Base Part #:
	LUMBAR ADJUST SWITCH, DRIVER SIDE	14A699D	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1094 (PK)	16	Lumbar compressor motor +/-	
2	517 (BK-WH)	16	Voltage supplied at all times (overload protected)	
3	1094 (PK)	16	Lumbar compressor motor +/-	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	1097 (BN)	16	Lumbar compressor motor +/-	

Fig. 129: Identifying Connector C361 (Lumbar Adjust Switch, Driver Side)
Courtesy of FORD MOTOR CO.

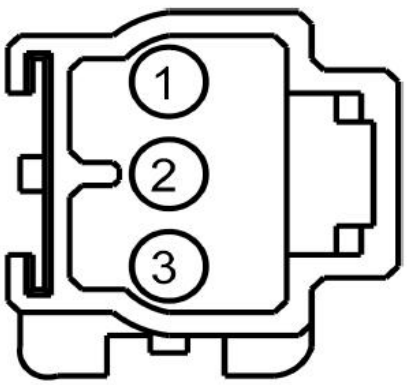
Connector: C364	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER, LEFT FRONT	14A699D	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1065 (WH-LB)	18	heater return	
2	1061 (BN-LB)	22	Temperature return	
3	1060 (BK-LB)	22	Temperature signal	
4	1064 (YE-LB)	18	heater feed	

Fig. 130: Identifying Connector C364 (Seat Cushion Heater, Left Front)
Courtesy of FORD MOTOR CO.

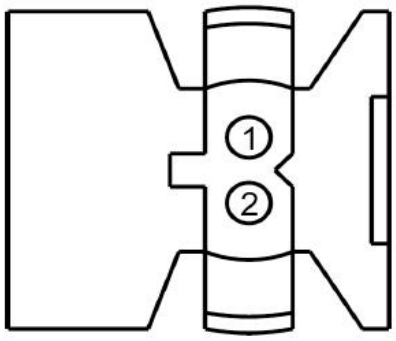
Connector: C366	Description:	Harness:	Base Part #:
	DRIVER SEAT LUMBAR COMPRESSOR MOTOR	14A699D	65500



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1094 (PK)	16	Lumbar compressor motor +/-	
2	1097 (BN)	16	Lumbar compressor motor +/-	
3	57 (BK)	16	Ground	

Fig. 131: Identifying Connector C366 (Driver Seat Lumbar Compressor Motor)
Courtesy of FORD MOTOR CO.

Connector: C367	Description:	Harness:	Base Part #:
	SIDE AIR BAG MODULE, LEFT	14716	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1257 (WH-LB)	20	Side air bag module impact - Left +	
2	1258 (RD)	20	Side air bag module impact - Left -	

Fig. 132: Identifying Connector C367 (Side Air Bag Module, Left)
Courtesy of FORD MOTOR CO.

Connector: C368	Description:	Harness:	Base Part #:
	POWER SEAT MOTOR ASSEMBLY, LEFT	14A699D	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	918 (GY)	14	Seat backrest motor +/-	
2	919 (GY-BK)	14	Seat backrest motor +/-	

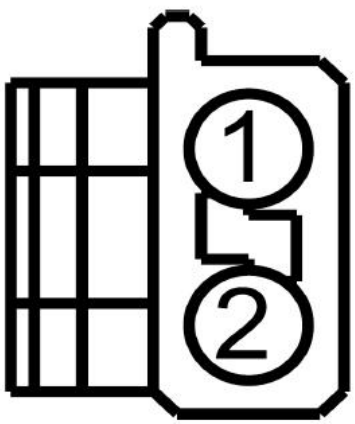


Fig. 133: Identifying Connector C368 (Power Seat Motor Assembly, Left)
Courtesy of FORD MOTOR CO.

Connector: C380	Description:	Harness:	Base Part #:
	POWER POINT	14B079	19N236

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1049 (BN-PK)	16	Voltage supplied at all times (overload protected)	
2	*	*	not used	
3	57 (BK)	16	Ground	

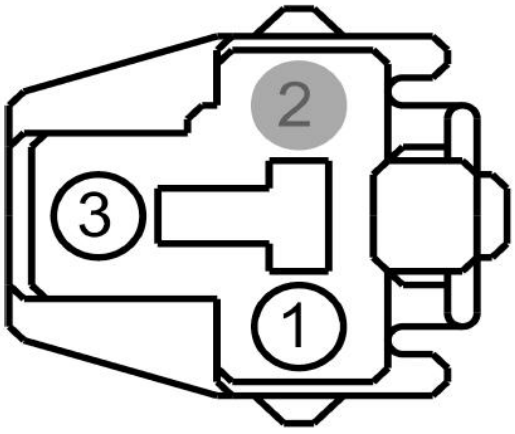
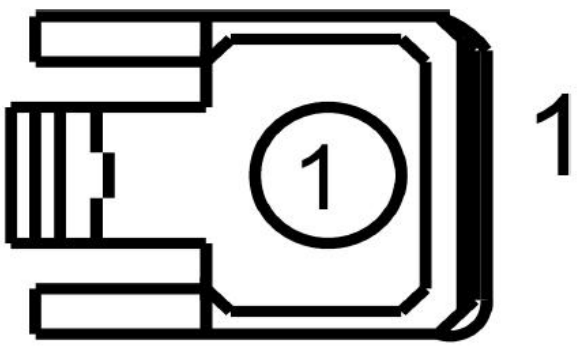


Fig. 134: Identifying Connector C380 (Power Point)
Courtesy of FORD MOTOR CO.

Connector: C402A	Description:	Harness:	Base Part #:
	REAR WINDOW DEFROST GRID	14A005	

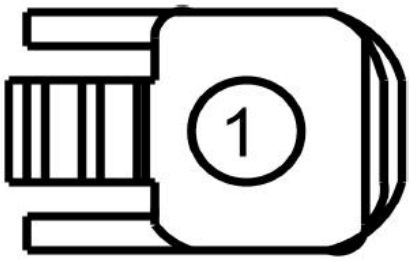


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	186 (BN-LB)	12	Rear window defrost relay switched power	

Fig. 135: Identifying Connector C402A (Rear Window Defrost Grid)
Courtesy of FORD MOTOR CO.

Connector: C402B

Description:	Harness:	Base Part #:
ANTENNA MODULE	14A005	



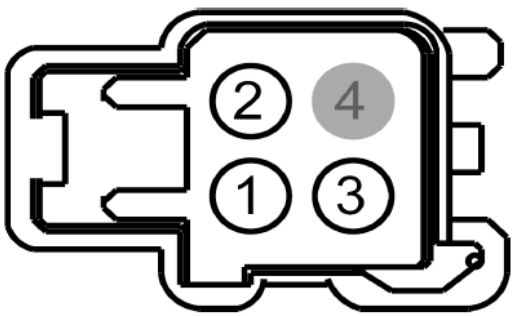
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	12	Voltage supplied at Start and Run (overload protected)	

Fig. 136: Identifying Connector C402B (Antenna Module)
Courtesy of FORD MOTOR CO.

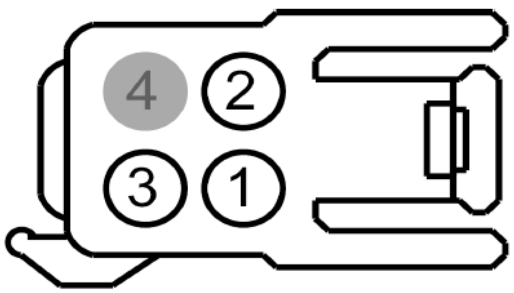
Inline: C405

Description:	Base Part #:
Inline	

MALE
Harness: 14A227



FEMALE
Harness: 13412



Pin: 1 - 14(BN) - Power, Exterior lamps, Gauge: 20

Pin	Circuit	Gauge	Qualifier
1	14 (BN)	20	
2	140 (BK-PK)	16	14A227
2	140 (BK-PK)	20	13412
3	57 (BK)	20	
4	*	*	

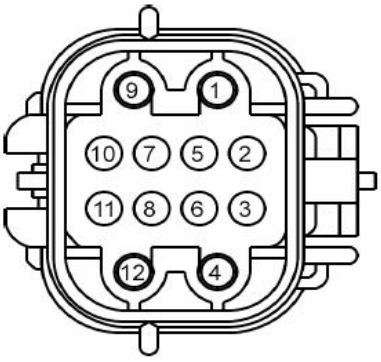
Fig. 137: Identifying Connector C405 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C406

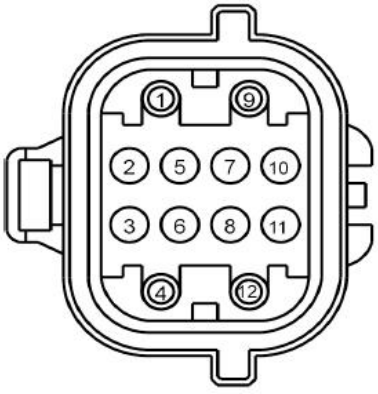
Description:
Inline

Base Part #:

MALE
Harness: 14A733-C



FEMALE
Harness: 15A599



Pin	Circuit	Gauge	Qualifier
1	57 (BK)	14	
2	3012 (WH)	18	15A599
2	3012 (WH)	20	14A733-C
3	3013 (GY-BK)	18	15A599
3	3013 (GY-BK)	20	14A733-C
4	3258 (RD-YE)	10	
5	3005 (VT-LG)	18	15A599
5	3005 (VT-LG)	20	14A733-C
6	3006 (VT-LG)	18	15A599
6	3006 (VT-LG)	20	14A733-C
7	3007 (VT-YE)	18	15A599
7	3007 (VT-YE)	20	14A733-C
8	3008 (VT)	18	15A599
8	3008 (VT)	20	14A733-C
9	2300 (RD)	10	
10	453 (PK-LG)	16	15A599
10	453 (PK-LG)	18	14A733-C
11	3011 (BK-OG)	18	15A599
11	3011 (BK-OG)	20	14A733-C
12	3009 (OG-RD)	18	15A599
12	3009 (OG-RD)	20	14A733-C

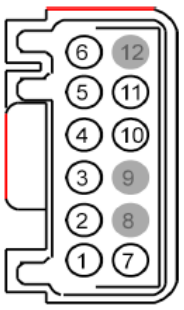
Fig. 138: Identifying Connector C406 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C408

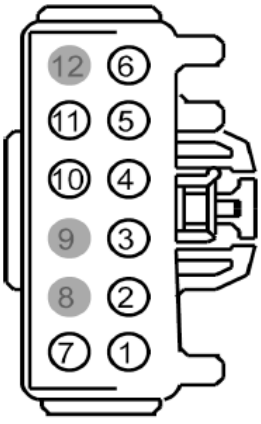
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14A227



Pin	Circuit	Gauge	Qualifier
1	1271 (VT)	16	
2	705 (LG-OG)	18	14A227
2	705 (LG-OG)	20	14A005
3	5 (OG-LB)	18	
4	9 (LG-OG)	18	
5	9 (LG-OG)	16	
6	5 (OG-LB)	16	
7	57 (BK)	14	
8	*	*	
9	*	*	
10	486 (BN-WH)	20	
11	84 (VT-YE)	14	
12	*	*	

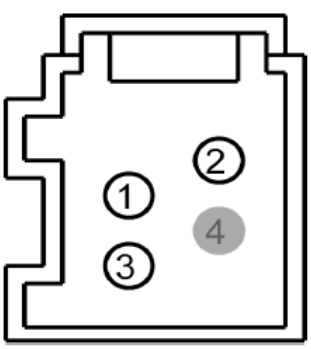
Fig. 139: Identifying Connector C408 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C410

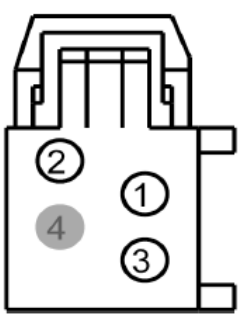
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 13407



Pin: 3 - 57(BK) - Ground, Gauge: 16

Pin	Circuit	Gauge	Qualifier
1	5 (OG-LB)	20	13410_L
1	9 (LG-OG)	16	14A005
2	14 (BN)	20	
3	57 (BK)	16	14A005
3	57 (BK)	20	13410_L
4	*	*	

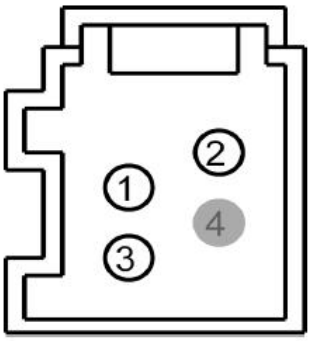
Fig. 140: Identifying Connector C410 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C411

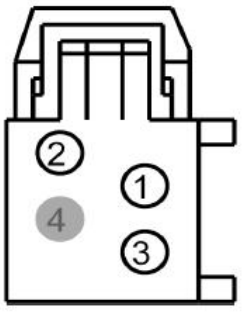
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 13407



Pin	Circuit	Gauge	Qualifier
1	5 (OG-LB)	16	14A005
1	5 (OG-LB)	20	13410_R
2	14 (BN)	20	
3	57 (BK)	16	14A005
3	57 (BK)	20	13410_R
4	*	*	

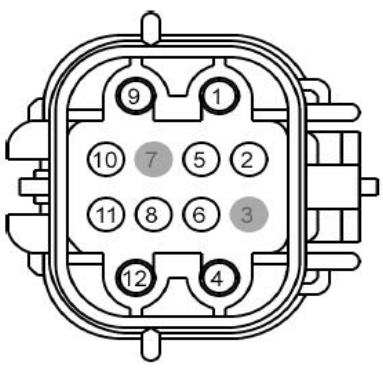
Fig. 141: Identifying Connector C411 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C422

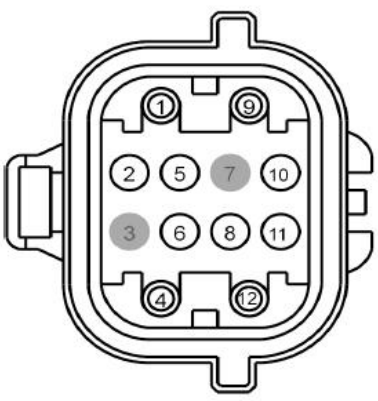
Description:
Inline

Base Part #:

MALE
Harness: 15A559



FEMALE
Harness: 14A733-B



Pin	Circuit	Gauge	Qualifier
1	2301 (RD-WH)	10	
2	401 (PK)	20	
3	*	*	
4	37 (YE)	16	
5	57 (BK)	16	
6	23 (TN-LG)	16	
7	*	*	
8	24 (DB-OG)	20	
9	2301 (RD-WH)	10	
10	25 (DG-VT)	18	15A599
10	25 (DG-VT)	20	14A733-B
11	30 (BK-LG)	16	
12	2301 (RD-WH)	10	

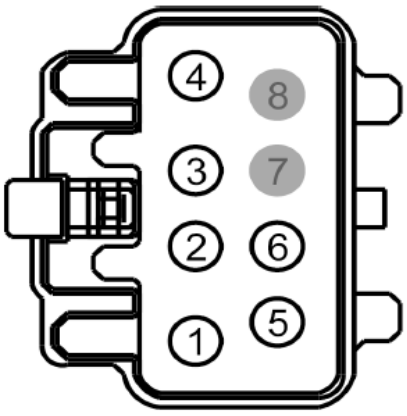
Fig. 142: Identifying Connector C422 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C423

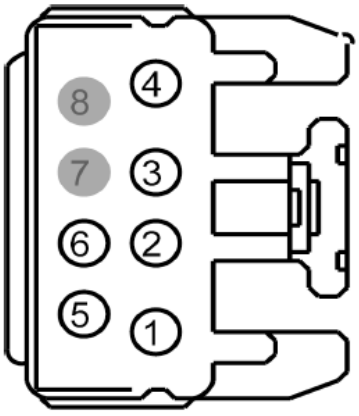
Description: Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14A227



Pin: 5 - 140(BK-PK) - Voltage supplied in reverse, Gauge: 16

Pin	Circuit	Gauge	Qualifier
1	84 (VT-YE)	14	14A227
1	84 (VT-YE)	16	14A005
2	486 (BN-WH)	20	
3	14 (BN)	20	
4	57 (BK)	14	
5	140 (BK-PK)	16	14A227
5	140 (BK-PK)	18	14A005
6	1350 (WH-PK)	18	
7	*	*	
8	*	*	

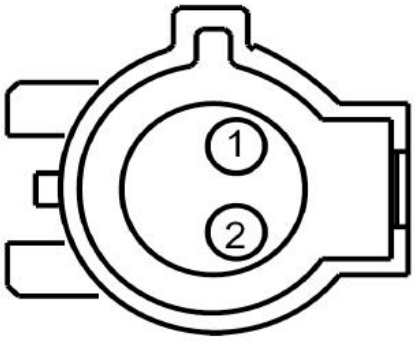
Fig. 143: Identifying Connector C423 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C426

Description: WHEEL SPEED SENSOR, RIGHT REAR

Harness: 14A005

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	523 (RD-PK)	20	Wheel speed sensor, right rear -	
2	524 (PK-BK)	20	Wheel speed sensor, right rear +	

Fig. 144: Identifying Connector C426 (Wheel Speed Sensor, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C428

Description:	Harness:	Base Part #:
LUGGAGE COMPARTMENT LAMP	14A005	13A756

Pin: 1 - 705(LG-OG) - Demand lighting, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	705 (LG-OG)	20	Demand lighting	
2	1092 (PK-OG)	20	Luggage compartment lamp switched ground	

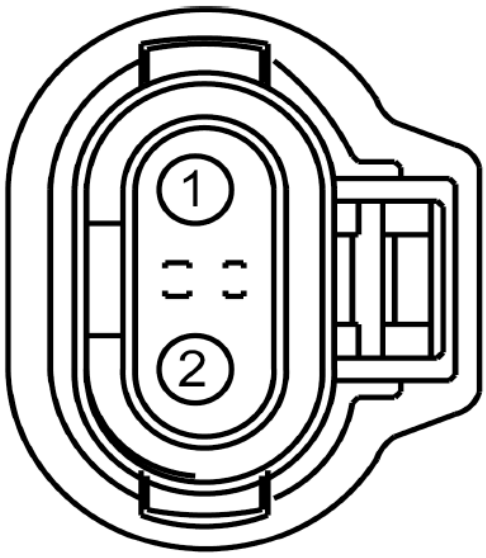


Fig. 145: Identifying Connector C428 (Luggage Compartment Lamp)
Courtesy of FORD MOTOR CO.

Connector: C430

Description:	Harness:	Base Part #:
LUGGAGE COMPARTMENT LID RELEASE SOLENOID	14A227	

Pin: 2 - 84(VT-YE) - Luggage compartment switch, switched power, Gauge: 14

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	486 (BN-WH)	20	Luggage compartment lid release solenoid signal	
2	84 (VT-YE)	14	Luggage compartment switch, switched power	
3	57 (BK)	14	Ground	

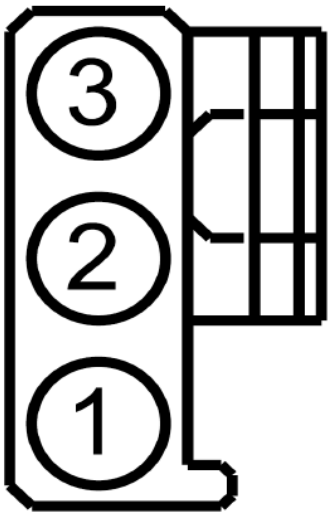


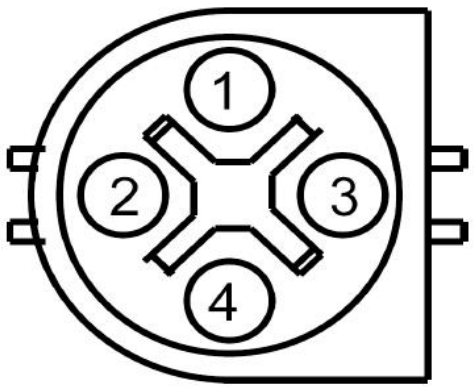
Fig. 146: Identifying Connector C430 (Luggage Compartment Lid Release Solenoid)
Courtesy of FORD MOTOR CO.

Inline: C431

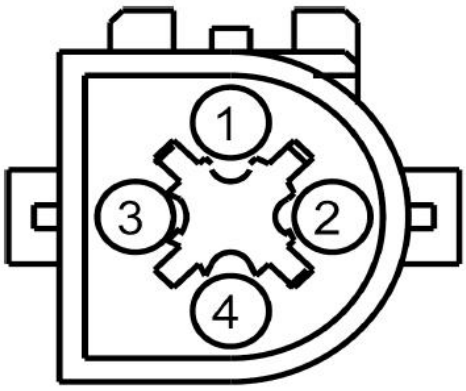
Description:
Inline

Base Part #:

MALE
Harness: 14A733-C



FEMALE
Harness: 15A559



Pin	Circuit	Gauge	Qualifier
1	401 (PK)	12	
2	1682 (RD-LB)	10	
3	13 (RD-BK)	16	
4	14 (BN)	16	

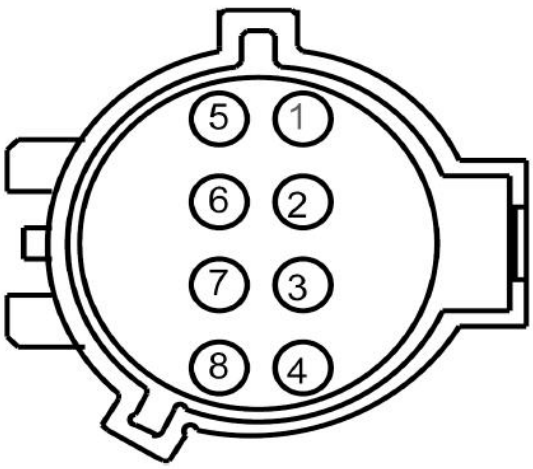
Fig. 147: Identifying Connector C431 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C433

Description:
FUEL TANK UNIT

Harness:
14A005

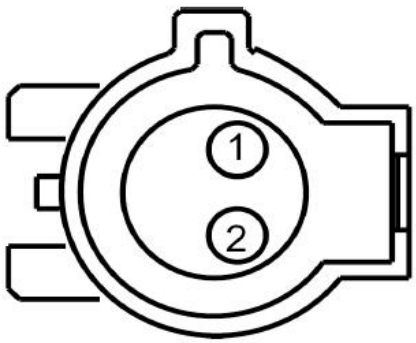
Base Part #:
9H307



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	359 (GY-RD)	20	Signal return	
3	791 (RD-PK)	20	Fuel tank pressure transducer sensor signal	
4	351 (BN-WH)	20	Reference voltage	
5	29 (YE-WH)	20	Fuel sender signal	
6	789 (BN-WH)	14	Fuel pump, return	
7	787 (PK-BK)	14	Fuel pump, feed	
8	1843 (BK-OG)	20	Signal return	

Fig. 148: Identifying Connector C433 (Fuel Tank Unit)
Courtesy of FORD MOTOR CO.

Connector: C440	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, LEFT REAR	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	518 (LG-RD)	18	Wheel speed sensor, left rear -	
2	519 (LG-BK)	18	Wheel speed sensor, left rear +	

Fig. 149: Identifying Connector C440 (Wheel Speed Sensor, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C450	Description:	Harness:	Base Part #:
	EVAP CANISTER VENT CONTROL SOLENOID	14A005	9F945

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	729 (RD-WH)	20	Voltage supplied at all times (overload protected)	
2	91 (VT-WH)	20	EVAP canister vent control solenoid control	

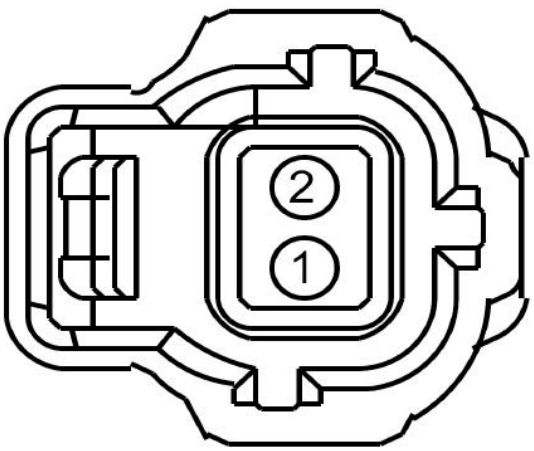
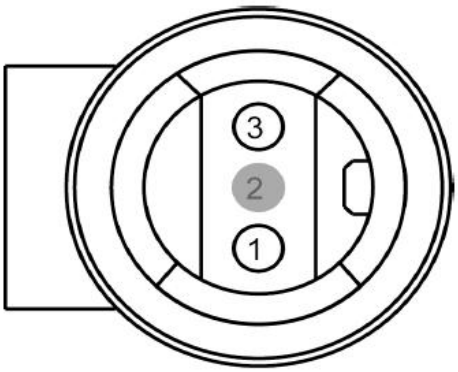


Fig. 150: Identifying Connector C450 (EVAP Canister Vent Control Solenoid)
Courtesy of FORD MOTOR CO.

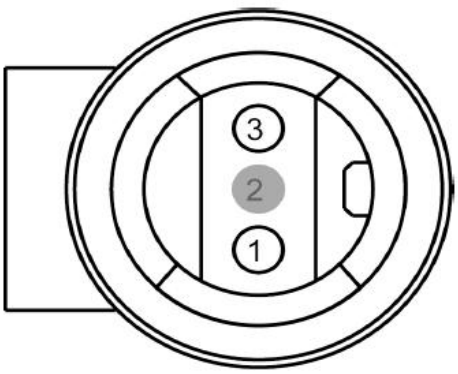
Connector: C451	Description:	Harness:	Base Part #:
	REVERSING LAMP, LEFT	13412	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	*	*	not used	
3	140 (BK-PK)	20	Voltage supplied in reverse	

Fig. 151: Identifying Connector C451 (Reversing Lamp, Left)
Courtesy of FORD MOTOR CO.

Connector: C461	Description:	Harness:	Base Part #:
	REVERSING LAMP, RIGHT	13412	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	*	*	not used	
3	140 (BK-PK)	20	Voltage supplied in reverse	

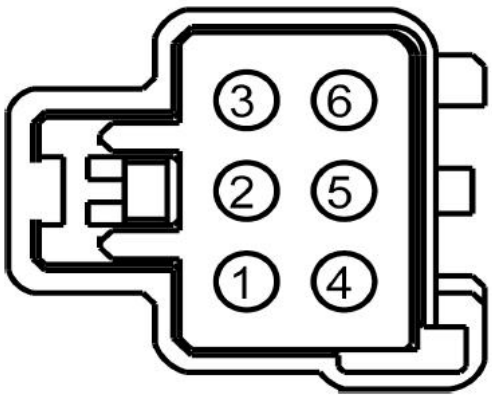
Fig. 152: Identifying Connector C461 (Reversing Lamp, Right)
Courtesy of FORD MOTOR CO.

Inline: C465

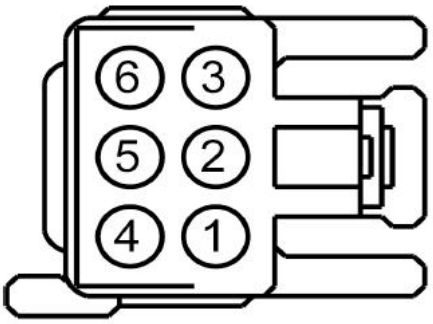
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14A411



Pin	Circuit	Gauge	Qualifier
1	57 (BK)	20	
2	1114 (BN-PK)	20	
3	1115 (TN-WH)	20	
4	432 (BK-PK)	20	
5	427 (PK-BK)	20	
6	417 (VT-OG)	20	

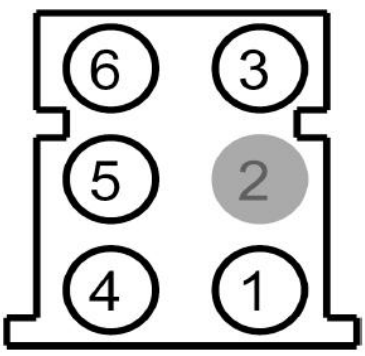
Fig. 153: Identifying Connector C465 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C466

Description:
SUBWOOFER AMPLIFIER

Harness:
14A005

Base Part #:
18C804



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	694 (BK-LG)	16	Ground	
2	*	*	not used	
3	720 (RD-YE)	16	Voltage supplied at all times (overload protected)	
4	167 (BN-OG)	22	Subwoofer -	
5	168 (RD-BK)	22	Subwoofer +	
6	173 (DG-VT)	22	Subwoofer, High, mute	

Fig. 154: Identifying Connector C466 (Subwoofer Amplifier)
Courtesy of FORD MOTOR CO.

Connector: C475

Description:	Harness:	Base Part #:
HIGH MOUNTED STOPLAMP	14A005	13A613

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	10 (LG-RD)	20	Brake pedal position switch, switched power fused feed	
2	57 (BK)	20	Ground	

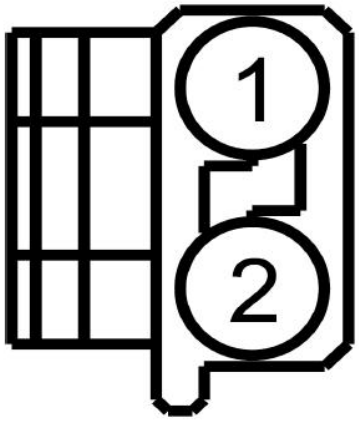


Fig. 155: Identifying Connector C475 (High Mounted Stoplamp)
Courtesy of FORD MOTOR CO.

Connector: C484

Description:	Harness:	Base Part #:
SPEAKER, LEFT REAR	14A005	18808

Pin: 2 - 801(TN-YE) - Speaker, left rear -, Gauge: 18

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	800 (GY-LB)	18	Speaker, left rear +	
2	801 (TN-YE)	18	Speaker, left rear -	

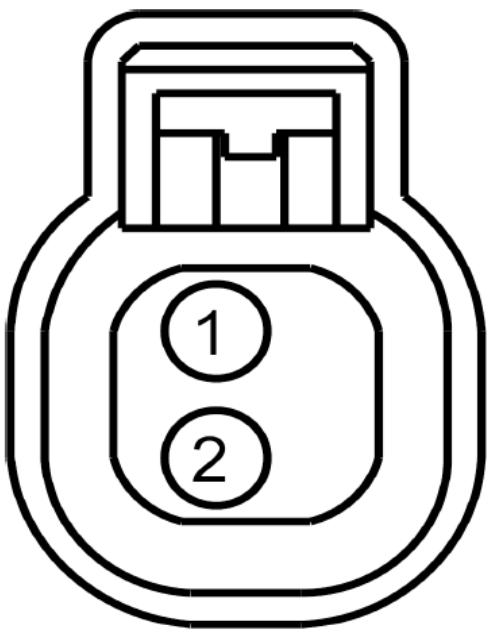


Fig. 156: Identifying Connector C484 (Speaker, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C485	Description:	Harness:	Base Part #:
	SPEAKER, RIGHT REAR	14A005	18808

Pin	Circuit	Gauge	Circuit Function Qualifier
1	802 (OG-RD)	18	Speaker, right rear +
2	803 (BN-PK)	18	Speaker, right rear -

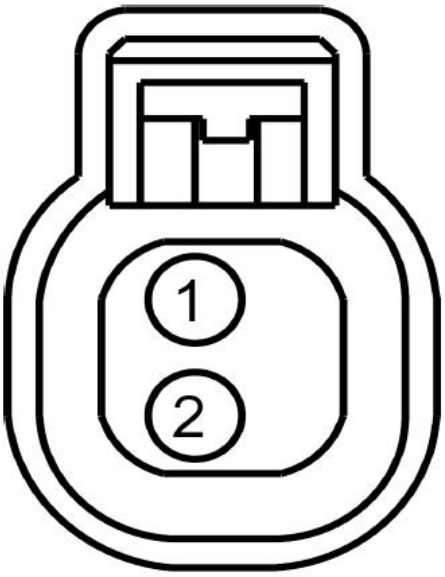
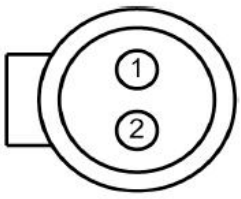


Fig. 157: Identifying Connector C485 (Speaker, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C490	Description:	Harness:	Base Part #:
	LICENSE LAMPS	13412	13550



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps

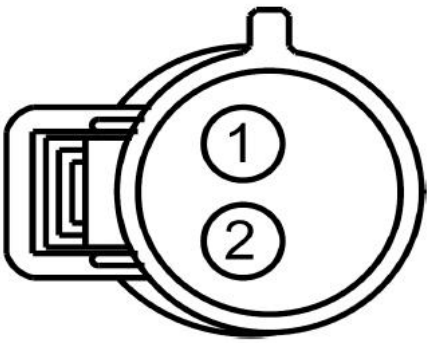
Fig. 158: Identifying Connector C490 (License Lamps)
Courtesy of FORD MOTOR CO.

Inline: C494

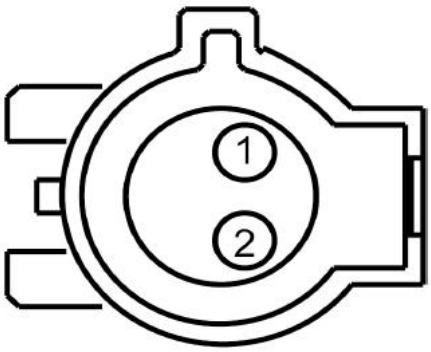
Description: Inline

Base Part #:

MALE
Harness: 14A733-C



FEMALE
Harness: 15A599



Pin	Circuit	Gauge	Qualifier
1	6 (YE-LG)	16	15A599
1	6 (YE-LG)	20	14A733-C
2	6 (YE-LG)	16	15A599
2	6 (YE-LG)	18	14A733-C

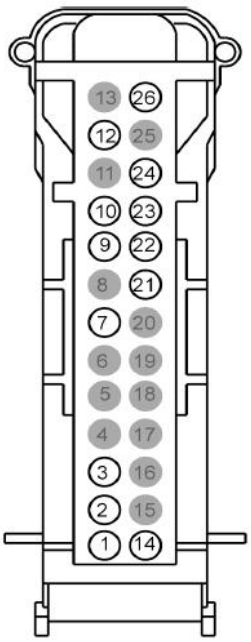
Fig. 159: Identifying Connector C494 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C501A

Description: DRIVER DOOR MODULE (DDM)

Harness: 14A005

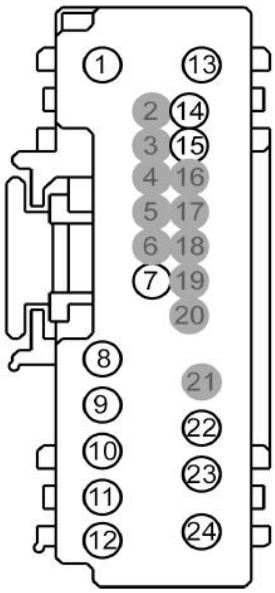
Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	914 (TN-OG)	20	SCP Bus +	
2	79 (LG-RD)	22	Key pad, output, 3/4	
3	121 (YE-BK)	22	Key pad, output, 5/6	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	78 (LB-YE)	22	Key pad, output, 1/2	
8	*	*	not used	
9	119 (PK-YE)	22	Door lock switch signal, Lock	
10	120 (PK-LG)	22	Door lock switch signal, Unlock	
11	*	*	not used	
12	26 (WH-VT)	22	Decklid ajar signal	
13	*	*	not used	
14	915 (PK-LB)	20	SCP Bus -	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	165 (TN-WH)	20	High beam disable	
22	867 (DB)	20	Driver door open signal	
23	1010 (DB-OG)	22	Rear defrost switch signal on demand	
24	1312 (LG-BK)	22	Anti-theft inhibit switch, arm	
25	*	*	not used	
26	66 (LB)	22	Key pad illumination -	

Fig. 160: Identifying Connector C501A (Driver Door Module (DDM))
Courtesy of FORD MOTOR CO.

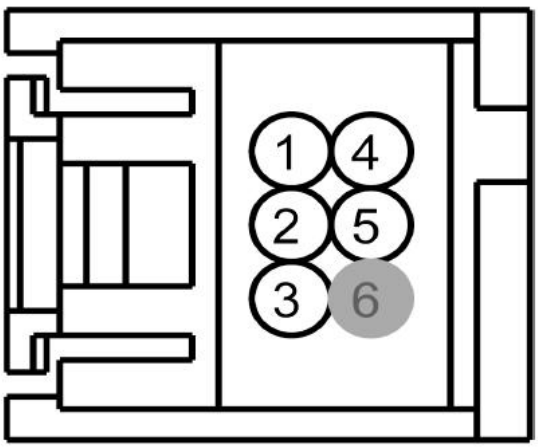
Connector: C501B | **Description:** DRIVER DOOR MODULE (DDM) | **Harness:** 14A005 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	117 (PK-BK)	16	All door lock +	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	627 (BK-OG)	20	Door ajar switch signal, right front	
8	163 (RD-OG)	18	Driver door Unlock -	
9	163 (RD-OG)	18	Driver door Unlock -	
10	1213 (WH-LB)	16	Voltage supplied at all times (overload protected)	
11	1213 (WH-LB)	16	Voltage supplied at all times (overload protected)	
12	84 (VT-YE)	16	Luggage compartment switch, switched power	
13	118 (PK-OG)	16	Passenger doors Unlock -	
14	19 (LB-RD)	20	Variable dimmer Instrument illumination feed	
15	688 (GY-LB)	22	Rear window defrost relay control	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	1523 (DG)	20	Voltage supplied at all times (overload protected)	
23	676 (PK-OG)	20	Ground	
24	57 (BK)	16	Ground	

Fig. 161: Identifying Connector C501B (Driver Door Module (DDM))
Courtesy of FORD MOTOR CO.

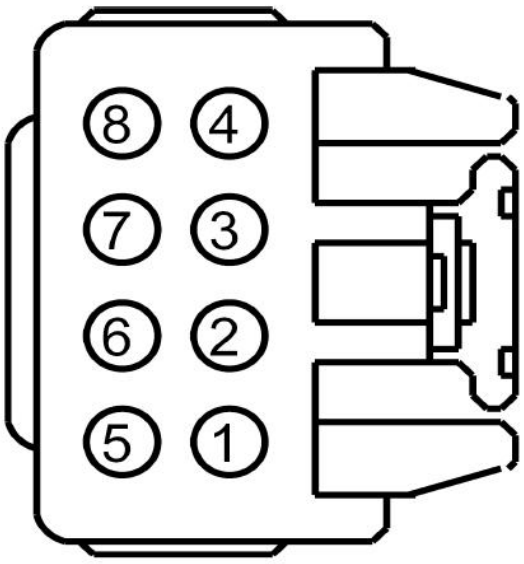
Connector: C501C | **Description:** DRIVER DOOR MODULE (DDM) | **Harness:** 14A005 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2305 (VT-LB)	20	Antenna enable	
2	2306 (GY-RD)	20	Antenna ask/fsk	
3	2307 (BK-WH)	20	Antenna ground	
4	2308 (RD-WH)	20	Antenna power	
5	2309 (LB-BK)	20	Antenna data	
6	*	*	not used	

Fig. 162: Identifying Connector C501C (Driver Door Module (DDM))
Courtesy of FORD MOTOR CO.

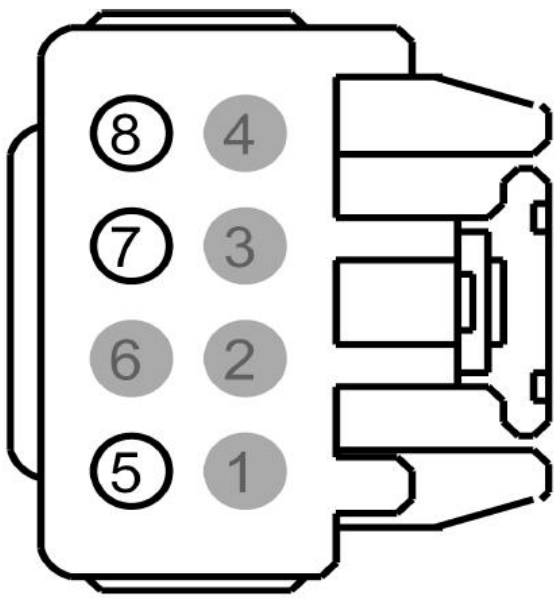
Connector: C504A | **Description:** MASTER WINDOW ADJUST SWITCH | **Harness:** 14A005 | **Base Part #:** 14540



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	316 (YE-LB)	14	Left rear window circuit, up switch sense	
2	317 (GY-OG)	14	Left rear window circuit, down switch sense	
3	319 (YE-BK)	12	Right rear window circuit, down switch sense	
4	320 (RD-BK)	12	Right rear window circuit, up switch sense	
5	226 (WH-BK)	14	Power window motor, driver side front +/-	
6	227 (YE)	14	Power window motor, driver side front +/-	
7	313 (WH-YE)	12	Passenger front window circuit switch sense	
8	314 (TN-LB)	12	Passenger front window circuit switch sense	

Fig. 163: Identifying Connector C504A (Master Window Adjust Switch)
Courtesy of FORD MOTOR CO.

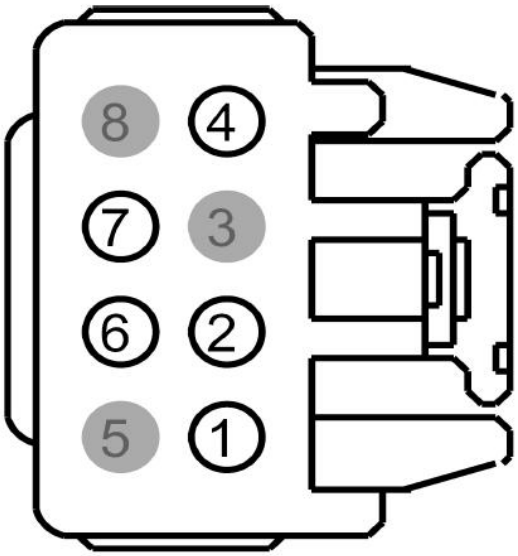
Connector: C504B | **Description:** MASTER WINDOW ADJUST SWITCH | **Harness:** 14A005 | **Base Part #:** 14540



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	57 (BK)	12	Ground	
6	*	*	not used	
7	170 (RD-LB)	12	Window lockout signal	
8	193 (YE-LG)	12	Accessory relay output	

Fig. 164: Identifying Connector C504B (Master Window Adjust Switch)
Courtesy of FORD MOTOR CO.

Connector: C505 | **Description:** DOOR LOCK SWITCH, DRIVER SIDE | **Harness:** 14A005 | **Base Part #:** 14963

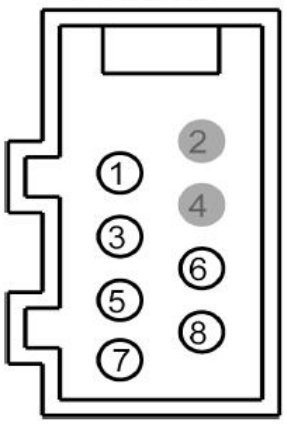


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	20	Voltage in Run or Accessory (overload protected)	
2	119 (PK-YE)	22	Door lock switch signal, Lock	
3	*	*	not used	
4	1523 (DG)	20	Voltage supplied at all times (overload protected)	
5	*	*	not used	
6	120 (PK-LG)	22	Door lock switch signal, Unlock	
7	57 (BK)	20	Ground	
8	*	*	not used	

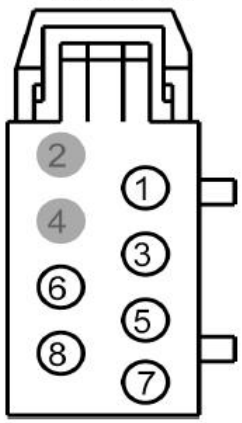
Fig. 165: Identifying Connector C505 (Door Lock Switch, Driver Side)
Courtesy of FORD MOTOR CO.

Inline: C510 | **Description:** Inline | **Base Part #:**

MALE
Harness: 14C719



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	1020 (DG-VT)	20	
2	*	*	
3	964 (DB-LG)	20	14C719
3	964 (DB-LG)	22	14A005
4	*	*	
5	1019 (TN-LB)	20	
6	1255 (WH-RD)	22	
7	1018 (LG-OG)	20	
8	57 (BK)	22	

Fig. 166: Identifying Connector C510 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C516	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, LEFT	14A005	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	940 (DB-OG)	22	Left mirror, Up/Down mirror movement +/-	
2	945 (YE-BK)	22	Mirror motor common	
3	942 (RD-OG)	22	Left mirror, Right/Left mirror movement +/-	
4	57 (BK)	20	Ground	
5	*	*	not used	
6	59 (DG-VT)	20	Fused rear window defrost relay, switched power	

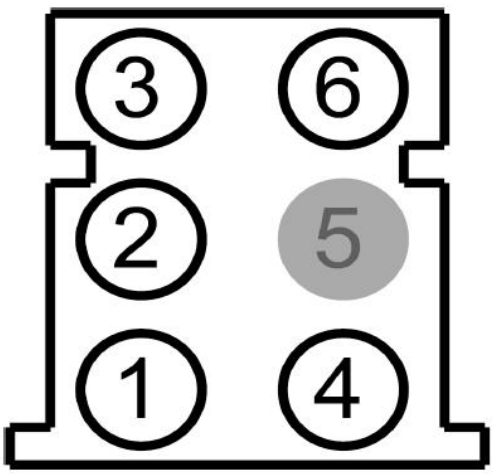


Fig. 167: Identifying Connector C516 (Exterior Rear View Mirror, Left)
Courtesy of FORD MOTOR CO.

Connector: C519	Description:	Harness:	Base Part #:
	SEAT ADJUST SWITCH, DRIVER SIDE FRONT	14A005	14B709

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	979 (RD-LB)	14	Front height motor +/-	
2	918 (GY)	14	Seat backrest motor +/-	
3	919 (GY-BK)	14	Seat backrest motor +/-	
4	983 (RD-LG)	14	Rear height motor +/-	
5	982 (YE-LG)	14	Rear height motor +/-	
6	*	*	not used	
7	57 (BK)	14	Ground	
8	978 (YE-LB)	14	Front height motor +/-	
9	980 (YE-WH)	14	Fwd/Rwd motor +/-	
10	981 (RD-WH)	14	Fwd/Rwd motor +/-	
11	517 (BK-WH)	14	Voltage supplied at all times (overload protected)	
12	*	*	not used	

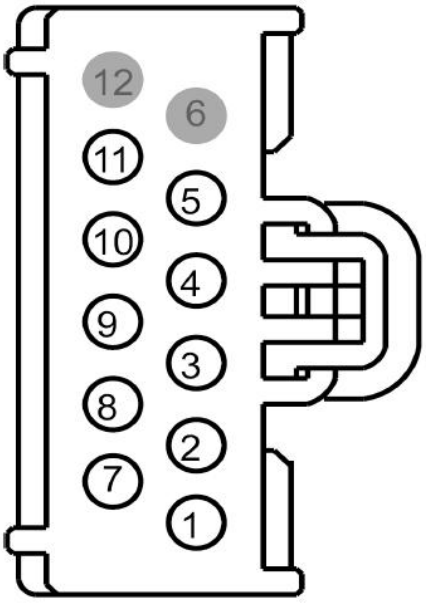


Fig. 168: Identifying Connector C519 (Seat Adjust Switch, Driver Side Front)
Courtesy of FORD MOTOR CO.

Connector: C523	Description:	Harness:	Base Part #:
	SPEAKER, LEFT FRONT	14A005	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	804 (OG-LG)	18	Speaker, left front +	
2	813 (LB-WH)	18	Speaker, left front -	

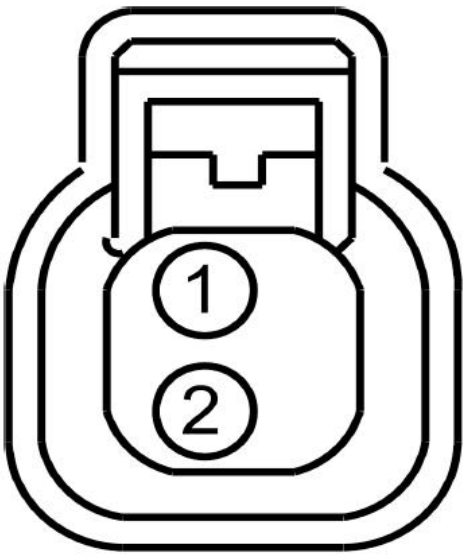


Fig. 169: Identifying Connector C523 (Speaker, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C524	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, DRIVER SIDE FRONT	14A005	23395

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	226 (WH-BK)	14	Power window motor, driver side front +/-	
2	227 (YE)	14	Power window motor, driver side front +/-	

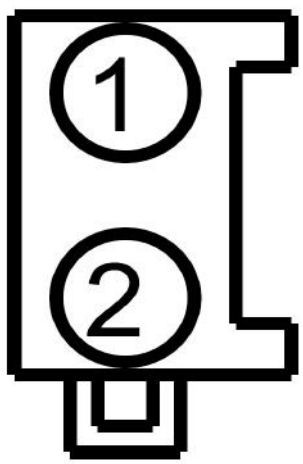
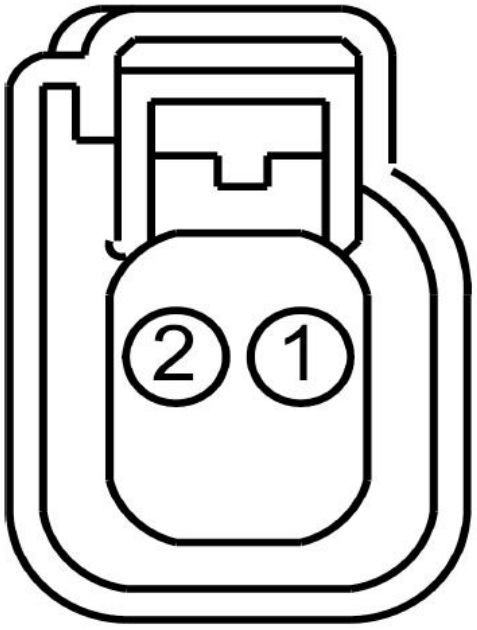


Fig. 170: Identifying Connector C524 (Power Window Motor, Driver Side Front)
Courtesy of FORD MOTOR CO.

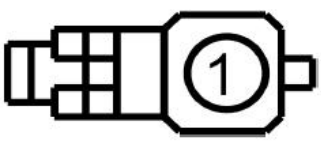
Connector: C525	Description:	Harness:	Base Part #:
	DOOR LOCK ACTUATOR, LEFT FRONT	14A005	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	163 (RD-OG)	16	Driver door Unlock -
2	117 (PK-BK)	16	All door lock +

Fig. 171: Identifying Connector C525 (Door Lock Actuator, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C526A	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, DRIVER SIDE FRONT	14A005	14018



Pin	Circuit	Gauge	Circuit Function Qualifier
1	867 (DB)	20	Driver door opm signal

Fig. 172: Identifying Connector C526A (Door Ajar Switch, Driver Side Front)
Courtesy of FORD MOTOR CO.

Connector: C526B	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, DRIVER SIDE FRONT	14A005	14018

Pin: 1 - 57(BK) - Ground, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	

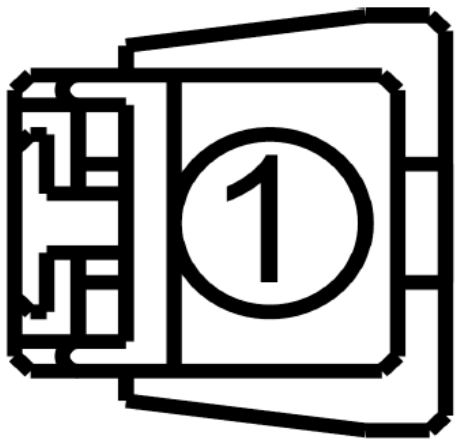


Fig. 173: Identifying Connector C526B (Door Ajar Switch, Driver Side Front)
Courtesy of FORD MOTOR CO.

Connector: C527	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR SWITCH	14A005	17B676

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	942 (RD-OG)	22	Left mirror, Right/Left mirror movement +/-	
2	944 (DG-OG)	20	Right mirror, Right/Left mirror movement +/-	
3	*	*	not used	
4	1523 (DG)	20	Voltage supplied at all times (overload protected)	
5	943 (VT-OG)	20	Right mirror, Up/Down mirror movement +/-	
6	940 (DB-OG)	22	Left mirror, Up/Down mirror movement +/-	
7	945 (YE-BK)	22	Mirror motor common	
8	57 (BK)	20	Ground	

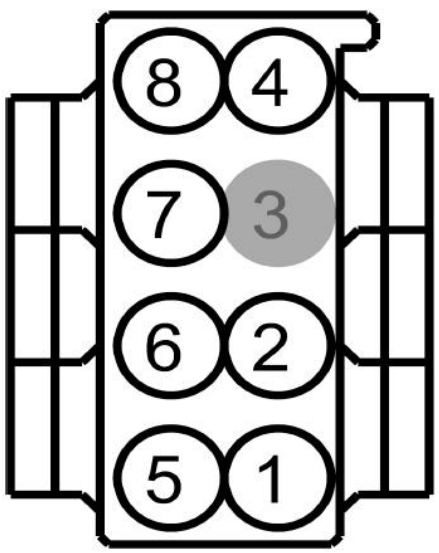
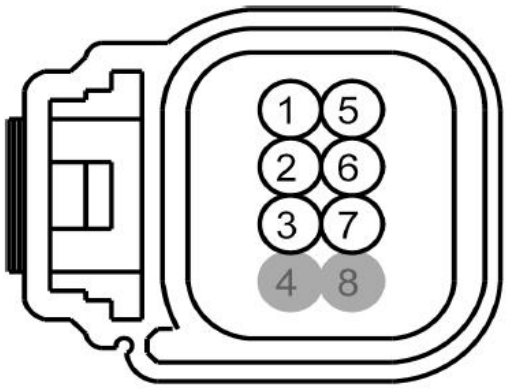


Fig. 174: Identifying Connector C527 (Exterior Rear View Mirror Switch)
Courtesy of FORD MOTOR CO.

Connector: C530 | **Description:** KEYLESS ENTRY KEYPAD | **Harness:** 14A005 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	78 (LB-YE)	22	Key pad, output, 1/2	
2	1523 (DG)	20	Voltage supplied at all times (overload protected)	
3	79 (LG-RD)	22	Key pad, output, 3/4	
4	*	*	not used	
5	66 (LB)	22	Key pad illumination -	
6	57 (BK)	22	Ground	
7	121 (YE-BK)	22	Key pad, output, 5/6	
8	*	*	not used	

Fig. 175: Identifying Connector C530 (Keyless Entry Keypad)
Courtesy of FORD MOTOR CO.

Connector: C534 | **Description:** LUGGAGE COMPARTMENT LID RELEASE SWITCH 1 | **Harness:** 14A005 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	193 (YE-LG)	14	Accessory relay output	
1	1523 (DG)	22	Voltage supplied at all times (overload protected)	
2	26 (WH-VT)	22	Decklid ajar signal	

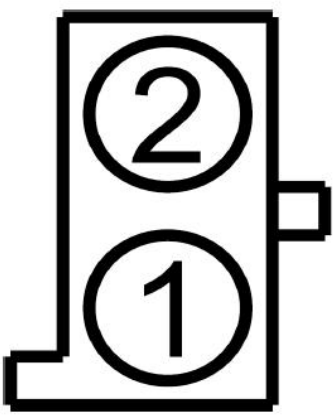
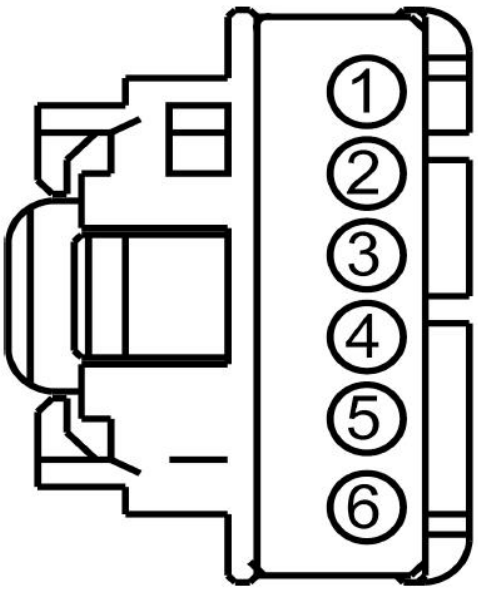


Fig. 176: Identifying Connector C534 (Luggage Compartment Lid Release Switch 1)
Courtesy of FORD MOTOR CO.

Connector: C538	Description:	Harness:	Base Part #:
	SEAT HEATER SWITCH, DRIVER SIDE	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	Ground	
2	1255 (WH-RD)	22	Low temperature switch signal	
3	1018 (LG-OG)	20	Low temperature indicator control	
4	1019 (TN-LB)	20	High temperature indicator control	
5	964 (DB-LG)	20	Voltage in Run or Accessory (overload protected)	
6	1020 (DG-VT)	20	High temperature switch signal	

Fig. 177: Identifying Connector C538 (Seat Heater Switch, Driver Side)
Courtesy of FORD MOTOR CO.

Connector: C579	Description:	Harness:	Base Part #:
	DRIVER DOOR PERIMETER DISARM SWITCH	14A005	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	25 (DG-VT)	22	R4.B5 relay control	
2	*	*	not used	
3	57 (BK)	22	Ground	
4	*	*	not used	

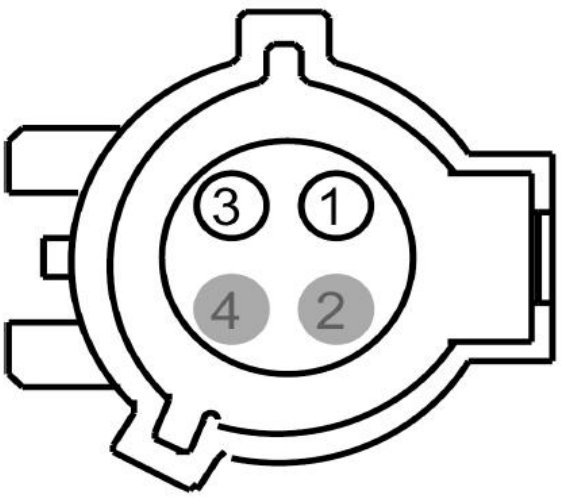
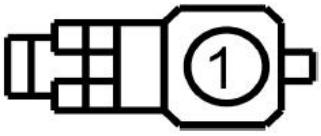


Fig. 178: Identifying Connector C579 (Driver Door Perimeter Disarm Switch)
Courtesy of FORD MOTOR CO.

Connector: C602A	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, PASSENGER SIDE FRONT	14A005	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	627 (BK-OG)	20	Door ajar switch signal, right front	

Fig. 179: Identifying Connector C602A (Door Ajar Switch, Passenger Side Front)
Courtesy of FORD MOTOR CO.

Connector: C602B	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, PASSENGER SIDE FRONT	14A005	14018

Pin: 1 - 57(BK) - Ground, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	

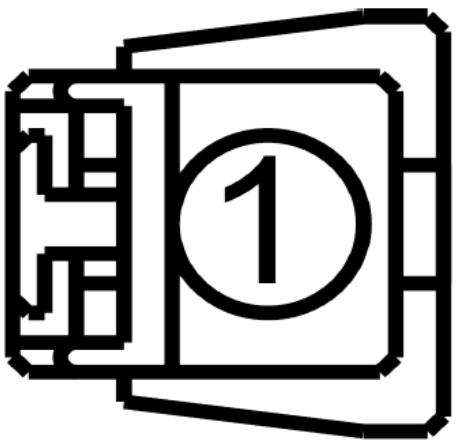


Fig. 180: Identifying Connector C602B (Door Ajar Switch, Passenger Side Front)
Courtesy of FORD MOTOR CO.

Connector: C603

Description:	Harness:	Base Part #:
DOOR LOCK ACTUATOR, PASSENGER SIDE	14A005	218A42

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	118 (PK-OG)	16	Passenger doors Unlock -	
2	117 (PK-BK)	16	All door lock +	

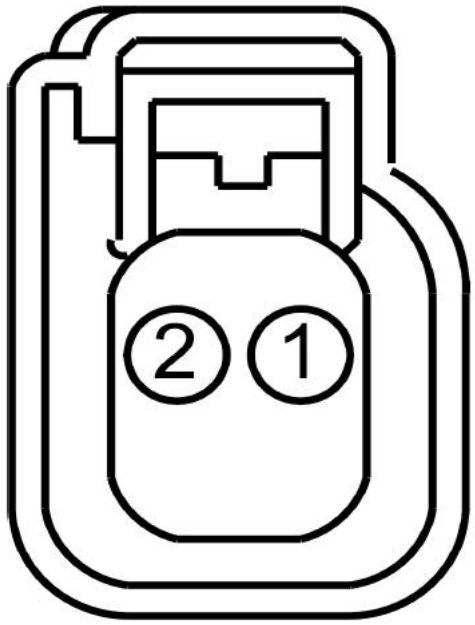


Fig. 181: Identifying Connector C603 (Door Lock Actuator, Passenger Side)
Courtesy of FORD MOTOR CO.

Connector: C605

Description:	Harness:	Base Part #:
DOOR LOCK SWITCH, PASSENGER SIDE	14A005	14963

Pin: 2 - 119(PK-YE) - Door lock switch signal, Lock, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	20	Voltage in Run or Accessory (overload protected)	
2	119 (PK-YE)	20	Door lock switch signal, Lock	
3	*	*	not used	
4	1523 (DG)	20	Voltage supplied at all times (overload protected)	
5	*	*	not used	
6	120 (PK-LG)	20	Door lock switch signal, Unlock	
7	57 (BK)	20	Ground	
8	*	*	not used	

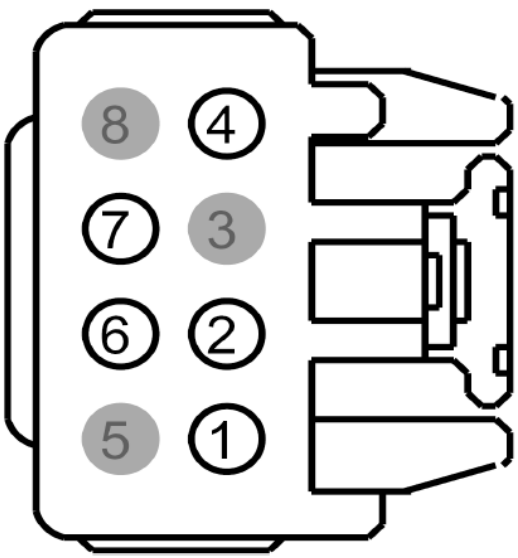


Fig. 182: Identifying Connector C605 (Door Lock Switch, Passenger Side)
Courtesy of FORD MOTOR CO.

Connector: C608

Description: POWER WINDOW MOTOR, PASSENGER SIDE FRONT

Harness: 14A005

Base Part #: 23394

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	334 (RD-YE)	14	Power window motor, left rear +/-	
2	333 (YE-RD)	14	Power window motor, left rear +/-	

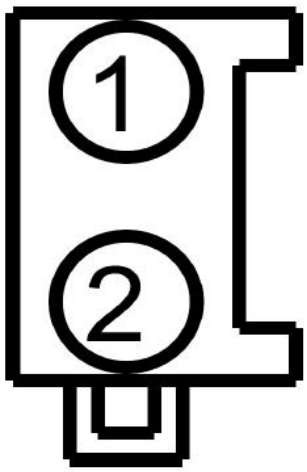


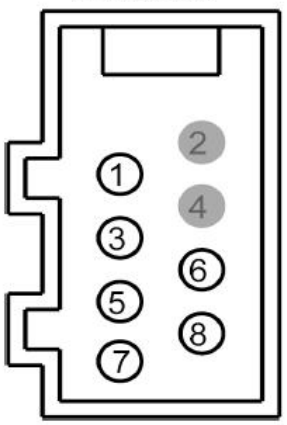
Fig. 183: Identifying Connector C608 (Power Window Motor, Passenger Side Front)
Courtesy of FORD MOTOR CO.

Inline: C610

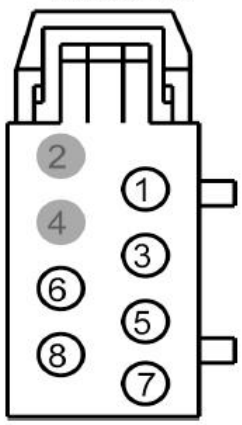
Description: Inline

Base Part #:

MALE
Harness: 14C719



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	1020 (DG-VT)	20	14C719
1	581 (RD)	20	14A005
2	*	*	
3	964 (DB-LG)	20	
4	*	*	
5	1019 (TN-LB)	20	14C719
5	580 (BN)	20	14A005
6	1255 (WH-RD)	20	14C719
6	1256 (WH-YE)	20	14A005
7	1018 (LG-DG)	20	14C719
7	579 (BK-OG)	20	14A005
8	57 (BK)	22	

Fig. 184: Identifying Connector C610 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C612

Description:	Harness:	Base Part #:
SPEAKER, RIGHT FRONT	14A005	18808

Pin: 2 - 811(DG-OG) - Speaker, right front -, Gauge: 18

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	805 (WH-LG)	18	Speaker, right front +	
2	811 (DG-OG)	18	Speaker, right front -	

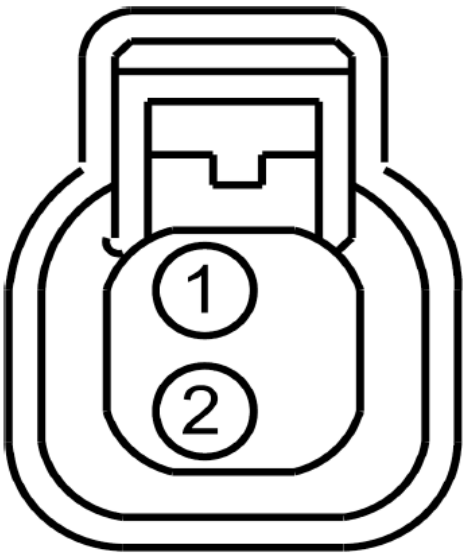


Fig. 185: Identifying Connector C612 (Speaker, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C622

Description:	Harness:	Base Part #:
EXTERIOR REAR VIEW MIRROR, RIGHT	14A005	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	943 (VT-OG)	20	Right mirror, Up/Down mirror movement +/-	
2	945 (YE-BK)	20	Mirror motor common	
3	944 (DG-OG)	20	Right mirror, Right/Left mirror movement +/-	
4	57 (BK)	20	Ground	
5	*	*	not used	
6	59 (DG-VT)	20	Fused rear window defrost relay, switched power	

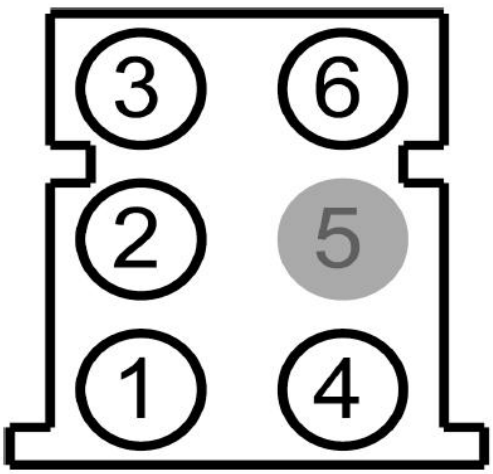
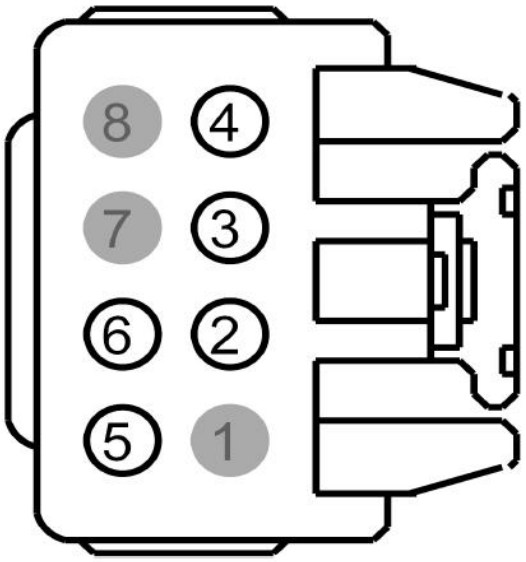


Fig. 186: Identifying Connector C622 (Exterior Rear View Mirror, Right)
Courtesy of FORD MOTOR CO.

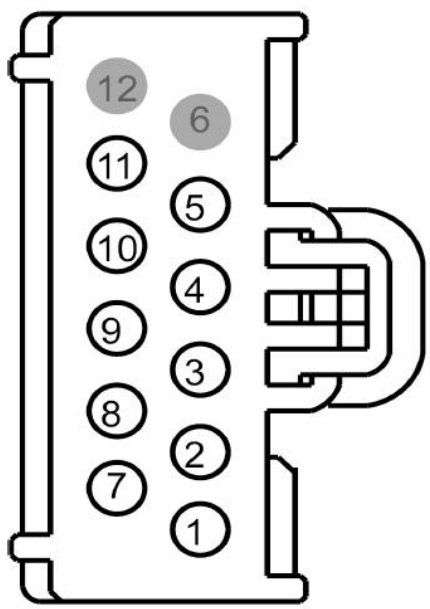
Connector: C624 | **Description:** POWER WINDOW SWITCH, RH SIDE FRONT | **Harness:** 14A005 | **Base Part #:** 14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	334 (RD-YE)	14	Power window motor, left rear +/-	
3	313 (WH-YE)	12	Passenger front window circuit switch sense	
4	170 (RD-LB)	14	Window lockout signal	
5	314 (TN-LB)	12	Passenger front window circuit switch sense	
6	333 (YE-RD)	14	Power window motor, left rear +/-	
7	*	*	not used	
8	*	*	not used	

Fig. 187: Identifying Connector C624 (Power Window Switch, Rh Side Front)
Courtesy of FORD MOTOR CO.

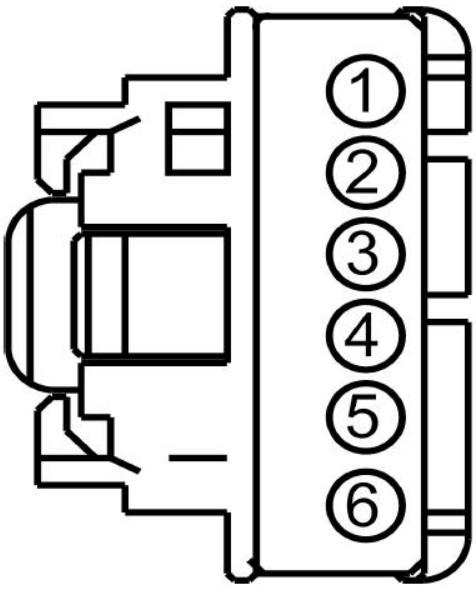
Connector: C627 | **Description:** SEAT ADJUST SWITCH, PASSENGER SIDE FRONT | **Harness:** 14A005 | **Base Part #:** 14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	985 (RD-LB)	14	Front height motor +/-	
2	918 (GY)	14	Seat backrest motor +/-	
3	919 (GY-BK)	14	Seat backrest motor +/-	
4	989 (RD-LG)	14	Rear height motor +/-	
5	988 (YE-LG)	14	Rear height motor +/-	
6	*	*	not used	
7	57 (BK)	14	Ground	
8	984 (YE-LB)	14	Front height motor +/-	
9	986 (YE-WH)	14	Fwd/Rwd motor +/-	
10	987 (RD-WH)	14	Fwd/Rwd motor +/-	
11	517 (BK-WH)	14	Voltage supplied at all times (overload protected)	
12	*	*	not used	

Fig. 188: Identifying Connector C627 (Seat Adjust Switch, Passenger Side Front)
Courtesy of FORD MOTOR CO.

Connector: C630 | Description: SEAT HEATER SWITCH, PASSENGER SIDE | Harness: 14C719 | Base Part #:

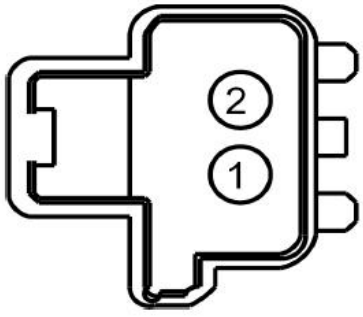


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	Ground	
2	1255 (WH-RD)	20	Low temperature switch signal	
3	1018 (LG-DG)	20	Low temperature indicator control, passenger side	
4	1019 (TN-LB)	20	High temperature indicator control, passenger side	
5	964 (DB-LG)	20	Voltage in Run or Accessory (overload protected)	
6	1020 (DG-VT)	20	High temperature switch, passenger side signal	

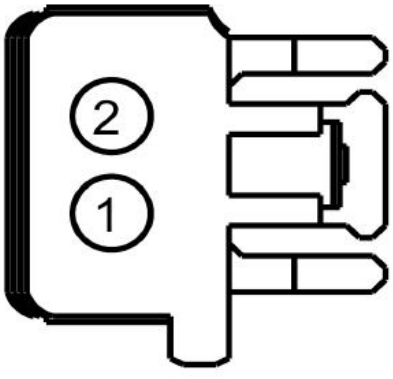
Fig. 189: Identifying Connector C630 (Seat Heater Switch, Passenger Side)
Courtesy of FORD MOTOR CO.

Inline: C700 | Description: Inline | Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14632

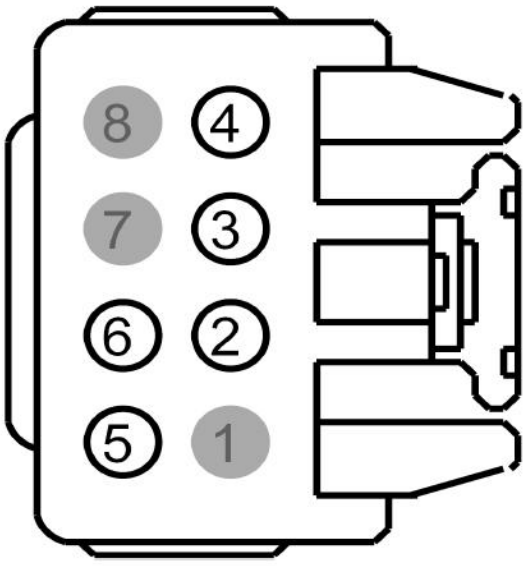


Pin	Circuit	Gauge	Qualifier
1	334 (RD-YE)	12	14632
1	334 (RD-YE)	14	14A005
2	333 (YE-RD)	12	14632
2	333 (YE-RD)	14	14A005

Fig. 190: Identifying Connector C700 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C701

Description:	Harness:	Base Part #:
WINDOW ADJUST SWITCH, LEFT REAR	14A005	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	333 (YE-RD)	14	Power window motor, left rear +/-	
3	317 (GY-OG)	14	Left rear window circuit, down switch sense	
4	170 (RD-LB)	12	Window lockout signal	
5	316 (YE-LB)	14	Left rear window circuit, up switch sense	
6	334 (RD-YE)	14	Power window motor, left rear +/-	
7	*	*	not used	
8	*	*	not used	

Fig. 191: Identifying Connector C701 (Window Adjust Switch, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C703

Description:	Harness:	Base Part #:
POER WINDOW MOTOR, LEFT REAR	14632	23394

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	334 (RD-YE)	12	Power window motor, left rear +/-	
2	333 (YE-RD)	12	Power window motor, left rear +/-	

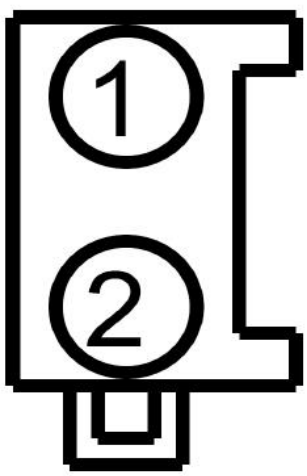
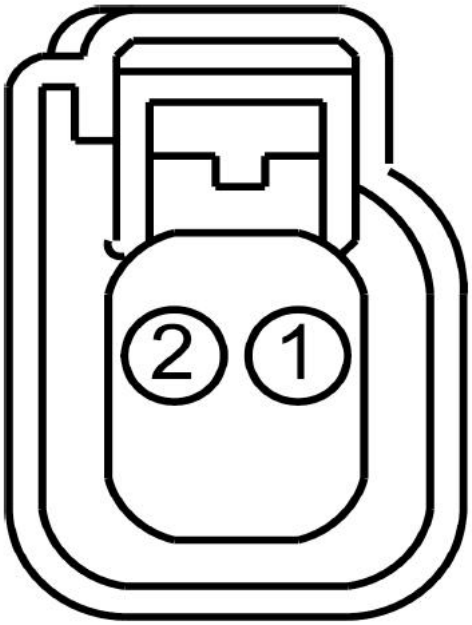


Fig. 192: Identifying Connector C703 (Power Window Motor, Left Rear)
Courtesy of FORD MOTOR CO.

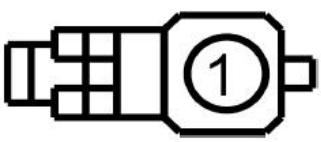
Connector: C704	Description:	Harness:	Base Part #:
	DOOR LOCK ACTUATOR, LEFT REAR	14A005	218A43



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	118 (PK-OG)	16	Passenger doors Unlock -	
2	117 (PK-BK)	16	All door lock +	

Fig. 193: Identifying Connector C704 (Door Lock Actuator, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C715A	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, DRIVER SIDE REAR	14A005	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	627 (BK-OG)	20	Door ajar switch signal, right rear	

Fig. 194: Identifying Connector C715A (Door Ajar Switch, Driver Side Rear)
Courtesy of FORD MOTOR CO.

Connector: C715B

Description: DOOR AJAR SWITCH, DRIVER SIDE REAR

Harness: 14A005

Base Part #: 14018

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	

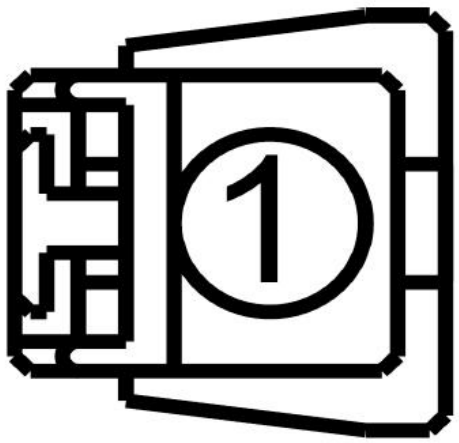


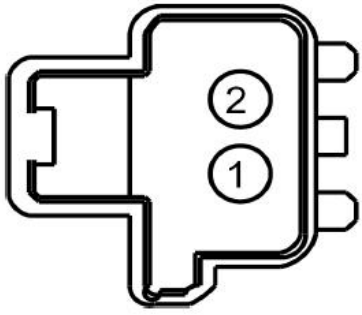
Fig. 195: Identifying Connector C715B (Door Ajar Switch, Driver Side Rear)
Courtesy of FORD MOTOR CO.

Inline: C800

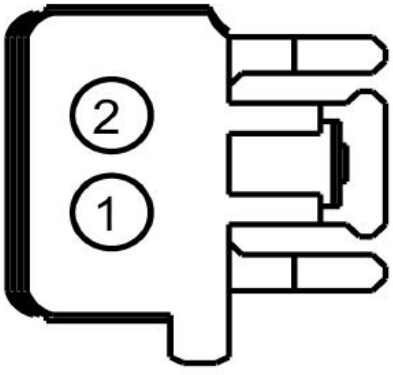
Description: Inline

Base Part #:

MALE
Harness: 14A005



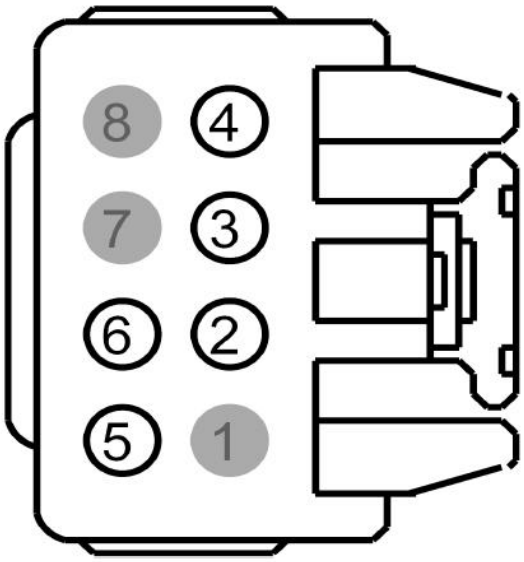
FEMALE
Harness: 14632



Pin	Circuit	Gauge	Qualifier
1	334 (RD-YE)	12	
2	333 (YE-RD)	12	

Fig. 196: Identifying Connector C800 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C801	Description:	Harness:	Base Part #:
	WINDOW ADJUST SWITCH, RIGHT REAR	14A005	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	333 (YE-RD)	12	Power window motor, left rear +/-	
3	319 (YE-BK)	12	Right rear window circuit, down switch sense	
4	170 (RD-LB)	12	Window lockout signal	
5	320 (RD-BK)	12	Right rear window circuit, up switch sense	
6	334 (RD-YE)	12	Power window motor, left rear +/-	
7	*	*	not used	
8	*	*	not used	

Fig. 197: Identifying Connector C801 (Window Adjust Switch, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C803	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, RIGHT REAR	14632	23394

Pin: 2 - 333(YE-RD) - Power window motor, left rear +/-, Gauge: 12

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	334 (RD-YE)	12	Power window motor, left rear +/-	
2	333 (YE-RD)	12	Power window motor, left rear +/-	

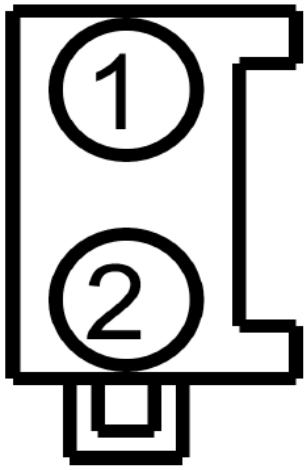


Fig. 198: Identifying Connector C803 (Power Window Motor, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C804	Description:	Harness:	Base Part #:
	DOOR LOCK ACTUATOR, RIGHT REAR	14A005	218A42

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	118 (PK-OG)	16	Passenger doors Unlock -	
2	117 (PK-BK)	16	All door lock +	

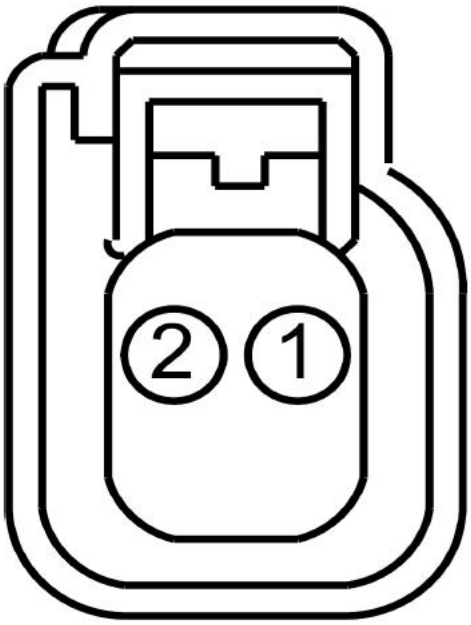
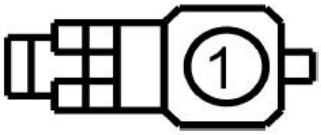


Fig. 199: Identifying Connector C804 (Door Lock Actuator, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C820A	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, PASSENGER SIDE REAR	14A005	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	627 (BK-OG)	20	Door ajar switch signal, left rear	

Fig. 200: Identifying Connector C820A (Door Ajar Switch, Passenger Side Rear)
Courtesy of FORD MOTOR CO.

Connector: C820B	Description:	Harness:	Base Part #:
	DOOR AJAR SWITCH, PASSENGER SIDE REAR	14A005	14018

Pin: 1 - 57(BK) - Ground, Gauge: 20

Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground

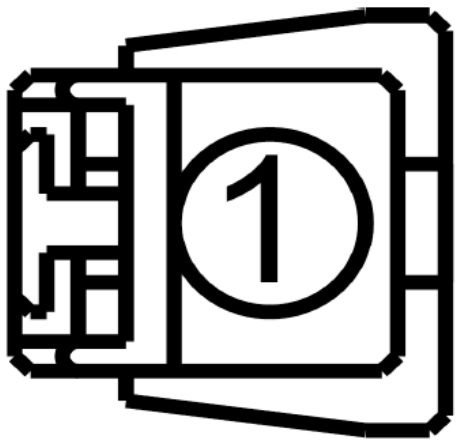


Fig. 201: Identifying Connector C820B (Door Ajar Switch, Passenger Side Rear)
Courtesy of FORD MOTOR CO.

Connector: C906	Description:	Harness:	Base Part #:
	VANITY MIRROR LAMP, RIGHT	14334	04100

Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	22	Ground
2	705 (LG-OG)	20	Demand lighting

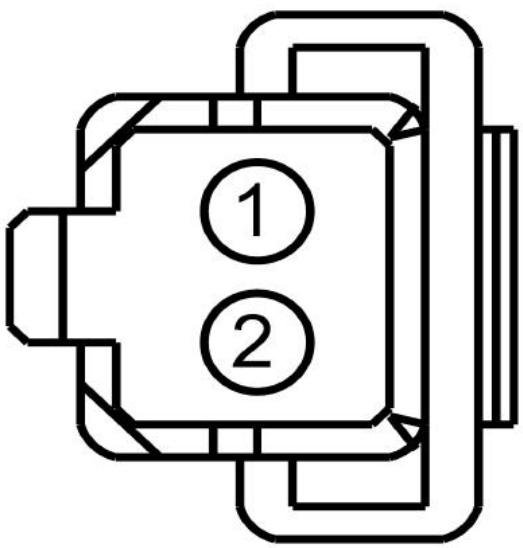


Fig. 202: Identifying Connector C906 (Vanity Mirror Lamp, Right)
Courtesy of FORD MOTOR CO.

Connector: C907	Description:	Harness:	Base Part #:
	VANITY MIRROR LAMP, LEFT	14334	04100

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	Ground	
2	705 (LG-OG)	20	Demand lighting	

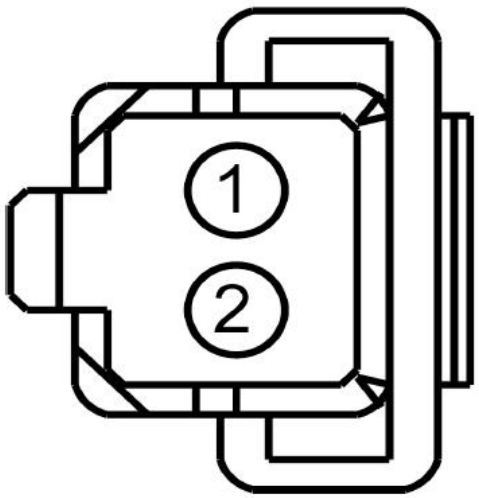


Fig. 203: Identifying Connector C907 (Vanity Mirror Lamp, Left)
Courtesy of FORD MOTOR CO.

Connector: C911	Description:	Harness:	Base Part #:
	ELECTROCHROMATIC INSIDE MIRROR UNIT	14334	17700

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
2	57 (BK)	22	Ground	
3	140 (BK-PK)	22	Voltage supplied in reverse	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	

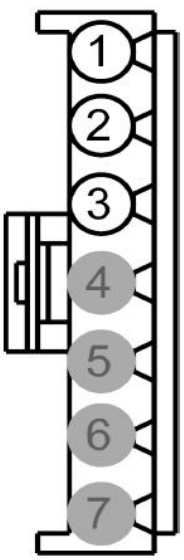


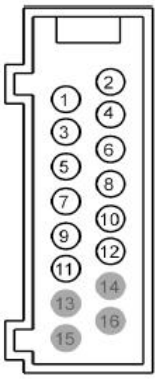
Fig. 204: Identifying Connector C911 (Electrochromatic Inside Mirror Unit)
Courtesy of FORD MOTOR CO.

Inline: C913

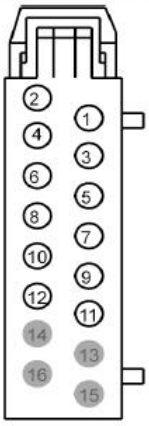
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14334



Pin	Circuit	Gauge	Qualifier
1	705 (LG-OG)	20	
2	53 (BK-LB)	20	
3	964 (DB-LG)	22	
4	57 (BK)	14	14A005
4	57 (BK)	20	14334
5	676 (PK-OG)	16	14A005
5	676 (PK-OG)	22	14334
6	484 (OG-BK)	20	14A005
6	484 (OG-BK)	22	14334
7	140 (BK-PK)	22	
8	679 (GY-BK)	22	
9	914 (TN-OG)	20	14A005
9	914 (TN-OG)	22	14334
10	915 (PK-LB)	20	14A005
10	915 (PK-LB)	22	14334
11	931 (RD-BK)	14	14A005
11	931 (RD-BK)	16	14334
12	19 (LB-RD)	20	
13	*	*	
14	*	*	
15	*	*	
16	*	*	

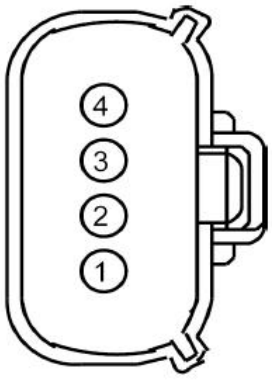
Fig. 205: Identifying Connector C913 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C919

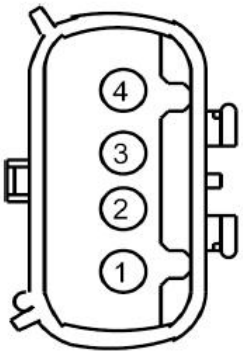
Description:
Inline

Base Part #:

MALE
Harness: PIA



FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	2319 (RD-YE)	20	
2	2315 (BK-PK)	20	
3	2314 (LB-PK)	20	
4	1203 (BK-LB)	20	

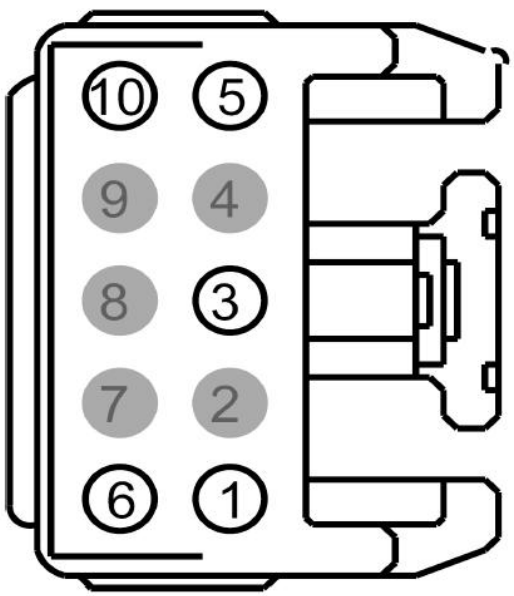
Fig. 206: Identifying Connector C919 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C921

Description:
ROOF OPENING PANEL UNIT

Harness:
14334

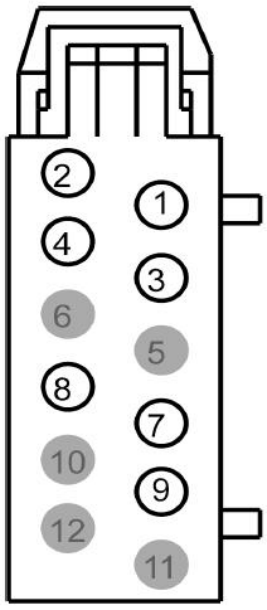
Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	16	Ground	
2	*	*	not used	
3	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
4	*	*	not used	
5	1174 (WH-RD)	22	Roof opening panel switch, Close, Up, signal	
6	931 (RD-BK)	16	Voltage supplied at all times (overload protected)	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	1175 (TN-RD)	22	Roof opening panel switch, Open, Down, signal	

Fig. 207: Identifying Connector C921 (Roof Opening Panel Unit)
Courtesy of FORD MOTOR CO.

Connector: C930 | **Description:** OVERHEAD CONSOLE | **Harness:** 14334 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
2	676 (PK-OG)	22	Ground	
3	679 (GY-BK)	22	vehicle speed signal	
4	484 (OG-BK)	22	Switch illumination +	
5	*	*	not used	
6	*	*	not used	
7	53 (BK-LB)	20	Courtesy lamps feed	
8	705 (LG-OG)	20	Demand lighting	
9	57 (BK)	20	Ground	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	

Fig. 208: Identifying Connector C930 (Overhead Console)
Courtesy of FORD MOTOR CO.

Connector: C932 | **Description:** INTERIOR/MAP LAMPS ASSEMBLY, REAR | **Harness:** 14334 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	705 (LG-OG)	20	Demand lighting	
2	53 (BK-LB)	20	Courtesy lamps feed	
3	57 (BK)	20	Ground	

Fig. 209: Identifying Connector C932 (Interior/Map Lamps Assembly, Rear)
Courtesy of FORD MOTOR CO.

Connector: C954 | **Description:** SPOT LAMP, INTERIOR | **Harness:** 14334 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function Qualifier
1	705 (LG-OG)	20	Demand lighting
2	57 (BK)	20	Ground

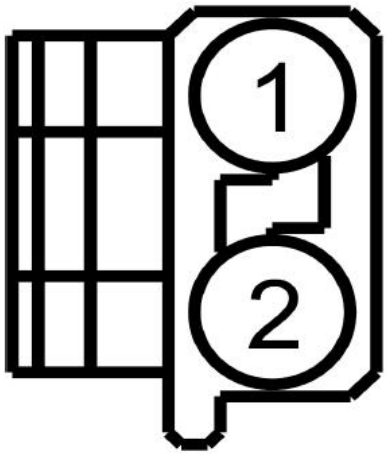


Fig. 210: Identifying Connector C954 (Spot Lamp, Interior)
Courtesy of FORD MOTOR CO.

Connector: C978 | **Description:** MAP READING LAMPS | **Harness:** 14334 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function Qualifier
1	53 (BK-LB)	20	Courtesy lamps feed
2	57 (BK)	20	Ground
3	705 (LG-OG)	20	Demand lighting

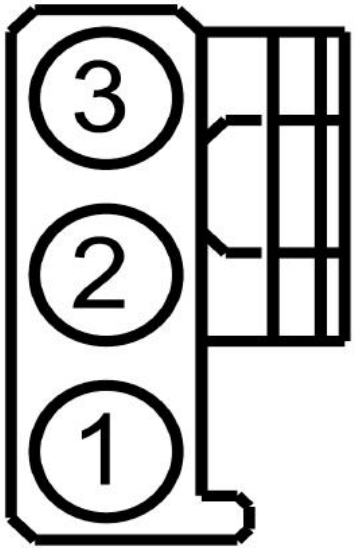
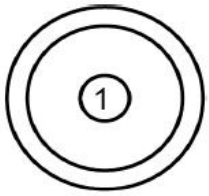


Fig. 211: Identifying Connector C978 (MAP Reading Lamps)
Courtesy of FORD MOTOR CO.

Connector: C994 | Description: TAXI ROOF LAMP | Harness: 14401 | Base Part #:

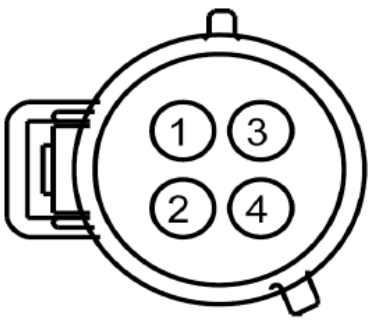


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	42 (RD-WH)	14	Taxi roof lamp power feed	

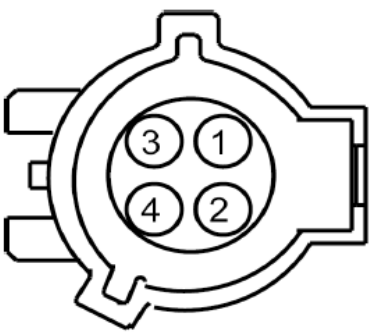
Fig. 212: Identifying Connector C994 (Taxi Roof Lamp)
Courtesy of FORD MOTOR CO.

Inline: C1010 | Description: Inline | Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 15A219



Pin: 3 - 14(BN) - Power, Exterior lamps, Gauge: 20

Pin	Circuit	Gauge	Qualifier
1	57 (BK)	20	
2	380 (VT-YE)	18	
3	14 (BN)	20	
4	3 (LG-WH)	18	14290
4	3 (LG-WH)	20	15A219

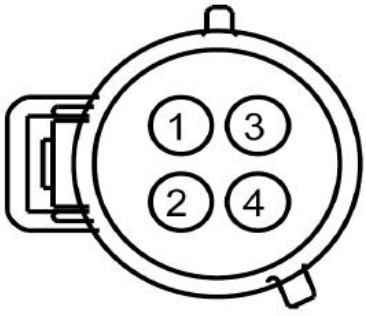
Fig. 213: Identifying Connector C1010 (Inline)
Courtesy of FORD MOTOR CO.

Inline: C1019

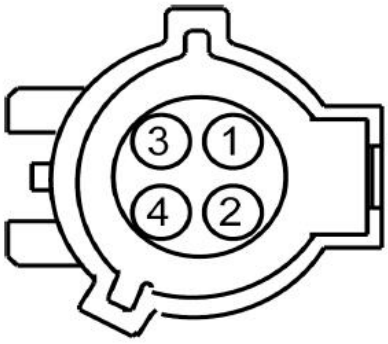
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 15A219



Pin	Circuit	Gauge	Qualifier
1	57 (BK)	20	
2	379 (BN-WH)	18	
3	14 (BN)	20	
4	2 (WH-LB)	18	14290
4	2 (WH-LB)	20	15A219

Fig. 214: Identifying Connector C1019 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C1021

Description:
HEADLAMP, LEFT

Harness:
14290

Base Part #:
13008

Pin: 1 - 160(DB-WH) - Headlamp, left Low beam lamp feed, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	160 (DB-WH)	20	Headlamp, left Low beam lamp feed	
2	57 (BK)	16	Ground	
3	1337 (VT-YE)	20	Headlamp, left high beam lamp feed	

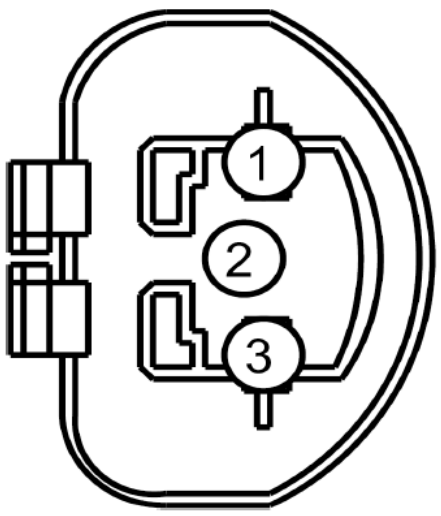


Fig. 215: Identifying Connector C1021 (Headlamp, Left)
Courtesy of FORD MOTOR CO.

Connector: C1023	Description:	Harness:	Base Part #:
	PARK/TURN LAMP, LEFT FRONT	13105	13411

Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	3 (LG-WH)	18	Left turn signal

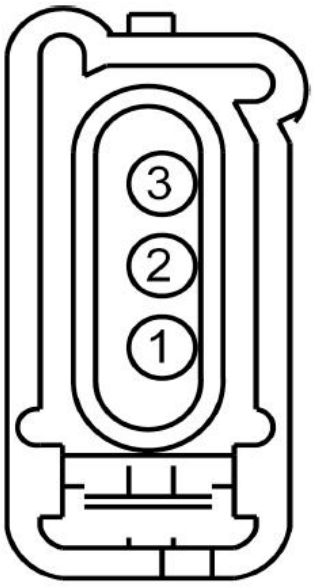
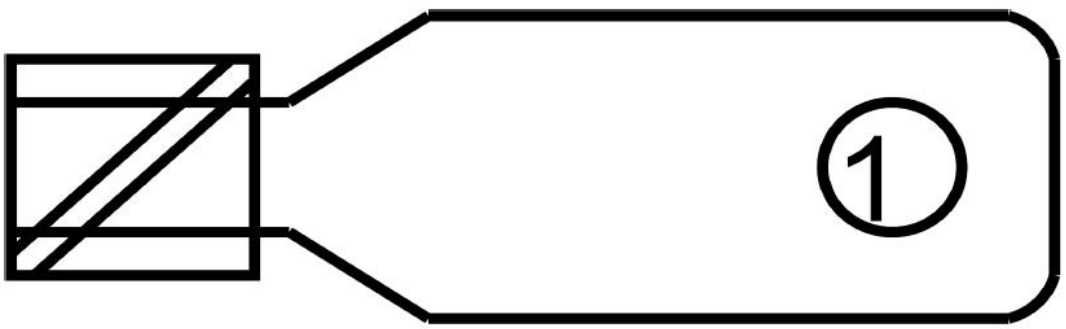


Fig. 216: Identifying Connector C1023 (Park/Turn Lamp, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C1035	Description:	Harness:	Base Part #:
	BATTERY JUNCTION BOX (BJB)	14B060	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	2037 (RD)	04	Battery cable +

Fig. 217: Identifying Connector C1035 (Battery Junction Box (BJB))
Courtesy of FORD MOTOR CO.

Connector: C1041	Description:	Harness:	Base Part #:
	HEADLAMP, RIGHT	14290	13008

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	161 (DG-OG)	20	Headlamp, right low beam lamp feed	
2	57 (BK)	16	Ground	
3	1335 (YE-WH)	20	Headlamp, right high beam lamp feed	

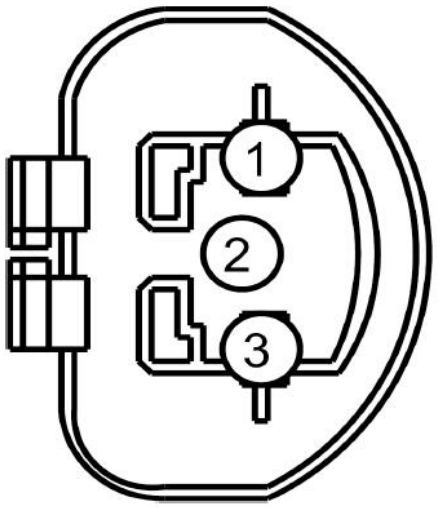


Fig. 218: Identifying Connector C1041 (Headlamp, Right)
Courtesy of FORD MOTOR CO.

Connector: C1043	Description:	Harness:	Base Part #:
	PARK/TURN LAMP, RIGHT FRONT	13105_P	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	14 (BN)	20	Power, Exterior lamps	
3	2 (WH-LB)	18	Right turn signal	

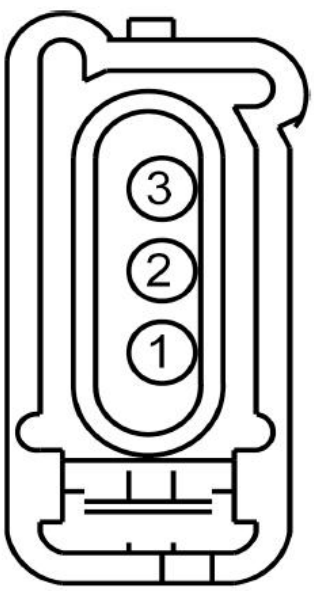
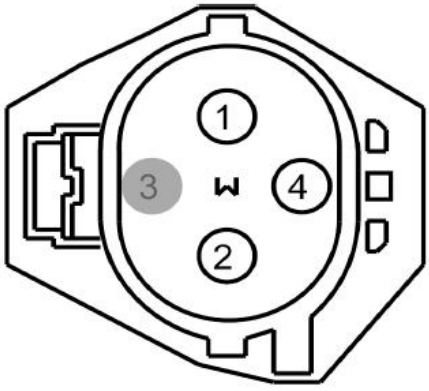


Fig. 219: Identifying Connector C1043 (Park/Turn Lamp, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C1048

Description:	Harness:	Base Part #:
ENGINE COOLING FAN MODULE	14290	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1153 (RD-BK)	10	Voltage supplied at all times (overload protected)	
2	57 (BK)	10	Ground	
3	*	*	not used	
4	229 (RD-OG)	20	Engine cooling fan motor control	

Fig. 220: Identifying Connector C1048 (Engine Cooling Fan Module)
Courtesy of FORD MOTOR CO.

Connector: C1068

Description:	Harness:	Base Part #:
EGR SYSTEM MODULE (ESM)	12B637	

Pin: 1 - 360(BN-PK) - EGR Vacuum regulator signal, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	360 (BN-PK)	20	EGR Vacuum regulator signal	
2	351 (BN-WH)	20	Reference voltage	
3	3067 (LB-RD)	20	Manifold Absolute Pressure (MAP) sensor input	
4	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
5	352 (BN-LG)	20	Differential Pressure Feedback EGR (DPFE) sensor input	
6	359 (GY-RD)	20	Signal return	

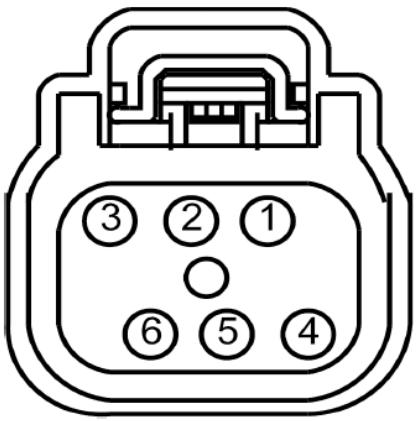


Fig. 221: Identifying Connector C1068 (EGR System Module (ESM))
Courtesy of FORD MOTOR CO.

Connector: C1073	Description:	Harness:	Base Part #:
	FUEL RAIL PRESSURE/TEMPERATURE SENSOR	12B637	

Pin: 3 - 1164(LB) - Fuel rail temperature sensor signal, Gauge: 20

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	141 (RD-PK)	20	Fuel rail pressure sensor signal	
2	351 (BN-WH)	20	Reference voltage	
3	1164 (LB)	20	Fuel rail temperature sensor signal	
4	359 (GY-RD)	20	Signal return	

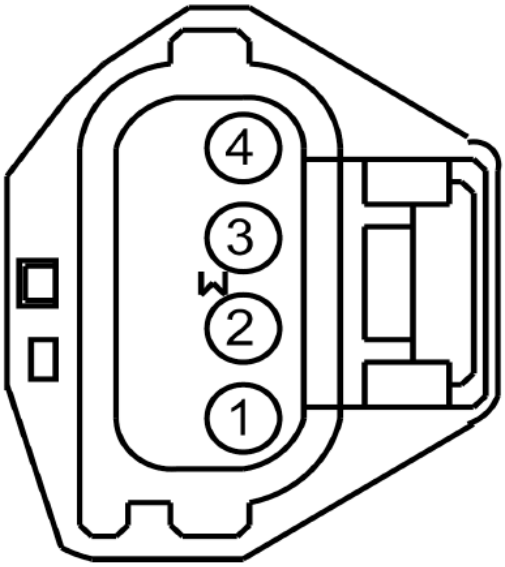


Fig. 222: Identifying Connector C1073 (Fuel Rail Pressure/Temperature Sensor)
Courtesy of FORD MOTOR CO.

Connector: C1081	Description:	Harness:	Base Part #:
	A/C LOW PRESSURE SWITCH	12B637	19E561

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	883 (PK-LB)	20	A/C Low pressure switch signal	
2	*	*	not used	
3	*	*	not used	
4	348 (VT)	20	A/C demand signal	

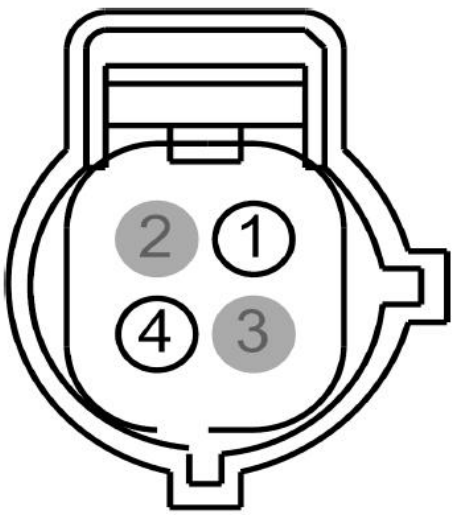


Fig. 223: Identifying Connector C1081 (A/C Low Pressure Switch)
Courtesy of FORD MOTOR CO.

Connector: C1100A	Description:	Harness:	Base Part #:
	BATTERY	14B060	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2037 (RD)	04	Battery cable +	

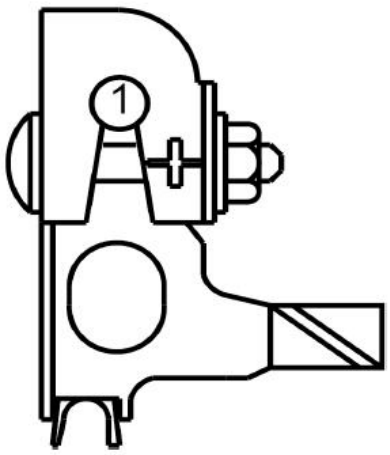
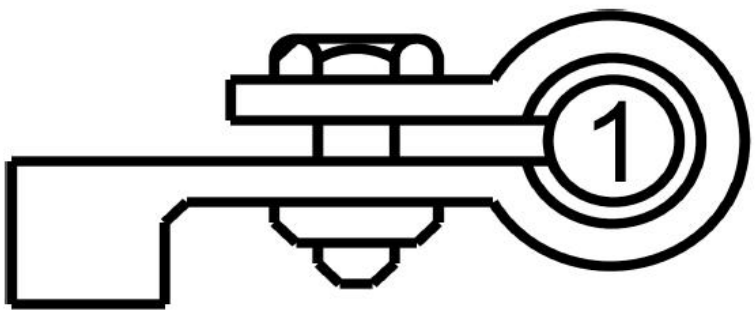


Fig. 224: Identifying Connector C1100A (Battery)
Courtesy of FORD MOTOR CO.

Connector: C1100B	Description:	Harness:	Base Part #:
	BATTERY	14B060	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2057 (BK)	04	Battery cable -	

Fig. 225: Identifying Connector C1100B (Battery)
Courtesy of FORD MOTOR CO.

Connector: C1107	Description:	Harness:	Base Part #:
	OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7M101

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	359 (GY-RD)	20	Signal return	
2	136 (DB-YE)	20	Output shaft speed (OSS) sensor signal	

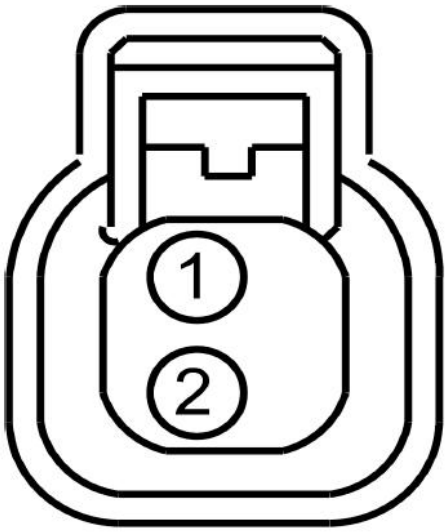


Fig. 226: Identifying Connector C1107 (Output Shaft Speed (OSS) Sensor)
Courtesy of FORD MOTOR CO.

Connector: C1113	Description:	Harness:	Base Part #:
	PARKING LAMP, LEFT FRONT	15A219	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	14 (BN)	20	Power, Exterior lamps	
2	57 (BK)	20	Ground	

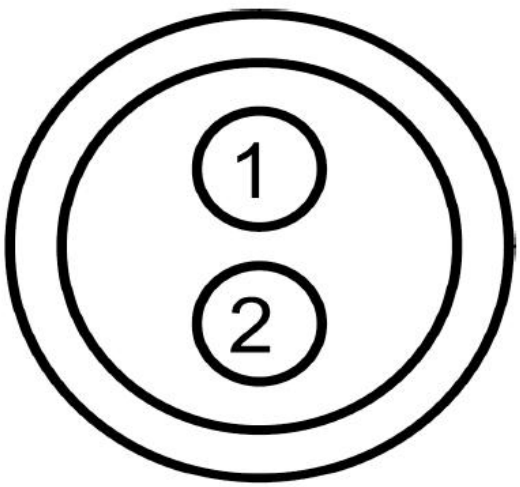


Fig. 227: Identifying Connector C1113 (Parking Lamp, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C1114

Description:	Harness:	Base Part #:
PARKING LAMP, RIGHT FRONT	15A219	

Pin: 2 - 57(BK) - Ground, Gauge: 20

Pin	Circuit	Gauge	Circuit Function Qualifier
1	14 (BN)	20	Power, Exterior lamps
2	57 (BK)	20	Ground

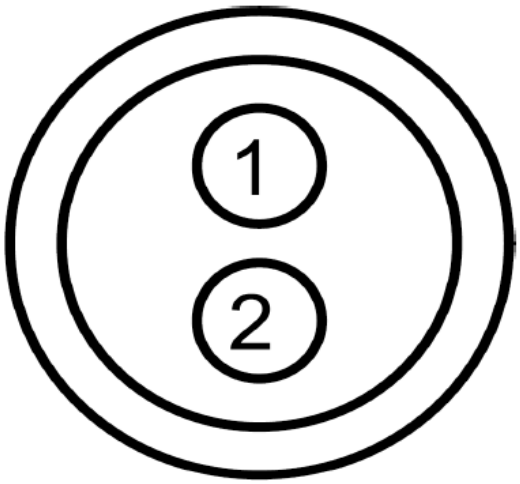
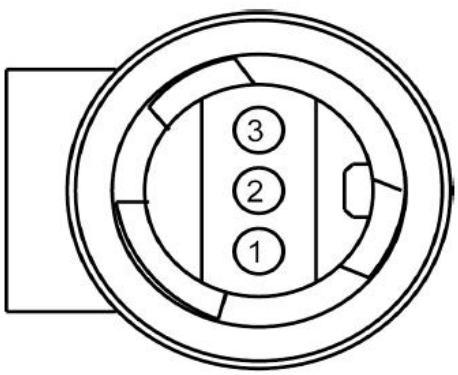


Fig. 228: Identifying Connector C1114 (Parking Lamp, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C1115

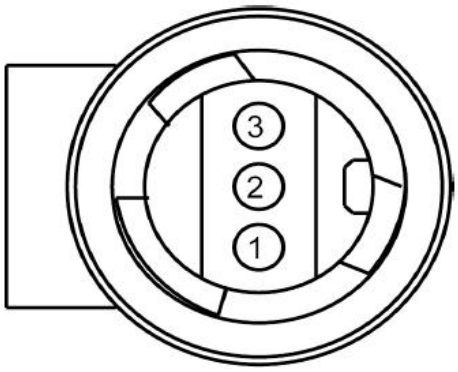
Description:	Harness:	Base Part #:
PARK/ TURN LAMP, LEFT FRONT	15A219	13411



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	3 (LG-WH)	20	Left turn signal

Fig. 229: Identifying Connector C1115 (Park/ Turn Lamp, Left Front)
Courtesy of FORD MOTOR CO.

Connector: C1116	Description:	Harness:	Base Part #:
	PARK/ TURN LAMP, RIGHT FRONT	15A219	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	14 (BN)	20	Power, Exterior lamps	
3	2 (WH-LB)	20	Right turn signal	

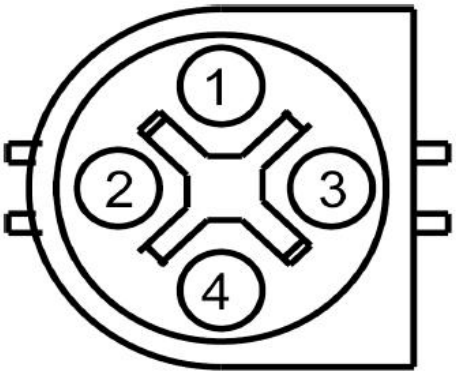
Fig. 230: Identifying Connector C1116 (Park/ Turn Lamp, Right Front)
Courtesy of FORD MOTOR CO.

Connector: C1120	Description:	Harness:	Base Part #:
	CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	139 (GY-YE)	20	Crankshaft position sensor -	
2	138 (BK-PK)	20	Crankshaft postion sensor +	

Fig. 231: Identifying Connector C1120 (Crankshaft Position Sensor)
Courtesy of FORD MOTOR CO.

Connector: C1179	Description:	Harness:	Base Part #:
	AIR SUSPENSION COMPRESSOR ASSEMBLY	14290	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	12	Ground	
2	538 (GY-RD)	12	Air suspension compressor relay switched power	
3	57 (BK)	18	Ground	
4	421 (PK)	18	Air suspension compressor, vent	

Fig. 232: Identifying Connector C1179 (Air Suspension Compressor Assembly)
Courtesy of FORD MOTOR CO.

Connector: C1191	Description:	Harness:	Base Part #:
	POWER STEERING PRESSURE SWITCH	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	330 (YE-LG)	20	Power steering pressure switch signal	
2	359 (GY-RD)	20	Signal return	

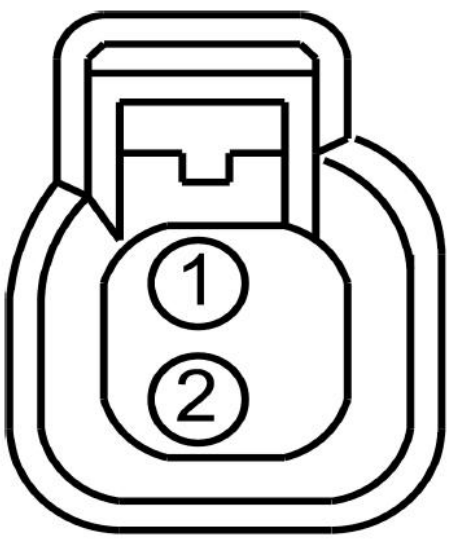
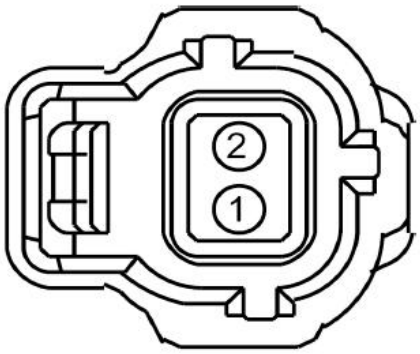


Fig. 233: Identifying Connector C1191 (Power Steering Pressure Switch)
Courtesy of FORD MOTOR CO.

Connector: C1195	Description:	Harness:	Base Part #:
	EVAP CANISTER PURGE VALVE	12B637	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
2	191 (LG-BK)	20	EVAP Canister purge valve control	

Fig. 234: Identifying Connector C1195 (EVAP Canister Purge Valve)
Courtesy of FORD MOTOR CO.

Connector: C1196	Description:	Harness:	Base Part #:
	IGNITION TRANSFORMER CAPACITOR	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1118 (RD)	20	Ignition coils relay switched power	

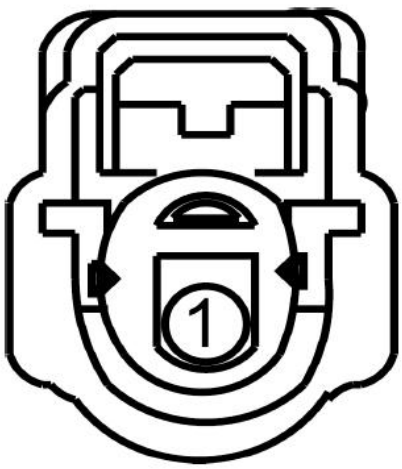


Fig. 235: Identifying Connector C1196 (Ignition Transformer Capacitor)
Courtesy of FORD MOTOR CO.

Connector: C1227

Description:	Harness:	Base Part #:
FRONT BLOWER MOTOR	14290	19805

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	371 (PK-WH)	10	Blower motor relay switched power	
2	261 (OG-BK)	10	Blower motor speed control	
2	515 (OG-RD)	10	Front blower motor speed control	

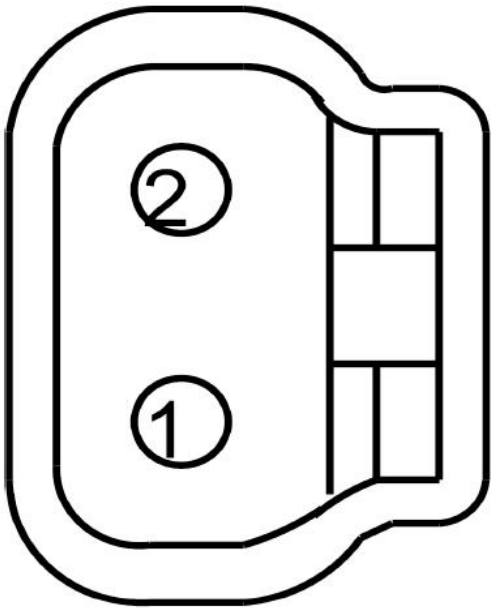


Fig. 236: Identifying Connector C1227 (Front Blower Motor)
Courtesy of FORD MOTOR CO.

Connector: C1260

Description:	Harness:	Base Part #:
A/C PRESSURE TRANSDUCER SENSOR	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	359 (GY-RD)	20	Signal return	
2	351 (BN-WH)	20	Reference voltage	
3	1154 (WH-BK)	20	A/C pressure transducer sensor signal	
4	*	*	not used	

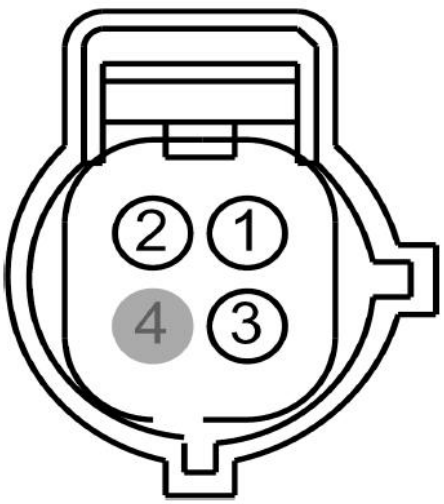
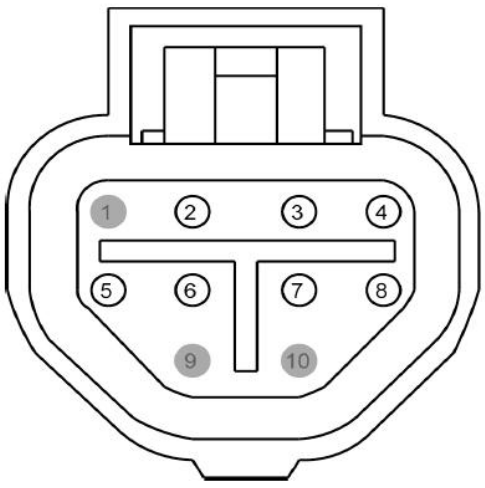


Fig. 237: Identifying Connector C1260 (A/C Pressure Transducer Sensor)
Courtesy of FORD MOTOR CO.

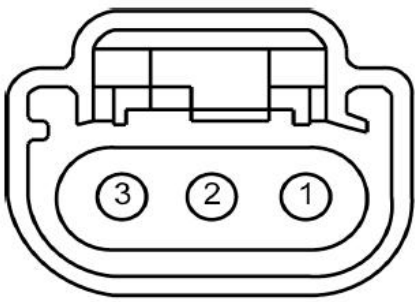
Connector: C1274	Description:	Harness:	Base Part #:
	4R70E TRANSMISSION	12B637	7A091



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	359 (GY-RD)	20	Signal return	
3	126 (VT-YE)	20	Torque Converter Clutch (TCC) solenoid	
4	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
5	923 (OG-BK)	20	Transmission Fluid Temperature (TFT) sensor	
6	925 (WH-YE)	20	Electronic Pressure Control (EPC) solenoid	
7	237 (OG-YE)	20	Shift solenoid A	
8	315 (VT-OG)	20	Shift solenoid B	
9	*	*	not used	
10	*	*	not used	

Fig. 238: Identifying Connector C1274 (4R70E Transmission)
Courtesy of FORD MOTOR CO.

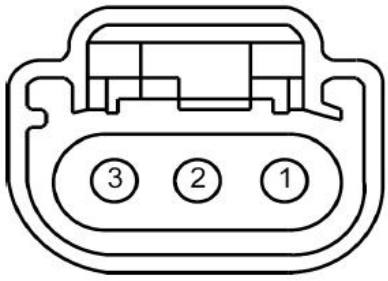
Connector: C1284	Description:	Harness:	Base Part #:
	HEADLAMP, LEFT	14290	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	160 (DB-WH)	20	Headlamp, left Low beam lamp feed	
2	57 (BK)	16	Gound	
3	1337 (VT-YE)	20	Headlamp, left high beam lamp feed	

Fig. 239: Identifying Connector C1284 (Headlamp, Left)
Courtesy of FORD MOTOR CO.

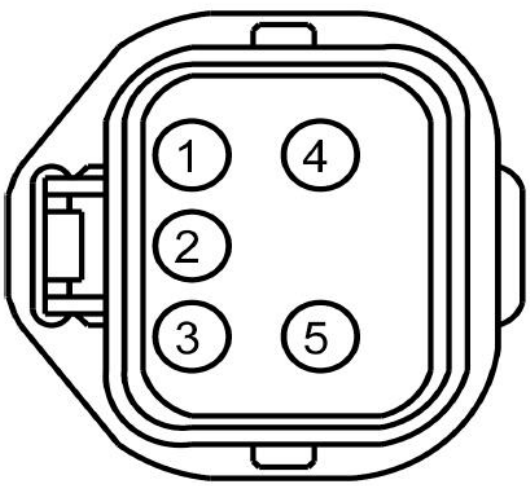
Connector: C1285	Description:	Harness:	Base Part #:
	HEADLAMP, RIGHT	14290	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	161 (DG-OG)	20	Headlamp, right low beam lamp feed	
2	57 (BK)	16	Ground	
3	1335 (YE-WH)	20	Headlamp, right high beam lamp feed	

Fig. 240: Identifying Connector C1285 (Headlamp, Right)
Courtesy of FORD MOTOR CO.

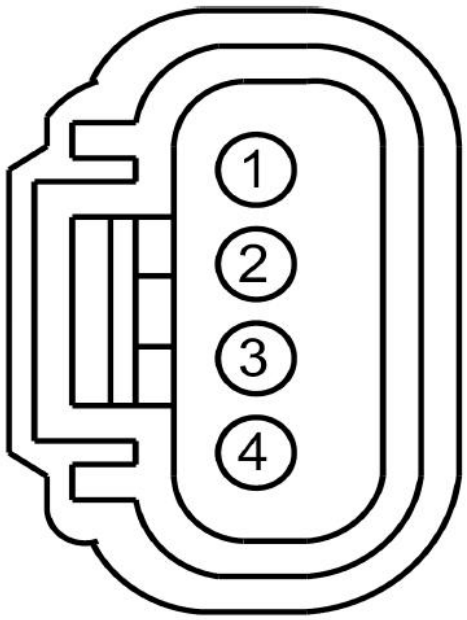
Connector: C1308	Description:	Harness:	Base Part #:
	FRONT BLOWER MOTOR SPEED CONTROLLER	14290	19E624



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	260 (OG-BK)	20	Blower motor speed controller input	
2	752 (YE-RD)	20	Blower motor speed control, common	
3	754 (LG-WH)	20	Blower motor speed control, high	
4	515 (OG-RD)	10	Front blower motor speed control	
5	57 (BK)	10	Ground	

Fig. 241: Identifying Connector C1308 (Front Blower Motor Speed Controller)
Courtesy of FORD MOTOR CO.

Connector: C1349 | Description: FRONT BLOWER MOTOR RESISTER ASSEMBLY | Harness: 14290 | Base Part #: 19A706

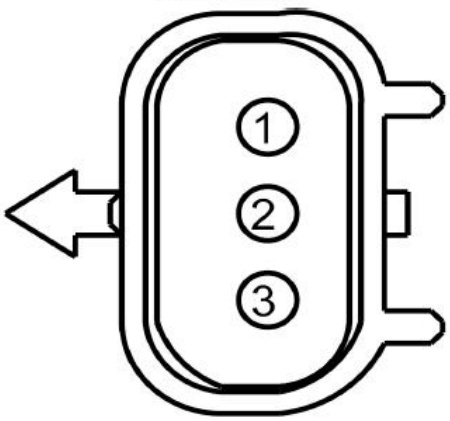


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	754 (LG-WH)	12	Blower motor speed control, high	
2	57 (BK)	12	Ground	
3	752 (YE-RD)	12	Blower motor speed control, common	
4	261 (OG-BK)	12	Blower motor speed control	

Fig. 242: Identifying Connector C1349 (Front Blower Motor Resister Assembly)
Courtesy of FORD MOTOR CO.

Inline: C1352 | Description: Inline | Base Part #:

MALE
Harness: 14290



FEMALE
Harness:

Pin	Circuit	Gauge	Qualifier
1	1335 (YE-WH)	20	
2	1337 (VT-YE)	20	
3	165 (TN-WH)	20	

Fig. 243: Identifying Connector C1352 (Inline)
Courtesy of FORD MOTOR CO.

Connector: C1365

Description:	Harness:	Base Part #:
WIG/WAG MODULE	15A599	

Pin: C - 57(BK) - Ground, Gauge: 16

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	7 (LG-YE)	16	R2.A2 relay switched power	
B	1335 (YE-WH)	16	Headlamp, left high beam lamp feed	
C	57 (BK)	16	Ground	
D	1337 (VT-YE)	16	Headlamp, left high beam lamp feed	

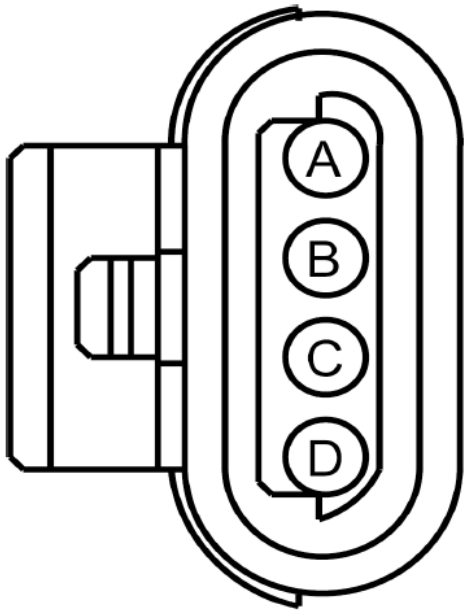


Fig. 244: Identifying Connector C1365 (WIG/WAG Module)
Courtesy of FORD MOTOR CO.

Connector: C1368

Description:	Harness:	Base Part #:
ELECTRONIC THROTTLE CONTROL (ETC) MOTOR	12B637	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1835 (DB-YE)	20	Electronic throttle control motor +/-	
2	1836 (OG-YE)	20	Electronic throttle control motor +/-	

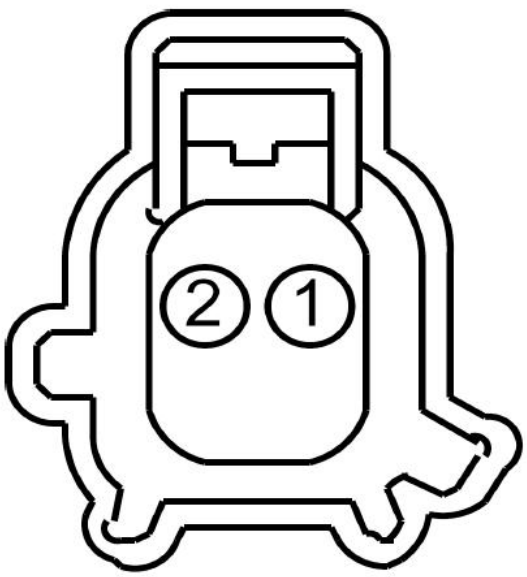


Fig. 245: Identifying Connector C1368 (Electronic Throttle Control (ETC) Motor)
Courtesy of FORD MOTOR CO.

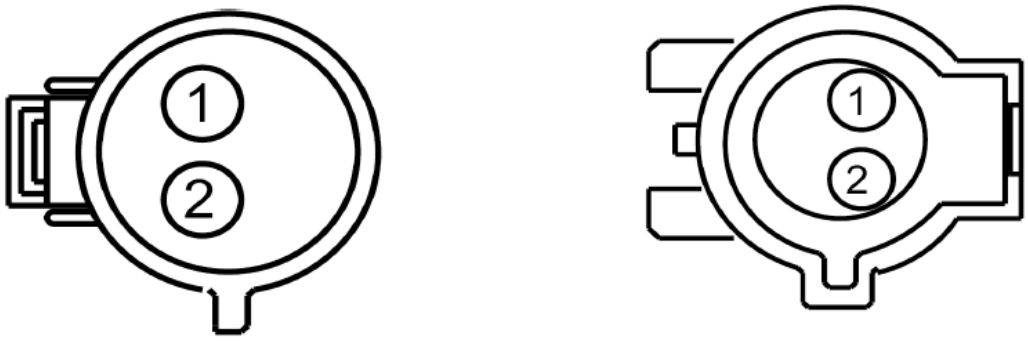
Inline: C1386

Description:
Inline

Base Part #:

MALE
Harness: 14290

FEMALE
Harness: 15A211



Pin: 2 - 57(BK) - Ground, Gauge: 20

Pin	Circuit	Gauge	Qualifier
1	478 (TN-OG)	18	15A211_R
1	478 (TN-OG)	20	14290
2	57 (BK)	20	

Fig. 246: Identifying Connector C1386 (Inline)
Courtesy of FORD MOTOR CO.

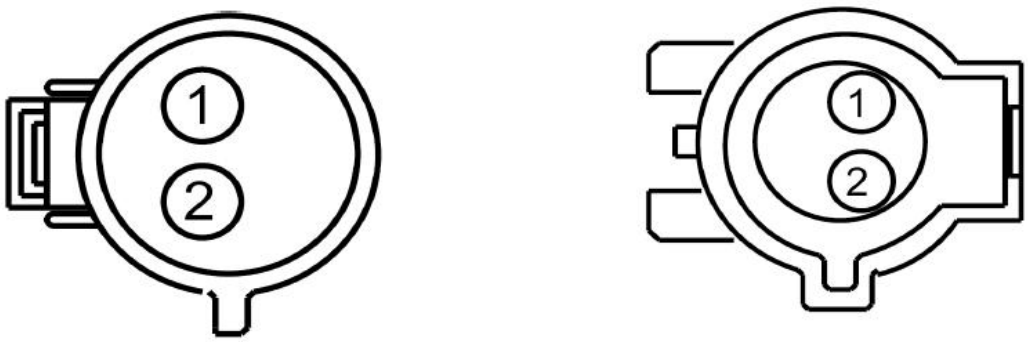
Inline: C1393

Description:
Inline

Base Part #:

MALE
Harness: 14290

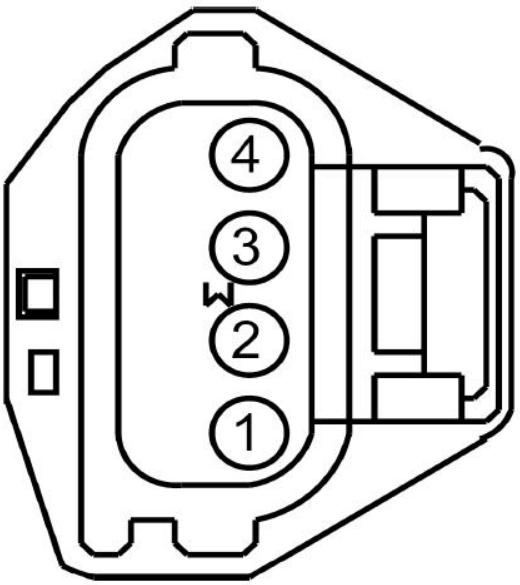
FEMALE
Harness: 15A211



Pin	Circuit	Gauge	Qualifier
1	478 (TN-OG)	18	15A211_L
1	478 (TN-OG)	20	14290
2	57 (BK)	20	

Fig. 247: Identifying Connector C1393 (Inline)
Courtesy of FORD MOTOR CO.

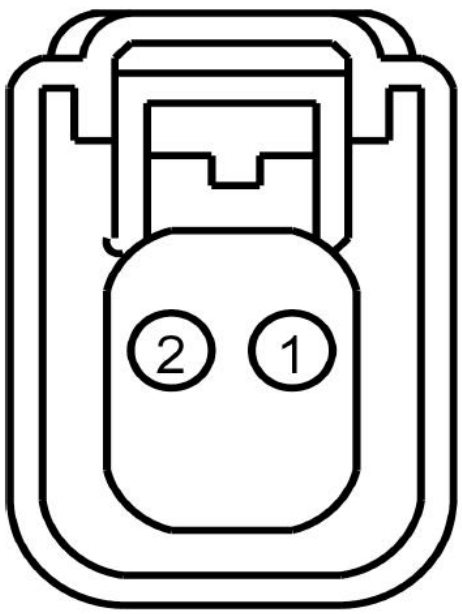
Connector: C1449	Description:	Harness:	Base Part #:
	ELECTRONIC THROTTLE CONTROL (ETC) MODULE	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	357 (YE-WH)	20	Throttle position (TPS) sensor signal 2	
2	1857 (YE-WH)	20	Electronic throttle control module reference voltage	
3	1858 (PK-OG)	20	Electronic throttle control module signal return	
4	355 (GY-WH)	20	Throttle position (TPS) sensor signal 1	

Fig. 248: Identifying Connector C1449 (Electronic Throttle Control (ETC) Module)
Courtesy of FORD MOTOR CO.

Connector: C1465	Description:	Harness:	Base Part #:
	FRONT IMPACT SEVERITY SENSOR, LEFT	14290	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	617 (PK-OG)	20	Front impact severity sensor feed	
2	618 (VT-LG)	20	Front impact severity sensor return	

Fig. 249: Identifying Connector C1465 (Front Impact Severity Sensor, Left)
Courtesy of FORD MOTOR CO.

Connector: C1466 | Description: FRONT IMPACT SEVERITY SENSOR, RIGHT | Harness: 14290 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	619 (PK-WH)	20	Air bag crash sensor #2 feed	
2	620 (VT-LB)	20	Air bag crash sensor #2 ground monitor	

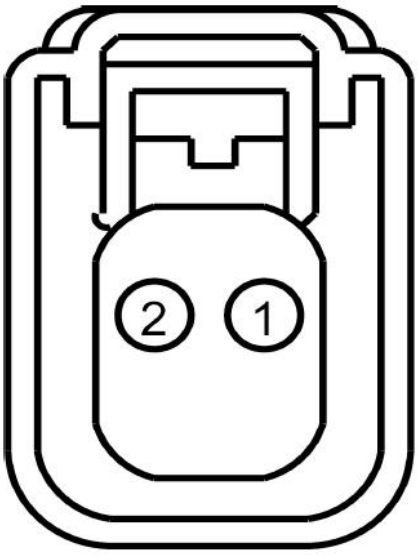
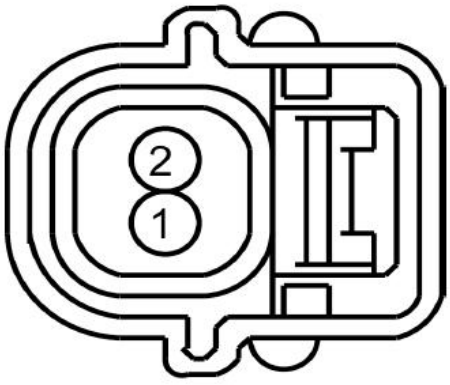


Fig. 250: Identifying Connector C1466 (Front Impact Severity Sensor, Right)
Courtesy of FORD MOTOR CO.

Connector: C1470 | Description: HEATED PCV | Harness: 12B637 | Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	391 (RD-YE)	20	Voltage supplied at Start and Run (overload protected)	
2	369 (WH-OG)	20	Heated PCV control	

Fig. 251: Identifying Connector C1470 (Heated PCV)
Courtesy of FORD MOTOR CO.

Connector: C1471	Description:	Harness:	Base Part #:
	SIREN SPEAKER	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	13 (RD-BK)	16	siren +	
B	14 (BN)	16	Power, Exterior lamps	

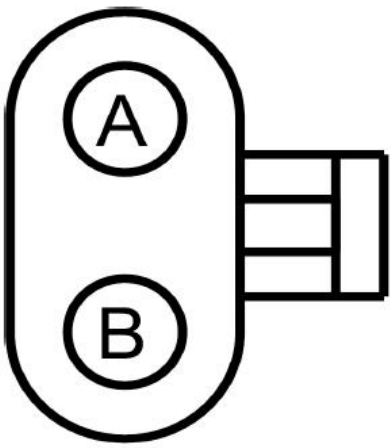


Fig. 252: Identifying Connector C1471 (Siren Speaker)
Courtesy of FORD MOTOR CO.

Connector: C1478	Description:	Harness:	Base Part #:
	LEFT FRONT STROBE ASSEMBLY	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	188 (WH-BK)	16	Left front strobe -	
C	57 (BK)	16	Ground	

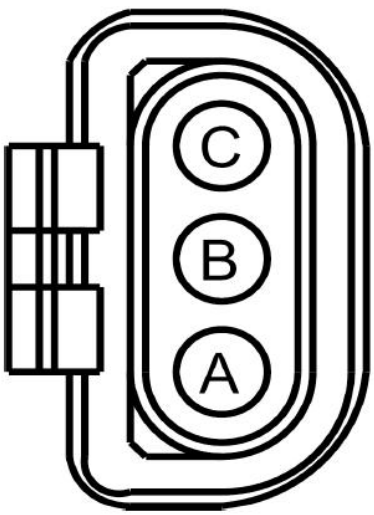


Fig. 253: Identifying Connector C1478 (Left Front Strobe Assembly)
Courtesy of FORD MOTOR CO.

Connector: C1479 | **Description:** RIGHT FRONT STROBE ASSEMBLY | **Harness:** 15A599 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	1055 (WH-LG)	16	Voltage supplied at all times (overload protected)	
C	57 (BK)	16	Ground	

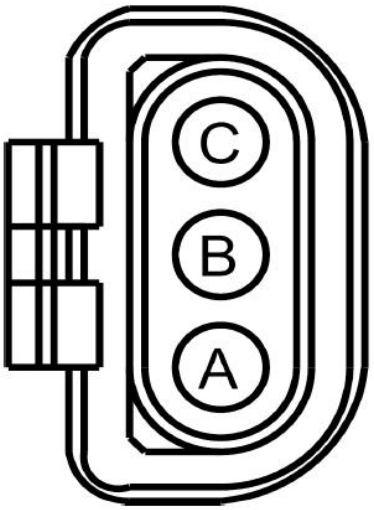


Fig. 254: Identifying Connector C1479 (Right Front Strobe Assembly)
Courtesy of FORD MOTOR CO.

Connector: C1480 | **Description:** LEFT GRILLE STROBE ASSEMBLY | **Harness:** 15A599 | **Base Part #:**

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	385 (WH-RD)	16	Rear flasher relay switched power	
C	57 (BK)	16	Ground	

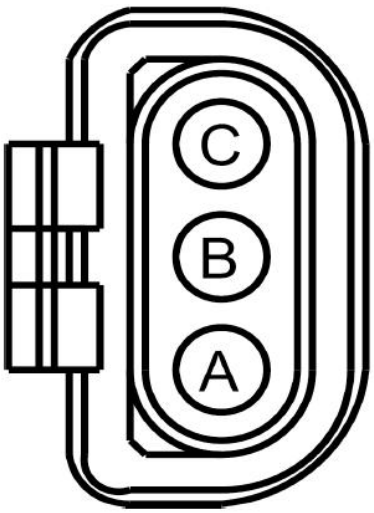


Fig. 255: Identifying Connector C1480 (Left Grille Strobe Assembly)
Courtesy of FORD MOTOR CO.

Connector: C1481 | Description: RIGHT GRILLE STROBE ASSEMBLY | Harness: 15A599 | Base Part #:

Pin: B - 556(WH) - Fuel Injector 2 control, Gauge: 16

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	556 (WH)	16	Fuel injector 2 control	
C	57 (BK)	16	Ground	

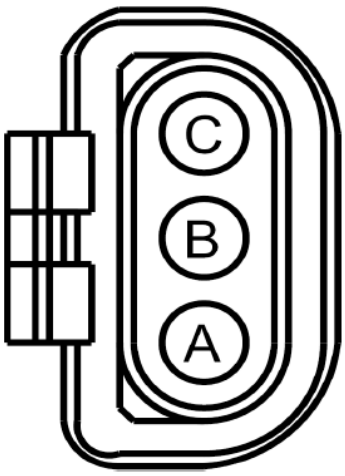
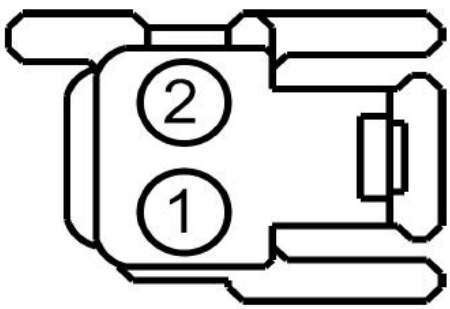


Fig. 256: Identifying Connector C1481 (Right Grille Strobe Assembly)
Courtesy of FORD MOTOR CO.

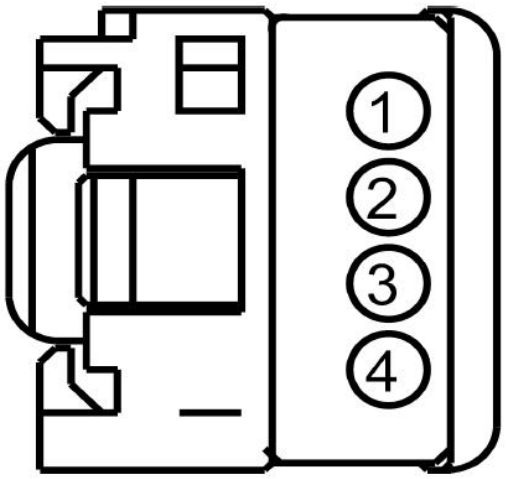
Connector: C2003 | Description: ADJUSTABLE PEDAL MOTOR | Harness: 14A005 | Base Part #: 2C429



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1495 (WH)	20	Adjustable pedal motor +/-	
2	1494 (RD)	20	Adjustable pedal motor +/-	

Fig. 257: Identifying Connector C2003 (Adjustable Pedal Motor)
Courtesy of FORD MOTOR CO.

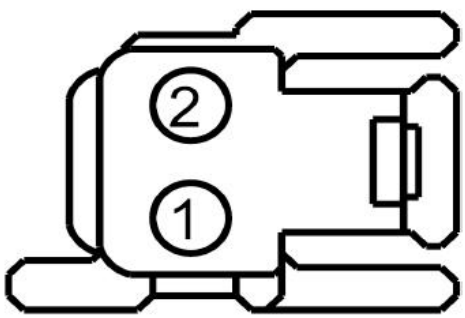
Connector: C2007	Description:	Harness:	Base Part #:
	PASSIVE ANTI-THEFT TRANSCEIVER	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1266 (RD-YE)	20	Voltage supplied in Start and Run (overload protected)	
2	676 (PK-OG)	22	Ground	
3	1215 (WH-LG)	22	TX signal	
4	1216 (GY-OG)	22	RX signal	

Fig. 258: Identifying Connector C2007 (Passive Anti-Theft Transceiver)
Courtesy of FORD MOTOR CO.

Connector: C2008	Description:	Harness:	Base Part #:
	BRAKE SHIFT INTERLOCK	14401	3Z719



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	20	Ground	
2	810 (RD-LG)	22	Brake shift interlock +	

Fig. 259: Identifying Connector C2008 (Brake Shift Interlock)
Courtesy of FORD MOTOR CO.

Connector: C2015	Description:	Harness:	Base Part #:
	PARK BRAKE SWITCH	14A005	15A851

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	409 (TN-BK)	20	Brake fluid level switch signal	
2	57 (BK)	22	Ground	

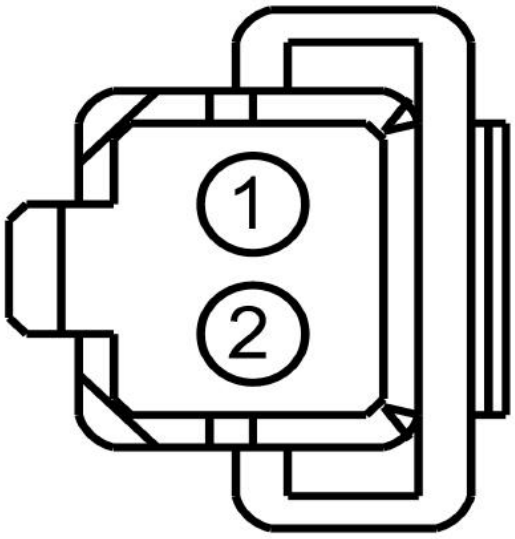
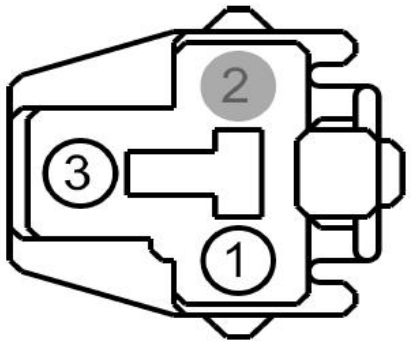


Fig. 260: Identifying Connector C2015 (Park Brake Switch)
Courtesy of FORD MOTOR CO.

Connector: C2031	Description:	Harness:	Base Part #:
	CIGAR LIGHTER, FRONT	15080	15055



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	40 (LB-WH)	16	Voltage supplied at all times (overload protected)	
2	*	*	not used	
3	57 (BK)	16	Ground	

Fig. 261: Identifying Connector C2031 (Cigar Lighter, Front)
Courtesy of FORD MOTOR CO.

Connector: C2033

Description:	Harness:	Base Part #:
POWER POINT	15080	19N236

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1049 (BN-PK)	16	Voltage supplied at all times (overload protected)	
2	*	*	not used	
3	57 (BK)	16	Ground	

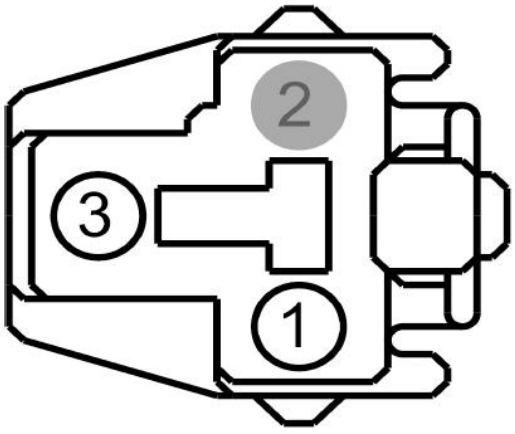


Fig. 262: Identifying Connector C2033 (Power Point)
Courtesy of FORD MOTOR CO.

Connector: C2040

Description:	Harness:	Base Part #:
ACCELERATOR PEDAL POSITION SENSOR	14A005	

Pin: 8 - 3015(WH-RD) - Accelerator pedal position 3 signal, Gauge: 22

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1284 (TN-WH)	22	Electronic throttle control, signal return	
2	1283 (TN-YE)	22	Accelerator pedal position 1 signal	
3	359 (GY-RD)	22	Signal return	
4	*	*	not used	
5	3012 (WH)	22	Accelerator pedal position 2 signal	
6	3091 (LB-BK)	22	Electronic throttle control, Vref 2	
7	3093 (WH-LB)	22	Electronic throttle control, Vref 1	
8	3015 (WH-RD)	22	Accelerator pedal position 3 signal	

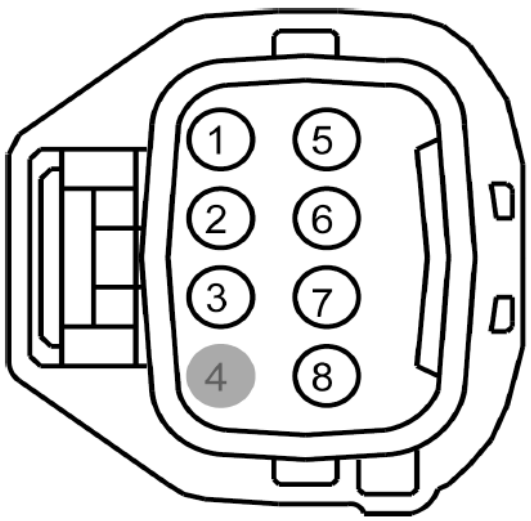
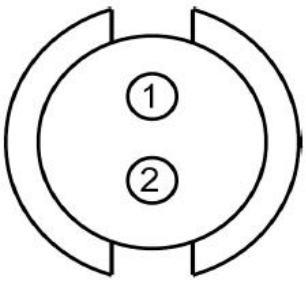


Fig. 263: Identifying Connector C2040 (Accelerator Pedal Position Sensor)
Courtesy of FORD MOTOR CO.

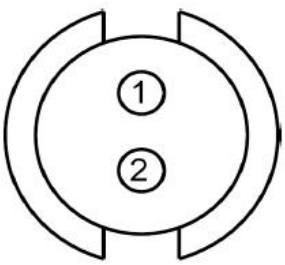
Connector: C2056	Description:	Harness:	Base Part #:
	COURTESY LAMP, LEFT FOOTWELL	14401	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	53 (BK-LB)	20	Courtesy lamps feed
2	57 (BK)	22	Ground

Fig. 264: Identifying Connector C2056 (Courtesy Lamp, Left Footwell)
Courtesy of FORD MOTOR CO.

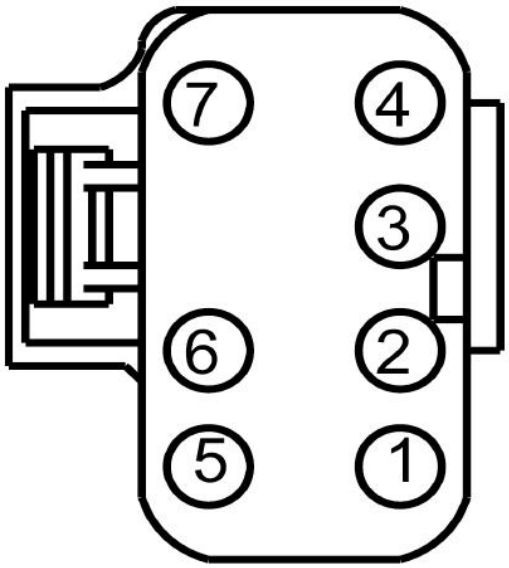
Connector: C2057	Description:	Harness:	Base Part #:
	COURTESY LAMP, RIGHT FOOTWELL	14401	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	53 (BK-LB)	20	Courtesy lamps feed
2	57 (BK)	22	Ground

Fig. 265: Identifying Connector C2057 (Courtesy Lamp, Right Footwell)
Courtesy of FORD MOTOR CO.

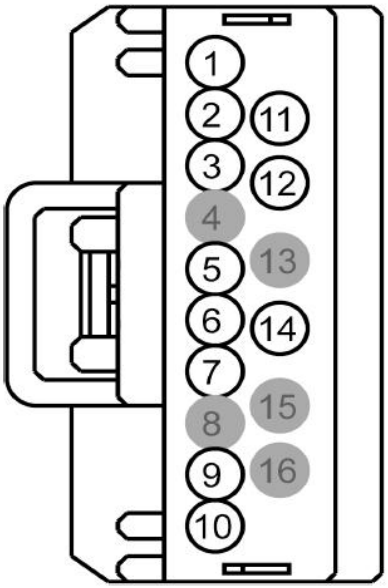
Connector: C2089 | **Description:** ADJUSTABLE PEDAL SWITCH | **Harness:** 14401 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1495 (WH)	18	Adjustable pedal motor +/-	
2	1567 (RD-LB)	18	Voltage supplied at all times (overload protected)	
3	57 (BK)	18	Ground	
4	57 (BK)	18	Ground	
5	484 (OG-BK)	18	Switch illumination +	
6	57 (BK)	18	Ground	
7	1494 (RD)	18	Adjustable pedal motor +/-	

Fig. 266: Identifying Connector C2089 (Adjustable Pedal Switch)
Courtesy of FORD MOTOR CO.

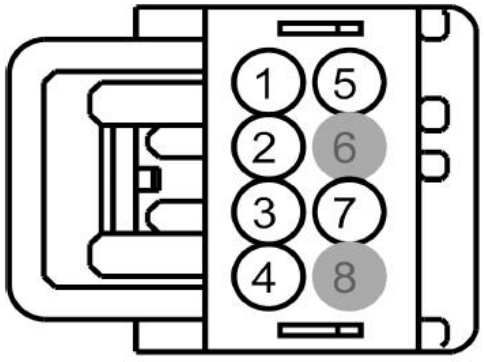
Connector: C2131A | **Description:** VEHICLE DYNAMICS MODULE (VDM) | **Harness:** 14290 | **Base Part #:** 3C142



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	115 (LB-YE)	20	Power steering valve solenoid -	
2	114 (LB-YE)	20	Power steering valve solenoid +	
3	1003 (GY-YE)	20	Voltage supplied in Run (overload protected)	
4	*	*	not used	
5	57 (BK)	22	Ground	
6	420 (DB-YE)	20	Air suspension compressor relay control	
7	421 (PK)	20	Air suspension compressor vent	
8	*	*	not used	
9	1828 (PK-LG)	22	HS CAN -	
10	1827 (WH-LG)	22	HS CAN +	
11	418 (DG-YE)	20	Voltage supplied at all times (overload protected)	
12	418 (DG-YE)	20	Voltage supplied at all times (overload protected)	
13	*	*	not used	
14	57 (BK)	18	Ground	
15	*	*	not used	
16	*	*	not used	

Fig. 267: Identifying Connector C2131A (Vehicle Dynamics Module (VDM))
Courtesy of FORD MOTOR CO.

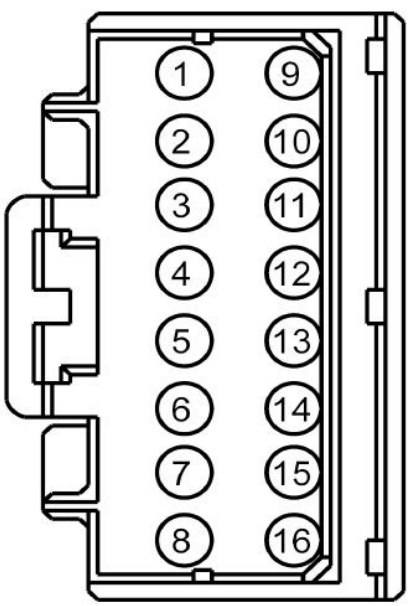
Connector: C2131B	Description:	Harness:	Base Part #:
	VEHICLE DYNAMICS MODULE (VDM)	14A005	3C142



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	427 (PK-BK)	20	Air suspension height sensor signal	
2	1115 (TN-WH)	20	Air spring solenoid valve control, right rear	
3	1114 (BN-PK)	20	Air spring solenoid valve control, left rear	
4	417 (VT-OG)	20	Air suspension height sensor power feed	
5	432 (BK-PK)	20	Air suspension height sensor signal return	
6	*	*	not used	
7	635 (YE)	20	Air Suspension On/Off signal	
8	*	*	not used	

Fig. 268: Identifying Connector C2131B (Vehicle Dynamics Module (VDM))
Courtesy of FORD MOTOR CO.

Connector: C2145A	Description:	Harness:	Base Part #:
	LIGHTING CONTROL MODULE (LCM)	14401	



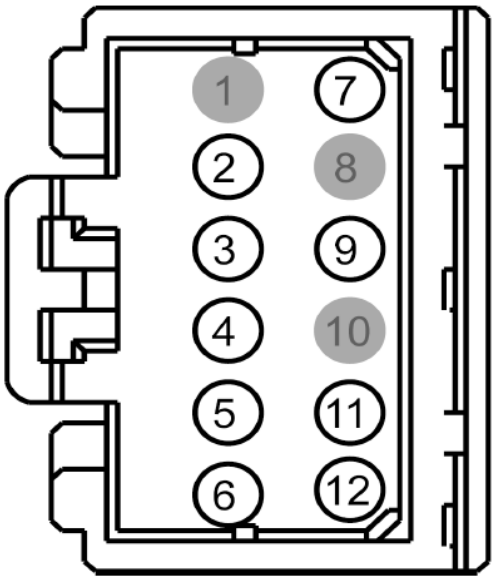
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	218 (WH-VT)	22	Autolamp sensor signal	
2	1304 (VT-OG)	22	Anti-theft hood switch signal	
3	1033 (RD-YE)	22	Headlamp, On, signal	
4	1083 (LB-PK)	22	Air bag, tone driver	
5	640 (RD-YE)	22	Voltage supplied in Start and Run (overload protected)	
6	810 (RD-LG)	22	Brake shift interlock +	
7	1036 (BN-WH)	22	Illumination dimmer signal	
8	914 (TN-OG)	22	SCP Bus +	
9	1032 (WH-BK)	22	Park lamps, On, signal	
10	158 (BK-PK)	18	Key warning switch signal	
11	676 (PK-OG)	20	Ground	
12	1347 (DB-WH)	22	Fog lamp relay control	
13	221 (OG-WH)	22	Voltage supplied at all times (overload protected)	
14	961 (WH-PK)	18	Traction assist on/off indicator lamp	
15	220 (VT-OG)	22	Autolamp On/Off signal	
15	218 (WH-VT)	22	Autolamp sensor signal	
16	915 (PK-LB)	22	SCP Bus -	

Fig. 269: Identifying Connector C2145A (Lighting Control Module (LCM))
Courtesy of FORD MOTOR CO.

Connector: C2145B

Description:	Harness:	Base Part #:
LIGHTING CONTROL MODULE (LCM)	14401	

Pin: 4 - 486(BN-WH) - Luggage compartment lid release solenoid signal, Gauge: 22

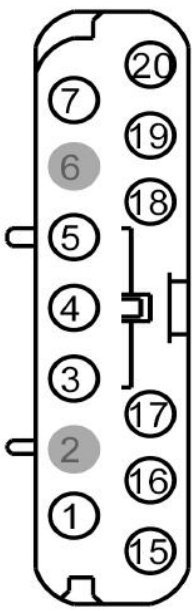


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	1400 (TN-WH)	22	Headlamps Off signal	
3	1034 (BK-WH)	22	Front dome lamp switch signal	
4	486 (BN-WH)	22	Luggage compartment lid release solenoid signal	
5	1651 (WH-RD)	22	Brake pedal position switch signal	
6	297 (BK-LG)	22	Voltage in Run or Accessory (overload protected)	
7	1 (DB)	22	Horn relay control	
8	*	*	not used	
9	25 (DG-VT)	20	R4.B5 relay control	
10	*	*	not used	
11	477 (LB-BK)	22	Fog lamp signal	
12	1350 (WH-PK)	22	Trunk lock disarm switch signal	

Fig. 270: Identifying Connector C2145B (Lighting Control Module (LCM))
Courtesy of FORD MOTOR CO.

Connector: C2145C

Description:	Harness:	Base Part #:
LIGHTING CONTROL MODULE (LCM)	14401	

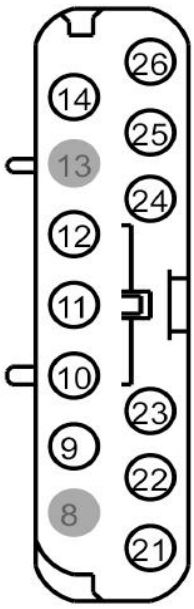


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	910 (PK)	18	Voltage supplied at all times (overload protected)	
2	*	*	not used	
3	484 (OG-BK)	22	Switch illumination +	
4	54 (LG-YE)	20	Voltage supplied at all times (overload protected)	
5	1651 (WH-RD)	22	Brake pedal position switch signal	
5	53 (BK-LB)	20	Courtesy lamps feed	
6	*	*	not used	
7	676 (PK-OG)	20	Ground	
15	1335 (YE-WH)	20	Headlamp, left high beam lamp feed	
16	1337 (VT-YE)	20	Headlamp, left high beam lamp feed	
17	905 (GY-LB)	16	Voltage supplied at all times (overload protected)	
18	705 (LG-OG)	18	Demand lighting	
19	1056 (DB-LG)	18	Voltage supplied at all times (overload protected)	
20	161 (DG-OG)	20	Headlamp, left low beam lamp feed	

Fig. 271: Identifying Connector C2145C (Lighting Control Module (LCM))
Courtesy of FORD MOTOR CO.

Connector: C2145D

Description:	Harness:	Base Part #:
LIGHTING CONTROL MODULE (LCM)	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
8	*	*	not used	
9	1092 (PK-OG)	20	Luggage compartment lamp switched ground	
10	14 (BN)	20	Power, Exterior lamps	
11	385 (WH-RD)	16	Rear flasher relay switched power	
12	385 (WH-RD)	16	Rear flasher relay switched power	
13	*	*	not used	
14	28 (BK-PK)	22	Wiper ON/OFF signal	
21	1055 (WH-LG)	18	Voltage supplied at all times (overload protected)	
22	160 (DB-WH)	20	Low beam power feed	
23	195 (TN-WH)	16	Voltage supplied at all times (overload protected)	
24	44 (LB)	16	Turn lamps power feed	
25	44 (LB)	16	Turn lamps power feed	
26	12 (LG-BK)	18	High beam signal	

Fig. 272: Identifying Connector C2145D (Lighting Control Module (LCM))
Courtesy of FORD MOTOR CO.

Connector: C2203

Description:	Harness:	Base Part #:
LUGGAGE COMPARTMENT LID RELEASE SWITCH 2	14401	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	84 (VT-YE)	14	Luggage compartment switch, switched power	
2	517 (BK-WH)	14	Voltage supplied at all times (overload protected)	

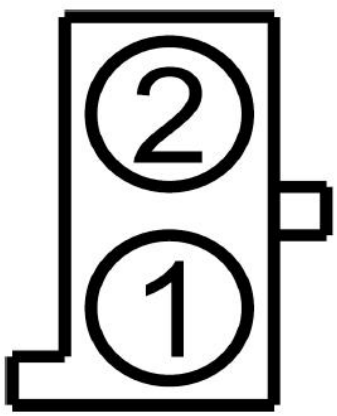


Fig. 273: Identifying Connector C2203 (Luggage Compartment Lid Release Switch 2)
Courtesy of FORD MOTOR CO.

Connector: C2204	Description:	Harness:	Base Part #:
	LUGGAGE COMPARTMENT LID RELEASE SWITCH 2	14401	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	84 (VT-YE)	14	Luggage compartment switch, switched power	
2	193 (YE-LG)	14	Accessory relay output	

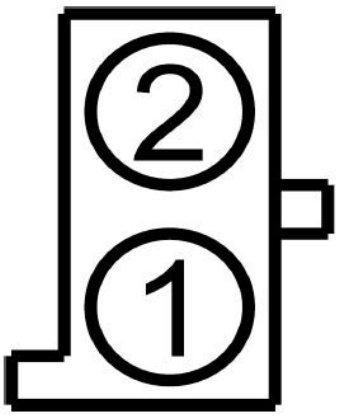
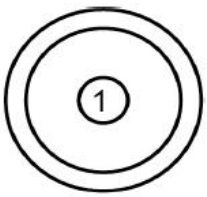


Fig. 274: Identifying Connector C2204 (Luggage Compartment Lid Release Switch 2)
Courtesy of FORD MOTOR CO.

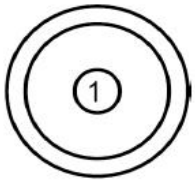
Connector: C2205	Description:	Harness:	Base Part #:
	SPOT LAMP, LH SIDE	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	931 (RD-BK)	18	Voltage supplied at all times (overload protected)	

Fig. 275: Identifying Connector C2205 (Spot Lamp, LH Side)
Courtesy of FORD MOTOR CO.

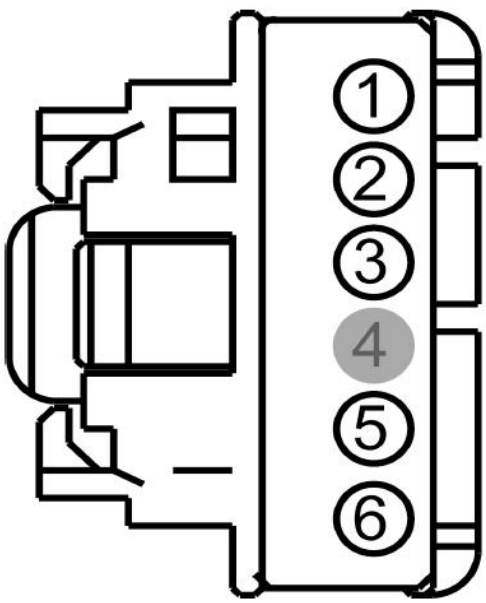
Connector: C2206	Description:	Harness:	Base Part #:
	SPOT LAMP, RH SIDE	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	931 (RD-BK)	18	Voltage supplied at all times (overload protected)	

Fig. 276: Identifying Connector C2206 (Spot Lamp, RH Side)
Courtesy of FORD MOTOR CO.

Connector: C2208	Description:	Harness:	Base Part #:
	AUDIO/CLIMATE CONTROL SWITCH	13B319	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	484 (OG-BK)	22	Switch illumination +	
2	57 (BK)	22	Ground	
3	57 (BK)	22	Ground	
4	*	*	not used	
5	595 (LB-RD)	22	Audio/climate control switch, Radio, signal	
6	1070 (BN-LB)	22	Audio/climate control switch, Climate, signal	

Fig. 277: Identifying Connector C2208 (Audio/Climate Control Switch)
Courtesy of FORD MOTOR CO.

Connector: C2213

Description:	Harness:	Base Part #:
TAXI ROOF LAMP SWITCH	14401	

Pin: 2 - 42(RD-WH) - Taxi roof lamp power feed, Gauge: 14

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1567 (RD-LB)	20	Voltage supplied at all times (overload protected)	
2	42 (RD-WH)	14	Taxi roof lamp power feed	
3	57 (BK)	12	Ground	

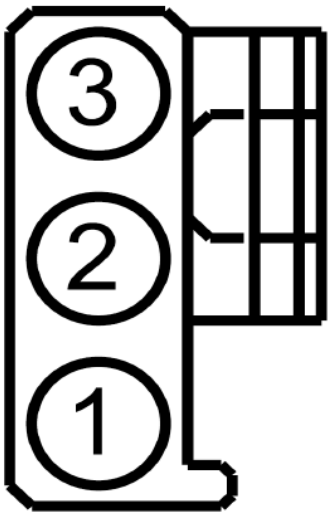
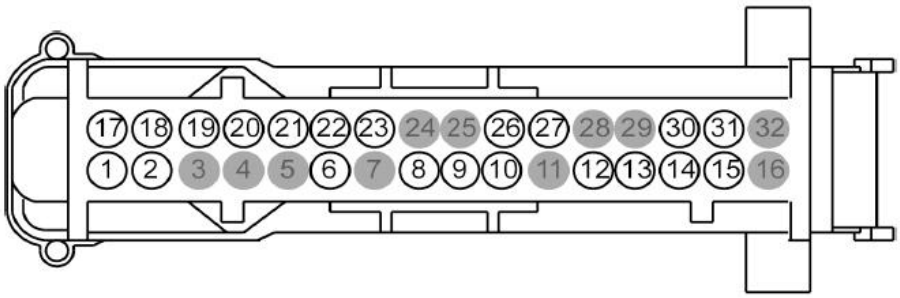


Fig. 278: Identifying Connector C2213 (Taxi Roof Lamp Switch)
Courtesy of FORD MOTOR CO.

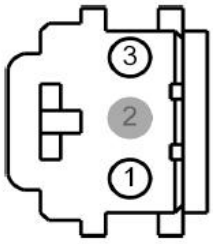
Connector: C2220 | **Description:** INSTRUMENT CLUSTER (IC) | **Harness:** 14401 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1523 (DG)	20	Voltage supplied at all times (overload protected)	
2	676 (PK-OG)	20	Ground	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	31 (WH-RD)	20	Engine oil pressure indicator, control	
7	*	*	not used	
8	977 (VT-WH)	20	Brake indicator, control	
9	82 (PK-YE)	20	Low washer fluid indicator control	
10	419 (DG-LG)	20	Air suspension module malfunction indicator lamp	
10	2318 (LG-RD)	20	Fire suppresion module malfunction indicator lamp	
11	*	*	not used	
12	608 (BK-YE)	20	Air bag indicator control	
13	1411 (GY-OG)	22	Message center signal return	
14	143 (LB-YE)	22	Message center switch 1	
15	152 (LB-WH)	22	Message center switch 2	
16	*	*	not used	
17	1003 (GY-YE)	20	Voltage supplied in Run (overload protected)	
18	57 (BK)	20	Ground	
19	640 (RD-YE)	20	Voltage supplied in Start and Run (overload protected)	
20	914 (TN-OG)	22	SCP Bus +	
21	915 (PK-LB)	22	SCP Bus -	
22	2 (WH-LB)	20	Right turn signal	
23	3 (LG-WH)	20	Left turn signal	
24	*	*	not used	
25	*	*	not used	
26	29 (YE-WH)	20	Fuel sender signal	
27	1843 (BK-OG)	22	Signal return	
28	*	*	not used	
29	*	*	not used	
30	1827 (WH-LG)	20	HS CAN +	
31	1828 (PK-LG)	20	HS CAN -	
32	*	*	not used	

Fig. 279: Identifying Connector C2220 (Instrument Cluster (IC))
Courtesy of FORD MOTOR CO.

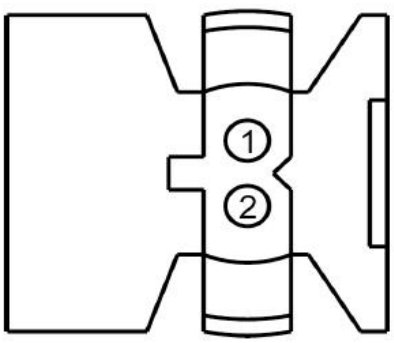
Connector: C2286	Description:	Harness:	Base Part #:
	PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	937 (RD-WH)	22	Voltage supplied in Start and Run (overload protected)	
2	*	*	not used	
3	1632 (TN-LB)	22	Passenger air bag deactivation indicator control	

Fig. 280: Identifying Connector C2286 (Passenger Air Bag Deactivation (Pad) Indicator)
Courtesy of FORD MOTOR CO.

Connector: C2318	Description:	Harness:	Base Part #:
	DEPLOYABLE STEERING COLUMN	14N000	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2136 (OG)	20	Deployable steering column feed	
2	2137 (RD-LB)	20	Deployable steering column return	

Fig. 281: Identifying Connector C2318 (Deployable Steering Column)
Courtesy of FORD MOTOR CO.

Connector: C2322	Description:	Harness:	Base Part #:
	BRAKE SHIFT INTERLOCK	14401	3Z719

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1040 (RD-BK)	20	Voltage supplied at all times (overload protected)	
2	57 (BK)	20	Ground	
3	1651 (WH-RD)	22	Brake pedal position switch signal	

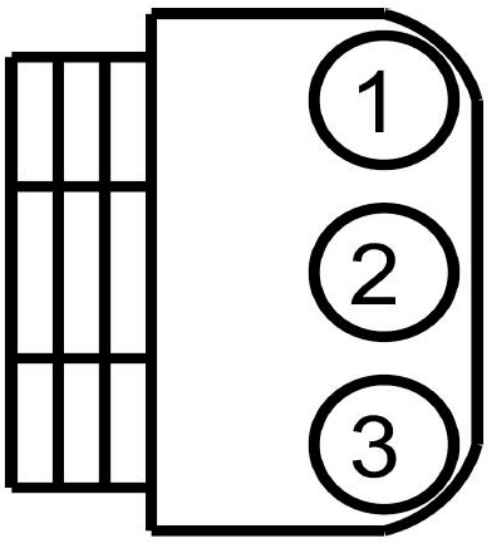


Fig. 282: Identifying Connector C2322 (Brake Shift Interlock)
Courtesy of FORD MOTOR CO.

Connector: C2330A	Description:	Harness:	Base Part #:
	STEERING WHEEL/ SPEED CONTR0L SWITCH	13B319	9E740

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	151 (LB-BK)	22	Speed control switch reference voltage	
2	131 (VT-OG)	22	Voltage supplied at all times (overload protected)	
3	848 (DG-OG)	22	Speed control switch, Signal return	
4	*	*	not used	
5	57 (BK)	22	Ground	
6	484 (OG-BK)	22	Switch illumination +	

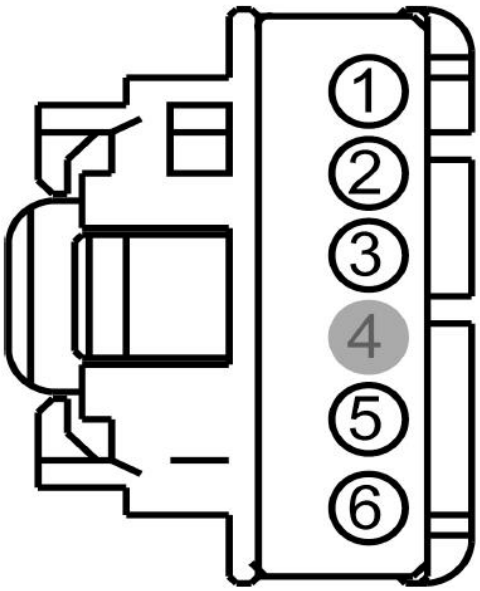
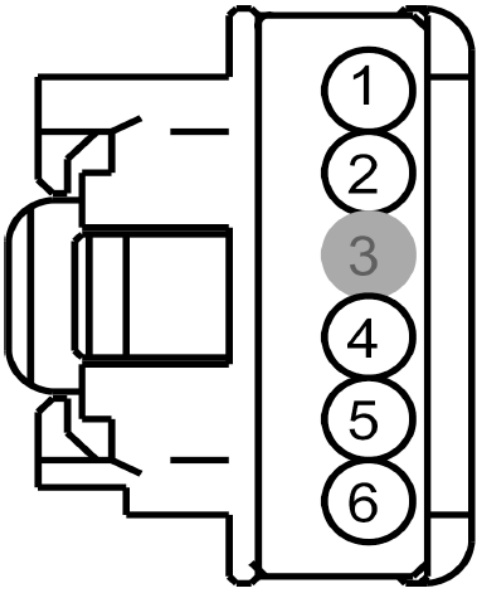


Fig. 283: Identifying Connector C2330A (Steering Wheel/ Speed Control Switch)
Courtesy of FORD MOTOR CO.

Connector: C2330B

Description:	Harness:	Base Part #:
STEERING WHEEL/ SPEED CONTROL SWITCH	13B319	9E740

Pin: 5 - 131(VT-OG) - Voltage supplied at all times (overload protected), Gauge: 22

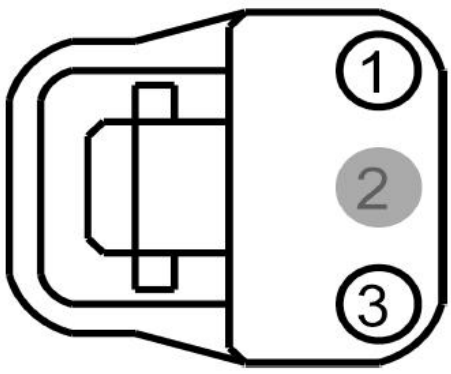


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	484 (OG-BK)	22	Switch illumination +	
2	57 (BK)	22	Ground	
3	*	*	not used	
4	848 (DG-OG)	22	Speed control switch, Signal return	
5	131 (VT-OG)	22	Voltage supplied at all times (overload protected)	
6	151 (LB-BK)	22	Speed control switch reference voltage	

Fig. 284: Identifying Connector C2330B (Steering Wheel/ Speed Control Switch)
Courtesy of FORD MOTOR CO.

Connector: C3014

Description:	Harness:	Base Part #:
DRIVER SAFETY BELT RETRACTOR PRETENSIONER	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1079 (LG-RD)	20	Driver safety belt retractor pretensioner, feed	
2	*	*	not used	
3	1080 (LG-BK)	20	Driver safety belt retractor pretensioner, return	

Fig. 285: Identifying Connector C3014 (Driver Safety Belt Retractor Pretensioner)
Courtesy of FORD MOTOR CO.

Connector: C3015 | Description: POWER SEAT MOTOR ASSEMBLY, RIGHT | Harness: 14A005 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	987 (RD-WH)	14	Fwd/Rwd motor +/-	
2	984 (YE-LB)	14	Front height motor +/-	
3	985 (RD-LB)	14	Front height motor +/-	
4	986 (YE-WH)	14	Fwd/Rwd motor +/-	
5	989 (RD-LG)	14	Rear height motor +/-	
6	988 (YE-LG)	14	Rear height motor +/-	

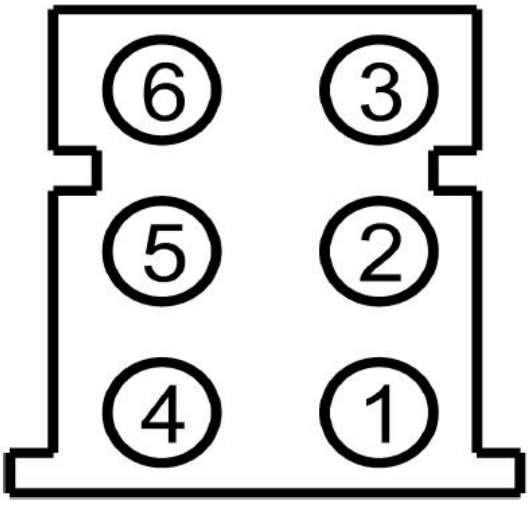


Fig. 286: Identifying Connector C3015 (Power Seat Motor Assembly, Right)
Courtesy of FORD MOTOR CO.

Connector: C3042 | Description: OCCUPANT CLASSIFICATION SENSOR (OCS) | Harness: 14A699P | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1568 (RD-WH)	22	Occupant classification sensor +	
2	1570 (TN-BK)	22	Occupant classification sensor signal	
3	1569 (GY-LB)	22	Occupant classification sensor -	

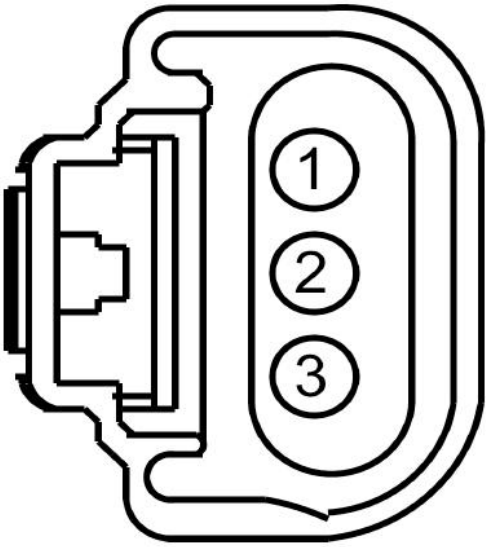
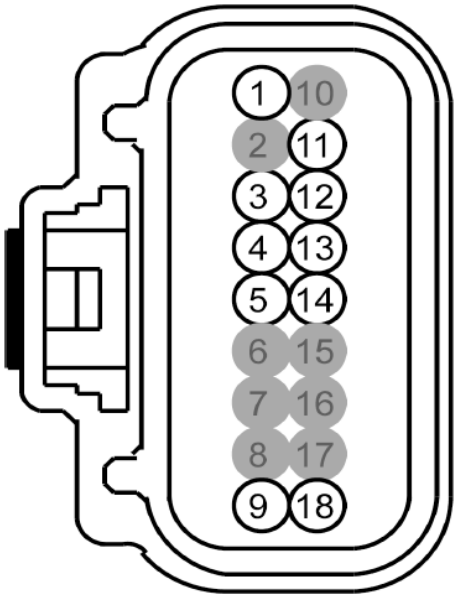


Fig. 287: Identifying Connector C3042 (Occupant Classification Sensor (OCS))
Courtesy of FORD MOTOR CO.

Connector: C3043 | Description: OCCUPANT CLASSIFICATION SENSOR MODULE (OCSM) | Harness: 14A699P | Base Part #:

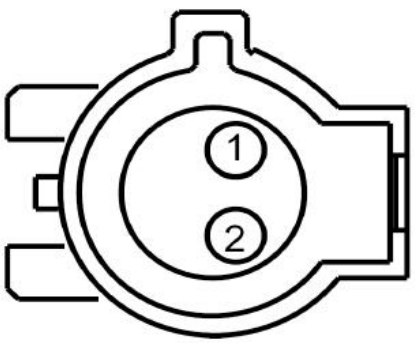
Pin: 5 - 1569(GY-LB) - Occupant classification sensor -, Gauge: 22



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	937 (RD-WH)	22	Voltage supplied in Start and Run (overload protected)	
2	*	*	not used	
3	1568 (RD-WH)	22	Occupant classification sensor +	
4	1570 (TN-BK)	22	Occupant classification sensor signal	
5	1569 (GY-LB)	22	Occupant classification sensor -	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	1919 (PK-OG)	22	CAN +	
10	*	*	not used	
11	2088 (TN-RD)	22	Safety belt sensor, passenger, feed	
12	2089 (OG-BK)	22	Safety belt sensor, passenger, signal	
13	2090 (DB-OG)	22	Safety belt sensor, passenger, return	
14	676 (PK-OG)	22	Ground	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	1918 (BN-WH)	22	CAN -	

Fig. 288: Identifying Connector C3043 (Occupant Classification Sensor Module (OCSM))
Courtesy of FORD MOTOR CO.

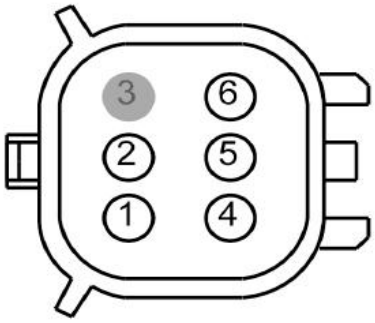
Connector: C3065 | Description: SAFETY BELT SENSOR, DRIVER SIDE | Harness: 14A699D | Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	85 (BN-LB)	22	Safety belt buckle switch, driver +	
2	1558 (TN-BK)	22	Signal return	

Fig. 289: Identifying Connector C3065 (Safety Belt Sensor, Driver Side)
Courtesy of FORD MOTOR CO.

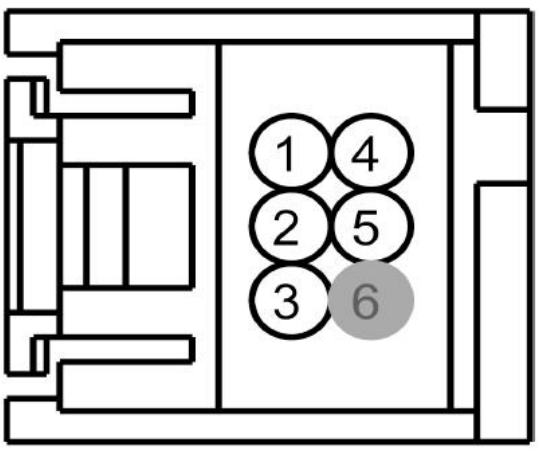
Connector: C3066	Description:	Harness:	Base Part #:
	SAFETY BELT SENSOR, PASSENGER SIDE	14A699	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1514 (RD-BK)	22	Safety belt bukle switch, passenger signal	
2	1558 (TN-BK)	22	Signal return	
3	*	*	not used	
4	2088 (TN-RD)	22	Safety belt sensor, passenger feed	
5	2090 (DB-OG)	22	Safety belt sensor, passenger return	
6	2089 (OG-BK)	22	Safety selt sensor, passenger signal	

Fig. 290: Identifying Connector C3066 (Safety Belt Sensor, Passenger Side)
Courtesy of FORD MOTOR CO.

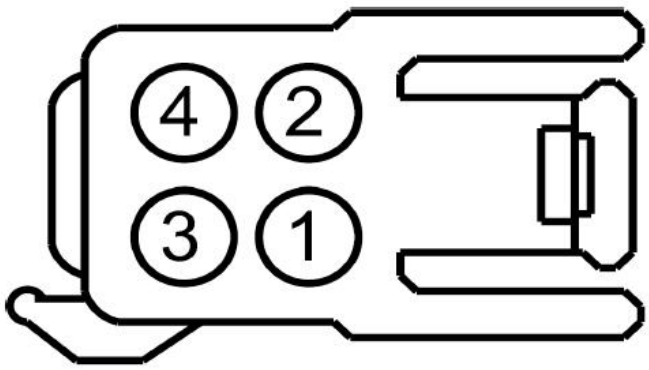
Connector: C3183	Description:	Harness:	Base Part #:
	ANTENNA	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2305 (VT-LB)	20	Antenna enable	
2	2306 (GY-RD)	20	Antenna ask/fsk	
3	2307 (BK-WH)	20	Antenna ground	
4	2308 (RD-WH)	20	Antenna power	
5	2309 (LB-BK)	20	Antenna data	
6	*	*	not used	

Fig. 291: Identifying Connector C3183 (Antenna)
Courtesy of FORD MOTOR CO.

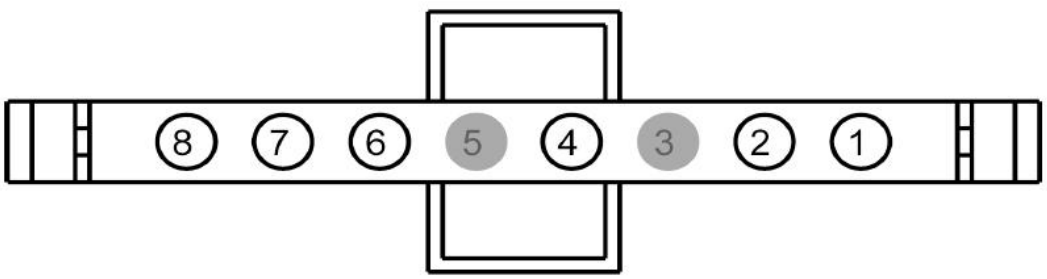
Connector: C3247 | **Description:** FLOOR SHIFTER | **Harness:** 14B079 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	224 (TN-WH)	22	Switch Illumination +	
2	484 (OG-BK)	22	Transmission control switch signal	
3	640 (RD-YE)	20	Voltage supplied in Start or Run (overload protected)	
4	57 (BK)	16	Ground	

Fig. 292: Identifying Connector C3247 (Floor Shifter)
Courtesy of FORD MOTOR CO.

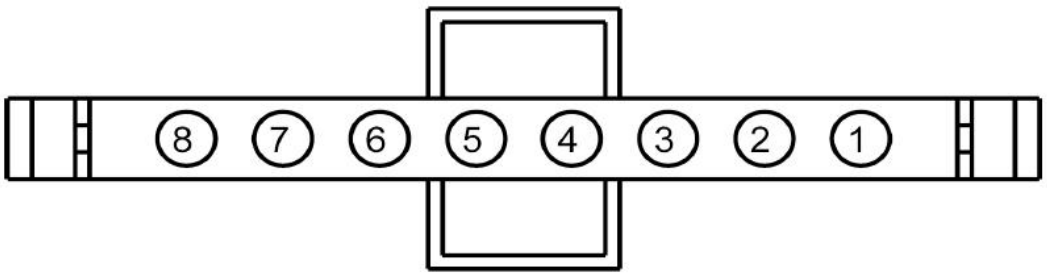
Connector: C3257A | **Description:** STROBE/ LIGHT BAR CONTROL SWITCH | **Harness:** 15A599 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	24 (DB-OG)	18	R2.A2 relay control	
2	25 (DG-VT)	18	R4.B5 relay control	
3	*	*	not used	
4	57 (BK)	18	Ground	
5	*	*	not used	
6	18 (OG-YE)	18	Jumper	
7	18 (OG-YE)	18	Jumper	
8	401 (PK)	18	Police power relay switched power	

Fig. 293: Identifying Connector C3257A (Strobe/ Light Bar Control Switch)
Courtesy of FORD MOTOR CO.

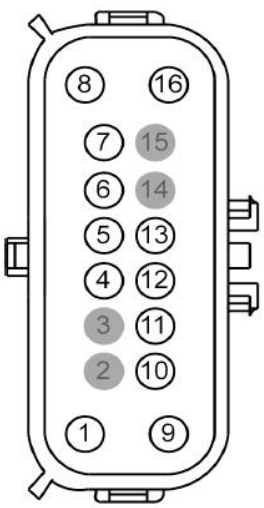
Connector: C3257B | **Description:** STROBE/ LIGHT BAR CONTROL SWITCHES | **Harness:** 15A599 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	3005 (VT-LG)	18	R4.C1 relay control	
2	3006 (VT-LG)	18	R4.C2 relay control	
3	3007 (VT-YE)	18	R4.C3 relay control	
4	3008 (VT)	18	R4.C4 relay control	
5	3009 (OG-RD)	18	R4.C5 relay control	
6	3011 (BK-OG)	18	R4.C6 relay control	
7	3012 (WH)	18	Accelerator pedal position 2 signal	
8	3013 (GY-BK)	18	R4.C8 relay control	

Fig. 294: Identifying Connector C3257B (Strobe/ Light Bar Control Switches)
Courtesy of FORD MOTOR CO.

Connector: C3281A | **Description:** FIRE SUPPRESSION SYSTEM MODULE (FSSM) | **Harness:** 14A005 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2319 (RD-YE)	20	Voltage in Start and Run (overload protected)	
2	*	*	not used	
3	*	*	not used	
4	2313 (BK-WH)	20	Fire suppressor, LH #1 return	
5	2312 (LG)	20	Fire suppressor, LH #1 feed	
6	2318 (LG-RD)	20	Fire suppression module malfunction indicator lamp	
7	1203 (BK-LB)	20	Gound	
8	1828 (PK-LG)	20	HS CAN -	
9	70 (LB-WH)	22	ISO Bus	
10	2315 (BK-PK)	20	Fire suppression manual switch high	
11	2314 (LB-PK)	20	Fire suppression manual switch low	
12	2310 (OG)	20	Fire suppressor, RH #1 feed	
13	2311 (DG)	20	Fire suppressor, RH #1 return	
14	*	*	not used	
15	*	*	not used	
16	1827 (WH-LG)	20	HS CAN +	

Fig. 295: Identifying Connector C3281A (Fire Suppression System Module (FSSM))
Courtesy of FORD MOTOR CO.

Connector: C3281B

Description: FIRE SUPPRESSION SYSTEM MODULE (FSSM)

Harness: 14C369

Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2327 (BK-WH)	18	Fire suppressor, RH #2 return	
2	2326 (LG)	18	Fire suppressor, RH #2 feed	
3	2329 (DG)	18	Fire suppressor, LH #2 return	
4	2328 (OG)	18	Fire suppressor, LH #2 feed	

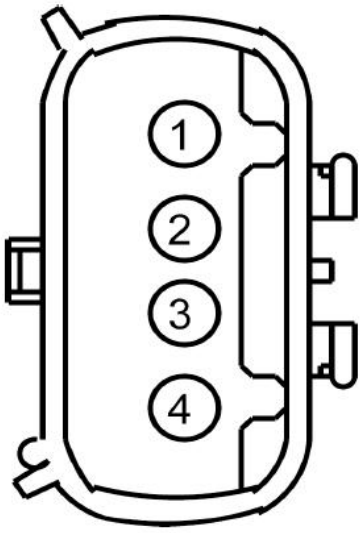


Fig. 296: Identifying Connector C3281B (Fire Suppression System Module (FSSM))
Courtesy of FORD MOTOR CO.

Connector: C4033

Description: FUEL PUMP DRIVER MODULE

Harness: 14A005

Base Part #: 9H307

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	238 (DG-YE)	22	Fuel pump monitor	
2	789 (BN-WH)	14	Fuel pump, return	
3	57 (BK)	14	Ground	
4	787 (PK-BK)	14	Fuel pump, feed	
5	866 (WH)	14	Inertia Fuel Shutoff (IFS) output	
6	926 (LB-OG)	22	Modulated fuel pump signal	

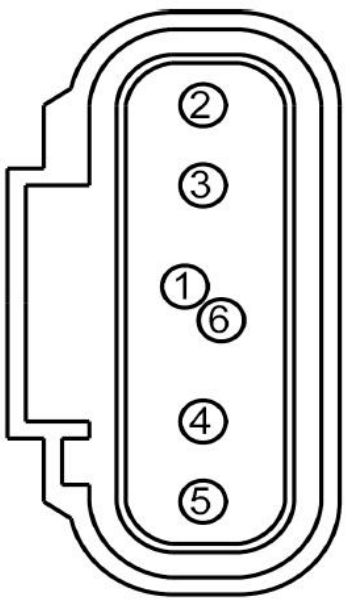
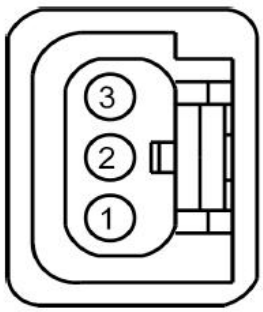


Fig. 297: Identifying Connector C4033 (Fuel Pump Driver Module)
Courtesy of FORD MOTOR CO.

Connector: C4043	Description:	Harness:	Base Part #:
	AIR SUSPENSION HEIGHT SENSOR	14A411	3C131



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	432 (BK-PK)	20	Air suspension height sensor signal return	
2	427 (PK-BK)	20	Air suspension height sensor signal	
3	417 (VT-OG)	20	Air suspension height sensor power feed	

Fig. 298: Identifying Connector C4043 (Air Suspension Height Sensor)
Courtesy of FORD MOTOR CO.

Connector: C4044	Description:	Harness:	Base Part #:
	AIR SPRING SOLENOID VALVE, LEFT REAR	14A411	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1114 (BN-PK)	20	Air spring solenoid valve control, left rear	
2	57 (BK)	20	Ground	

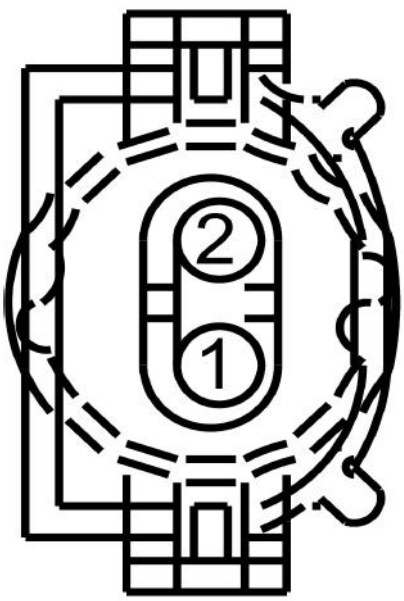


Fig. 299: Identifying Connector C4044 (Air Spring Solenoid Valve, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C4045 | Description: AIR SPRING SOLENOID VALVE, RIGHT REAR | Harness: 14A411 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1115 (TN-WH)	20	Air spring solenoid valve control, right rear	
2	57 (BK)	20	Ground	

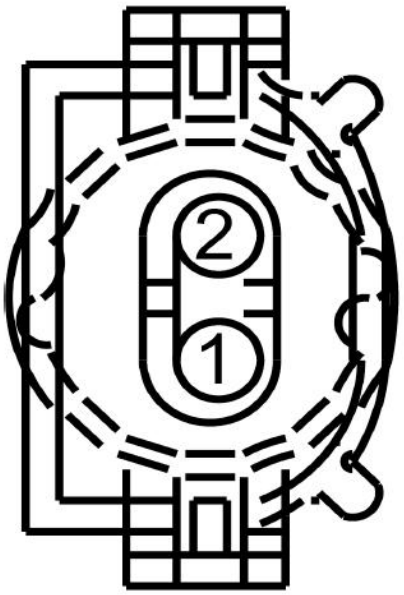


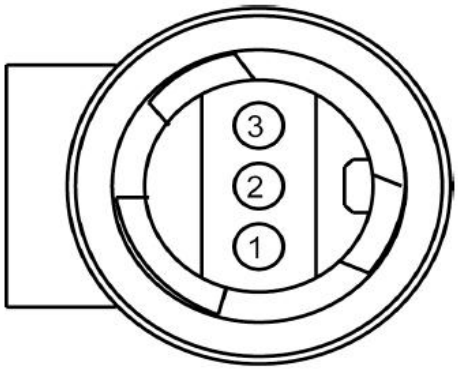
Fig. 300: Identifying Connector C4045 (Air Spring Solenoid Valve, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C4087 | Description: AIR SUSPENSION DISABLE SWITCH | Harness: 14A005 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	635 (YE)	20	Air suspension On/Off signal	
2	417 (VT-OG)	20	Air suspension height sensor power feed	
3	*	*	not used	

Fig. 301: Identifying Connector C4087 (Air Suspension Disable Switch)
Courtesy of FORD MOTOR CO.

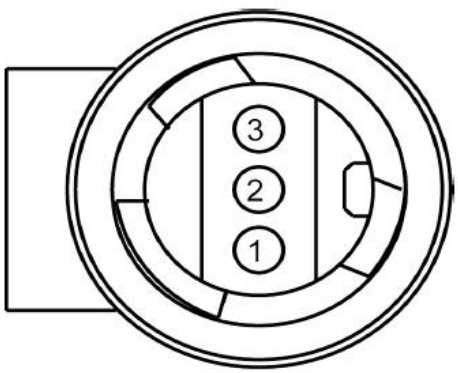
Connector: C4112	Description:	Harness:	Base Part #:
	PARK/STOP/ TURN LAMP 1, LEFT REAR	13407_L	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	9 (LG-OG)	20	Left rear turn signal

Fig. 302: Identifying Connector C4112 (Park/Stop/ Turn Lamp 1, Left Rear)
Courtesy of FORD MOTOR CO.

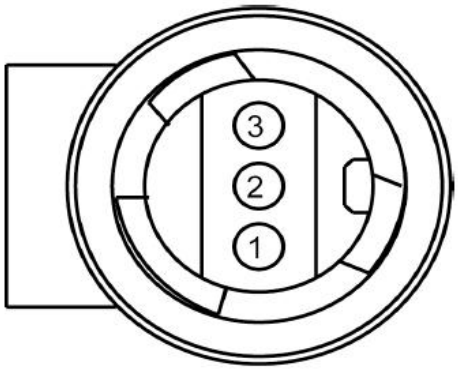
Connector: C4113	Description:	Harness:	Base Part #:
	PARK/STOP/ TURN LAMP 2, LEFT REAR	13407_L	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	9 (LG-OG)	20	Left rear turn signal

Fig. 303: Identifying Connector C4113 (Park/Stop/ Turn Lamp 2, Left Rear)
Courtesy of FORD MOTOR CO.

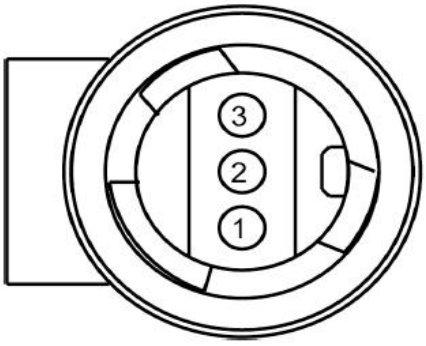
Connector: C4114	Description:	Harness:	Base Part #:
	PARK/STOP/ TURN LAMP 1, RIGHT REAR	13407_R	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	5 (OG-LB)	20	Left rear turn signal

Fig. 304: Identifying Connector C4114 (Park/Stop/ Turn Lamp 1, Right Rear)
Courtesy of FORD MOTOR CO.

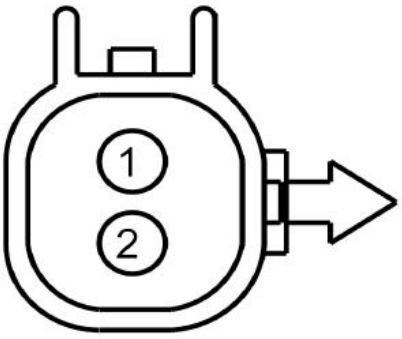
Connector: C4115	Description:	Harness:	Base Part #:
	PARK/STOP/ TURN LAMP 2, RIGHT REAR	13407_R	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	57 (BK)	20	Ground
2	14 (BN)	20	Power, Exterior lamps
3	5 (OG-LB)	20	Left rear turn signal

Fig. 305: Identifying Connector C4115 (Park/Stop/ Turn Lamp 2, Right Rear)
Courtesy of FORD MOTOR CO.

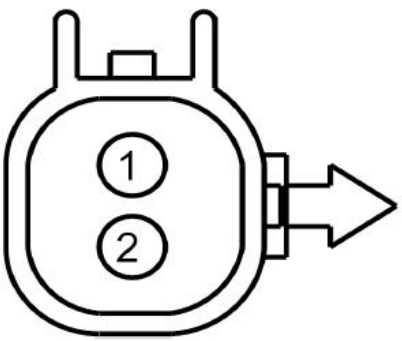
Connector: C4163	Description:	Harness:	Base Part #:
	POLICE FLASHER LAMP, LEFT REAR	14A227	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	3 (LG-WH)	16	Left turn signal
2	57 (BK)	18	Ground

Fig. 306: Identifying Connector C4163 (Police Flasher Lamp, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C4164	Description:	Harness:	Base Part #:
	POLICE FLASHER LAMP, RIGHT REAR	14A227	



Pin	Circuit	Gauge	Circuit Function Qualifier
1	2 (WH-LB)	16	Right turn signal
2	57 (BK)	18	Ground

Fig. 307: Identifying Connector C4164 (Police Flasher Lamp, Right Rear)
Courtesy of FORD MOTOR CO.

Connector: C4168	Description:	Harness:	Base Part #:
	INERTIA FUEL SHUTOFF (IFS) SWITCH	14A005	9341

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	866 (WH)	14	Inertia Fuel Shutoff (IFS) output	
2	366 (RD-BK)	12	Fuel pump relay switched power	
3	*	*	not used	

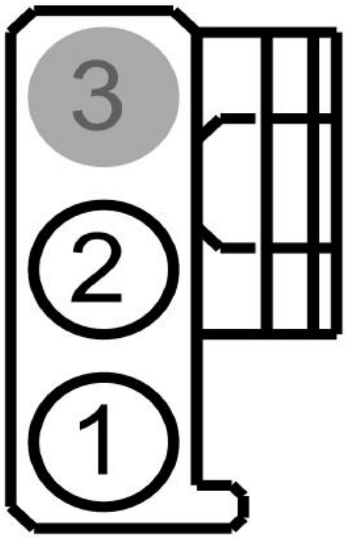
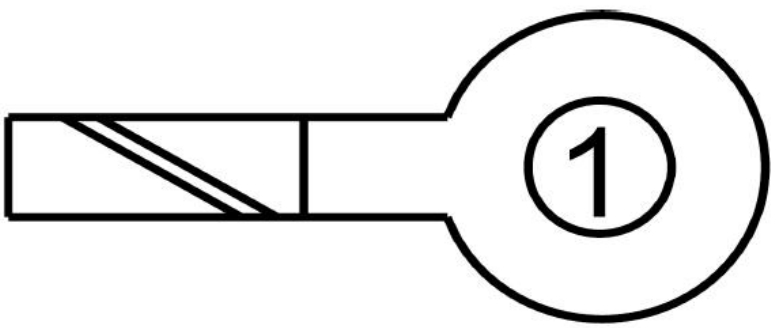


Fig. 308: Identifying Connector C4168 (Inertia Fuel Shutoff (IFS) Switch)
Courtesy of FORD MOTOR CO.

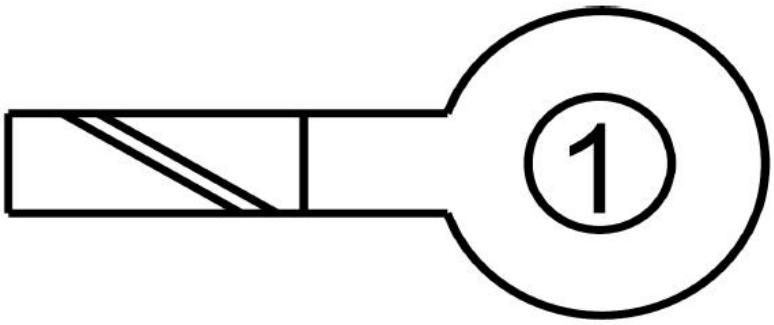
Connector: C4170A	Description:	Harness:	Base Part #:
	POLICE AUXILIARY JUNCTION BOX, REAR	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2300 (RD)	10	Voltage supplied at all times (overload protected)	
1	2301 (RD-WH)	10	Voltage supplied at all times (overload protected)	

Fig. 309: Identifying Connector C4170A (Police Auxiliary Junction Box, Rear)
Courtesy of FORD MOTOR CO.

Connector: C4170B	Description:	Harness:	Base Part #:
	POLICE AUXILIARY JUNCTION BOX, REAR	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	06	Ground	

Fig. 310: Identifying Connector C4170B (Police Auxiliary Junction Box, Rear)
Courtesy of FORD MOTOR CO.

Connector: C4231A	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	30 (BK-LG)	16	R4.B2 relay switched power	
3	57 (BK)	16	Ground	

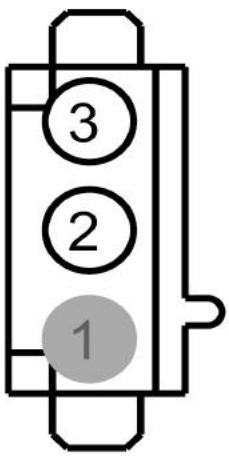


Fig. 311: Identifying Connector C4231A (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231B	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	23 (TN-LG)	16	R4.B5 relay switched power	
3	57 (BK)	16	Ground	

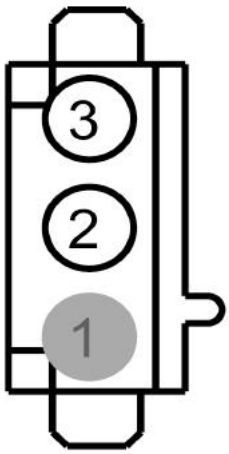
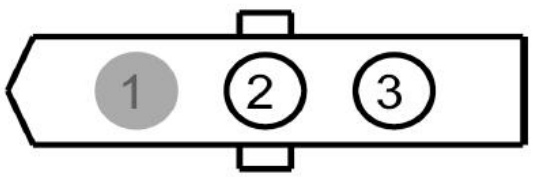


Fig. 312: Identifying Connector C4231B (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231C	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	57 (BK)	16	Ground	
3	37 (YE)	16	R4.B1 relay switched power	

Fig. 313: Identifying Connector C4231C (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231D	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	188 (WH-BK)	16	Left front strobe -	

Fig. 314: Identifying Connector C4231D (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231E	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	1055 (WH-LG)	16	Voltage supplied at all times (overload protected)	

Fig. 315: Identifying Connector C4231E (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231F	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	556 (WH)	16	Fuel injector 2 control	

Fig. 316: Identifying Connector C4231F (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231G	Description:	Harness:	Base Part #:
	STROBE CONTROL MODULE	15A599	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	385 (WH-RD)	16	Rear flasher relay switched power	

Fig. 317: Identifying Connector C4231G (Strobe Control Module)
Courtesy of FORD MOTOR CO.

Connector: C4231H	Description:	Harness:	Base Part #:
	STROBE CONTROL TRUNK	12663	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	556 (WH)	16	Fuel injector 2 control	

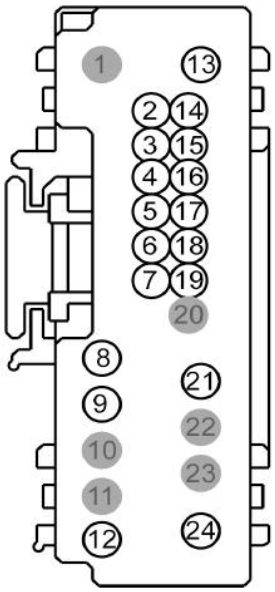
Fig. 318: Identifying Connector C4231H (Strobe Control Trunk)
Courtesy of FORD MOTOR CO.

Connector: C4231J	Description:	Harness:	Base Part #:
	STROBE CONTROL TRUNK	12663	

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
2	57 (BK)	16	Ground	
3	556 (WH)	16	Fuel injector 2 control	

Fig. 319: Identifying Connector C4231J (Strobe Control Trunk)
Courtesy of FORD MOTOR CO.

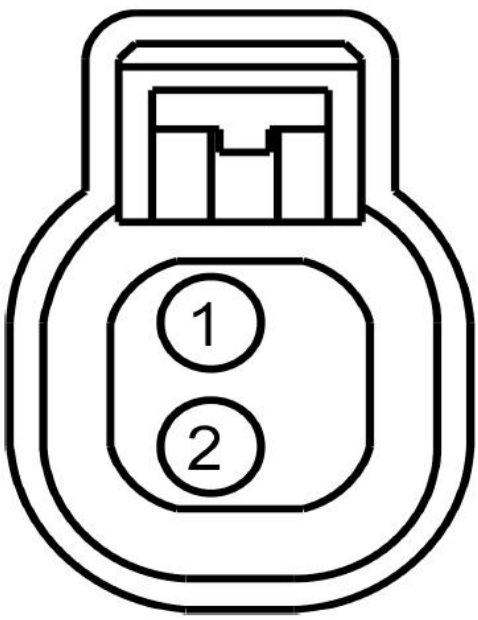
Connector: C4232 | **Description:** SMART SIREN AMPLIFIER | **Harness:** 14A733-C | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	3005 (VT-LG)	20	R4.C1 relay control	
3	3006 (VT-LG)	20	R4.C2 relay control	
4	3007 (VT-YE)	20	R4.C3 relay control	
5	3008 (VT)	20	R4.C4 relay control	
6	1 (DB)	20	Horn relay control	
7	6 (YE-LG)	20	Horn relay output	
8	13 (RD-BK)	16	siren +	
9	453 (PK-LG)	18	Ends in harness	
10	*	*	not used	
11	*	*	not used	
12	14 (BN)	16	Power, Exterior lamps	
13	1678 (WH-VT)	14	Voltage in Run or Accessory (overload protected)	
14	3009 (OG-RD)	20	R4.C5 relay control	
15	3011 (BK-OG)	20	R4.C6 relay control	
16	3012 (WH)	20	Accelerator pedal position 2 signal	
17	3013 (GY-BK)	20	R4.C8 relay control	
18	176 (PK-LG)	20	Ends in harness	
19	179 (OG-RD)	20	Ends in harness	
20	*	*	not used	
21	167 (BN-OG)	16	Subwoofer -	
22	*	*	not used	
23	*	*	not used	
24	57 (BK)	14	Ground	

Fig. 320: Identifying Connector C4232 (Smart Siren Amplifier)
Courtesy of FORD MOTOR CO.

Connector: C4233 | **Description:** TRUNK AIR CIRCULATION FAN MOTOR | **Harness:** 15A599 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	401 (PK)	18	Police power relay switched power	
2	57 (BK)	18	Ground	

Fig. 321: Identifying Connector C4233 (Trunk Air Circulation Fan Motor)
Courtesy of FORD MOTOR CO.

Connector: C4234 | Description: REAR DECK LED FLASHER | Harness: 15A599 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	23 (TN-LG)	16	R4.B5 relay switched power	
3	57 (BK)	16	Ground	

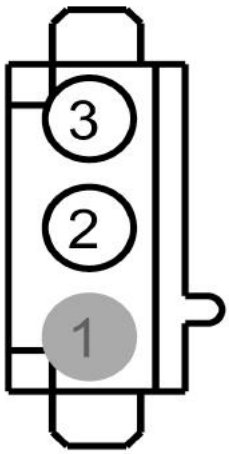


Fig. 322: Identifying Connector C4234 (Rear Deck Led Flasher)
Courtesy of FORD MOTOR CO.

Connector: C4235 | Description: LEFT REAR STROBE ASSEMBLY | Harness: 12663 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	556 (WH)	16	Fuel injector 2 control	
C	57 (BK)	16	Ground	

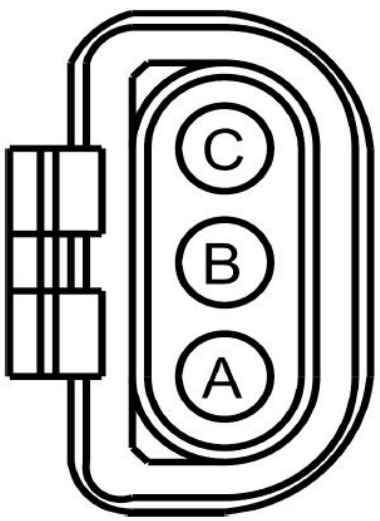


Fig. 323: Identifying Connector C4235 (Left Rear Strobe Assembly)
Courtesy of FORD MOTOR CO.

Connector: C4236 | Description: RIGHT REAR STROBE ASSEMBLY | Harness: 12663 | Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	361 (RD)	16	Voltage supplied in Start and Run (overload protected)	
B	556 (WH)	16	Fuel injector 2 control	
C	57 (BK)	16	Ground	

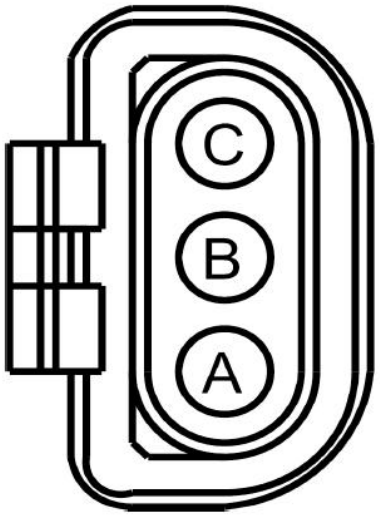
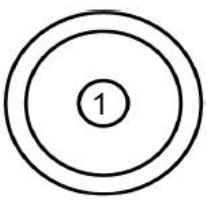


Fig. 324: Identifying Connector C4236 (Right Rear Strobe Assembly)
Courtesy of FORD MOTOR CO.

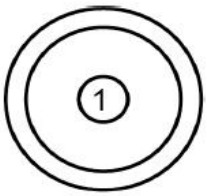
Connector: C4298 | Description: POLICE TRAY LAMP, RIGHT REAR | Harness: 14A005 | Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	5 (OG-LB)	16	Left rear turn signal	

Fig. 325: Identifying Connector C4298 (Police Tray Lamp, Right Rear)
Courtesy of FORD MOTOR CO.

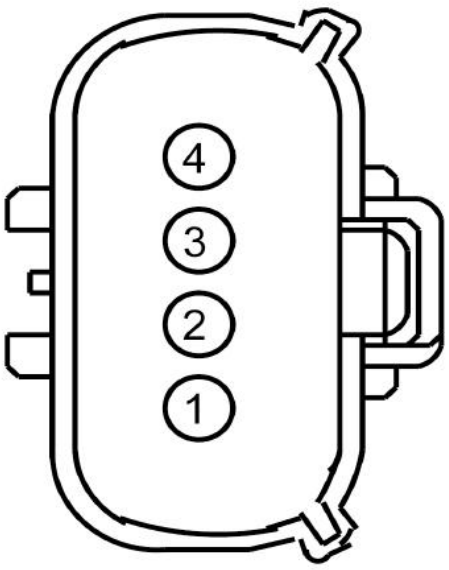
Connector: C4299	Description:	Harness:	Base Part #:
	POLICE TRAY LAMP, LEFT REAR	14A005	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	9 (LG-OG)	16	Left rear turn signal	

Fig. 326: Identifying Connector C4299 (Police Tray Lamp, Left Rear)
Courtesy of FORD MOTOR CO.

Connector: C4316	Description:	Harness:	Base Part #:
	FIRE SUPPRESOR, RH	14C369	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2310 (OG)	18	Fire suppressor, RH #1 feed	
2	2311 (DG)	18	Fire suppressor, RH #1 return	
3	2326 (LG)	18	Fire suppressor, RH #2 feed	
4	2327 (BK-WH)	18	Fire suppressor, RH #2 return	

Fig. 327: Identifying Connector C4316 (Fire Suppresor, RH)
Courtesy of FORD MOTOR CO.

Connector: C4317

Description: FIRE SUPPRESSOR, LH

Harness: 14C369

Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2312 (LG)	18	Fire suppressor, LH #1 feed	
2	2313 (BK-WH)	18	Fire suppressor, LH #1 return	
3	2328 (OG)	18	Fire suppressor, LH #2 feed	
4	2329 (DG)	18	Fire suppressor, LH #2 return	

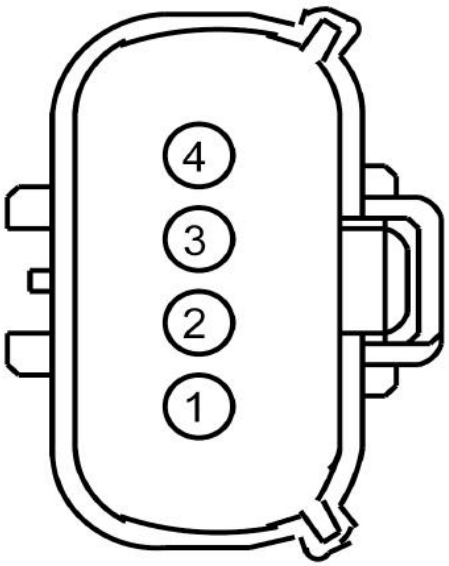


Fig. 328: Identifying Connector C4317 (Fire Suppressor, LH)
Courtesy of FORD MOTOR CO.

Connector: C4330

Description: TRUNK PERIMETER DISARM SWITCH

Harness: 14A227

Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	Ground	
2	1350 (WH-PK)	22	Trunk lock disarm switch signal	

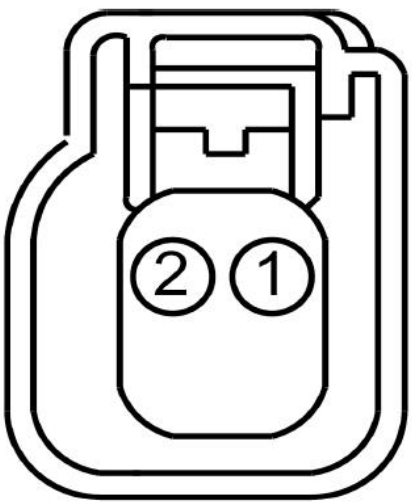
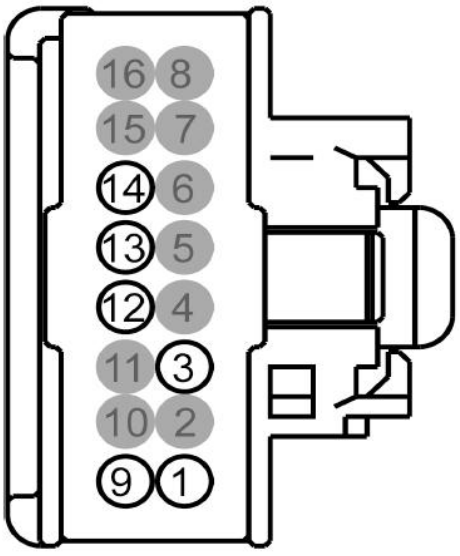


Fig. 329: Identifying Connector C4330 (Trunk Perimeter Disarm Switch)
Courtesy of FORD MOTOR CO.

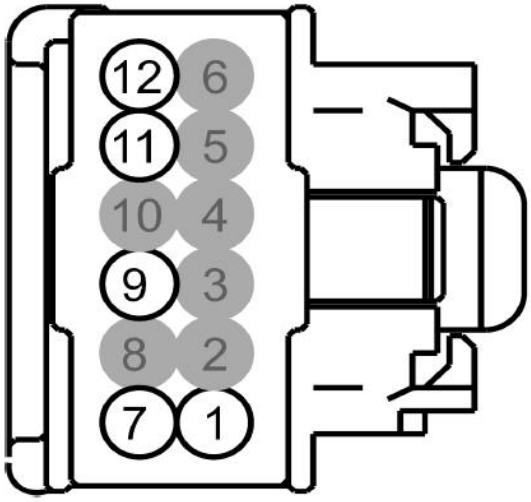
Connector: C9013A | **Description:** OVERHEAD CONSOLE | **Harness:** 14334 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	964 (DB-LG)	22	Voltage in Run or Accessory (overload protected)	
2	*	*	not used	
3	676 (PK-OG)	22	Ground	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	931 (RD-BK)	18	Voltage supplied at all times (overload protected)	
10	*	*	not used	
11	*	*	not used	
12	1174 (WH-RD)	22	Roof opening panel switch, Close, Up, signal	
13	1175 (TN-RD)	22	Roof opening panel switch, Open, Down, signal	
14	53 (BK-LB)	20	Courtesy lamps feed	
15	*	*	not used	
16	*	*	not used	

Fig. 330: Identifying Connector C9013A (Overhead Console)
Courtesy of FORD MOTOR CO.

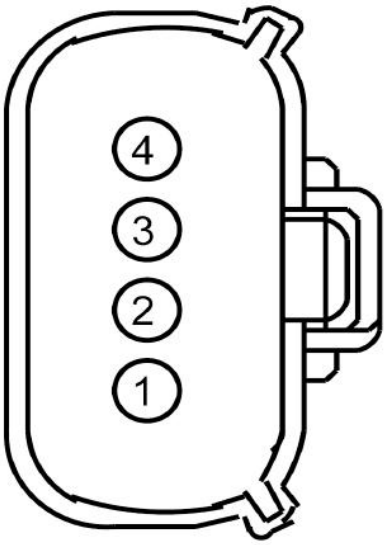
Connector: C9013B | **Description:** OVERHEAD CONSOLE | **Harness:** 14334 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	914 (TN-OG)	22	SCP Bus +	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	915 (PK-LB)	22	SCP Bus -	
8	*	*	not used	
9	679 (GY-BK)	22	vehicle speed signal	
10	*	*	not used	
11	705 (LG-OG)	20	Demand lighting	
12	19 (LB-RD)	20	Variable dimmer Instrument illumination feed	

Fig. 331: Identifying Connector C9013B (Overhead Console)
Courtesy of FORD MOTOR CO.

Connector: C9034 Description: FIRE SUPPRESION MANUAL SWITCH Harness: PIA Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	2319 (RD-YE)	20	Voltage in Start and Run (overload protected)	
2	2315 (BK-PK)	20	Fire suppression manual switch high	
3	2314 (LB-PK)	20	Fire suppression manual switch low	
4	1203 (BK-LB)	20	Gound	

Fig. 332: Identifying Connector C9034 (Fire Suppresion Manual Switch)
Courtesy of FORD MOTOR CO.

2007 ELECTRICAL

Battery, Mounting and Cables - Expedition, Expedition EL, Navigator & Navigator L

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Battery cable harness bracket nuts	10	-	89
Battery ground cable nut	25	18	-
Battery ground cable-to-cowl panel bolt	12	9	-
Battery ground cable-to-frame bolt	20	15	-
Battery hold-down clamp bolt	9	-	80
Battery negative terminal bolt	5	-	44
Battery tray bolts	17	13	-
Generator harness terminal/central junction box (CJB) cable nut	6	-	53
Positive battery terminal nut	6	-	53
Starter solenoid positive cable nut	12	9	-
Starter solenoid wire nut	5	-	44

DESCRIPTION AND OPERATION

BATTERY AND CABLES

Vehicles are equipped with a 12-volt maintenance-free battery.

The battery and cable system consists of the following components:

- Battery
- Battery cable assembly
- Battery tray

Ford Motor Company strongly recommends that lead-acid batteries be returned to an authorized recycling facility for disposal.

Fig. 1: Identifying Lead Acid Battery Recycling Label

Courtesy of FORD MOTOR CO.

DIAGNOSTIC TESTS

BATTERY

Special Tools

Illustration	Tool Name	Tool Number
ST2442-A	Micro 490 Digital Battery Analyzer	162-00004 or equivalent

Principles of Operation

Battery Eye Operation

The purpose of the battery eye is to indicate the state of charge of the battery in the assembly plant and while on the dealership lot. The battery eye can also indicate the state-of-charge when the vehicle is delivered to the dealership and during the pre-delivery inspection process. The battery eye is made up of a viewing plate, 2 balls and a small passage. The balls indicate the specific gravity of the electrolyte by floating higher or lower in the passageway. It is important to note that the battery eye checks the specific gravity on only a single battery cell.

The color of the battery eye indicates the approximate state of charge.

- Red usually indicates the battery state-of-charge is at 40% or less.
- Yellow indicates the battery state-of-charge is between 40% and 57%.
- Green indicates the battery state-of-charge is above 57%.
- No color/black can occur after the battery has been in service for several years and some of the plate material has coated the balls.
- A clear battery eye can occur if the battery case becomes damaged and the electrolyte has fallen below the plates.

NOTE: The battery eye may remain red for a period of time (up to several days), even after the battery is fully charged, because the acid is not yet fully mixed.

Do not install a new battery based solely on the indication of the battery eye. The battery eye color simply indicates the battery state-of-charge, not its condition. For example, a red or yellow battery eye usually indicates the battery is discharged, not defective. If the battery eye indicates the battery may be discharged, it is necessary to recharge the battery before testing its condition.

Charging a Battery

Batteries discharge while the vehicle is on the dealer lot or parked by the customer for an extended period of time due to normal parasitic key-off loads. Also, vehicles still in dealer inventory or in long-term storage may be driven short distances with heavy electrical loads. Over a period of time (30 days or more), this

could result in vehicles having shallow or deeply discharged batteries.

- Deeply discharged - A battery that is drained over a prolonged period of time, such as an unsold vehicle or a vehicle in storage, to the point the battery is dead.
- Shallow discharge - A battery that is drained by leaving an accessory on for several hours or a few days and has a very low charge.

The vehicle's charging system is designed to supply the electrical power needed to maintain the battery near full charge during normal vehicle use. The charging system is not capable of bringing a deeply discharged battery back near full charge in a short amount of time such as allowing the vehicle to idle for 15 minutes to "recharge the battery." Discharged batteries should be charged using an external charger.

NOTE: Battery chargers have improved greatly with the addition of the new generation pulse chargers. These chargers pulse current into the battery, breaking down the sulfation layer on the battery plates and generally reduce charging times to less than an hour.

NOTE: Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature.

The following chart summarizes 2 recommended methods of charging.

Type of Battery Discharge	Pulse Charger	Standard Charger
Deeply discharged	Follow directions supplied with the pulse charger	2 to 8 hours and may take up to an hour to accept initial charge
Shallow discharge	45 minutes to an hour charge	2 hours (40A) on manual setting or medium automatic setting

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Battery • Battery mounting	• Battery cables • Battery posts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, go to **Pinpoint Test A**.

Pinpoint Tests

Pinpoint Test A: Battery Condition Test

Normal Operation

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

This pinpoint test is intended to diagnose the following:

- Battery charge
- Battery

PINPOINT TEST A: BATTERY CONDITION TEST

A1 TEST THE BATTERY CONDITION

NOTE: No battery with a red test-eye should be replaced. The red eye only means the battery is discharged, not necessarily defective.

NOTE: Failure to fully charge the battery before retesting may cause false readings.

- Verify the battery condition using the battery analyzer.
- **Is the battery OK?**

  YES : If the meter reads GOOD BATTERY, RETURN the battery to service.

  If the meter reads GOOD-RECHARGE, CHARGE the battery and RETURN it to service.

  If the meter reads CHARGE & RETEST, fully CHARGE and RETEST the battery.

  NO : If the meter reads REPLACE BATTERY, INSTALL a new battery.

  If the meter reads BAD CELL-REPLACE, INSTALL a new battery.

GENERAL PROCEDURES

BATTERY DISCONNECT

WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors,

instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of SUPPLEMENTAL RESTRAINT SYSTEM article for location of the RCM and impact sensor (s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

CAUTION: If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted during the first 30 seconds, permanent damage to the CD6 audio unit will result.

NOTE: When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system setpoint may also vary. The vehicle may need to be driven to relearn its strategy.

NOTE: When the battery is disconnected and connected, the illumination display needs to be calibrated. After the battery is connected, rotate the dimmer switch from the lowest dim position to the full bright, dome ON position.

CAUTION: Do not lift the battery ground terminal by grabbing onto the wire or damage to the wire or terminal may result.

1. Disconnect the battery negative cable.
   - To connect, tighten to 5 Nm (44 lb-in).

CAUTION: Do not lift the positive battery terminal by grabbing onto the wire or lifting underneath the terminal cover or damage to the wire or terminal may result.

2. Disconnect the positive battery cable.
   - To connect, tighten to 6 Nm (53 lb-in).

CAUTION: Do not tap, press or excessively push on the battery terminals or damage to the terminals may result.

NOTE: Make sure the battery terminals slide all of the way down the battery post and the battery terminals are not tilted.

3. To connect, reverse the disconnect procedure.

REMOVAL AND INSTALLATION

BATTERY AND BATTERY TRAY - EXPLODED VIEW

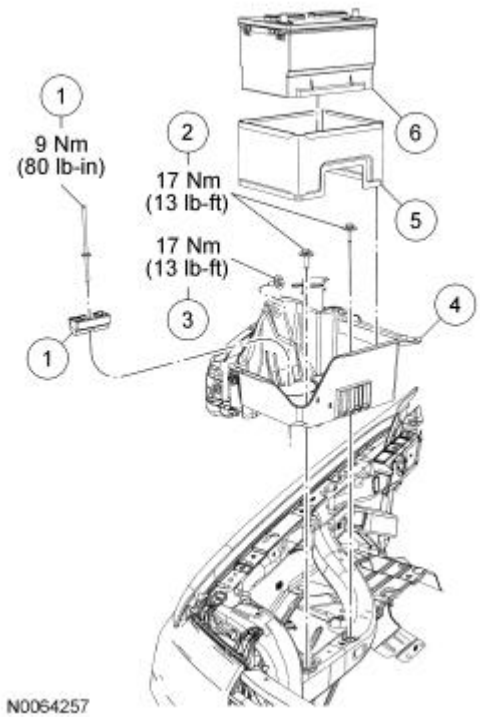


Fig. 2: Exploded View Of Battery & Battery Tray (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	10747	Battery hold-down clamp and bolt
2	N811866	Battery tray bolts (2 required)
3	N811866	Battery tray bolt
4	10732	Battery tray
5	10A687	Battery heat shield
6	10655	Battery

1. For additional information, refer to the procedures.

BATTERY

REMOVAL AND INSTALLATION

1. Disconnect the battery cables. For additional information, refer to **Battery Disconnect**.
2. Loosen and remove the battery hold-down bolt and clamp.
    - To install, tighten to 9 Nm (80 lb-in).

WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

3. Remove the battery and the heat shield.
4. To install, reverse the removal procedure.

BATTERY TRAY

REMOVAL AND INSTALLATION

1. Remove the battery. For additional information, refer to **Battery**.

NOTE: The battery tray is integrated with the washer reservoir and cannot be serviced separately.

2. Remove the battery tray. For additional information refer to Washer Reservoir in **WIPERS AND WASHERS** article.

BATTERY CABLES

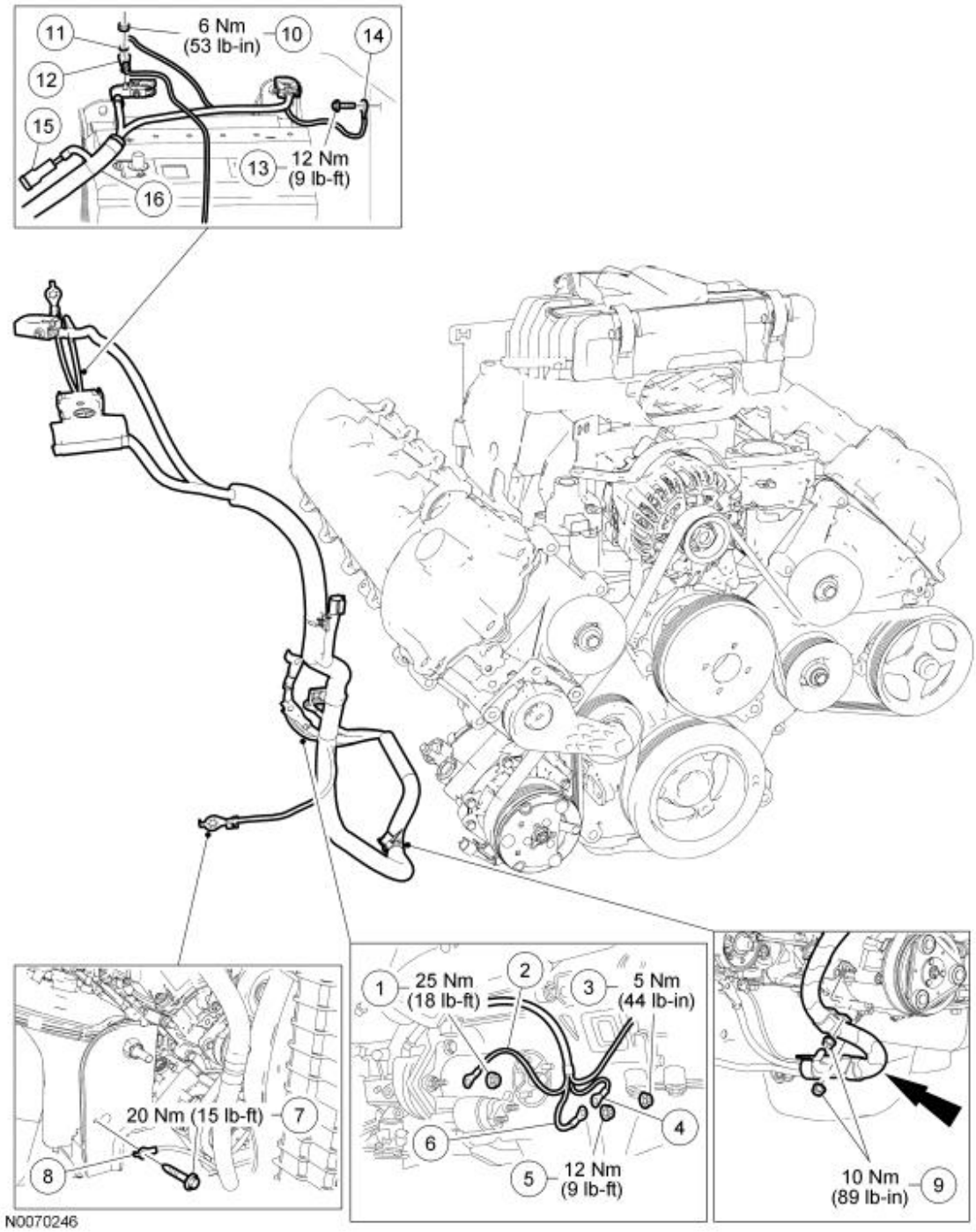


Fig. 3: Exploded View Of Battery Cables (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N805024	Battery ground cable nut
2	-	Battery ground cable terminal (part of 14B060)
3	N805320	Starter solenoid wire nut
4	-	Starter solenoid wire terminal (part of 14B060)

5	W706414	Starter solenoid positive cable nut
6	-	Starter solenoid positive cable terminal (part of 14B060)
7	-	Battery ground cable-to-frame bolt (part of 14B060)
8	-	Battery ground cable frame terminal (part of 14B060)
9	N621906	Battery cable harness bracket nuts (2 required)
10	W520101	Generator harness terminal/central junction box (CJB) cable nut
11	-	CJB cable terminal (part of 14300)
12	-	Generator harness terminal (part of 14305)
13	N806925	Battery ground cable-to-cowl panel bolt
14	-	Battery ground cable-to-body terminal (part of 14B060)
15	-	Battery cable harness in-line electrical connector (part of 14B060)
16	14B060	Battery cable harness assembly

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery. For additional information, refer to **Battery Disconnect**.
3. Remove the nut and position the battery ground cable terminal aside at the starter.
   - To install, tighten to 25 Nm (18 lb-ft).
4. Remove the nut and position the starter solenoid positive cable terminal aside.
   - To install, tighten to 12 Nm (9 lb-ft).
5. Remove the nut and position the starter solenoid wire terminal aside.
   - To install, tighten to 5 Nm (44 lb-in).
6. Remove the 2 nuts and position the 2 battery cable harness brackets from the A/C compressor mounting bolts.
   - To install, tighten to 10 Nm (89 lb-in).
7. Remove the bolt and position the battery ground cable-to-frame terminal aside.
   - To install, tighten to 20 Nm (15 lb-ft).
8. Remove the nut and position the generator harness terminal and the central junction box (CJB) cable terminal aside.
   - To install, tighten to 6 Nm (53 lb-in).
9. Remove the bolt and position the battery ground cable-to-cowl panel terminal aside.
   - To install, tighten to 12 Nm (9 lb-ft).
10. Disconnect the battery cable harness in-line electrical connector, release the harness locator and remove the battery cable harness assembly.
11. To install, reverse the removal procedure.

2007 GENERAL INFORMATION

Charging System - General Information - Expedition, Expedition EL, Navigator & Navigator L

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Generator amps	89/157 amp (max) @ 1,800-6,000 generator rpm, approximately 500-2,000 engine rpm
Voltage	12 volts

DESCRIPTION AND OPERATION

CHARGING SYSTEM

The charging system consists of the following:

- Generator
- Charging system warning indicator
- Necessary wiring and cables

The charging system is a negative ground system. The generator (including an internal voltage regulator) is belt-driven by the engine accessory drive system. When the engine is started, the generator begins to generate AC, which is internally converted to DC. This current is then supplied to the vehicle electrical system through the output (B+) terminal of the generator.

Battery

The battery is a 12V DC source connected in a negative ground system. The battery case is sealed with 2 vent holes to release gases. The battery has 3 major functions:

- Engine cranking power source
- Voltage stabilizer for the electrical system
- Temporary power source when electrical loads exceed the generator output current

DIAGNOSTIC TESTS

CHARGING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent

ST1137-A		
ST2173-A	SABRE Premium Battery & Electrical System Tester	010-00736 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
ST2574-A	Flex Probe Kit	105-R025B or equivalent

Principles of Operation

The PCM controlled charging system determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator. This system is unique in that it has 2 communication lines between the PCM and the generator/regulator. Both of these communication lines are pulse-width modulated (PWM). The generator communication (GENCOM) line communicates the desired setpoint from the PCM to the voltage regulator. The generator monitor (GENMON) line communicates the generator load and error conditions to the PCM. The third pin on the voltage regulator, the A circuit pin, is a dedicated battery voltage sense line.

The generator charges the battery and at the same time supplies power for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm. The PCM is able to adjust the charging voltage according to the battery temperature by using a signal from the intake air temperature (IAT) sensor. This means the voltage setpoint is calculated by the PCM and communicated to the regulator by the GENCOM circuit.

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged the PCM raises engine speed to increase generator output.

To minimize the engine drag when starting the engine, the PCM does not allow the generator to produce any output until the engine has started. The PCM turns off the generator during cranking to reduce the starter load and improve cranking speed. Once the engine starts, the PCM slowly increases generator output to help establish a stable engine speed.

The PCM controls the charging system warning indicator by sending a message over the high speed CAN to the instrument cluster (IC). The PCM turns the charging system warning indicator off when generator output begins. The charging system warning indicator is also illuminated by the PCM whenever the key is ON with

the engine OFF.

This is a System 4 charging system, which uses the GENMON and GENCOM lines to control and monitor the charging system through the PCM. System 4 charging systems are virtually identical in design and therefore, share the same diagnostics. The circuit numbers and colors may be different, but the functions are the same.

Inspection and Verification

WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

CAUTION: Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses or fusible links.

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

NOTE: While carrying out any pinpoint test, disregard any DTCs set while following a specific pinpoint test. After the completion of a test, be sure to clear all DTCs in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Battery • Generator drive belt	• Circuitry • Fusible links • Cables

• Generator pulley	• Generator • PCM • Charging system warning indicator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Verify the battery condition. Refer to **BATTERY, MOUNTING AND CABLES** article.
5. Check the operation of the charging system warning indicator at the instrument cluster (IC). Normal operation is as follows:
   - With the key OFF, the charging system warning indicator should be off.
   - With the key ON and the engine OFF, the charging system warning indicator should be on.
   - With the engine running, the charging system warning indicator should be off.
6. Turn off the headlamps and the A/C system (if equipped). Turn the climate control blower to low/off. Check the battery voltage before and after starting the engine to determine if the battery voltage increases.

NOTE: Make sure to use the latest scan tool software release.

7. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

8. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
9. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
11. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM and the IC.
12. If the DTCs retrieved are related to the concern, go to the DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
13. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

NOTE: DTC P0622 can be set by the loss of the communication lines between the

generator and the PCM. The charging system warning indicator then illuminates until the engine is operated at greater than 4,500 RPM (approximately wide open throttle [WOT]) for a minimum of 3 seconds. At this time, the generator self-excites. The charging system warning indicator remains illuminated, and the generator operates in a default mode (approximately 13.5 volts) until the engine is turned off.

DTC CHART

DTCs	Description	Source	Action
B1317	Battery Voltage High	Various Modules	Go to **Pinpoint Test B**.
B1318	Battery Voltage Low	Various Modules	Go to **Pinpoint Test F**.
B1676	Battery Voltage Out of Range	Various Modules	Go to **Pinpoint Test F**.
P0563	System Voltage High	PCM	Go to **Pinpoint Test B**.
P0620	Generator Control Circuit	PCM	Go to **Pinpoint Test B**.
P0625	Generator Field Terminal Circuit - Low	PCM	Go to **Pinpoint Test B**.
P0626	Generator Field Terminal Circuit - High	PCM	Go to **Pinpoint Test B**.
P065B	Generator Control Circuit Range /Performance	PCM	Go to **Pinpoint Test B**.
All other DTCs	-	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The battery is discharged or battery voltage is low	• High key-off current drain(s) • Engine, generator and battery grounds • Positive battery cable • Circuitry • Battery • Generator	• Go to **Pinpoint Test A**.
• The charging system warning indicator is on with the engine running and no charging system DTCs present	• Circuitry • PCM • Generator • Instrument cluster (IC)	• Go to **Pinpoint Test C**.
• The generator is noisy	• Accessory drive belt • Loose bolts/brackets • Generator/pulley	• Go to **Pinpoint Test D**.
	• Generator	• Go to **Pinpoint Test**

• Radio interference	• Circuitry • In-vehicle entertainment system	**E**.

Pinpoint Tests

CAUTION: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage can result.

Refer to Inspection and Verification, the DTC Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: The Battery is Discharged or Battery Voltage is Low

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

The generator output voltage is supplied through the positive battery output (B+), circuit SDC02 (RD) terminal on the rear of the generator to the battery and electrical system. During normal operation the charging system warning indicator is off with the key in the ON position and the engine running. The charging system warning indicator is on with the key in the ON position and the engine off.

This pinpoint test is intended to diagnose the following:

- High key-off current drain(s)
- Engine, generator and battery grounds
- Positive battery cable
- Circuit high resistance
- Battery
- Generator

PINPOINT TEST A: THE BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

A1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Does the battery pass the condition test?**

  YES : Go to A2.

  NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK THE GENERATOR OUTPUT

- Carry out the Generator On-Vehicle Load Test and No Load Test. Refer to the Component Tests.
- **Does the generator pass the component tests?**

  YES : Go to A3.

NO : Go to **Pinpoint Test B**.

A3 CHECK FOR CURRENT DRAINS

- Carry out the Battery - Drain Testing. Refer to the Component Tests.
- **Are any circuits causing excessive current drains?**

  YES : REPAIR as necessary. TEST the system for normal operation.

  NO : Go to A4.

A4 CHECK THE VEHICLE GROUNDS

- Key in START position.

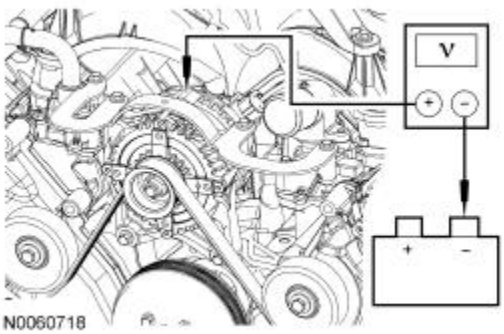


Fig. 1: Checking Voltage Drop
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between the generator housing and the negative battery terminal.
- **Is the voltage drop less than 0.1 volt?**

  YES : Go to A5.

  NO : CHECK the engine ground, generator ground and the battery ground for corrosion. TEST the system for normal operation.

A5 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC02 (RD)

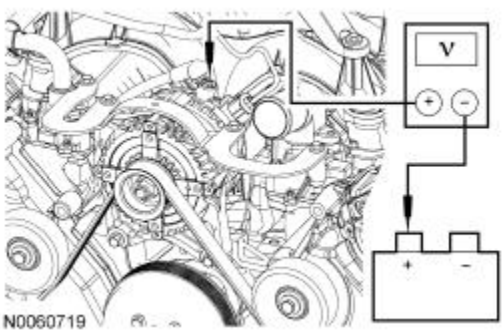


Fig. 2: Checking Voltage Drop
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b circuit SDC02 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

  YES : CHECK if the customer left any electrical system(s) on or if there is an intermittent excessive battery draw. TEST the system for normal operation.

NO : CHECK for any corrosion in the B+ SDC02 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test B: The Charging System Warning Indicator is On and Any Charging System DTC Stored

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The sense A circuit SDC02 (RD) to the generator field coil is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired setpoint. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC02 (RD) is the generator output voltage supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- IC
- PCM

PINPOINT TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON AND ANY CHARGING SYSTEM DTC STORED

NOTE: Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

B1 CONFIRM THE BATTERY CONDITION

- Carry out the Battery Condition Test. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to B2.

  NO : CORRECT the battery condition and Go to B2.

B2 CHECK THE FUSIBLE LINKS

- Check the fusible links.
- **Are the fusible links OK?**

  YES : Go to B3.

  NO : REPAIR circuit SDC02 (RD) and INSTALL a fusible link. INSPECT PCM and engine ground circuits and make sure they are securely attached. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B3 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position

- Inspect generator C102b circuit SDC02 (RD) connection. Connection should be tight.

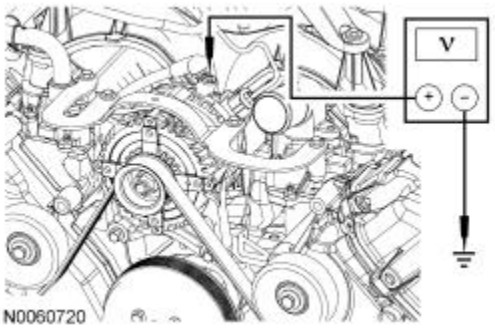


Fig. 3: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b circuit SDC02 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

  YES : Go to B4.

  NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B4 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE OFF (KOEO)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Clear the PCM DTCs
- Enter the following diagnostic mode on the diagnostic tool: Select PCM PIDs

NOTE: Many of the PCM PIDs selected will be monitored later in this pinpoint test.

Select and monitor the following PCM PIDs:

- Generator Monitor (GENMON).
- Generator Command Duty Cycle (GENCMD).
- Generator Voltage Desired (GENVDSD).
- Generator Fault Indicator Lamp (GENFIL).
- Engine Revolutions Per Minute (RPM).
- Module Supply Voltage (VPWR).

- Monitor the GENMON PID.
- **Does the GENMON PID read 0%?**

  YES : Go to B5.

  NO : Go to B8.

B5 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE RUNNING (KOER)

- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.

- Monitor PID GENMON at idle and 3,000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to B6.

  NO : Go to B8.

B6 MONITOR THE PCM PIDs GENERATOR MONITOR, MODULE SUPPLY VOLTAGE AND GENERATOR DESIRED VOLTAGE WITH THE ENGINE AT 3,000 RPM

- Turn all electrical accessories (lights, blower motor, etc.) off.

NOTE: If GENMON PID does not remain below 85%, make sure that the battery is at an acceptable state of charge and that all electrical accessories are off.

- Increase the engine speed to 3,000 RPM (or road test).
- **Does the VPWR PID remain within ± 0.5 volt of the GENVDSD PID when the GENMON PID is less than 85%?**

  YES : Go to B7.

  NO : Go to B17.

B7 MONITOR THE PCM PIDs GENERATOR MONITOR, MODULE SUPPLY VOLTAGE AND GENERATOR DESIRED VOLTAGE WITH THE ENGINE AT IDLE

- Return the engine speed to idle.

CAUTION: On vehicles with low electrical loads, it may be necessary to add external loads (devices connected to power points, etc.) to determine the maximum GENMON value. GENMON value will not read between 95%-98% on a vehicle with minimal electrical accessories. As long as there is a significant increase in the GENMON PID following the procedure below, answer YES to the question.

- Determine the maximum GENMON PID value by lowering engine idle RPM to 500 RPM or less using output state control (manual transaxle vehicles require the parking brake applied and the clutch pedal depressed) and turn on all electrical accessories until the VPWR PID is less than the GENVDSD PID by at least 0.7 volt. Under this condition the GENMON PID should read between 95% and 98%.
- **Does the GENMON PID read between 95% and 98%?**

  YES : Go to B19.

  NO : Go to B17.

B8 CHECK THE VOLTAGE OUTPUTS FROM THE PCM

- Key in OFF position.
- Disconnect: Generator C102a
- Key in ON position.
- Measure the voltage of the following circuits:

EXPECTED VOLTAGES

Generator Connector	Circuit	Expected Voltage (Approximate)
C102a-1	CDC15 (VT)	8-11 volts (should be less than battery voltage)
C102a-2	CDC10 (BU/OG)	0 volts
C102a-3	SDC02 (RD)	Battery voltage

- **Are the voltages as indicated for each circuit?**

  YES : Go to B13.

  NO : If a fault is detected in the GENCOM circuit CDC10 (BU/OG) or GENMON circuit CDC15 (VT), go to B9.

  If a fault is detected in the A sense SDC02 (RD) circuit, go to B12.

B9 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a
- Disconnect: PCM C175b
- Inspect the following for damaged or pushed-out pins:

Component	Connector	Circuit
PCM	C175b-22	CDC10 (BU/OG)
PCM	C175b-23	CDC15 (VT)
Generator	C102a-2	CDC10 (BU/OG)
Generator	C102a-1	CDC15 (VT)

- Measure the resistance between circuit C175b-22 and C102a-2 and circuit C175b-23 and C102a-1.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B10.

  NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B10 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between circuits C102a-1, CDC15 (VT) and C102a-2, CDC10 (BU/OG).
- **Are the voltages approximately 0 volt?**

  YES : Go to B11.

NO : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B11 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between circuit C102a-1, CDC15 (VT) harness side and ground and C102a-2, CDC10 (BU/OG) harness side and ground and also measure resistance. between each other:
- **Are the resistances less than 5 ohms?**

  YES : Go to B24.

  NO : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B12 CHECK CIRCUIT SDC02 (RD) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a
- Inspect C102a-3 for damaged or pushed-out pins.
- Measure the resistance of the circuit A sense circuit SDC02 (RD) between the battery and C102a-3 generator connector.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B24.

  NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B13 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Verify that PID GENMON reads 100%.
- Carry out the wiggle test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

  YES : REPAIR short circuit on CDC15 (VT) C102a-1.

  NO : Go to B14.

B14 CHECK THE PCM PID GENERATOR MONITOR INPUT TO THE PCM

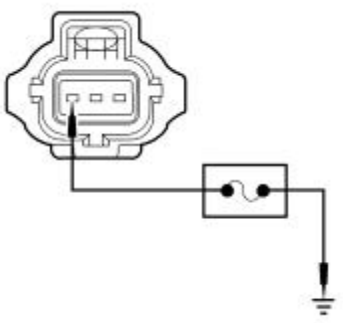


Fig. 4: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness

side and ground.

- Key in ON position.
- Monitor the GENMON PID while performing a wiggle test on the wire harness.
- **Does the GENMON PID read 0%?**

  YES : Go to B15.

  NO : REPAIR open connection on circuit CDC15 (VT). INSPECT generator C102a-1 and PCM C175e-16 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B15 COMPARE THE PCM PIDs GENERATOR MONITOR AND GENERATOR FIELD DUTY CYCLE

- Key in OFF position.
- Disconnect: Fused (10A) Jumper Wire

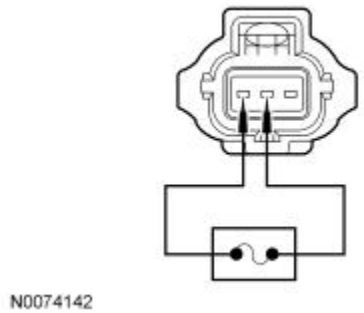


Fig. 5: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and generator C102a-2, circuit CDC10 (BU/OG), harness side.
- Key in ON position.
- Monitor the GENMON and GENCMD PIDs while performing a wiggle test on the harness.
- **Does the GENMON PID read within 2% of the GENCMD PID?**

  YES : Go to B16.

  NO : INSPECT C175b-66, circuit GD113 (BK/YE), PCM ground circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B16 A SENSE CIRCUIT LOAD TEST

NOTE: This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault.

- Key in ON position.
- Using a 12-volt test lamp, check for voltage at C102a-3, circuit SDC02 (RD).
- **Does the test lamp illuminate?**

  YES : Go to B23.

  NO : REPAIR connection on circuit SDC02 (RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B17 CHECK THE PCM VPWR PID

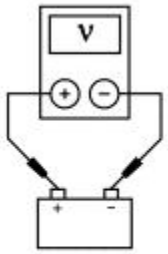


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Fig. 6: Checking The Battery Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and VPWR PID within 0.5 volt of each other?**

  YES : Go to B19.

  NO : Go to B18.

B18 MEASURE THE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Connect a fused (10A) jumper wire between C175b-8 circuit CE607 (BN/YE) and ground.
- Key in ON position.

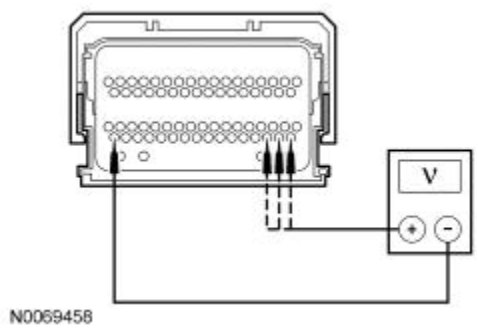

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Fig. 7: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51, 52 and 53 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

  YES : Go to B24.

  NO : REPAIR high resistance or loose connections between C175b-51 circuit CBB76 (BU/BN), C175b-52 circuit CBB76 (BU/BN), C175b-53 circuit CBB76 (BU/BN) PCM power circuits or C175b-66, circuit GD113 (BK/YE), PCM ground circuit.

B19 CHECK THE GENERATOR B+ RESISTANCE

- Key in OFF position.
- Disconnect: Battery
- Disconnect: Generator C102b

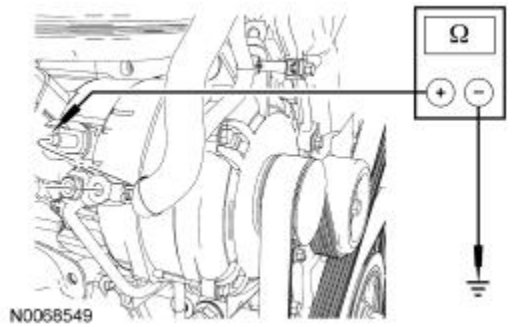

Fig. 8: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between generator C102b, component side and the generator housing.
- **Is the resistance greater than 125K ohms?**

  YES : Go to B20.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B20 CHECK THE RESISTANCE OF THE VOLTAGE REGULATOR INTERNAL CIRCUITS TO GROUND

- Measure the resistance between generator C102a, component side and ground. Refer to the following table.

Pin	Expected Resistance
1	Greater than 1,000K ohms
2	Greater than 125K ohms
3	Greater than 125K ohms

- **Are the resistance values as indicated?**

  YES : Go to B21.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B21 ROAD TEST IN AN ATTEMPT TO VERIFY THE FAULT

- Connect: Generator C102b
- Connect: Generator C102a
- Connect: Battery
- Carry out a road test and monitor the following PIDs:
  - Generator monitor (GENMON).
  - Generator voltage desired (GENVDSD).

  - Module supply voltage (VPWR).
- **Does the GENMON PID read either 0% or 100% during the road test?**

  YES : Go to B2.

  NO : If a road test did not cause the fault to occur, intermittent fault condition may be present. Go to B22.

B22 USE THE VEHICLE DATA RECORDER (VDR) TO CAPTURE INTERMITTENT FAULT CONDITION

- Connect a VDR to the vehicle and setup to capture the following PIDs:
  - Generator monitor (GENMON).
  - Generator command duty cycle (GENCMD).
  - Generator voltage desired (GENVDSD).
  - Generator fault indicator lamp (GENFIL).
  - Engine revolutions per minute (RPM).
  - Module supply voltage (VPWR).
- Set the VDR to trigger if any of the following events occur during vehicle operation (waiting 15 seconds after start):
  - VPWR PID reads greater than 15.2 volts.
  - GENMON PID reads 0% or 100%.
- Road test the vehicle.
- **Was a fault captured by the VDR?**

  YES : RECORD any values from the VDR that may have been captured. If no charging system DTCs are present, go to **Pinpoint Test C**. If any charging system DTCs are present, go to B3.

  NO : No problem found at this time. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B23 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b
- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for DTCs.
- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

B24 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b

- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for DTCs.
- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article.

  NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

Pinpoint Test C: The Charging System Warning Indicator is On With the Engine Running and No Charging System DTCs Present

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The A circuit SDC02 (RD) from the battery B+ to the generator regulator is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired setpoint. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC02 (RD) is the generator output supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- Circuitry
- IC
- PCM

PINPOINT TEST C: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND NO CHARGING SYSTEM DTCs PRESENT

NOTE: Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

C1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Does the battery pass the condition test?**

YES : Go to C2.

NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

C2 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position.
- Inspect generator C102b circuit SDC02 (RD) connection. Connection should be tight.

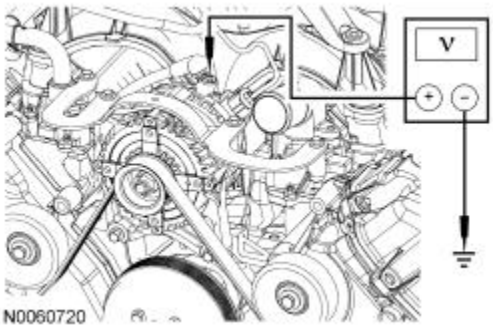

Fig. 9: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b circuit SDC02 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

YES : Go to C3.

NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the any DTCs. REPEAT the self-test. TEST the system for normal operation.

C3 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC02 (RD)

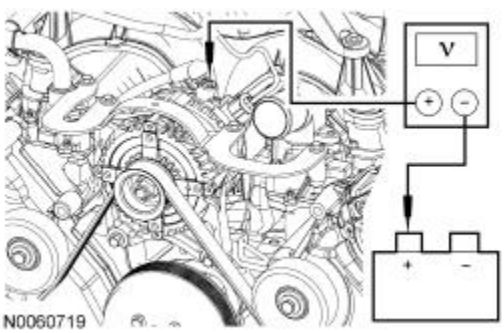

Fig. 10: Checking Voltage Drop
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b circuit SDC02 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

YES : Go to C4.

NO : CHECK for any corrosion in the B+ C102b circuit SDC02 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

C4 CHECK THE DTCs IN THE PCM

- Key in OFF position.

- Connect the diagnostic tool.
- Key in START position.
- Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs
- Use the recorded PCM DTCs from the continuous and on-demand self tests.
- **Are any PCM DTCs recorded?**

  YES : For all DTCs EXCEPT charging system DTCs, REFER to the **Introduction - Gasoline Engines** article. If any charging system DTCs are present, go to **Pinpoint Test B**. If referred here by the PC/ED, go to C5.

  NO : Go to C5.

C5 MONITOR PID GENFIL

- With the engine running, monitor PID GENFIL.
- **Does PID GENFIL show fault?**

  YES : Go to C6.

  NO : REPAIR/INSTALL a new IC, IC-to-PCM connection or the PCM. TEST the system for normal operation.

C6 MONITOR PID VPWR

- With the engine running, monitor PIDS VPWR, GENFIL, GENVDSD.
- **Is PID VPWR greater than 15.6 volts?**

  YES : Go to C7.

  NO : Go to C8.

C7 CHECK PCM VPWR PID

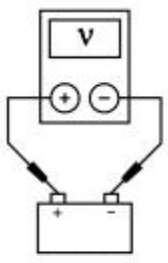

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Fig. 11: Checking The Battery Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and VPWR PID within 0.6 volt of each other?**

  YES : Go to C8.

  NO : Go to C9.

C8 MEASURE THE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Connect a fused (10A) jumper wire between C175b-8 circuit CE607 (BN/YE) and ground.

- Key in ON position.

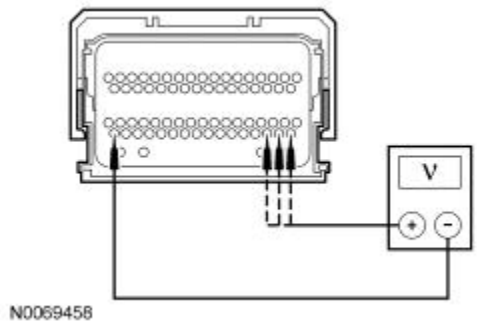


Fig. 12: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51, 52 and 53 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

  YES : INSTALL a new PCM.

  NO : REPAIR high resistance or loose connections between C175b-51 circuit CBB76 (BU/BN), C175b-52 circuit CBB76 (BU/BN), C175b-53 circuit CBB76 (BU/BN) PCM power circuits or C175b-66, circuit GD113 (BK/YE), PCM ground circuit.

C9 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE RUNNING

- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.
- Monitor PID GENMON at idle and 3,000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to C10.

  NO : Go to C11.

C10 MONITOR PID GENVDSD

- With the engine running, monitor PID GENVDSD.
- **Is PID GENVDSD greater than 15.2 volts?**

  YES : REPAIR connection on circuit SDC02 (RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If no problems are found, INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : INSTALL a new PCM.

C11 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Verify that PID GENMON reads 100%.
- Carry out the wiggle test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

YES : REPAIR short circuit on C102a-1 CDC15 (VT).

NO : Go to C12.

C12 CHECK THE PCM PID GENERATOR MONITOR INPUT TO THE PCM

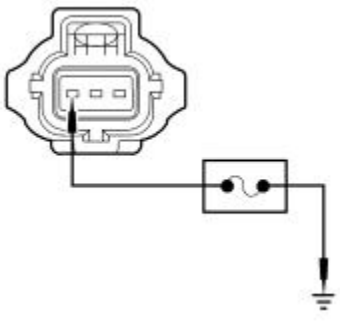


Fig. 13: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and ground.
- Key in ON position.
- Monitor the GENMON PID while carrying out a wiggle test on the wire harness.
- **Does the GENMON PID read 0%?**

  YES : REPAIR open connection on circuit CDC15 (VT) C102a-1, and PCM C175b-23. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: The Generator is Noisy

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

The generator is belt-driven by the engine accessory drive system.

This pinpoint test is intended to diagnose the following:

- Accessory drive belt
- Loose bolts/brackets
- Generator/pulley

PINPOINT TEST D: THE GENERATOR IS NOISY

D1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS

- Key in OFF position.
- Check the accessory drive belt for damage and correct installation. Refer to **ACCESSORY**

DRIVE article.

- Check the accessory mounting brackets and generator pulley for looseness or misalignment.
- **Is the accessory drive OK?**

  YES : Go to D2.

  NO : REPAIR as necessary. REFER to **ACCESSORY DRIVE** article for diagnosis and testing of the accessory drive system. TEST the system for normal operation.

D2 CHECK THE GENERATOR MOUNTING

- Check the generator mounting for loose bolts or misalignment.
- **Is the generator mounted correctly?**

  YES : Go to D3.

  NO : REPAIR as necessary. TEST the system for normal operation.

D3 CHECK THE GENERATOR FOR ELECTRICAL NOISE

- Disconnect: Generator C102b
- Key in START position.
- With the engine running, use a stethoscope or equivalent listening device to probe the generator.
- **Is the noise still present?**

  YES : Go to D4.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

D4 CHECK THE GENERATOR FOR MECHANICAL NOISE

- With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise.
- **Is the generator the noise source?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the source of the engine noise.

Pinpoint Test E: Radio Interference

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- Circuitry
- In-vehicle entertainment system

PINPOINT TEST E: RADIO INTERFERENCE

E1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE

NOTE: If the OEM audio unit has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to OEM condition before following this pinpoint test.

- Key in START position.
- Start and run the engine.
- Tune the audio unit to a station where the interference is present.
- Key in OFF position.
- Disconnect: Generator C102b
- Key in START position.
- With the engine running, determine if the interference is still present.
- **Is the interference present with the generator disconnected?**

  YES : REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article for diagnosis and testing of the in-vehicle entertainment system.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

Pinpoint Test F: DTC B1318 or B1676 - Battery Voltage Low or Battery Voltage Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

Various control modules within the vehicle operate at a voltage between 10-17 volts. Voltage to these modules is supplied through the vehicle harness to the module(s). Ground for the modules is provided by the modules ground circuit(s). If voltages to these modules rise above 17 volts, DTC B1317 or B1676 may set or if voltage drops below 10 volts, DTC B1318 or B1676 may set.

This pinpoint test is intended to diagnose the following:

- Battery
- Charging system
- Module voltage supply
- Module ground

NOTE: DTC B1317 or B1318 can be set if the vehicle has had a discharged battery, has had been recently jump started or has had the vehicle battery charged.

PINPOINT TEST F: DTC B1318 OR B1676 - BATTERY VOLTAGE LOW OR BATTERY VOLTAGE OUT OF RANGE

F1 CHECK FOR DTCs

- Key in OFF position.
- Connect the diagnostic tool.

- Enter the following diagnostic mode on the diagnostic tool: Retrieve all continuous DTCs
- **Is DTC B1318 or B1676 present in only one module?**

  YES : If DTC B1317 or B1676 are recorded in only ONE module, go to F2.

  NO : If DTC B1318 or B1676 are recorded in more than one module, go to **Pinpoint Test B**.

F2 CHECK THE BATTERY VOLTAGE

- Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running, all accessory loads OFF.
- **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**

  YES : Go to F3.

  NO : CHECK and/or REPAIR the charging system as necessary. Go to **Pinpoint Test B**. TEST the system for normal operation. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK THE VOLTAGE TO THE MODULE

- Key in OFF position.
- Disconnect: Affected module which recorded the DTC B1317 or B1676
- Key in ON position.
- Measure all of the affected module's power circuits, harness side to ground. Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information..
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

  NO : REPAIR the module power circuit(s). CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE MODULE GROUNDS

- Key in OFF position.
- Measure the resistance between all of the affected module's ground circuits, harness side to ground. Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information..
- **Is the resistance less than 5 ohms?**

  YES : Go to F5.

  NO : REPAIR the module ground circuit(s). CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE MODULE FOR CORRECT OPERATION

- Key in OFF position.
- Disconnect: All of the affected module connectors
- Check the connector and module for:
  - corrosion.
  - pushed-out or damaged pins.
  - connector or module damage.
- Connect: All of the affected module connectors
- Clear all DTCs.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new module. REFER to the removal and installation procedure in the affected module's section. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been the result of a loose connection, may recently have had a discharged battery or may have been jump started. CLEAR the DTCs. REPEAT the self-test.

Component Tests

Battery - Drain Testing

WARNING: Do not attempt to service, charge, recharge or jump start a battery unless the following information has been read and understood. Failure to follow this instruction may result in serious personal injury.

CAUTION: To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.

CAUTION: If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted during the first 30 seconds, permanent damage to the CD6 audio unit will result.

NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure.

NOTE: Many electronic modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Use an in-line ammeter between the negative battery post and its respective cable.

NOTE: Typically, a drain of approximately one amp is attributed to an engine compartment lamp, glove compartment lamp or interior lamp staying on continually. Other component failures or wiring shorts are located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all the fuses, it is due to the generator.

NOTE: To accurately test the drain on a battery, an in-line ammeter must be used. Use of a test lamp or voltmeter is not an accurate method due to the number of electronic modules.

1. Make sure the junction box(es)/fuse panel(s) is accessible without turning on the interior lights or the underhood lights.
2. Drive the vehicle at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.
3. Allow the vehicle to sit with the key off for at least 40 minutes to allow the modules to time out/power down.
4. Connect a fused jumper wire (30A) between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.
5. Disconnect the negative battery cable from the negative battery post without breaking the connection of the jumper wire.

NOTE: It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated.

6. Connect the battery tester between the negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10 amp capability.

NOTE: If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

NOTE: Amperage draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.

NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

7. Remove the jumper wire.
8. Note the amperage draw. Draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.
9. If the draw is found to be excessive, remove the fuses from the smart junction box (SJB) one at a time and note the current reading. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed and then install one fuse, note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse.
10. If the current draw is still excessive, remove the fuses from the battery junction box (BJB) one at a time and note the current drop. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed, then install one fuse, note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.
11. Check the wiring diagrams for any circuits that run from the battery without passing through the BJB or the SJB. If the current draw is still excessive, disconnect these circuits until the draw is found. Also, disconnect the generator electrical connections if the draw cannot be located. The generator may be internally shorted, causing the current drain.

Generator On-Vehicle Tests

CAUTION: To prevent damage to the generator, do not make the jumper wire connections except as directed.

CAUTION: Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with the key on or off. A short circuit may result and burn out the diodes.

NOTE: Battery posts and cable clamps must be clean and tight for accurate meter indications.

NOTE: Refer to the battery tester manual for complete directions for testing the charging system.

1. Turn off all lamps and electrical components.
2. Place the transmission in NEUTRAL and apply the parking brake.
3. Carry out the Load Test and No-Load Test according to the following component tests:

Generator On-Vehicle Tests - Load Test

1. Switch the tester to the ammeter function.
2. Connect the positive and negative leads of the tester to the corresponding battery terminals.
3. Connect the current probe to the generator B+ output terminal, circuit SDC02 (RD).
4. With the engine running at approximately 2,000 RPM, adjust the tester load bank to determine the output of the generator. Generator output should be greater than the graph shown below. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

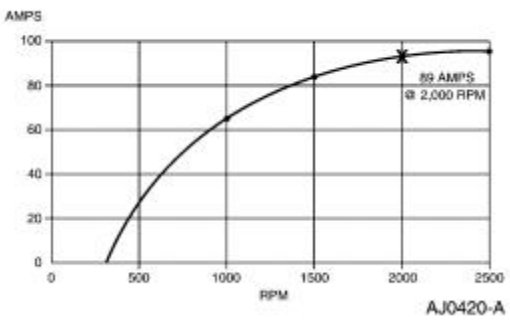


Fig. 14: Generator Output Chart
Courtesy of FORD MOTOR CO.

Generator On-Vehicle Tests - No-Load Test

1. Switch the tester to the voltmeter function.
2. Connect the voltmeter positive lead to the generator B+ terminal, circuit SDC02 (RD), and the negative lead to ground.
3. Turn all electrical accessories off.
4. With the engine running at approximately 2,000 RPM, check the generator output voltage. The voltage should be between 13.2 and 15.5 volts. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

2007 ELECTRICAL

Generator and Regulator - Expedition, Expedition EL, Navigator & Navigator L

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Generator	
Rating	89/157 amp (max) @ 1,800-6,000 generator rpm, approximately 500-2,000 engine rpm
Generator pulley ratio	2.96:1
Voltage regulator type	Electronic internal with generator

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Generator B+ terminal nut	8	-	71
Generator bolts	25	18	-
Generator bracket bolts	10	-	89

DESCRIPTION AND OPERATION

GENERATOR

The generator is belt-driven by the engine accessory drive system. The generator has an internal voltage regulator that is not replaced separately. The generator and voltage regulator are repaired as an assembly.

DIAGNOSTIC TESTS

GENERATOR

Refer to **CHARGING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

GENERATOR

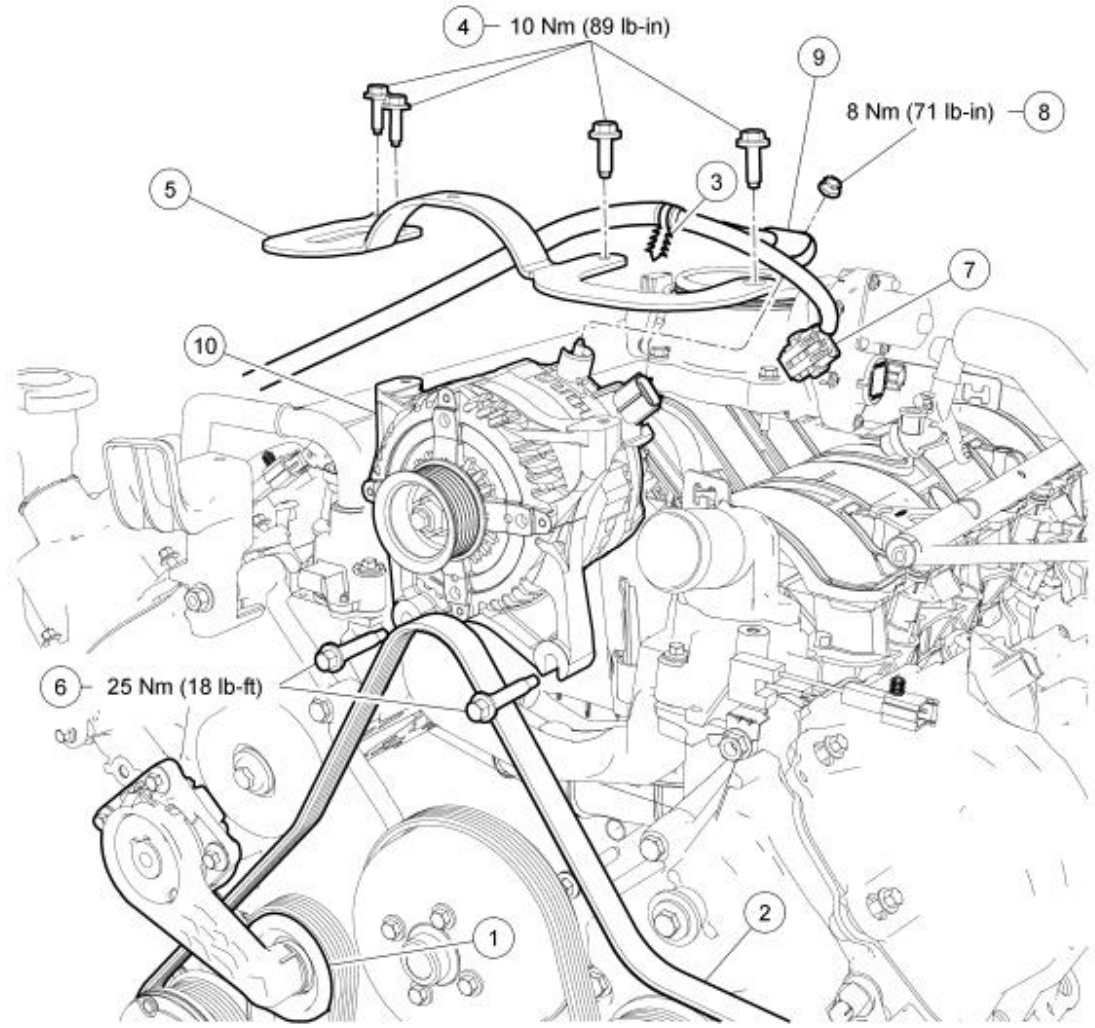


Fig. 1: Exploded View Of Generator (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6B209	Front end accessory drive belt tensioner
2	8620	Front end accessory drive belt
3	-	Generator harness locator
4	N807309	Generator bracket bolts (4 required)
5	10153	Generator bracket
6	N811334	Generator bolts (2 required)
7	-	Generator electrical connector (part of 12B637)
8	W705790-S901	Generator B+ terminal nut
9	-	Generator B+ terminal (part of 12B637)
10	10300	Generator

REMOVAL AND INSTALLATION

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

1. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. For Navigator, release the 2 retainers and remove the engine cover.
3. Remove the air cleaner intake pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
4. Rotate the front end accessory drive belt tensioner counterclockwise and position the accessory drive belt aside.
5. Remove the harness locator from the generator bracket.
6. Remove the 4 bolts and the generator bracket.
   - To install, tighten to 10 Nm (89 lb-in).
7. Remove the 2 bolts and position the generator aside.
   - Tighten to 25 Nm (18 lb-ft).
8. Disconnect the generator electrical connector.
9. Position the generator B+ protective cover aside, remove and discard the nut, then position the generator B+ terminal aside.
   - Install a new B+ terminal nut; tighten to 8 Nm (71 lb-in).
10. Remove the generator.
11. To install, reverse the removal procedure.

2007 ENGINE

Starting System - Expedition, Expedition EL, Navigator & Navigator L

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Starting System	
Normal engine cranking speed	140-220 rpm
Starter motor armature shaft maximum runout	0.11 mm (0.004 in)
Starter motor brush manufactured length	16.8 mm (0.66 in)
Starter motor brush spring tension	18 N (65 oz)
Starter motor commutator maximum runout	0.12 mm (0.005 in)
Starter motor diameter	101.6 mm (4.0 in)
Starter motor maximum load	800 amps
Starter motor minimum stall torque (at 5 volts)	14.7 N.m (10.8 lb-ft)
Starter motor no load current draw	60-80 amps
Starter motor normal load current draw	130-220 amps
Starter circuit maximum voltage drop (engine at normal operating temperature)	0.5 volts

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Starter motor bolts	25	18	-
Starter motor stud bolt	25	18	-
Starter motor ground cable nut	25	18	-
Starter solenoid B terminal nut	12	9	-
Starter solenoid S terminal nut	6	-	53

DESCRIPTION AND OPERATION

STARTING SYSTEM

The starting system consists of the following:

- Starter motor
- Starter motor relay
- Starter drive
- Battery
- Transmission range (TR) sensor
- Ignition switch

- Powertrain control module (PCM)
- One-touch integrated start (OTIS) diode (Late built vehicles)

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start. When the starter solenoid is energized, a magnetic field is created in the starter solenoid windings. The iron plunger core is drawn into the starter solenoid coil, and a drive lever and pin connected to the starter drive engages the drive pinion gear to the flexplate ring gear. When the plunger is pulled all the way in, the contact disc closes the circuit between the battery and the motor feed terminals. This sends current to the motor and the drive pinion gear cranks the flexplate to start the engine. When current flows to the starter motor, the starter solenoid pull-in coil is bypassed, and the hold-in coil keeps the drive pinion gear engaged with the flexplate.

Automatic transmissions have a transmission range (TR) sensor in the transmission. The TR sensor prevents operation of the starter motor unless NEUTRAL or PARK is selected.

Late Build Vehicles - One-Touch Integrated Start (OTIS)

This vehicle has one-touch integrated start (OTIS), a computer-assisted cranking system. This feature assists in starting the engine. If the ignition key is turned to the START position and released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

Once the ignition is turned to the START position, the PCM reads starter motor request (SMR) from the ignition switch and gains control of the starter engagement. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on the following events:

- The engine is started (RPM threshold)
- A set time has been exceeded
- The ignition key has been turned to the OFF position

DIAGNOSTIC TESTS

STARTING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
ST1137-A	73III Automotive Meter	105-R0057 or equivalent
ST2574-A	Flex Probe Kit	105-R025C or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic	

ST2834-A	System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

The starting system is electronically controlled by PCM. The PCM recognizes the signal from the ignition switch and provides a ground for the starter relay. The energized relay provides voltage to the starter solenoid, thereby allowing the starter motor to activate.

Starting System - Anti-Theft Intervention

The starting system is electronically controlled by the passive anti-theft system (PATS). The PATS recognizes the correct electronically coded ignition key and signals the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid, thereby allowing the starter motor to activate.

Inspection and Verification

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

NOTE: The PATS must be functioning correctly before a logical starting system diagnosis can be carried out. Address PATS concerns before continuing.

1. Verify the customer concern by operating the starting system to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Starter motor • Brackets • Starter motor bolts • Flexplate	• Battery • Failed battery junction box (BJB) fuse 40 (30A) • Failed smart junction box (SJB) fuse 27 (20A) • Circuitry • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to PCM DTC Chart or the Starter and PATS DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

PCM DTC CHART

DTC	Description	Source	Action
P0512	Starter Request Circuit - Circuit has Power With the Ignition in the OFF Position	PCM	CARRY OUT the Ignition Switch Component Test. Refer to COMPONENT TESTING. If necessary, INSTALL a new ignition switch. If the ignition switch passed the component test, REPAIR circuit CDC35 (BU/WH) for a short to power.
P0701	Transmission Control System - Range Operation	PCM	Refer to the appropriate Automatic Transmission article for the procedure..
P0705	Transmission Range (TR) Sensor Circuit Error	PCM	Refer to the appropriate Automatic Transmission article for the procedure..

PASSIVE ANTI-THEFT SYSTEM (PATS) - DTC CHART

DTC	Description	Source	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

B1342	Electronic Control Unit (ECU) is Faulted	Instrument Cluster	CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to **INSTRUMENT CLUSTER** article. CYCLE the ignition. REPEAT the self-test.
B1600	PATS Key Transponder is Not Received	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1681	PATS Transceiver Module Signal is Not Received	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2103	Antenna Not Connected	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2141	Non Volatile Memory (NVM) Configuration	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2431	Transponder Programming Failed	Instrument Cluster	The ignition key was not programmed. PROGRAM the key. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The engine does not crank and the relay does click (all vehicles)	• Battery • Battery junction box (BJB) fuse 40 (30A) • BJB • Starter motor/solenoid • Circuit	• Go to **Pinpoint Test A**.
• The engine does not crank and the relay does not click (early build vehicles)	• PCM • Smart junction box (SJB) • BJB • Battery • Starter relay	• Go to **Pinpoint Test B**.

	• Ignition switch • Circuit	
• The engine does not crank and the relay does not click (late build vehicles)	• PCM • SJB • BJB • Battery • Starter relay • Start diode • Ignition switch • Circuit	• Go to **Pinpoint Test C**.
• The engine cranks slowly	• Battery • Starter motor/solenoid • Circuit	• Go to **Pinpoint Test D**.
• Unusual starter noise	• Starter motor mounting • Starter motor • Flexplate	• Go to **Pinpoint Test E**.
• The starter spins but the engine does not crank	• Starter motor • Damaged flexplate ring gear teeth	• INSPECT the starter motor mounting and engagement. INSTALL a new starter motor. REFER to **Starter Motor**. • INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as required.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank and the Relay Does Click (All Vehicles)

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

In normal operation, constant voltage is supplied to the battery junction box (BJB) fuse 40 (30A) and to the stater relay pin 30. Voltage is supplied from the smart junction box (SJB) through circuit SBP27 (BU/RD) to the ignition switch. When the ignition switch is placed in the START position, voltage is supplied through circuit CDC35 (BU/WH) to circuit CDC38 (WH/VT) to the starter relay located in the BJB. The starter relay coil is supplied ground from the PCM through circuit CDC12 (YE). When the starter relay is energized, voltage supplied to the relay switch from BJB fuse 40 (30A) is sent to the starter motor solenoid through circuit CDC25 (BN/GN). Battery voltage is supplied to the starter motor through circuit SDC02 (RD) at all times.

This pinpoint test is intended to diagnose the following:

- Failed BJB fuse 40 (30A)
- An open in circuit CDC25 (BN/GN), SDC04 or SDC02 (RD)
- Starter motor relay
- Starter

PINPOINT TEST A: THE ENGINE DOES NOT CRANK AND THE RELAY DOES CLICK (ALL VEHICLES)

A1 CHECK THE STARTER MOTOR GROUND

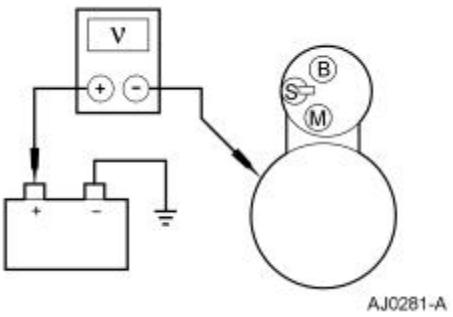


Fig. 1: Checking Starter Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the battery positive post and the starter motor case.
- **Is the voltage reading greater than 10 volts?**

  YES : Go to A2.

  NO : CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.

A2 CHECK THE VOLTAGE TO THE STARTER MOTOR SOLENOID

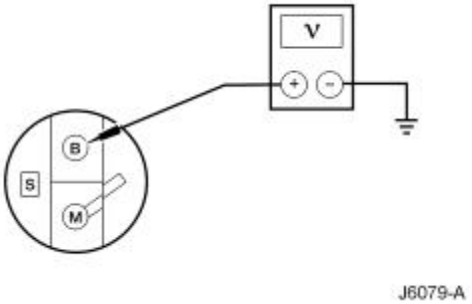


Fig. 2: Checking Voltage To Starter Motor Solenoid
Courtesy of FORD MOTOR CO.

- Measure the voltage between the starter motor solenoid positive terminal and ground.
- **Is the voltage 10 volts or greater?**

  YES : Go to A3.

  NO : REPAIR circuit SDC02 (RD) for an open. TEST the system for normal operation.

A3 MANUALLY JUMP THE STARTER MOTOR

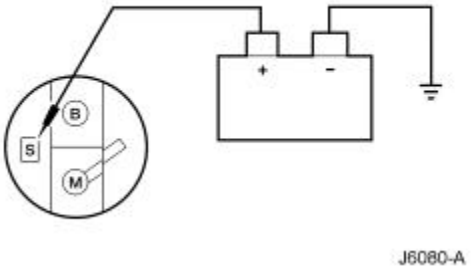


Fig. 3: Manually Jump Starter Motor
Courtesy of FORD MOTOR CO.

- Connect one end of a fused (15A) jumper wire to the positive terminal of the battery and touch the other end to the starter solenoid S-terminal.
- **Does the starter solenoid engage and the starter motor crank?**

  YES : Go to A4.

  NO : INSTALL a new starter motor. REFER to **Starter Motor**. TEST the system for normal operation.

A4 CHECK THE START INPUT TO THE STARTER MOTOR

- Disconnect: Starter S-Connector
- Key in START position.

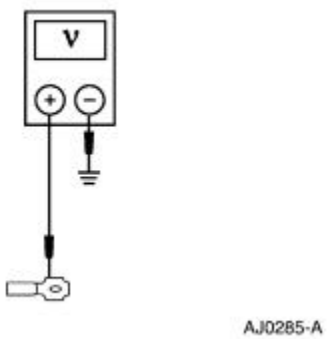


Fig. 4: Checking Start Input To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage at the starter motor solenoid S-terminal.
- **Is the voltage reading greater than 10 volts?**

  YES : CLEAN the starter motor solenoid S-terminal and connector. CHECK the wiring and the starter motor for a loose or intermittent connection. TEST the system for normal operation.

  NO : Go to A5.

A5 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY

- Key in OFF position.
- Disconnect: Starter Motor Relay

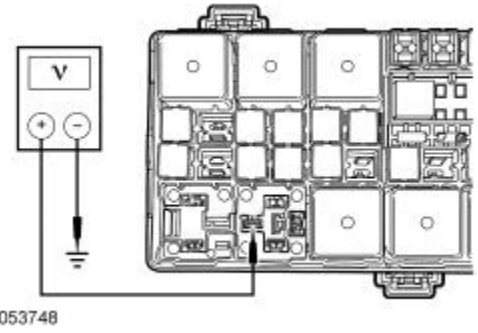


Fig. 5: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage at starter motor relay connector pin 30.
- **Is the voltage reading greater than 10 volts?**

  YES : Go to A9.

  NO : Go to A6.

A6 CHECK BJB FUSE 40 (30A) FOR AN OPEN

- Key in OFF position.
- Disconnect: BJB Fuse 40 (30A)
- Check fuse: BJB Fuse 40 (30A)
- **Is BJB fuse 40 (30A) open?**

  YES : Go to A7.

  NO : Go to A8.

A7 CHECK CIRCUIT CDC25 (BN/GN) FOR A SHORT TO GROUND

- Disconnect: Starter Solenoid S-Connector

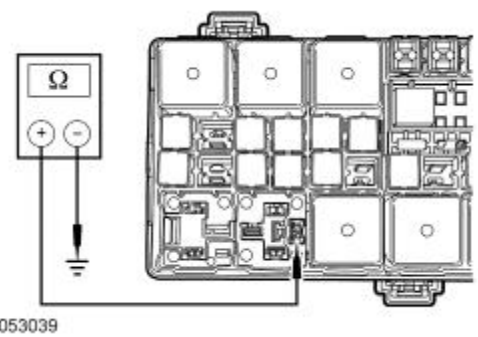


Fig. 6: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance of circuit CDC25 (BN/GN) between starter relay connector pin 87 and the starter solenoid S-connector.
- **Is the resistance less than 10,000 ohms?**

  YES : REPAIR circuit CDC25 (BN/GN) for a short to ground. INSTALL a new BJB fuse 40 (30A). TEST the system for normal operation.

  NO : INSTALL a new BJB fuse 40 (30A). TEST the system for normal operation.

A8 CHECK CIRCUIT SDC04 (RD) FOR POWER SUPPLY TO THE BJB

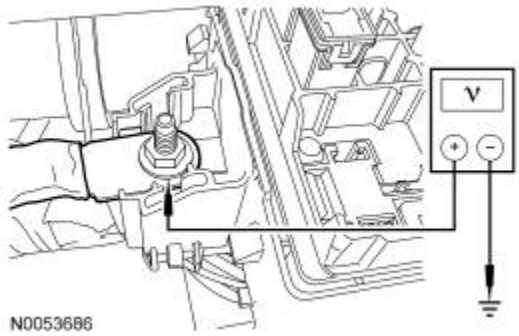


Fig. 7: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the BJB power supply terminal, circuit SDC04 (RD) and ground.
- **Is the voltage 10 volts or greater?**

  YES : INSTALL a new BJB.

  NO : REPAIR circuit SDC04 (RD) for an open. TEST the system for normal operation.

A9 CHECK CIRCUIT CDC25 (BN/GN) FOR AN OPEN

- Disconnect: Starter Solenoid S-Connector

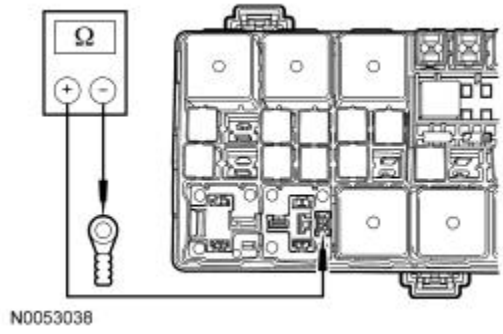


Fig. 8: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance of circuit CDC25 (BN/GN) between starter relay connector pin 87 and the starter solenoid S-connector.
- **Is the resistance reading 5 ohms or less?**

  YES : INSTALL a new starter relay. TEST the system for normal operation.

  NO : REPAIR circuit CDC25 (BN/GN) for an open. TEST the system for normal operation.

Pinpoint Test B: The Engine Does Not Crank and the Relay Does Not Click (Early Build Vehicles)

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

In normal operation, constant voltage is supplied to the battery junction box (BJB) fuse 40 (30A) and to the stater relay pin 30. Voltage is supplied from the smart junction box (SJB) through circuit SBP27 (BU/RD) to the ignition switch. When the ignition switch is placed in the START position, voltage is supplied through

circuit CDC35 (BU/WH) to circuit CDC38 (WH/VT) to the starter relay located in the BJB. The starter relay coil is supplied ground from the PCM through circuit CDC12 (YE). When the starter relay is energized, voltage supplied to the relay switch from BJB fuse 40 (30A) is sent to the starter motor solenoid through circuit CDC25 (BN/GN). Battery voltage is supplied to the starter motor through circuit SDC02 (RD) at all times.

This pinpoint test is intended to diagnose the following:

- Battery
- An open in circuit CDC38 (WH/VT), CDC12 (YE) or CDC35 (BU/WH)
- PCM
- SJB
- Ignition switch
- Starter motor relay

PINPOINT TEST B: THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK (EARLY BUILD VEHICLES)

B1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to B2.

  NO : CHARGE or INSTALL a new battery as required. TEST the system for normal operation.

B2 CHECK CIRCUIT CDC38 (WH/VT) FOR VOLTAGE

- Disconnect: Starter Motor Relay
- Key in START position.

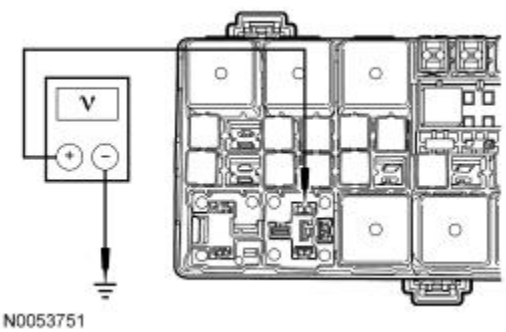


Fig. 9: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor relay pin 85, circuit CDC38 (WH/VT) and ground while holding the key in the START position.
- **Is the voltage greater than 10 volts?**

  YES : Go to B7.

  NO : Go to B3.

B3 CHECK THE START INPUT FROM THE SJB

- Key in START position.
- Disconnect: SJB C2280A

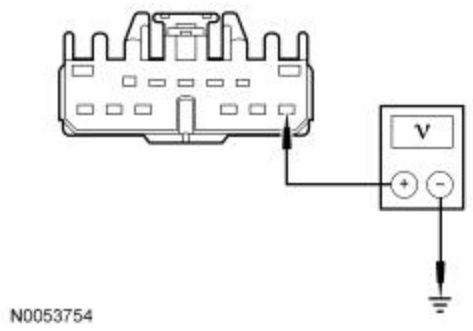


Fig. 10: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage at SJB C2280A-8, while holding the key in the START position.
- **Is the voltage reading greater than 10 volts?**
  YES : REPAIR circuit CDC38 (WH/VT) for an open. TEST the system for normal operation.
  NO : Go to B4.

B4 CHECK THE START INPUT TO THE SJB

- Key in START position.
- Disconnect: SJB C2280G

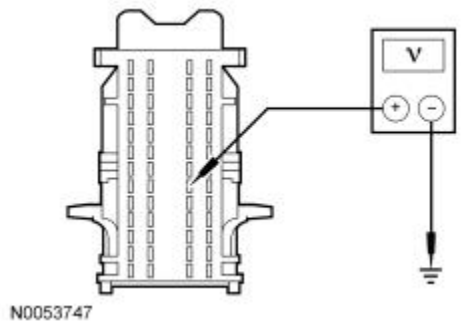


Fig. 11: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage at SJB C2280G-32, while holding the key in the START position.
- **Is the voltage reading greater than 10 volts?**
  YES : INSTALL a new SJB. TEST the system for normal operation.
  NO : Go to B5.

B5 CHECK FOR START INPUT FROM THE IGNITION SWITCH

- Disconnect: Ignition Switch C250
- Key in START position.

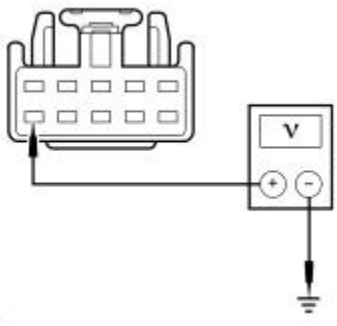


Fig. 12: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage at ignition switch C250-10, from the harness side, while holding the key in the START position.
- **Is the voltage reading greater than 10 volts?**

  YES : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

  NO : Go to B6.

B6 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to COMPONENT TESTING article.
- **Did the ignition switch pass the component test?**

  YES : REPAIR circuit SBP27 (BU/RD) for an open. TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

B7 CHECK THE STARTER RELAY GROUND

- Key in START position.
- Disconnect: Starter Motor Relay

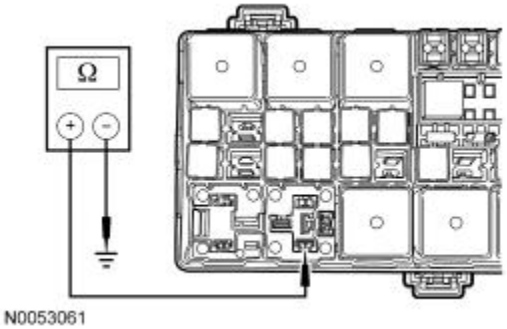


Fig. 13: Checking Circuit For Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between starter motor relay connector pin 86, circuit CDC12 (YE) and ground while holding the key in the START position.
- **Is the resistance reading 5 ohms or less?**

  YES : INSTALL a new starter relay. TEST the system for normal operation.

  NO : Go to B8.

B8 CHECK CIRCUIT CDC12 (YE) FOR AN OPEN

- Disconnect: PCM C175B

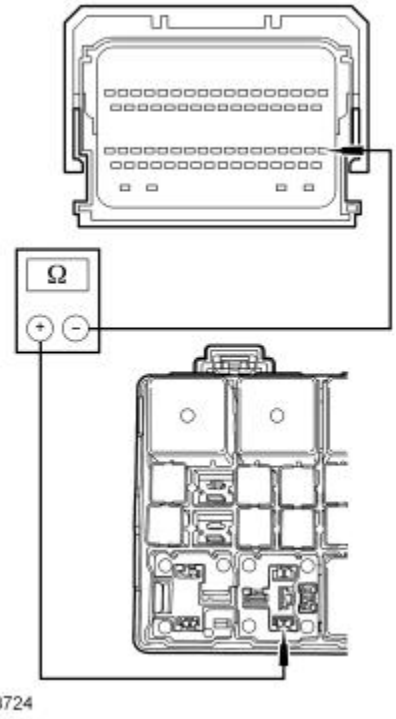


Fig. 14: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between starter motor relay connector pin 86, circuit CDC12 (YE) and PCM C175B-34.
- **Is the resistance reading 5 ohms or less?**

  YES : DIAGNOSE the PCM. REFER to the **Introduction - Gasoline Engines** article.

  NO : REPAIR circuit CDC12 (YE) for an open. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Crank and the Relay Does Not Click (Late Build Vehicles)

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

Under normal operation, when the ignition switch is turned in the START position and released, the PCM receives a starter motor request (SMR) signal through circuit CDC35 (BU/WH), power is then supplied to the starter relay through circuit CDC38 (WH/VT) from the PCM. The PCM will receive a signal from the digital transmission range (TR) sensor that the vehicle is in PARK or NEUTRAL through circuit CET40 (GN/OG). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter relay coil to energize and the relay contacts to close. This allows power to be supplied from battery junction box (BJB) fuse 40 (30A) to the relay contacts, which then flows through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and close the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine. The PCM will disengage the starter motor based on engine running (RPM threshold), a set crank time has been exceeded or the ignition switch

has been turned to the OFF position.

This pinpoint test is intended to diagnose the following:

- Battery
- Ignition switch
- Starter relay
- Anti-theft system
- Circuitry
- PCM
- Start diode

PINPOINT TEST C: THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK (LATE BUILD VEHICLES)

C1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to C2.

  NO : CHARGE or INSTALL a new battery as necessary. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

C2 CHECK FOR PASSIVE ANTI-THEFT SYSTEM (PATS) DTCs

NOTE: PATS DTCs are the only DTCs of concern in this step. Only repair retrieved non-PATS DTCs if a customer concern is reported.

- Check for PATS DTCs.
- **Were any PATS DTCs retrieved?**

  YES : REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article to diagnose the PATS DTCs.

  NO : Go to C3.

C3 CHECK THE TR SENSOR PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- While observing the PCM TR sensor PID, place the vehicle in PARK and NEUTRAL.
- **Does the PID match the gear selection?**

  YES : Go to C5.

  NO : Go to C4.

C4 CHECK CIRCUIT CET40 (GN/OG) FOR AN OPEN

- Disconnect: Transmission C1548
- Disconnect: PCM C175B

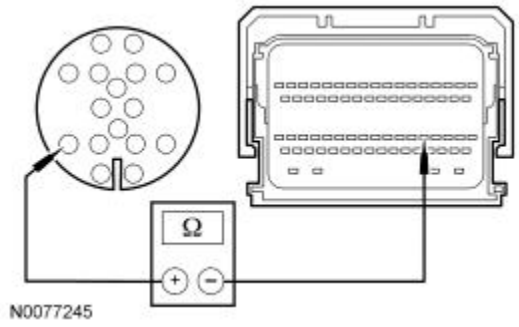


Fig. 15: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between transmission C175B-10 circuit CET40 (GN/OG), harness side, and PCM C175B-38, circuit CET40 (GN/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to the appropriate automatic transmission section to diagnose the TR sensor.

  NO : REPAIR the circuit CET40 (GN/OG). TEST the system for normal operation.

C5 CHECK CIRCUIT CDC35 (BU/WH) FOR VOLTAGE AT THE START DIODE

- Disconnect: Start Diode
- Key in START position.

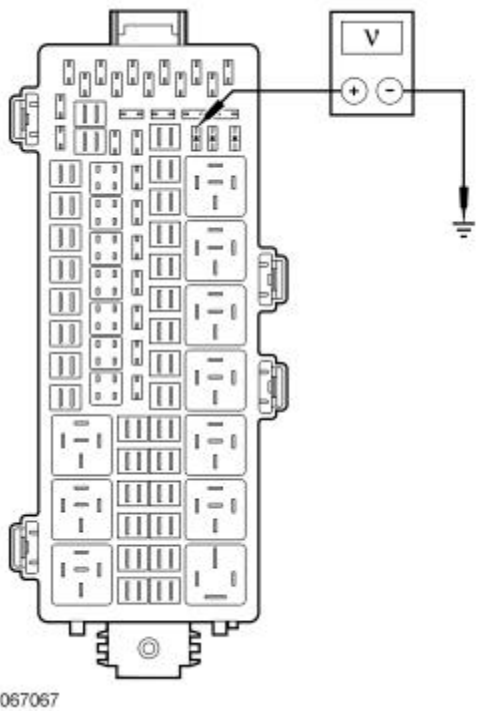


Fig. 16: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between BJB start diode cell, circuit CDC35 (BU/WH) and ground with the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

YES : Go to C8.

NO : Go to C6.

C6 CHECK CIRCUIT SBB27 (BU/RD) FOR VOLTAGE

- Disconnect: Ignition Switch C250

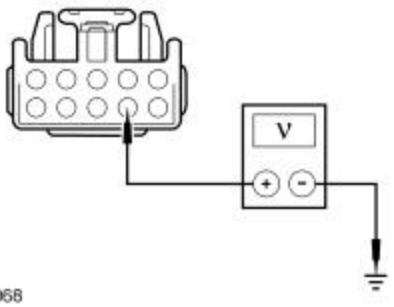


Fig. 17: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-7, circuit SBP27 (BU/RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C7.

  NO : REPAIR circuit SBB27 (BU/RD). TEST the system for normal operation.

C7 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to COMPONENT TESTING article.
- **Did the ignition switch pass the component test?**

  YES : REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

C8 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Start Diode
- Disconnect: PCM C175B

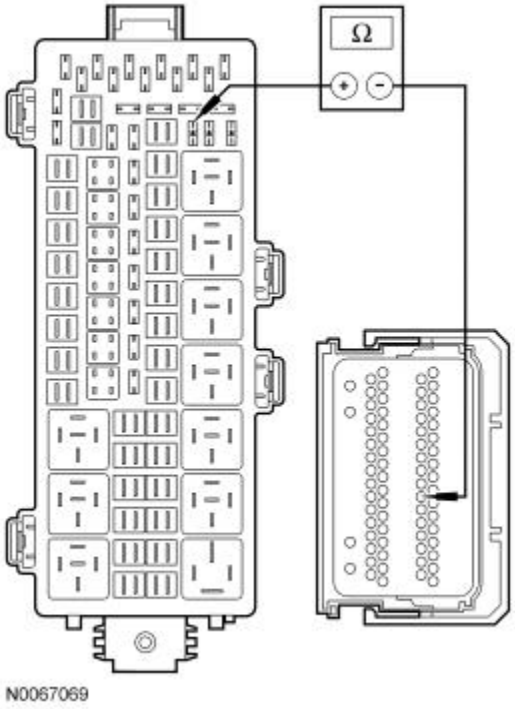


Fig. 18: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between BJB start diode cell, circuit CDC35 (BU/WH) and PCM C175B-24, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit CDC35 (BU/WH). TEST the system for normal operation.

C9 CHECK THE START DIODE

- Check the start diode.
- **Is the start diode open or shorted?**

  YES : INSTALL a new start diode. TEST the system for normal operation.

  NO : Go to C10.

C10 CHECK CIRCUIT CDC38 (WH/VT) FOR VOLTAGE

- Connect: Start Diode
- Connect: PCM C175B
- Disconnect: Starter Motor Relay
- Key in START position.

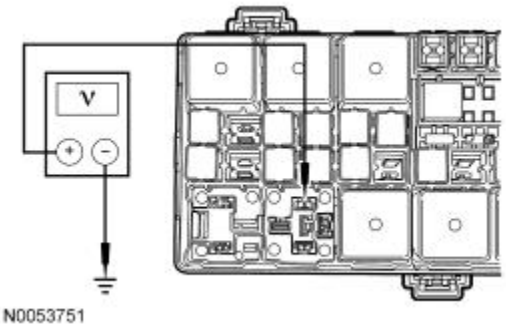


Fig. 19: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between BJB starter motor relay connector pin 85, circuit CDC38 (WH/VT) and ground with the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

  YES : Go to C11.

  NO : REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation.

C11 CHECK PCM CIRCUIT CDC38 (WH/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: PCM C175B

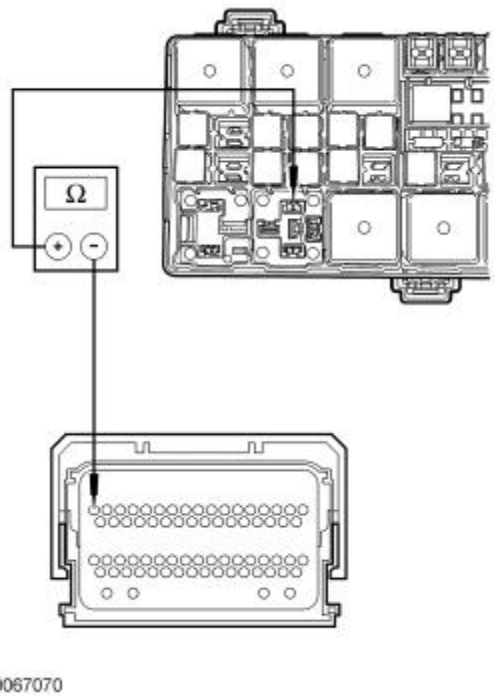


Fig. 20: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175B-17, circuit CDC38 (WH/VT), harness side and BJB starter relay pin 85, circuit CDC38 (WH/VT).
- **Is the resistance reading 5 ohms or less?**

YES : Go to C12.

NO : REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation.

C12 CHECK CIRCUIT CDC12 (YE) FOR AN OPEN

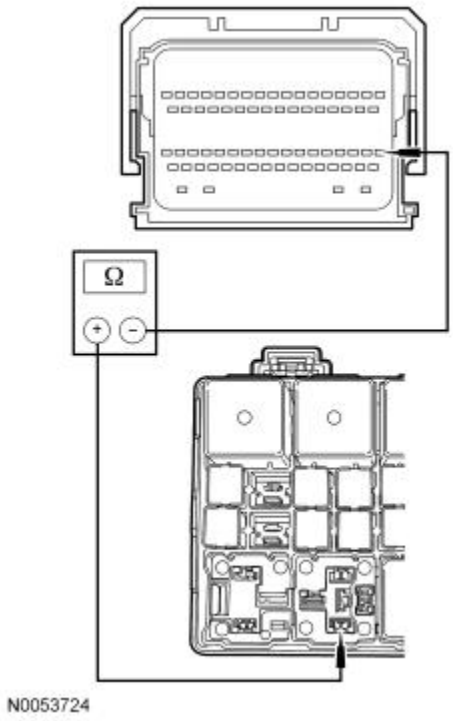


Fig. 21: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the starter motor relay connector pin 86, circuit CDC12 (YE) and PCM C175B-34, circuit CDC12 (YE).
- **Is the resistance reading 5 ohms or less?**

  YES : DIAGNOSE the PCM. REFER to the **Introduction - Gasoline Engines** article.

  NO : REPAIR circuit CDC12 (YE) for an open. TEST the system for normal operation.

Pinpoint Test D: The Engine Cranks Slowly

Refer to **SYSTEM WIRING DIAGRAMS** (Expedition), **SYSTEM WIRING DIAGRAMS** (Expedition EL), **SYSTEM WIRING DIAGRAMS** (Navigator) or **SYSTEM WIRING DIAGRAMS** (Navigator L) for schematic and connector information.

Normal Operation

In normal operation, constant voltage is supplied to the battery junction box (BJB) fuse 40 (30A) and to the stater relay pin 30. Voltage is supplied from the smart junction box (SJB) through circuit SBP27 (BU/RD) to the ignition switch. When the ignition switch is placed in the START position, voltage is supplied through circuit CDC35 (BU/WH) to circuit CDC38 (WH/VT) to the starter relay located in the BJB. The starter relay coil is supplied ground from the PCM through circuit CDC12 (YE). When the starter relay is energized, voltage supplied to the relay switch from BJB fuse 40 (30A) is sent to the starter motor solenoid through circuit CDC25 (BN/GN). Battery voltage is supplied to the starter motor through circuit SDC02 (RD) at all times.

This pinpoint test is intended to diagnose the following:

- Battery
- Circuit CDC25 (RD)
- Ground circuit
- Starter motor

PINPOINT TEST D: THE ENGINE CRANKS SLOWLY

D1 CHECK THE BATTERY

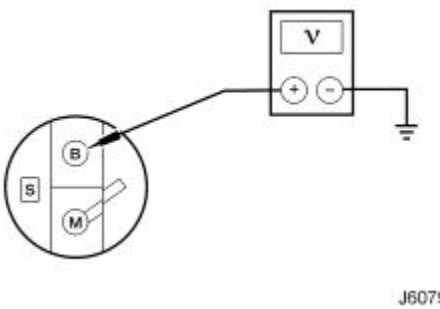
- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to D2.

  NO : CHARGE or INSTALL a new battery as required. TEST the system for normal operation.

D2 CHECK THE VOLTAGE TO THE STARTER

- Key in OFF position.



J6079-A

Fig. 22: Checking Voltage To Starter Motor Solenoid
Courtesy of FORD MOTOR CO.

- Measure the voltage between the starter motor solenoid positive terminal and ground.
- **Is the voltage 12.0 volts or greater?**

  YES : Go to D3.

  NO : REPAIR circuit CDC25 (RD). CLEAN and TIGHTEN the connections at the battery terminals. TEST the system for normal operation.

D3 CHECK THE MOTOR GROUND CIRCUIT

- Carry out the Motor Ground Circuit Test. Refer to the component tests.
- **Is the ground OK?**

  YES : INSTALL a new starter motor. TEST the system for normal operation.

  NO : REPAIR the ground circuit as necessary. TEST the system for normal operation.

Pinpoint Test E: Unusual Starter Noise

Normal Operation

In normal operation, constant voltage is supplied to the battery junction box (BJB) fuse 40 (30A) and to the

stater relay pin 30. Voltage is supplied from the smart junction box (SJB) through circuit SBP27 (BU/RD) to the ignition switch. When the ignition switch is placed in the START position, voltage is supplied through circuit CDC35 (BU/WH) to circuit CDC38 (WH/VT) to the starter relay located in the BJB. The starter relay coil is supplied ground from the PCM through circuit CDC12 (YE). When the starter relay is energized, voltage supplied to the relay switch from BJB fuse 40 (30A) is sent to the starter motor solenoid through circuit CDC25 (BN/GN). Battery voltage is supplied to the starter motor through circuit SDC02 (RD) at all times.

This pinpoint test is intended to diagnose the following:

- Starter motor mounting
- Starter motor mounting bolts
- Starter motor drive
- Flywheel or flexplate ring gear
- Starter motor

PINPOINT TEST E: UNUSUAL STARTER NOISE

E1 CHECK THE STARTER MOTOR MOUNTING

- Inspect the starter motor mounting bolts for looseness.
- **Is the starter motor mounted correctly?**

  YES : Go to E2.

  NO : REINSTALL the starter motor correctly. REFER to **Starter Motor**.

E2 CHECK FOR ENGINE NOISE

- Key in OFF position.

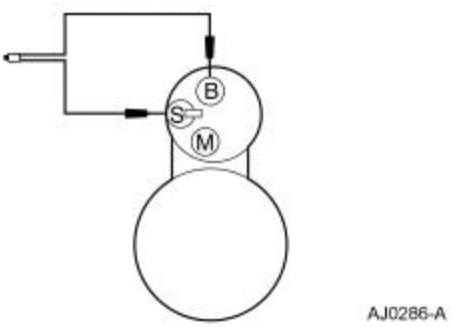


Fig. 23: Connecting Remote Starter Switch Between Starter Solenoid B & S Terminals
Courtesy of FORD MOTOR CO.

- Connect a remote starter switch between the starter solenoid B- and S- terminals.
- Engage the starter motor and verify that the noise is due to the starter operation.
- **Is the noise due to the starter motor engagement?**

  YES : Go to E3.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to continue the diagnosis.

E3 CHECK FOR UNUSUAL WEAR

- Remove the starter motor. Refer to **Starter Motor**.

- Inspect the flexplate for damaged or worn teeth.
- **Is the noise due to ring gear tooth damage?**

  YES : INSTALL a new flexplate. REFER to **ENGINE** article. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to **Starter Motor**. TEST the system for normal operation.

  NO : INSTALL a new starter motor. REFER to **Starter Motor**. TEST the system for normal operation.

Component Tests

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

Always make the 73III Automotive Meter connections at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged; carry out a battery load test. Refer to **BATTERY, MOUNTING AND CABLES** article.
2. Disconnect the inertia fuel shutoff (IFS) switch.
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect the negative lead to the starter solenoid M-terminal.

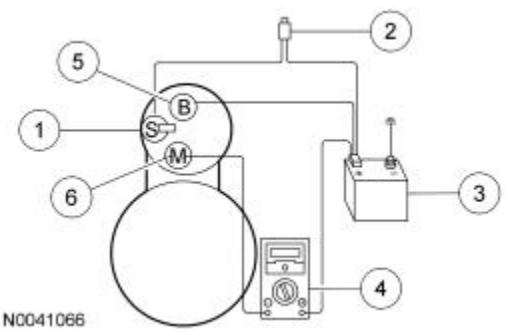


Fig. 24: Identifying S,M,B-Terminal, 73III Automotive Meter, Battery & Remote Starter Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
		73III

4	-	Automotive Meter
5	-	B-terminal
6	-	M-terminal

5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
6. If the voltage reading is 0.5 volt or less, go to the starter motor-ground circuit component test.
7. If the voltage reading is greater than 0.5 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.5 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

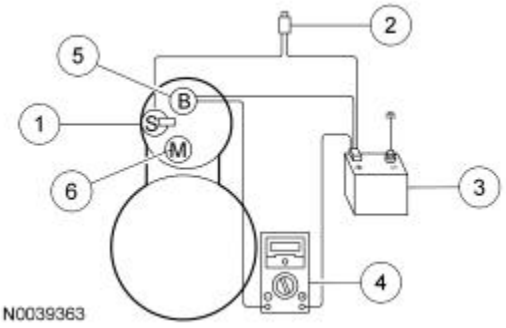


Fig. 25: Identifying S,M,B-Terminal, 73III Automotive Meter, Battery & Remote Starter Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.5 volt when checked at the M-terminal or less than 0.5 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself.
10. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable.

Starter Motor - Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.
2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.2 volt or less.
3. If the voltage drop is more than 0.2 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connection. Retest.
4. If the voltage drop is greater than 0.2 volt, install a new cable. If the voltage reading is less than 0.2 volt and the engine still cranks slowly, install a new starter motor.

REMOVAL AND INSTALLATION

STARTER MOTOR

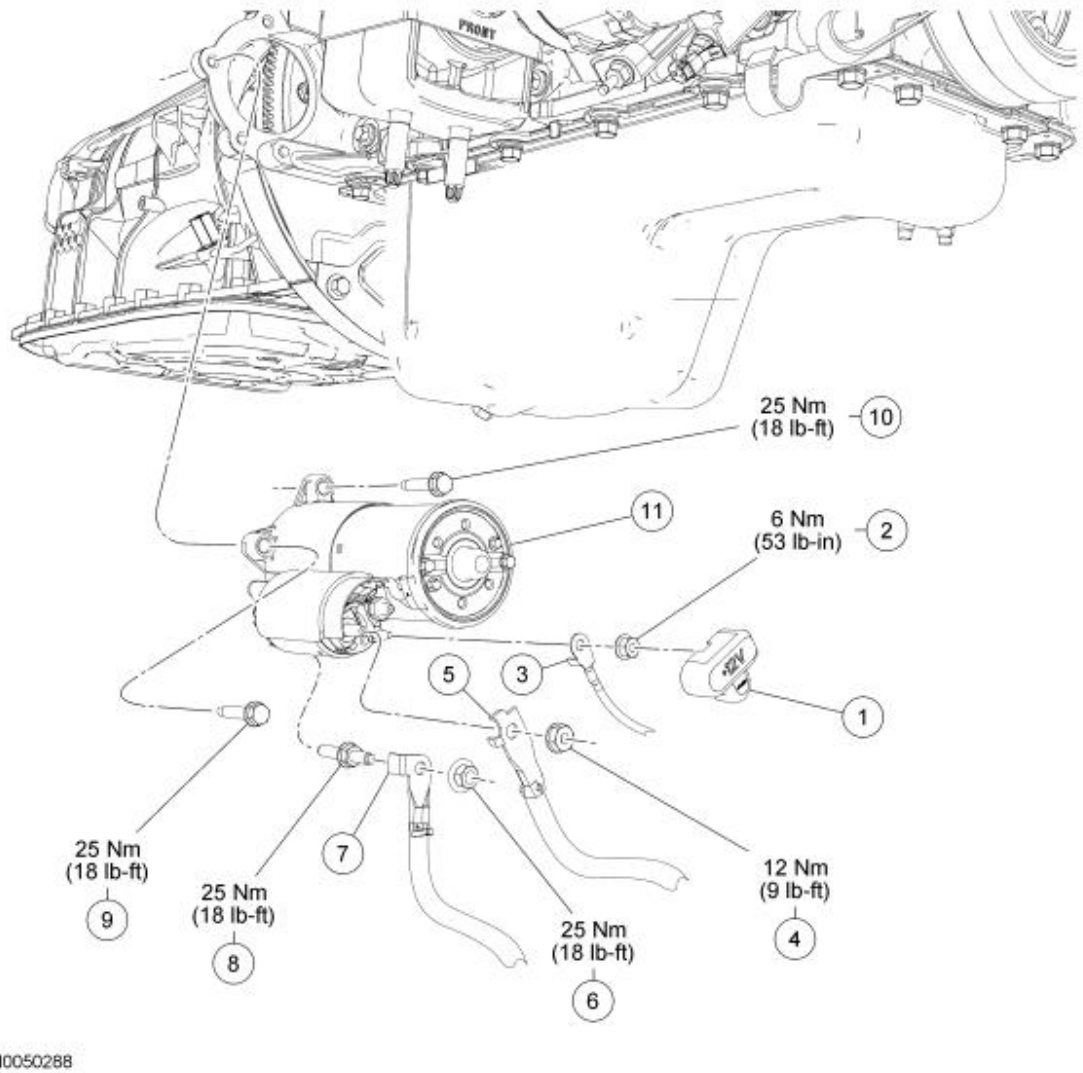


Fig. 26: Exploded View Of Starter Motor (With Torque Specifications)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	11N087	Terminal cover
2	N805320	Starter solenoid S-terminal nut
3	14463	Starter solenoid S-terminal eyelet
4	W706414	Starter solenoid B-terminal nut
5	14463	Starter solenoid B-terminal eyelet
6	N805024	Starter motor ground cable nut
7	14463	Starter motor ground cable eyelet
8	W704941	Starter motor mounting stud bolt
9	W704942	Starter motor mounting bolt
10	W704942	Starter motor mounting bolt
11	11000	Starter motor

REMOVAL

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the starter terminal cover and remove the nut and the solenoid S-terminal electrical connection.
4. Remove the nut and the solenoid B-terminal electrical connection.
5. Remove the nut and the starter battery ground cable from the stud.
6. Remove the 2 bolts, the stud bolt and the starter motor.

INSTALLATION

1. Position the starter and install the 2 bolts and the stud bolt in 3 stages.
   - Stage 1: Install the 2 starter bolts and the stud bolt finger tight.
   - Stage 2: Tighten the upper bolt to 25 Nm (18 lb-ft).
   - Stage 3: Tighten the lower bolt and stud bolt to 25 Nm (18 lb-ft).
2. Position the starter battery ground cable onto the stud and install the nut.
   - Tighten to 25 Nm (18 lb-ft).
3. Connect the solenoid B-terminal electrical connection and install the nut.
   - Tighten to 12 Nm (9 lb-ft).
4. Connect the solenoid S-terminal electrical connection and install the nut and the starter terminal cover.
   - Tighten to 6 Nm (53 lb-in).
5. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.